AUN-QA

SELF-ASSESSMENT REPORT

MASTER OF SCIENCE PROGRAM

IN PLANT SCIENCES

(INTERNATIONAL PROGRAM)

DEPARTMENT OF PLANT SCIENCE

FACULTY OF SCIENCES

DEPARTMENT OF PHARMACEUTICAL BOTANY

FACULTY OF PHARMACY

MAHIDOL UNIVERSITY

LIST OF ABBREVIATIONS

CDC	Curriculum Development Committee
CIF	Central Instrument Facility at the Faculty of Science, Mahidol University
CLOs	Course Learning Outcomes
ELOs	Expected Learning Outcomes
FTE	Full-Time Equivalent
GPA	Grade Point Average
HR	Human Resource
ISI	ISI Web of Science by Thompson Reuters
IT	Information Technology
LAN	Local Area Network
M.Sc.	Master of Science
MUIT	Division of Information Technology, Mahidol University
OBE	Outcome-Based Education
OHEC	Office of Higher Education Commission, Ministry of Education, Thailand
QA	Quality Assurance
SAR	Self-Assessment Report
TLA	Teaching and Learning Approaches
TOEIC	Test of English for International Communication
TQF	Thailand Qualification Framework
Wi-Fi	Local area wireless computer networking technology

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I. INTRODUCTION

EXECUTIVE SUMMARY

Master of Science Programs in Plant Sciences, offered by the Department of Plant Science, Faculty of Science and Department of Pharmaceutical Botany, Faculty of Pharmacy, Mahidol University, is the only one international program among the M.Sc. programs in Plant Sciences in Thailand, which opened since 2004. The program was designed to provide strong support for students' research. During one-year coursework, students begin their research by conducting literature reviews under the supervision of faculty members, and by enrolling in core courses that help students to identify thesis topics.

Our curriculum will be continuously revised every 5 years to make the curriculum structure comparable to similar academic programs offered by other universities abroad and to comply with Thailand Qualification Framework announced and regulated by the Ministry of Education. The current program specification was launched in the 2023 academic year in response to technological trends and impending disruption. In this SAR report, conformations of teaching and learning processes by our master program with the AUN-QA criteria are described with providing the key evidences in the Appendices.

ORGANIZATION OF THE SELF-ASSESSMENT REPORT

This SAR report is consisted of four main parts – I. Introduction, II. AUN-QA Criteria Requirements, III. Strength and Weakness Analysis, and IV. Appendices. The introduction part involves an executive summary and overview of the university, faculty, and department. The AUN-QA criteria requirements part is the main section demonstrating how our academic program complied with the mandatory criteria. The Strengths and Weaknesses Analysis part summarizes our findings of program strengths and weaknesses for subsequent program improvement plans. In the last part, Appendices provide key examples of documents and evidences for supporting the criteria justification.

OVERVIEW OF THE UNIVERSITY, FACULTY, DEPARTMENT

Mahidol University

Mahidol University has its origins in the establishment of Siriraj Hospital in 1888 by His Majesty King Chulalongkorn (RAMA V) and the hospital's medical school is the oldest institution of higher learning in Thailand, granting its first medical degree in 1893. The medical school later became the University of Medical Sciences in 1943. In 1969, the University of Medical Sciences was renamed, with great honor by H.M. King Bhumibol Adulyadej, to Mahidol University after his Royal Father H.R.H Prince Mahidol of Songkla, who has been recognized as the 'Father of Modern Medicine and Public Health in Thailand'. Mahidol University has since developed into one of the most prestigious universities in Thailand and internationally recognized for its high caliber research and teaching. Other than medical science, this diversified institution now offers top quality academic programs in numerous areas including arts, engineering, linguistic, music, social science, etc. This diversified institution now offered top quality in numerous social and cultural disciplines including the most master and doctoral programs of any institution in Thailand, yet have maintained its traditional excellence in medicine and the sciences. Mahidol University has set its own vision and mission as following:

Vision: Vision: To be 1 in 100 World Class University

Mission: To excel in health, sciences, arts, and innovation with integrity for the betterment of Thai society and the benefit of mankind.

[Source: https://mahidol.ac.th/core-value/ March 29th, 2023]

Faculty of Science

The Faculty of Science was initially founded as a Premedical School in 1958 by Professor Stang Mongkolsuk with supports from the Rockefeller Foundation and the Royal Thai Government. The Premedical School later took the name "Faculty of Science" in 1969. Currently, the Faculty of Science, Mahidol University has set its vision and mission as following:

Vision: To be a leader in integrated science education, research and innovation for well-being of mankind

Mission: To develop human resources with knowledge and morality and produce research output of international quality that benefits society

[Source: https://science.mahidol.ac.th/aboutsc.php Feb 21st, 2023]

Department of Plant Science

The Departmental of Plant Science at Mahidol University was established in 1992, as announced in the 109th Royal Gazette dated September 18, 1992 providing one program of B.Sc. (Plant Science). Most of our graduates decide to seek degrees in higher education, both within and outside the country. Many students have been awarded prestigious scholarships, such as the Royal Thai scholarship, scholarships from Office of the Higher Education Commission, and from other institutes and universities. A significant portion of our graduates choose to pursue careers in agriculture and horticulture as researchers at the National Science and Technology Development Agency (NSTDA), the Royal Project Foundation, universities, schools, and private companies, or as producers and exporters of fruits, vegetables, flowers, and other ornamental plants. In 2004, our department, in collaboration with the Department of Pharmaceutical Botany, Faculty of Pharmacy at Mahidol University, launched an international program for Master's degree in Plant Sciences. In 2016, our Ph.D. program in Botany were first opened for students.

Accordingly, the Department of Plant Science offers totally three programs-B.Sc., M.Sc., and Ph.D.; twelve academic staff and four supporting staff have well-carried functional responsibility in the department under the administration of the department head (as shown in the organization chart, Figure 1), so that the department can facilitate the three programs and activities smoothly.

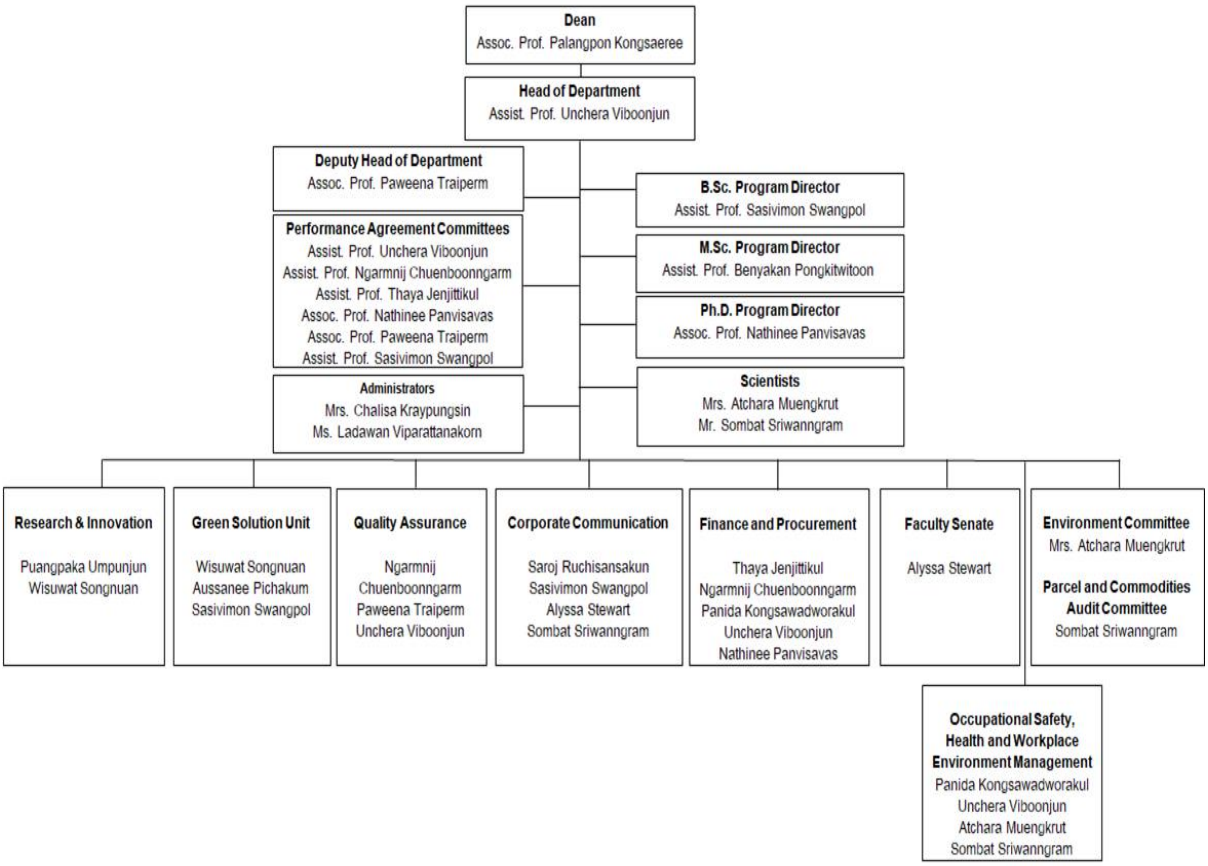

Figure 1. Organization Chart of Department of Plant Science, Faculty of Science, Mahidol University (2022-2023)

DEVELOPMENT OF THIS SAR

This SAR report was written by the program director and program administrative committees. The staff at Department of Plant Science, Faculty of Science, and Department of Pharmaceutical Botany, Faculty of Pharmacy, Mahidol University helped provided all key information for completing the required criteria. The first draft of SAR report was then presented to all staff of the Department for further suggestion and improvement. The final version of SAR report will be submitted for internal assessment by the committees from Faculty of Science, Mahidol University within the year 2023.

II. AUN-QA CRITERIA REQUIREMENTS

1. EXPECTED LEARNING OUTCOMES

1.1 The program to show that the expected learning outcomes are appropriately formulated in accordance with an established learning taxonomy, are aligned to the vision and mission of the university and are known to all stakeholders.

Program's expected learning outcomes (ELOs) are requirements that students must achieve by graduation. They can be achieved by incremental attainment over the courses of the program along with the verification via numerous assessment methods. The ELOs as well as curriculum structure of our Master of Science Program in Plant Sciences (International Program), was formulated according to the protocol briefly described as following. Program's ELOs as well as program structure and specification was drafted by taking into consideration of Thai Qualifications Framework for Higher Education (TQF:HEd) and the feedbacks received from stakeholders. The drafted curriculum is presented to and approved by the departmental staff meeting before submission to the Faculty of Graduate Studies. The Faculty of Graduate Studies rechecked the documents to certify that the curriculum conformed to the TQF requirement before further passing to a Peer Review Committee appointed by Mahidol University Council. According to the Peer Review Committee's comments, the curriculum was revised and sent for final approval by Mahidol University Council.

According to the last curriculum revision process in 2022, the ELOs of our master program in plant sciences have been formulated as shown in Table 1. Our ELOs were formulated using Bloom's Taxonomy levels ranging from understanding to creating. The Mahidol University, Faculty of Pharmacy, and the Faculty of Science share the same vision and mission of "directing to be a world-class institute by providing high-quality education and producing international-standard research outputs." Therefore, in terms of alignment with the vision and mission of the university, our program's ELOs aligned very well with the direction of the university. The vision and mission of Mahidol University, Faculty of Pharmacy, and the Faculty of Science have been well communicated to all students and staff by several ways, i.e., web site, meetings, program orientation, etc. The Master of Science Programs in Plant Sciences at the Department of Plant Science, Faculty of Science and Department of Pharmaceutical Botany, Faculty of Pharmacy, Mahidol University aims to produce master with national or international-level of knowledge, skills in Plant Sciences and Pharmaceutical Botany research, and graduated with at least one good quality of national or international publication in national or international journal. Accordingly, our program's ELOs are clearly aligned with the vision and mission of the university.

Table 1. ELOs of Master of Science Programs in Plant Sciences, Department of Plant Science, Faculty of Science and Department of Pharmaceutical Botany, Faculty of Pharmacy at Mahidol University.

Expected Learning Outcomes	Bloom's Taxonomy Level
1. Comply with institutional and societal regulations, and refrain from all forms of plagiarism.	Cognitive/Applying
2. Explain important principles and theories of plant science. Have the ability to research and stay abreast of current studies.	Cognitive/Understanding/ Evaluating
3. Think critically, and draw conclusions and problem-solve via the scientific method using knowledge about plant science. Think creatively. Be able to apply and integrate knowledge with other disciplines related to plant science.	Cognitive/Understanding/ Analyzing
4. Demonstrate both leadership skills and the ability to follow others, take responsibility for assigned tasks, and manage workloads independently.	Demonstrate/ Employ/Creating
5. Analyze data, communicate, and use information technology appropriately for disseminating plant science knowledge to the general public.	Describe/Illustrate/Conceptual /Recognize/Dramatize

1.2 The program to show that the expected learning outcomes for all courses are appropriately formulated and are aligned to the expected learning outcomes of the program.

The expected learning outcomes of each course (CLOs) were clearly defined and specific. They indicate what students are expected to know, understand, and be able to do after completing the course. The CLOs are measurable, so progress towards achieving them can be tracked and assessed.

The CLOs could be aligned with the PLOs, contributing to the overall goals and objectives of the program. The students who successfully complete all the courses have then achieved the PLOs.

1.3 The program to show that the expected learning outcomes consist of both generic outcomes (related to written and oral communication, problem-solving, information technology, teambuilding skills, etc) and subject specific outcomes (related to knowledge and skills of the study discipline).

Our program's ELOs can be categorized into subject-specific and generic skills. Subject-specific outcomes refer to knowledge and skills exclusive to the field of Plant Sciences and Pharmaceutical Botany. Alternatively, generic learning outcomes are generic competencies, which include skills such as communication, problem-solving, ethics, IT, leadership, conflict resolution, teamwork, etc. Accordingly, Table 2 demonstrates the classification of our program's ELOs into either generic or specific skills.

Table 2. Classification of program's ELOs as generic or subject-specific learning outcomes.

Program ELOs	Generic ELOs	Subject-Specific ELOs
1. Comply with institutional and societal regulations, and refrain from all forms of plagiarism.	√	
2. Explain important principles and theories of plant science. Have the ability to research and stay abreast of current studies.		√
3. Think critically, and draw conclusions and problem-solve via the scientific method using knowledge about plant science. Think creatively. Be able to apply and integrate knowledge with other disciplines related to plant science.		√
4. Demonstrate both leadership skills and the ability to follow others, take responsibility for assigned tasks, and manage workloads independently.	√	
5. Analyze data, communicate, and use information technology appropriately for disseminating plant science knowledge to the general public.		√

1.4 The program to show that the requirements of the stakeholders, especially the external stakeholders, are gathered, and that these are reflected in the expected learning outcomes.

During development of our curriculum, opinions and comments from all the stakeholders had been taken into consideration. Program stakeholders were defined as following: 1) academic staffs of the Department of Plant Science and Department of Pharmaceutical Botany or program, 2) current students at that time, 3) alumni from M.Sc. program in Plant Science, 4) Employer, and 5) Mahidol University. Opinions and comments from academic staffs and current students were obtained by brainstorming, questionnaire and interview. Feedbacks from alumni and employers were gathered from both questionnaires, interview and meeting. Requirements of Mahidol University on our graduate program were received in the form of comments/feedbacks/suggestions from the Peer-Review Committee during the curriculum development process (described earlier). The program's ELOs as well as program specification were drafted by taking feedbacks from stakeholders such as employers and alumni from the surveys into consideration to revise the courses in the curriculum to fullfil the knowledge and skills of the graduates to cover the needs of future workplace (Exhibit 1.1). Table 3 demonstrate the mapping of stakeholder's requirements and our program's ELOs

Table 3. Mapping of stakeholders' requirements and our graduate programs' ELOs. The symbol * indicates that the ELO reflects the need of individual stakeholders. The symbol ** means that the ELO was derived from emphasis suggested by the stakeholders.

Program ELOs	Academic Staffs	Students	Alumni	Employers	Mahidol University
1	**	*	*	**	*
2	**	*	*	**	*
3	**	**	*	**	*
4	**	**	*	**	*
5	**	**	*	**	*

1.5 The program to show that the expected learning outcomes are achieved by the students by the time they graduate.

The M.Sc. program in Plant Science aims to produce graduates excel in the Plant Science by acquiring life-long learning skills and exposure to problem-solving scenarios using interdisciplinary approach. The program is designed to support graduate students with the acquisition of ethics and morality necessary to conduct scientific research, data analysis, and research evaluation.

Students are expected to apply their knowledge and skills to complete the M.Sc. research and the national or international publication. Students will obtain feedback based on their ability and responsibility to complete the research. The ability to work as a team, and write the report will be evaluated by the committees. In addition, responsibility will be evaluated by the course coordinator through their performance on assigned tasks, while oral communication skills will be evaluated through the presentation at the end of the course by the audience in the class.

2. PROGRAM SPECIFICATION

Since 2009, Office of Higher Education Commission (OHEC), Ministry of Education, enforced the Outcome-Based Education (OBE) in Thailand in the form of Thailand Qualifications Framework (TQF), which is the regulation that all academic programs must follow. Accordingly, our Master of Science Program in Plant Sciences was formerly developed in 2004 to comply with the TQF requirement. Accordingly, our Master of Science Program in Plant Sciences was recently revised in 2023, program structure and specification were represented in the official TQF2 document (Exhibit 2.1) while course specifications are presented in the TQF3 documents.

2.1 The specifications of the program and all its courses are shown to be comprehensive, up-to-date, and made available and communicated to all stakeholders

The program specification of our Master Program in Plant Sciences is presented as the form of TQF2 (Exhibit 2.1), which provides the necessary information for stakeholders especially for prospective students, and current students. The key information regarding the study plan, program objectives, program learning outcomes, possible job after graduation, curriculum, course description, as well as list of lecturers and their qualifications are listed. The current program specification was inaugurated in the academic year of 2022 to respond to the changes in market trends of botany, plant science, and upcoming technological disruption.

The "Graduate Student Guide" (Exhibit 2.2) is comprehensive and up-to-date. It will be systematic revised if some detailed information needs to be updated (Exhibit 2.3). Program Administrative Committees monitor all teaching and learning activities throughout the academic year and annually organize a meeting between academic staffs and students in order to summarize and make appropriate plans for improvement. The students can express their satisfaction or dissatisfaction toward the teaching and learning processes and program organization. Certain feedbacks can be implemented immediately while some others that require adjustment of the program structure need to wait for the next program revision period.

At the end of the semester, course director and teaching staffs must evaluate the teaching and learning processes as well as assessment methods employed in course by taking into accounts student feedbacks. Strength and weakness information of each course will be used for improvement in the next semester. The report of each course is recorded in TQF5 (Exhibit 2.4). From these processes, it can be concluded that the information of our course specification (course syllabi) is comprehensive and up-to-date.

Both program and course specifications are disseminated to our current students, prospective students, as well as stakeholders, on the web site of the Department of Plant Science, Faculty of Science, at http://www.sc.mahidol.ac.th/scpl and the Department of Pharmaceutical Botany, Faculty of Pharmacy, at https://pharmacy.mahidol.ac.th/en/DepartmentofPharmaceuticalBotany/info/2, Mahidol University. For internal stakeholders, like lecturers, all aspect of the issues of the program and course specifications are discussed or informed in the program meeting. For students, the update "Graduate Student Guide" and course schedules are distributed. The overall program orientation meeting is held at the beginning of the first semester.

2.2 The design of the curriculum is shown to be constructive aligned with achieving the expected learning outcomes.

Contents and structures of our Master of Science Program in Plant Sciences are presented in the Program Specification (Exhibit 2.1). Here, a brief overview of the program structures and contents are explained. Figure 2 illustrates a diagram showing the overall structures of master program and the paths that students can go through from new entry to exiting the programs. Entry into the M.Sc. program requires a B.Sc. degree. The students are assessed for their achievement of ELO #3 via a qualifying examination. Before the students can continue with their graduate research, they must present thesis proposal for approval by the committees. Once the proposal is approved, the Thesis Advisory Committees will be appointed to provide guidance and to monitor the student's research progress. Upon completion of the research project with output achievement required by the programs, graduate students have to write and orally defend their thesis, all in English language. By passing all the requirements, students are awarded with the master degree.

Perspective Students		
Thai students : Bachelor's degree in Botany, Biology, Biotechnology, Pharmacy, Traditional Thai medicine GPA > 2.50	**Thai students :** Bachelor's degree in other field, GPA > 2.50	**Foreign students :** Bachelor's degree
↓ ↓ ↓ Interview ↓	↓ Application evaluated by Program Committee ↓ Interview ↓	↓ Application evaluated by Program Committee ↓ Phone or online interview (if necessary) ↓

↓

Year	Semester	Study Plan
1	1	**Basic knowledge in Plant Sciences and Pharmaceutical Botany**
		Generic Skills in Science Research, Integrative Plant Science, Integrative Pharmaceutical Botany, Elective course (6 credits)
	2	**Advanced knowledge in Plant Sciences and Pharmaceutical Botany**
		Biostatistics, Conservation and Utilization of Medicinal Plant Genetic Resources, Seminar in Plant Sciences, Elective course (6 credits)
2	1	**Research in Plant Sciences or Pharmaceutical Botany**
		Proposal Defense >Thesis Research
	2	**Research in Plant Sciences or Pharmaceutical Botany to create new knowledge and national or international publication**
		Thesis Research > Thesis writing > National or International research publication > Thesis defense > M.Sc. (Plant Sciences)

Figure 2. Diagram showing the structure of our program with the paths that students can go through, from application process toward completion or termination of the degree.

2.3 The design of the curriculum is shown to include feedback from stakeholders, especially external stakeholders.

As mentioned earlier, the program and curriculum are required to be revised every 5 years. Our program regularly collects feedback from stakeholders, including current students, graduates, alumni, instructors, and employers (Table 4). Information regarding stakeholders' comments was subjected to course improvement, program management, and curricular development.

Table 4. Methods to obtain the stakeholders' feedback

Stakeholder	Approaches	Example of issues	Frequency
Students	• Online survey • On-site meeting	• Teaching-learning process • Quality of instructors • Extra-curriculum activities	• At least twice a year (end of semester)
Graduate	• Online survey, Curriculum review	• Program satisfaction • Alignment of the courses • Skills obtained	• After thesis defense
Alumni	• Informal interview (Alumni meeting, SCPL event)	• Program satisfaction • Alignment of the courses • Skills obtained	• Occasionally
Academic staff	• Department meeting, • Informal meeting	• Problems on student skills • Duration of graduation	• Occasionally
Employers	• Informal meeting, Interview	• Graduate satisfaction • Skills missing	• Annually
External committee (Experts Persons)	• Formal meeting for curriculum development	• Knowledge and skills required	• Every 5 years (revising program)
Advisory committee	• Formal meeting for curriculum development	• Knowledge and skills required	• Every 5 years (revising program)

2.4 The contribution made by each course in achieving the expected learning outcomes is shown to be clear.

All the coursework as well as non-coursework activities within our curriculum have been designed to contribute, at least in part, to students' achievement of program learning outcome (PLOs). By integrating all teaching and learning processes along with non-coursework activities, all PLOs can be achieved. Table 5 exemplifies the alignment of PLOs and the contribution of individual courses. Table 6 further presents the assessment and key indicators for determining students' achievement of PLOs.

Table 5. Relationship between Courses of the Program and Program Learning Outcomes

Code & Course Name	Credits	PLOs				
		1	2	3	4	5
Required Courses						
SCID 516 Biostatistics	3(3-0-6)	-	I	I	-	I
SCID 518 Generic Skills in Science Research	1(1-0-2)	I	-	-	I	R
SCPL 562 Integrative Plant Sciences	3(2-3-5)	R	R	R	P	R
SCPL 672 Seminar in Plant Sciences 1	1(1-0-2)	R	R	R	P	R
PYPB 612 Conservation and Utilization of Medicinal Plant Genetic Resources	3(3-0-6)	R	R	R	M	R
PYPB 621 Integrative Pharmaceutical Botany	3(3-0-6)	R	R	R	P	R
Elective Courses						
SCPL 501 Advanced Plant Taxonomy	3(3-0-6)	-	R	R	P	R
SCPL 502 Ethnobotany	3(3-0-6)	R	R	R	P	-
SCPL 503 Pollen Biology	3(2-3-5)	-	R	R	P	R
SCPL 511 Plant Bioregulators	3(3-0-6)	-	R	R	-	R
SCPL 521 Plant Cytogenetics	3(2-3-5)	-	R	R	P	-
SCPL 522 Advanced Plant Molecular Biology	3(3-0-6)	-	R	R	-	M
SCPL 523 Techniques in Plant Molecular Biology	3(2-3-5)	R	R	R	P	R
SCPL 524 Plant Mutation	3(3-0-6)	-	R	R	P	R
SCPL 541 Advanced Plant Tissue Culture	3(3-0-6)	-	R	R	-	R
SCPL 543 Advanced Phytochemistry	3(2-3-5)	R	R	R	P	M
SCPL 544 Advanced Technique in Plant Tissue Culture	1(0-3-1)	R	R	R	P	M
SCPL 563 Plant-Microbe Interaction	3 (3-0-6)	-	R	R	-	R
SCPL 564 Plant Growth Promotion	3 (2-3-5)	-	R	R	P	R
SCPL 571 Current Topics in Plant Sciences	2(2-0-4)	R	M	M	M	M
SCPL 572 Applied Statistics for Plant Science	1 (1-0-2)	-	I	I	-	M
SCPL 611 Plant Adaptation to Environmental Changes	2(2-0-4)	-	R	R	-	R
SCPL 621 Applied Plant Genetics	2(2-0-4)	R	R	R	M	-
SCPL 671 Special Problems in Plant	2(1-3-3)	M	M	M	P	M

Code & Course Name	Credits	PLOs				
		1	2	3	4	5
Sciences						
PYPB 604 Medical Ethnobotany	3(2-3-5)	R	R	R	P	-
PYPB 607 Development of Herbal Medicine	3(2-3-5)	R	R	R	P	-
PYPB 610 Current Topics in Pharmaceutical Botany	2(2-0-4)	R	M	M	M	M
PYPB 622 Plant Database Construction and Management	3(2-3-5)	R	R	R	P	M
PYPH 695 Applied Plant Biotechnology in Pharmaceutical Sciences	3(2-3-5)	R	R	R	P	M
Thesis						
SCPL/PYPB 698 Thesis	12 (0-36-12)	M	M	M	M	M

I = ELO is introduced & assessed R = ELO is reinforced & assessed
P = ELO is practiced & assessed M = Level of Mastery is assessed

Table 6. Learning and assessment strategies for program learning outcomes evaluation

PLOs	Learning Method	Assessment
Graduates demonstrate moral and professional ethics, recognize the intellectual property rights, and respect the organization rules and social norms	1) Interactive lectures and laboratories 2) Individual and group assignments 3) Thesis	1) Behavioral observation in classrooms and laboratories 2) Assignment due dates 3) Evaluation from supervisor and thesis committee
Graduates are able to understand the concepts and principles in plant sciences and conduct self-directed learning on related topics as well as attain updated information following the current trends in plant science	1) Interactive lectures and laboratories 2) Group discussion 3) Individual and group assignments and presentations 4) Self-study and literature review	1) Written examinations 2) Evaluation of class participation and group discussion by rubrics 3) Evaluation of the quality of reports and presentations by rubrics
Graduates are able to think critically, apply their skills to conduct research leading to new findings or solutions and draw conclusions to scientific problems in the field of plant science and related areas	1) Laboratory practices 2) Group discussion 3) Seminar 4) Thesis	1) Evaluation group discussion by rubrics 2) Evaluation of quality of reports and presentations by rubrics 3) Evaluation from supervisor and thesis committee
Graduates demonstrate leadership attributes and work cooperatively as a team member with high responsibility for assigned tasks	1) Interactive lectures and laboratories 2) Group discussion 3) Group assignments and presentations 4) Extracurricular activities	1) Behavioral observation in classrooms and laboratories 2) Evaluation group discussion by rubrics 3) Evaluation of quality of reports and presentations by

PLOs	Learning Method	Assessment
		rubrics
Graduates exhibit skills in information literacy, statistical analysis, and data presentation to communicate	1) Interactive lectures and laboratories 2) Individual and group assignments and presentations 3) Seminar 4) Thesis	1) Evaluation of class participation and group discussion by rubrics 2) Evaluation of the quality of reports and presentations by rubrics 3) Evaluation from supervisor and thesis committee

2.5 The curriculum made by each course are logically structured, properly sequenced (progression from basic to intermediate to specialized courses) and are integrated.

Figure 2 shows the structure of our programs with the paths that students can go through, from application process toward completion or termination of the degree. Table 7 demonstrates the expectation of learning outcomes at the end of the academic year.

Table 7. The expectation of learning outcomes at the end of the academic year

Year of study	Knowledge, skills, and any other expected learning outcomes				
	PLO1	PLO2	PLO3	PLO4	PLO5
1st	/	/	/	/	/
2nd	/	/	/	/	/

Our Master of Science Program in Plant Sciences is a Credit-based system. To graduate, a student needs to complete all blocks of knowledge and skills in which there are coherence number of credits or adequate courses. After completing all requirements, students are expected to have acquired strong foundation in knowledge on Plant Sciences and Pharmaceutical Botany, both in breadth and depth. The curriculum encompasses 36 credits in total for M.Sc. program.

Total credits required of at least 36 credits

- Core courses 12 credits
- Elective courses *(at least)* 12 credits
- Thesis 12 credits

Integrative Plant Science (SCPL 562), Integrative Pharmaceutical Botany (PYPB 621), Conservation and Utilization of Medicinal Plant Genetic Resources (PYPB 612), Biostatistics (SCID 516), and Generic Skill in Science Research (SCID 518) are responsible for strengthening the core competencies of the master graduates by allowing the students to practice on ethical awareness, critical thinking, survey and critically review literature, formulation of research questions and hypotheses, experimental design, as well as communicating knowledge which are skills specified in ELO 1, 2 and 3. Seminar in Plant Science I (SCPL 672) further emphasize these skills through a series of seminar presentations, discussion, questions and answers which are skills specified in ELO 4. After

year with extensive coursework activities, thesis proposal examination will be taken in the first semester of the 2nd year. Thesis writing and defense as well as writing a national or international research publication are the ultimate activity to assess the students' learning outcomes which are skills specified in ELO 5.

2.6 The curriculum to have option(s) for students to pursue major and/or minor specializations.

The curriculum includes core courses that provide a foundation for the program. These courses cover the fundamental concepts and theories in the field and will be required for all students. The specializations should be based on the areas of interest of the students. Students can independently determine which areas they are most interested in pursuing. To allow students to customize their M.Sc. program to their interests and goals, the curriculum offers flexibility in the selection of both elective courses as well as electives outside of their specializations and their research topic. The research should be supervised by faculty members with expertise in the student's area of specialization.

2.7 The program to show that the curriculum is reviewed periodically following an established procedure and that it remains up-to-date and relevant to industry.

The curriculum is reviewed every five years. The committees have been formed to review the curriculum, consisting of faculty members and external committees. The committees will have diverse expertise and perspectives and will be representative of the program's stakeholders. Accordingly, the program regularly collected feedback from stakeholders, including current students, graduates, alumni, instructors, and employers from academic institutes and industry.

The committee has evaluated the trends to identify any changes or developments that may affect the program's curriculum. This includes analyzing the future perspective of jobs in the Plant Sciences and Pharmaceutical Botany area. The committees have also evaluated the program's goals and PLOs to ensure they remain relevant and aligned with the updated trends. Any changes or updates needed to the goals and learning outcomes were identified and incorporated into the curriculum.

The committee has reviewed the content of each course in the curriculum to ensure it remains up-to-date and relevant to trends, including updating course materials, incorporating new technologies, and adding new topics or areas of study. The committees seek feedback from stakeholders, including current students, alumni, and employers, to identify any areas of the curriculum that may need improvement or revision.

Based on the findings of the review process, updates and changes were made to the curriculum as needed. These changes were communicated to students and other stakeholders and implemented in a timely and effective manner. This helps to ensure that students receive a high-quality education that prepares them for successful careers in their chosen fields.

3 TEACHING AND LEARNING APPROACH

3.1 The educational philosophy is shown to be articulated and communicated to all stakeholders. It is also shown to be reflected in the teaching and learning activities.

Program educational philosophy is always presented in the Program Specifications and is available on the web site of the Department of Plant Science, Faculty of Science, Mahidol University at http://www.sc.mahidol.ac.th/scpl or the Department of Pharmaceutical Botany, Faculty of Pharmacy, at https://pharmacy.mahidol.ac.th/en/DepartmentofPharmaceuticalBotany/info/2.

The educational philosophy reflected in the program's teaching and learning activities uses active learning methods, emphasizes critical thinking and problem-solving skills, and promotes a collaborative and inclusive learning environment.

The alignment between the educational philosophy and teaching and learning activities was assessed periodically through various assessment methods, such as student feedback surveys and program evaluations. Based on the assessment results, the educational philosophy and teaching and learning activities have been revised and improved as needed. This can help to ensure that the program remains aligned with its educational philosophy and continues to meet the needs of the students and stakeholders.

3.2 Teaching and learning activities are shown to allow students to participate responsibly in the learning process.

Teaching and learning activities were designed in a way that encourages students to participate responsibly in the learning process for example, group discussions, problem-solving activities, and hands-on projects. Accordingly, setting clear expectation and providing feedback on their participation can encourage students to take responsibility for their learning and participate responsibly in the learning process.

During the COVID-19 outbreak, access to the onsite activities was limited to only serious issues or a small class; therefore, all lecture-based classes had to be switched to online mode. Students, with or without difficulties on the internet, must study at their accommodations. The disadvantages of taking an online course, such as a poor or intermittent internet connection, a lack of privacy for study, interruptions from family members, and a loss of concentration have been considered. The committee encouraged the course coordinators to provide video recordings for each class so students could attend all classes without unnecessary burden. This provided the flexibility of learning to students leading to more focus and an understanding of the knowledge and skills provided in the class.

For learning activities that can help students develop research skills, the assigned research projects that require students to use a variety of sources and to critically evaluate the information they find. Encourage students to use a range of resources, including academic journals, books, and credible websites, and to cite their sources correctly. For group discussion, encourage them to ask questions, challenge assumptions, and share their own perspectives. This can help students develop critical thinking skills and learn from each other. Writing assignments require students to synthesize information from multiple sources and to present their own ideas in a clear and concise manner. Encourage them to use evidence from their research to support their arguments. The students must present their research findings. This can help them develop their presentation skills, as well as their ability to communicate complex ideas to a general audience.

3.3 The teaching and learning activities are shown to involve active learning by the students.

Active learning implies activities that encourage thinking, discussing, investigating, and creating. Here are some teachings and learning activities in our program that are known to involve active learning by students.

Class discussions: All classes encourage students to participate in class discussions by asking open-ended questions that require them to share their opinions and ideas. This can help students develop critical thinking skills and learn from each other.

Interactive lectures: Incorporate interactive elements into lectures, such as small group discussions or activities that require students to apply course content in real time. This can help keep students engaged and focused during lectures.

Problem-based learning: Assign students problems or scenarios that they must solve using the knowledge and skills they have learned in class. This can help them apply what they have learned to real-life situations and develop problem-solving skills.

Field trips: Take students on field trips (extra-curriculum activity) to apply course content in real settings. This can help students understand how the course content is applied and develop a deeper understanding of the material.

Overall, teaching and learning activities that involve active learning by students can help them develop critical thinking, problem-solving, communication, and leadership skills, as well as a deeper understanding of the course content.

3.4 The teaching and learning activities are shown to promote learning, learning how to learn, and instilling in students a commitment for life-long learning (e.g., commitment to critical inquiry, information-processing skills, and a willingness to experiment with new ideas and practices).

Life-long learning is concerned with promoting skills and competences necessary for developing general capabilities and specific performance in work situations. Skills and competences developed are vital for how well the students can adapt their general and particular knowledge and competences to the new tasks. In this regard, the learning strategy functions as a tool to enhance their life-long learning.

Students registering thesis have to conduct the master research under supervision of advisory committees. Students are expected to develop their own research proposal, conduct research with concern of research ethics, collect and analyze data, interpret the results, report the result in terms of thesis, present and publish the research in national or international proceeding or journals. According to the thesis research, students' progress is continuously monitored by the advisory committee through regular lab/group meeting and progress report. Appropriate guidance and training are assiduously given.

During doing thesis research, students can achieve numerous skills in research competencies plus developing interpersonal communication and team-working skills with other students or researchers in the same laboratory or department. Ethical responsiveness is also enforced and monitored by the major advisor and advisory committees. All the skills achieved by the students are life-long experiences and also contribute to the accomplishment of the programs'ELOs.

3.5 The teaching and learning activities are shown to inculcate in students, new ideas, creative thought, innovation, and an entrepreneurial mindset.

In the curriculum, students have to create their own thesis proposal as part of inquiry-based learning that involves asking questions, making observations, and investigating topics in depth. This approach can help students develop an understanding of a topic as well as the ability to generate new ideas and think creatively. After that, they have to do their own research as part of the project-based learning. They must solve complex problems and think creatively. This helps students develop critical thinking skills, collaborate with others, and generate innovative solutions. The research experience can help students develop an entrepreneurial mindset, which involves a willingness to take risks, embrace uncertainty, and pursue innovative ideas. Entrepreneurship education can include activities such as business plan development, pitch competitions, and mentorship opportunities. Accordingly, the student can independently challenge themselves in different ways, i.e., by attending several types of conferences and pitching research activities, mentoring the B.Sc. in the advisor's lab, etc.

The developing of a business plan for science research can be an effective way to cultivate an entrepreneurial mindset in researchers. An entrepreneurial mindset involves a willingness to take risks, identify and pursue opportunities, and innovate in order to achieve goals.

3.6 The teaching and learning processes are shown to be continuously improved to ensure their relevance to the needs of industry and are aligned to the expected learning outcomes.

Continuous improvement of teaching and learning processes is essential to ensuring that they meet the needs of stakeholders and are aligned with ELOs. This was achieved through various means, such as ongoing feedback from stakeholders (i.e., lecturers, students, and alumni), assessment of student learning outcomes, and professional development for teachers.

To ensure that teaching and learning processes are relevant to stakeholders needs, it is important to establish strong partnerships with university and research institute leaders. These partnerships can provide valuable insights into the skills and knowledge required for success in the workplace, as well as opportunities for students to gain practical experience through internships, work placements, and collaborative projects. For example, our students have the opportunity to do internships in national and international institutes both in Thailand and abroad as also described in Criteria 8.3, Table 23.

Alignment with ELOs requires a clear understanding of the knowledge, skills, and competencies that students are expected to acquire. This can be achieved through the development of well-defined learning outcomes and assessment criteria, as well as the use of appropriate teaching and learning strategies to support student achievement. Continuous improvement of teaching and learning processes was regularly ongoing through evaluation and reflection.

Ultimately, a focus on continuous improvement of teaching and learning processes is essential to ensure that students are equipped with the knowledge and skills required for success in the workplace, and to meet the evolving needs of all stakeholders.

4. STUDENT ASSESSMENT

4.1 A variety of assessment methods are shown to be used and are shown to be constructively aligned to achieving the expected learning outcomes and the teaching and learning objectives.

The program employs teaching and learning strategies to ensure the achievement of both CLOs and ELOs. Most of core courses employ the small group discussions/presentations on scientific publications with leading questions or a set of scientific problems to promote the application of basic knowledge in order to train students with ability to integrate, translate and apply the knowledge in different fields of Plant Science and Pharmaceutical Botany. Seminars are also the learning activities that promote achievement of several programs' ELOs. Students must read papers, critically evaluate, and present via oral presentation. Finally, all students must conduct a master research, a research based on independent scientific work, which strengthens their knowledge, skills, and life-long experience. The curriculum mapping displaying contribution of individual courses toward achievement of the program ELOs is presented in Table 5. A full alignment between CLOs and programs' ELOs along with teaching and learning strategy is also listed in the course syllabi shown in Exhibit 4.1 (Course Specifications in TQF2).

Overall, by using a variety of assessment methods that are aligned with the expected learning outcomes (ELOs), teaching and learning process, and achievement indicators (Table 8), it can ensure that students are able to achieve the intended learning outcomes and develop the necessary skills and knowledge to succeed in their academic and professional pursuits.

Table 8. Assessment methods and key achievement indicators for assurance of students' attainment of the program ELOs.

Program ELOs	Teaching and Learning Process	Assessment Methods	Achievement Indicators
1. Conduct research and scientific works professionally with moral, ethics, academic integrity, discipline, and punctuality	• Orientation • Lecture/training • Learn by example • Emphasis and monitoring by major advisor and instructors	• Rubric check for written assignment and thesis • Research monitoring/lab meeting	• Passing Rubric check • No ethical misconduct • Accepted manuscript for national or international research publication
2. Critically evaluate scientific merit of up-to-date plant science and pharmaceutical botany knowledge and their integration with other related disciplines	• Lecture • Seminar • Group discussion • Assignments	• Rubric assessment • Q&A	• Approved master research proposal • Passing the thesis defense • Accepted manuscript for national or international research publication

Program ELOs	Teaching and Learning Process	Assessment Methods	Achievement Indicators
3. Create new knowledge in plant science and pharmaceutical botany or problem-solve new scenarios by analyze scientific questions and synthesize scientific information/findings using interdisciplinary approach	• Written research proposal • Thesis writing • Group discussion • Lab progress • Seminar	• Rational discussions of results in thesis or publication • Thesis progress • Q&A	• Approved master research proposal • Accepted manuscript for national or international publication
4. Demonstrate leadership, accountability, and decision-making skills in culturally diverse and multi-disciplinary team with personal and collective responsibility	• Group Assignment • Seminar/oral presentation • Lab progress • Soft skill practice	• Rubric assessment	• Ability to be team leader and member • Soft skill certificates
5. Transfer knowledge in plant science and pharmaceutical botany to audiences using adequate tools, appropriate technology, and statistics to critically evaluate the significance of scientific information and communication in an organized manner	• Lecture • Assignment/reports • Seminar/oral presentation • Thesis writing	• Written examination • Assignments • Rubric assessment for seminar/oral presentation Q&A	• Ability to explain fundamental knowledge • Ability to answer scientific questions • Passing the thesis defense

4.2 The assessments and assessment-appeal policies are shown to be explicit, communicated to students, and applied consistently.

The student assessments including timelines, methods, regulations, weight distribution, rubrics and grading are clearly defined in the detailed outlines of each course (Exhibit 4.1). Besides, it is the responsibility of each lecturer to inform their students about the course syllabus and assessment methods at the beginning of each course. To ensure that the goals of the class are fulfilled, lecturers must have adequate assessment methods and be responsible for addressing questions or complaints from students if they arise. Process performance is graded during each course. It bases on quiz, homework, seminar, presentation, report, and examination. Timeline as well as guidelines for non-coursework assessments such as qualifying examination, thesis/dissertation proposal presentation and defense are also addressed during new student orientation (Exhibit 4.2). In addition, the course syllabus for individual courses is made available online at the Department of Plant Science web site (https://plantscience.sc.mahidol.ac.th/) or the Department of Pharmaceutical Botany, Faculty of Pharmacy (https://pharmacy.mahidol.ac.th/en/DepartmentofPharmaceuticalBotany/info/2) for students and other stakeholders.

Students can directly contact the course coordinator or program coordinator to request for the course syllabus and asking question regarding to the course. Most of the courses also use Google Classroom as an additional platform that provided two-way communication between instructors and students. In case of unexpected situation, such as pandemic, the course coordinator can directly contact to all students via google classroom or the Line group of the students to sudden change.

4.3 The assessment standard procedures for student progression and degree completion, are shown to be explicit, communicated to students, and applied consistently.

Standard methods, including assessment rubrics and marking schemes, are used to ensure the validity, reliability and consistency of student assessment. Instructors are trained to understand different assessment methods and are able to design the assessment to match the learning outcomes. For the course which there is more than one instructor, the evaluation method, grading, and rubrics, are created based on the agreement among the instructor team.

For the progress in degree completion, students are encouraged to follow the study plan provided in TQF2, and in degree completion form distributed to students at the beginning of the student orientation day. All required courses in the curriculum as well as the minimum requirements for the elective courses are listed in the study plan. Prior to the registration in each semester, students are informed to take the required courses, and the confirmation process is made through the approval of advisor. Students are informed that they should pass all required courses in each semester and also register for the general courses, elective courses at a minimum credit based on the regulation to complete their study on time.

The thesis paper examination will be open to general audience and be held at the date specified in the document issued by the Thesis Defense Committee appointed by the Faculty of Graduate Studies. When the examination is complete, the Defense Committee will discuss and deliver their judgement of the examination result. The decision from individual committee member must be treated as confidential. The net result of the examination will be graded as follows:

(1) “Passed” means the student has satisfactorily completed the thesis paper and showed the ability to answer all questions asked by the Defense Committee. There are no further

corrections or additions in the thesis. The manuscript of the thesis is complete and ready to be printed and published.
(2) "Passed with Conditions" means the thesis is not satisfactorily completed and/or the student could not show ability to answer all questions asked by the Defense Committee. The Committee will require that the thesis paper be corrected or have main contents added or have the text revised. The conditions and time period for revising the thesis must be specified in order to allow the student to do so. This period, however, must not exceed 90 days or revising the thesis paper, respectively, starting from the date on which the student is informed of the examination results.

When MU applied the full credit-based system, teaching staff are responsible for all activities related to the course such as teaching, designing tests, organizing exams, marking, and publicizing the results to students; and the teaching staff must follow the approved course specification. The results of students' assessment are approved by the Dean before publicizing and storing. The assessment standards are explicit and consistent, but they must be adjusted because they depend on change of ELOs, program structure and contents and teaching and learning strategy.

4.4 The assessments methods are shown to include rubrics, marking schemes, timelines, and regulations, and these are shown to ensure validity, reliability, and fairness in assessment.

The instructors have been informed to maintain the standard for marking schemes, especially in classes with more than one instructor to mark or score students' performance and in classes where preferences may arise, such as seminars and assignments. In that case, the assessment rubric is extremely necessary to calibrate the marking schemes of all instructors. The course coordinator is responsible for creating and communicating assessment rubrics to instructors and sometimes students, and must manage the argument and find the appropriate way to normalize and create fairness in the scoring. Instructors are also responsible for improving the assessment rubric by giving suggestions or comments on the rubric. Then, if other instructors agree with the suggestion, the improved version will be distributed and used for the student assessment. In addition, after scoring is announced, students can request permission to view their own answer sheet and consult with the instructor for an explanation of the marking.

4.5 The assessment methods are shown to measure the achievement of the expected learning outcomes of the program and its courses.

As shown in Table 8, the assessment methods are designed based on the PLOs, and are revised annually according to the situation change each year. The course coordinators are in charge to design the course learning outcomes that aligned to the program learning outcomes and provide the information to the instructors in their courses. The instructors are informed to design the assessment method that matched their teaching and learning activities and the course learning outcomes.

4.6 Feedback of student assessment is shown to be provided in a timely manner.

Several courses, especially those emphasizing soft skill competencies, provide immediate feedbacks to students for improvement. For examples, in the seminar courses and the course containing assignment plus presentation, feedbacks on the strengths and weaknesses of students' presentations are made in both verbal and written comments at the

end of the presentation. Progress report conducted every semester also allows assessment of students' progression on their thesis research. Immediate feedback or comments on certain aspects of the research or technical problems are provided to the students by the advisory committees.

All lecture-based and laboratory-based courses divide the assessment to midterm and final examination. According to that, instructors are responsible for marking the students' performances and inform the course coordinators. For midterm examination, students will receive the exam score within 30 days after exam date via announcement by course coordinator. Therefore, students can see the result and can directly consult with instructors for the evaluation. In addition, the assessment of assignments and quiz also be available for students. For the seminar class, presenters in each week will receive the feedback from audiences within that day and will have a meeting with assigned instructors to discuss about possible improvements for future presentation.

4.7 The student assessment and its processes are shown to be continuously reviewed and improved to ensure their relevance to the needs of industry and alignment to the expected learning outcomes.

Feedback from students was timely collected through informal and formal approaches. Students can inform and discuss directly with the instructors during the class or with the course coordinators. At the end of the semester, all courses are subjected to being evaluated by students through the e-evaluation system. The evaluations were presented in quantitative form as a score (ranging from 1–5) and in descriptive form as suggestions or comments. The course coordinators have to report the students' evaluations in the TQF5. Response to the problems or issues related to the course has to be done with the proposed solution. The deadline for solving the issue also has to be set.

5. ACADEMIC STAFF QUALITY

5.1 The program to show that academic staff planning (including succession, promotion, re-deployment, termination, and retirement plans) is carried out to ensure that the quality and quantity of the academic staff fulfil the needs for education, research, and service.

To ensure smooth continuity on operation of our academic programs, academic staff planning have perpetually been performed. Regulation on new staff procurement is governed by the Faculty of Science, Faculty of Pharmacy and Mahidol University. The HR Unit of the Administrative and Clerical Division at the Faculty of Science or Faculty of Pharmacy constantly keep tracks and perform analysis on workforce capability and capacity needs. Workforce capacity is determined annually by the availability of positions while competency is defined by expertise needed by current and future research direction. Demand of new staff is/are requested by individual departments/units to the Deputy Dean for Administrative and compiled by the HR Unit. Approval of new staff acquisition is considered based on current and future workload of the departments/academic programs, student to staff ratio, students' and customers' requirements and expectations, present and prospective required core competencies, etc. The Faculty of Science or Faculty of Pharmacy has set the target that the students to staff ratio for any graduate program should not exceed 5:1. Individual departments/units are responsible for arranging the initial staff selection process before submitting the candidate's profile to the Faculty of Science or Faculty of Pharmacy for preapproval by the Academic Staff Recruitment Committee. Final approval of new staff hiring is carried out by Mahidol University.

At the department level, Department of Plant Science or Department of Pharmaceutical Botany generally keeps track of our academic staff in terms of teaching load, research activities, and retirement date (retirement age of 60 years old). The following conditions are considered for arranging a new staff acquisition process:

- There is academic staff retiring within the next 3-5 years
- New areas of research or teaching topics are required according to the advancement of scientific knowledge.
- Department committees screen candidates' curriculum vita for their track record in term of research competency. Candidates are then invited to give a seminar on their research work. Accordingly, the performances in terms of communication skills, ability to deliver knowledge to the audiences as well as question answering ability, etc. are evaluated. Other areas of qualification including personality and ethical awareness are further determined by direct interview. Decision is made in the department staff meeting before submitting the candidate' s profile to the Faculty of Science or Faculty of Pharmacy and Mahidol University for approval.

Both short-term and long-term planning of academic staff establishment or needs (including succession, promotion, re-deployment, termination, and retirement plans) are carried out to ensure that the quality and quantity of academic staff fulfill the needs for education, research and service. By March 2023, the MU-SCPL and MU-PYPB has 19 faculty members (Table 9); comprising 7 Associated Professors, 11 Assistant professors, and 1 lecturer. All the faculty members have Ph.D. degrees. For a short-term plan, the Department encourages and supports young lecturers to set up a plan to apply for promotion of the academic ranks at the level of Assistant Professor in the next 1-3 years. In addition, Assistant and Associate Professor are also encouraged to apply for academic promotion to the level of Associate Professor and Professor, respectively. For long-term planning, the training for

young staff and recruitment of new staff is carried out to ensure that a young staff generation is ready to take over tasks/responsibilities of the Department.

Table 9. List of the lecturers in the Department of Plant Science and Department of Pharmaceutical Botany

No.	Name	Title	Degree	Age	Number of International Publication
Department of Plant Science					
1.	Puangpaka Umpunjun	Associate Professor	Ph.D. in Science d'Agroressource	64	13
2.	Paweena Traiperm	Associate Professor	Ph.D. in Biological Science	45	49
3.	Nathinee Panvisavas	Associate Professor	Ph.D. in Plant Molecular Biology	53	28
4.	Aussanee Pichakum	Associate Professor	Ph.D. in Plant Science	61	25
5.	Thaya Jenjittikul	Assistant Professor	Ph.D. in Horticulture	60	42
6.	Ngarmnij Chuenboonngarm	Assistant Professor	Ph.D. in Bioscience	59	21
7.	Sasivimon Swangpol	Assistant Professor	Ph.D. in Biological Sciences	57	20
8.	Panida Kongsawadworakul	Assistant Professor	Ph.D. in Plant Cell and Molecular Biology	51	31
9.	Unchera Viboonjun	Assistant Professor	Ph.D. in Biotechnology	48	33
10.	Wisuwat Songnuan	Assistant Professor	Ph.D. in Genetics	43	24
11.	Alyssa B. Stewart	Associate Professor	Ph.D. in Ecology and Evolution	36	21
12.	Saroj Ruchisansakun	Assistant Professor	Ph.D. in Biology	36	14
Department of Pharmaceutical Botany					
13.	Sompop Prathanturarug	Associate Professor	Ph.D. in Pharmaceutical Biology	58	30
14.	Duangjai Tungmunnithum	Associate Professor	Ph.D. in Botany	37	48
15.	Bhanubong Bongcheewin	Assistant Professor	Ph.D in Plant Systematics	46	19
16.	Nisarat Siriwatanametanon	Assistant Professor	Ph.D. in Pharmacognosy and Phytotherapy	47	8
17.	Benyakan Pongkitwitoon	Assistant Professor	Ph.D. in Pharmaceutical Sciences	38	20
18	Methee Phumthum	Assistant Professor	Ph.D. in Bioscience	33	13

No.	Name	Title	Degree	Age	Number of International Publication
19	Thanika Pathomwichaiwat	Lecturer	Ph.D. in Phytopharmaceutical Sciences	38	9

Source: https://pharmacy.mahidol.ac.th/th/service-research.php?view=publication
https://plantscience.sc.mahidol.ac.th/?page_id=7918

5.2 The program to show that staff workload is measured and monitored to improve the quality of education, research, and service.

Staff to student ratio and workloads are constantly monitored by the Program Administrative Committees to ensure optimum quality of educational training. Qualification, number of academic staff and their workloads are presented in Table 10 while the staff-to-student ratio is shown in Table 11.

The workload of staff is monitored by SCPL committee twice a year through the performance evaluation (PE), which includes academic service hour, teaching load, and research project that matched with SCPL vision. All academic staff in SCPL are employed as full-time staffs with minimum requirement of workload at 1380 hour per year. The total FTEs of academic staffs is then considered from number of total staffs. The FTE of students is also considered based on the number of full-time students studied in each academic year as shown in Table 11. The staff-to-student ratio of our program is less than 1:7, reflecting small class that support effective teaching and learning activities.

Table 10. Table illustrating qualification, numbers and workload (FTEs) of academic staffs within the Master of Science Programs in Plant Sciences, Department of Plant Science, Faculty of Science, and Department of Pharmaceutical Botany, Faculty of Pharmacy, Mahidol University, as of academic year 2022.

Category	M	F	Total		Percentage of PhD
			Headcounts	FTEs*	
Professor	-	-	-	-	-
Associate Professor	1	6	7	813.60	100%
Assistant Professor	3	8	11	1627.20	100%
Lecturer	-	1	1	135.60	100%
Total	4	15	19	2576	100%

*FTE calculation is presented in more detail in Exhibit x.x using average number of students/staff of 1.

Source: https://pharmacy.mahidol.ac.th/th/service-research.php?view=publication
https://plantscience.sc.mahidol.ac.th/?page_id=7918

Table 11. Table illustrating staff to student ratio of the Master of Science Programs in Plant Sciences, Department of Plant Science, Faculty of Science, and Department of Pharmaceutical Botany, Faculty of Pharmacy, Mahidol University during 2022-2016.

Academic Year	Number of Academic Staffs	Total FTEs of Academic Staffs	Total FTEs of Students*	Staff-to-Student Ratio
2016	18	4412	50112	1 to 11.4
2017	18	4426	34092	1 to 7.7
2018	19	4284	45332	1 to 10.6
2019	19	3234	31710	1 to 9.8
2020	20	3212	31966	1 to 10
2021	20	3234	20656	1 to 6.4
2022	19	2576	17418	1 to 6.8

*FTE calculation is presented in more detail in Exhibit 6.1
Source: https://graduate.mahidol.ac.th/thai/staff/

5.3 The program to show that the competences of the academic staff are determined, evaluated, and communicated.

The teaching and research competencies of academic staff are identified during the selection process before joining the program through the Department of Plant Science or Department of Pharmaceutical Botany. In addition to a strong track record in research, the potential contribution of prospective staff toward teaching topics is also determined. Once employed, the teaching competence of academic staff is evaluated every semester via students' feedback on the overall course and individual instructors. Research competency is basically monitored by the publication outputs of each staff member. A grace period is given to newly-recruited staff as settling a new research laboratory usually takes a few years to generate the first research output. Moreover, Mahidol University and the Faculty of Science or Faculty of Pharmacy also enforce systems called Performance Agreement (PA) and Performance Evaluation (PE). PA is a promise that academic staff make to the department each year regarding their job responsibilities and outputs. The department can then compile the target achievements from the academic staff to come up with a PA with the Faculty of Science or Faculty of Pharmacy; the latter, in turn, can make a promise to Mahidol University. PE is the actual evaluation process used to determine staff members' performance. Before the start of any academic year, the departmental staff meets to come up with a consensus evaluation criterion to be used by taking into account problems faced during staff evaluation in the previous year.

The Department of Plant Science, Faculty of Science or the Department of Pharmaceutical Botany, Faculty of Pharmacy continuously keep track of the research activities of academic staff. Research grants and publication outputs are parts of the PE criteria. The status of research output in terms of international publications is reported monthly in the staff meeting. A summary of the number of international publications by academic staff for each academic year is presented in Table 12; a detailed list of publications is also available on the Faculty website at https://science.mahidol.ac.th/th/research/output.php.

Our academic staff holding Ph.D. degrees are required to engage in active research and have at least one publication per year, either a paper in the national leading journal or a presentation at a national professional conference. And 50% of the publications must be in international journals or at international conferences. Through their research, the academic

staff can both enhance their research competence and provide opportunities for students to take part in research activities. The academic staff can share their research results through national and international seminars, workshops, and conferences. During 2016–2022, the academic staff from the Department of Plant Science and Department of Pharmaceutical Botany achieved 131 scientific international publications. All research projects have been supported by national or international organizations in various fields. The scientific activities of the Department of Plant Science and Department of Pharmaceutical Botany have increasingly advanced plant science and pharmaceutical botany knowledge in both quantity and quality, expanding partnerships with national and international organizations. Our M.Sc. program in Plant Sciences is the only international master program in Thailand. In terms of benchmarking, obtaining comparable information is important, but its availability is quite limited.

One of the main components of demonstrating competency in research is to regularly publish research findings in international scientific journals. The scientific activities of SCPL or PYPB have increasingly advanced plant science and pharmaceutical botany knowledge in both quantity and quality, expanding partnerships with national and international organizations.

Table 12. Number of research output as international publications of academic staffs within the Master of Science Program in Plant Science at the Faculty of Science and Faculty of Pharmacy, Mahidol University during 2022-2016.

Academic Year	Number of International Publications by Academic Staffs	Number of Active Academic Staffs	No. of Publications per Academic Staff
2022	45	19	2.3
2021	30	20	1.5
2020	50	20	2.5
2019	36	19	1.8
2018	22	19	1.2
2017	20	18	1.1
2016	24	18	1.3
2015	16	18	0.8

Source: https://pharmacy.mahidol.ac.th/th/service-research.php?view=publication
https://plantscience.sc.mahidol.ac.th/?page_id=7918

5.4 The program to show that the duties allocated to the academic staff are appropriate to qualifications, experience, and aptitude.

This program regularly assesses the performance of academic staff by taking into account factors such as their teaching effectiveness, research productivity, and service to the institution and community.

The evaluation was structured to ensure that duties are allocated in a way that is consistent with the qualifications, experience, and aptitude of each academic staff member. The staff has opportunities for professional development, such as workshops and seminars, to support staff members in developing their skills and expertise in areas relevant to their duties. This can help to ensure that staff members are better equipped to perform their assigned duties effectively and efficiently.

Additionally, regular communication between academic staff members and their mentors can be established to ensure that duties are appropriately assigned and reviewed over time. This can help identify areas where staff members may require additional support or training to improve their performance, especially for supporting staff. This can help to ensure that staff members are able to perform their roles effectively and contribute positively to the institution's academic mission.

5.5 The program to show that promotion of the academic staff is based on a merit system which accounts for teaching, research, and service.

It is generally expected that promotions are awarded based on merit by taking into account the faculty member's achievements in teaching, research, and service. Here is a program to show that promotion of academic staff is based on a merit system that accounts for these three areas:

Teaching merit has been evaluated based on the faculty member's ability to deliver quality instruction and support the academic development of students. The following criteria may be considered in evaluating teaching merit: course design and development, teaching effectiveness and student engagement, curriculum development and innovation, and supervision of graduate students.

Research merit has been evaluated based on the faculty member's ability to conduct significant research and contribute to their academic field. The following criteria may be considered in evaluating research merit: publications in peer-reviewed journals and international conference proceedings; funding from external agencies; patents and intellectual property rights; research impact; and recognition.

Service merit has been based on the faculty member's ability to contribute to the academic community and society at large. The following criteria may be considered: leadership and involvement in academic and professional organizations, peer-review of scholarly work, contribution to institutional and departmental governance, public outreach, and community engagement.

5.6 The program to show that the rights and privileges, benefits, roles and relationships, and accountability of the academic staff, taking into account professional ethics and their academic freedom, are well defined and understood.

The university develops clear policies and guidelines that define the rights and privileges, benefits, roles and relationships, and accountability of academic staff. These policies and guidelines are accessible to all academic staffs and regularly updated to ensure they remain relevant and effective. New academic staff receive orientation and training that familiarizes them with the policies and guidelines of the university, including their rights and responsibilities as academic staff members. This helps ensure that all academic staffs have a common understanding of what is expected of them.

Professional ethics have been taken into account in defining the rights and responsibilities of academic staff. The university is concerned that all academic staffs understand and adhere to ethical principles, such as academic integrity, respect for intellectual property, and confidentiality.

For academic freedom, the academic staffs have the freedom to pursue their research and teaching interests without fear of retribution or censorship. For performance evaluation, the evaluation system is transparent and fair and holds academic staff accountable for their work. The system includes clear criteria for evaluation and a process for feedback and improvement.

5.7 The program to show that the training and developmental needs of the academic staff are systematically identified, and that appropriate training and development activities are implemented to fulfil the identified needs.

It is typical that newly recruited staff do not understand rules, regulations, expected responsibility, promotion tracks, teaching philosophy, etc. Mahidol University each year organizes workshops to train/educate/provide young staff with such information. Moreover, Mahidol University has focused on training outcome-based education (OBE) to academic staff during the annual workshop. This is to ensure that the educational philosophy of the university is deployed directly to the staff. The Faculty of Science or Faculty of Pharmacy also organizes the equivalent retreat or workshop on providing guidance for research grant hunting or helping setup research collaboration. Our entire academic staff actively conducts research and teaches in the area of plant science and pharmaceutical botany. Similar to any academic program in science around the world, learning new knowledge and strengthening the research competencies of academic staff can be achieved by allowing staff to attend scientific conferences, especially the international meetings. The Department of Plant Science or Department of Pharmaceutical Botany offers financial support to allow all academic staff to attend a national-level meeting once a year. For international conferences, the department, together with the Faculty of Science, Faculty of Pharmacy and the Faculty of Graduate Studies, offer a partial travel grant for the academic staff to attend. The number of available travel grants, depending on the available budget, is determined each year at the staff meeting.

5.8 The program to show that performance management including reward and recognition is implemented to assess academic staff teaching and research quality.

The Department of Plant Science, Faculty of Science, or Department of Pharmaceutical Botany, Faculty of Pharmacy and Mahidol University realize that rewards and recognition play a key role in motivating academic staff. Every year, Mahidol University announces many awards in recognition of academic staff who devote themselves to the best of their duties, primarily teaching and research. Examples of such awards include the Mahidol University Prize for Excellence in Research, the Mahidol University Prize for Excellence in Teaching, the Outstanding Lecturer Award from the Council of Mahidol University Faculty Senates, etc. In conjunction with Mahidol University, the Faculty of Science or Faculty of Pharmacy also announces an Outstanding Staff Award annually in recognition of academic and support staff with distinguished performances. Also available is a publication reward for academic staff who publish research outputs in high-quality international journals indexed by respectable databases, such as Scopus or ISI. The reward is in the form of prize money, the amount of which depends on the quality of the article and the staff's role in the authorship. In addition to the prize money, academic staff with qualified publication records are also eligible for promotion from lecturer to assistant professor, associate professor, and full professor, the process of which follows the rules and regulations of Mahidol University. Details on the criteria and guidelines for academic promotion at Mahidol University can be viewed at https://muic.mahidol.ac.th/eng/research-2/academic-promotion-request/. To facilitate the academic promotion processes, the Faculty of Science or Faculty of Pharmacy offers a proofreading service for the required documents and paperwork to ensure a high success rate of the applications.

6. STUDENT QUALITY AND SUPPORT

6.1 The student intake policy, admission criteria, and admission procedures to the program are shown to be clearly defined, communicated, published, and up-to-date.

In this criterion, systems employed by our graduate programs for student quality and support, starting from admission to graduation, are explained as follows: Admission criteria and policy for new graduate students are explicitly defined and communicated in the Program Specification, made available on the Department of Plant Science or Department of Pharmaceutical Botany web site and on the admission web site at the Faculty of Graduate Studies (https://graduate.mahidol.ac.th/inter/?p=curriculum&id=2130D01G). Prospective students can apply online via the Faculty of Graduate Studies at https://graduate.mahidol.ac.th/inter/. The candidates are screened by their overall undergraduate GPA. The applicants are then subjected to an interview in English, and their overall performance is judged using a rubric scale (Exhibit 6.1). The overall rubric assessment score must be at least 75%. In the event that the score is lower than 75%, the students are not admitted.

Methods and criteria for the selection of students are evaluated and discussed among academic staff within the Department of Plant Science or Department of Pharmaceutical Botany every year after the admission period is over. If specific issues arise during the admission process, solutions are sought, and revisions to the admission process will be made in the subsequent years.

Table 13 summarizes the admission statistics of our graduate programs in terms of the number of applicants and the number of admitted students. Our program has set a target of recruiting 5 M.Sc. students per year. Although the ratios of students who applied vs. those who enrolled in the programs suggest that the level of competitiveness is not very high, the program has indeed attracted undergraduate students from other universities in Thailand. In addition, most of the students admitted to our program also have scholarship support to cover their educational and living expenses. Such scholarships significantly reduce the operation cost of the program because the master program in Plant Sciences offers partial funding for students who do not have the financial support. Table 14 further shows the accumulation of our students each year.

Table 13. Number of student applicants vs. number admitted and enrolled in the M.Sc. Program in Plant Sciences at the Department of Plant Science, Faculty of Science, and Department of Pharmaceutical Botany, Faculty of Pharmacy, Mahidol University during 2022-2016.

Academic Year	Master Degree Program Applicants			
	Number Applied	Number Offered	Number Enrolled	Ratio Applied/Enrolled
2022	2	2	2	1:1
2021	2	2	2	1:1
2020	1	10	1	1:1
2019	7	10	7	1:1
2018	8	7	5	1.6:1
2017	7	5	6	1:1
2016	6	6	6	1:1

Source: https://graduate.mahidol.ac.th/thai/prospective-students/

Table 14. Number of students enrolled in the M.Sc. Program in Plant Sciences at the Department of Plant Science, Faculty of Science, and Department of Pharmaceutical Botany, Faculty of Pharmacy, Mahidol University during academic year 2016-2022.

Academic Year	Number of Master Students						Total
	1st Year	2nd Year	3rd Year	4th Year	>4th Year	Drop out	
2022	2	2	1	3	2	-	10
2021	2	1	7	1	1	-	12
2020	1	7	2	2	1	-	13
2019	7	5	5	5	2	-	24
2018	5	5	7	2	-	1	20
2017	6	5	9	6	12	0	38
2016	5	7	5	11	-	3	31

Source: https://graduate.mahidol.ac.th/thai/prospective-students/

6.2 Both short-term and long-term planning of academic and non-academic support services are shown to be carried out to ensure sufficiency and quality of support services for teaching, research, and community service.

Students are continuously monitored from the first year until they graduate by major advisor. First year students who have not chosen the major advisor yet are monitored and advised directly by the major academic adviser or program director. From the second year onward when the students choose their own major advisor, such monitoring job is then transferred to the major advisor. During the time that students are taking the coursework, they are monitored in terms of the courses they take and the grades they receive for each course. This is because the regulation by Mahidol University imposes that, for master students to graduate, the cumulative GPA must be at least 3.00. Should the students' cumulative GPA is below the requirement, they are advised to take additional courses. After the students finish all their coursework and present their thesis proposal, they are required to have a progress report on their research advancement every semester. The progress report is in the form of open oral presentation on students' cumulative results to the academic staffs. The program director and major advisor can also monitor the student registration and progress via the online monitoring tool offered by the Faculty of Graduate Studies (http://www.grad.mahidol.ac.th/en/facultystaff/). Every month, key issues on students' progression and situations, i.e. grades, qualifying examination, thesis proposal, overdue students, etc. are discussed among academic staffs. Students who fail any coursework or non-coursework activities, especially the required courses, are to be closely supervised and monitored by the advisors, course coordinator as well as by the program director.

6.3 An adequate system is shown to exist for student progress, academic performance, and workload monitoring. Student progress, academic performance, and workload are shown to be systematically recorded and monitored. Feedback to students and corrective actions are made where necessary.

Academic advices are given to new coming first year students during program orientation by the program director and academic adviser. The program director and academic adviser are also responsible for providing appropriate academic advices as well as

helping solve various technical issues (registration, credit transfer, financial problems, etc.) throughout the first year of study. Once the students appoint their own major advisor, the advices are direct responsibility of the advisor with monitoring from the program director for the overall progress of the students.

6.4 Co-curricular activities, student competition, and other student support services are shown to be available to improve learning experience and employability.

Besides the advisory and awarding systems, from time to time the Department of Plant Science, Department of Pharmaceutical Botany as well as the Faculty of Science or Faculty of Pharmacy organize special seminars by foreign visiting professors/researchers. Students are encouraged to attend such seminars to expand their scientific vision as well as to strengthen their motivation on research. The students can also learn how to deliver effective oral presentation from a regular seminar class.

From the first year onward, students can work part-time as teaching assistant (TA) to gain financial support. Students aiming for a job in academic institution are encouraged to work as a TA at least once to gain basic skills on teaching/handling undergraduate students. Several academic staffs within our master program also hold research grants or external scholarship that allow stipend support for students under his/her supervision.

6.5 The competences of the support staff rendering student services are shown to be identified for recruitment and deployment. These competences are shown to be evaluated to ensure their continued relevance to stakeholders needs. Roles and relationship are shown to be well-defined to ensure smooth delivery of the services.

Recruitment of new supporting staff begins with defying job description and qualification of the available position by the corresponding unit. Job description and qualification are important piece of information for proper deployment of the missions. Announcement of the vacant position is always made available on the announcement board and on the web site of the Faculty of Science or Faculty of Pharmacy. In the announcement, information on the position, job description, qualification, application process, selection method(s) are clearly presented.

For supporting staff to be recruited to the Department of Plant Science or Department of Pharmaceutical Botany, the departmental chairperson assigns a committee, usually includes the retiring staff in that position, to come up with the job description, exam questions (if applicable) and interview criteria. For supporting staff career progression, the Department of Plant Science or Department of Pharmaceutical Botany and the Faculty of Science or Faculty of Pharmacy both follow the regulations and guidelines of Mahidol University. Detail information about the regulation and guidelines are available at the Human Resource Division web site (https://muhr.mahidol.ac.th). Supporting staff can be promoted to more advanced position, for example from Practitioner to Senior Professional to Expert and to Advisory level, depending on the expertise and credentials.

Competencies of supporting staff have been identified since the recruitment process as indicated in the qualification of applicants. Each fiscal year, similar to the academic staff, every supporting staff member must also sign a Performance Agreement (PA) form with the head of the unit (departmental chairperson, assistant or deputy dean). Staff are then allowed to perform their tasks and their performances are evaluated every 6 months using Performance Evaluation (PE) form. In academic year 2023, the evaluation will be performed every year. Strengths, weaknesses and areas for improvement are then provided as feedbacks to individual staff to step up their performances.

Reminiscent of the HR planning for staff recruitment, training and developmental needs of supporting staff can be identified from both top-down and bottom-up directions. As described earlier, heads of each operating units are responsible for routine monitoring of the workload vs. number and competency of workforces for accomplishment of strategic action plans. In case that certain areas of staff competencies need to be further developed or trained, the department/unit can make plans accordingly. For examples, the IT staff can be trained on new tools like "Google Workspace for Education Plus" that the university or Faculty of Science or Faculty of Pharmacy purchased in order to further help train other personnels. In addition, laboratory staff at the Central Instrument Facility are often sent to seminars and trainings organized by the equipment companies for latest updates on technical advancement or new effective procedures that the current machines can perform, etc. For top-down policy, the executive team can also initiate the trainings for supporting staff that suit the prospective outlook or strategic plan of the Faculty of Science or Faculty of Pharmacy. Examples of such top-down initiatives include the training for English proficiency skills of supporting staff (to accommodate AEC), especially those who have TOEIC score less than 400, and a Team-Building Workshop that stimulate a team-working mindset.

Following the same approaches to stimulate and motivate academic staff, supporting staff at Mahidol University are also entitled for rewards and recognitions for their efficient and productive work processes and outcomes. Both Mahidol University and Faculty of Science or Faculty of Pharmacy announce Outstanding Staff Awards every year for excellent supporting staff who performed well on their respective duties (https://science.mahidol.ac.th/th/award.php for a list of exemplary staff and the awards they received). Other than awards and rewards, Mahidol University and the Faculty of Science or Faculty of Pharmacy also provide various kinds of pension and welfare benefits to every staff. For a full list and information on such benefits, please visit https://muhr.mahidol.ac.th.

6.6 Student support services are shown to be subjected to evaluation, benchmarking, and enhancement.

At the Stang Mongkolsuk Library, support services are analyzed yearly through a customer satisfaction survey. Both the Educational Affairs Division and the Classroom Appeal Form were subjected to the response of the staff involved. The program administrator for student service has consistently been regarded as a friendly and helpful individual, as shown by the graduate survey from each academic year and the interview. The purpose of evaluation is to identify areas that require improvement and determine the overall effectiveness of the services. For example, during the COVID pandemic, the equipment included computers or laptops, high-speed internet connections, webcams, microphones, and other hardware and software required for online classes, assignments, and exams. Moreover, the COVID-19 pandemic has had a significant impact on students' lives and education. To help students during this challenging time, the university has implemented various measures to provide support and assistance, including: mental health support, financial assistance, technology support, flexible learning options, communication, and resources. Overall, providing support and assistance to students during the COVID-19 pandemic is crucial for ensuring that they can continue their education and achieve their academic goals despite the challenges they may face.

7. FACILITIES AND INFRASTRUCTURE

7.1 The physical resources to deliver the curriculum. Including equipment, material. And information technology, are shown to be sufficient.

Our Master of Science Program in Plant Sciences at the Faculty of Science and Faculty of Pharmacy, Mahidol University aims to provide international quality of teaching and learning experiences to our graduate students. In doing so, facility and infrastructure are allocated sufficiently and efficiently by the Department of Plant Science and Department of Pharmaceutical Botany and by the Faculty of Science and Faculty of Pharmacy. In addition to standard teaching facilities and environments, advanced scientific equipment is the key resource that allows our students to conduct international-standard frontier research. In this criteria, elaboration of resources and infrastructure essential for operation of our graduate programs are presented as follows.

Our program employs both in- and off-department facilities and equipment. The Department of Plant Science has available 1 classroom, 1 conference room, 1 common room and several laboratory rooms. The Faculty of Science possesses a number of large lecture halls and small classrooms. The Department of Pharmaceutical Botany has available 1 classroom, 1 common room and several laboratory rooms. The Faculty of Pharmacy possesses 7 large lecture halls, 27 small classrooms and several laboratory rooms. All of them are available for the academic programs within the Faculty to use upon request or reservation. All lecture halls and rooms are air-conditioned and equipped with computer and LCD projector as well as visualizer. White/black board is also available for certain teaching strategies that require classical approaches. Most teaching and learning processes are conducted using classroom and facilities within the Department of Plant Science and Department of Pharmaceutical Botany. From satisfaction survey of our students, teaching and learning facilities are adequate. Should there be any malfunction of any teaching and learning facilities within the lecture halls/classrooms, staffs and students can report to responsible persons for immediate fix and solution.

7.2 The laboratories and equipment are shown to be up-to-date, readily available, and effectively deployed.

The Department of Plant Science possesses laboratory spaces allocated to all academic staffs to conduct their research. Each laboratory has basic equipment for research in the field of Plant Science i.e. Taxonomy, Anatomy, Physiology, Molecular Biology and Genetics, Tissue culture. In addition, there are central equipment facility rooms containing more expensive equipment shared by all staffs and students i.e. real-time qPCR, deep freezers, spectrophotometers, floor centrifuges, fluorescence microscopes, sliding microtome etc. Custodians are assigned for individual equipment to ensure proper usage and maintenance.

For more advanced and very expensive equipment, the Faculty of Science also makes available the Central Instrument Facility (CIF) please visit https://science.mahidol.ac.th/scre/booking/. Equipment available in the CIF include nano LC-MS/MS, GC-MS, HPLC, FPLC, flow cytometer, real-time PCR, confocal fluorescence microscope, spectrophotometers, ultra and preparative centrifuges, etc. For a complete list of equipment made available at the CIF, please visit http://www.sc.mahidol.ac.th/scre/cif/. A technician is assigned for each instrument at the CIF to help students who need guidance and training. For advance visualization of cell and molecular images, the Faculty of Science also hosts an Olympus Bio-imaging Center that, in collaboration with the company, provides the

most advanced instruments including confocal and fluorescent microscopes. Other than scientific instruments, the Faculty of Science also has Central Animal Facility (CAF, https://science.mahidol.ac.th/caf/) to provide services regarding animal model for research experiments needed by certain academic staffs/researchers.

The Department of Plant Science and the Faculty of Science have also allocated budget for regular equipment maintenance. In addition, list of prioritized in-need instruments is also drafted to make annual budget request to the government for approval. Should the requested proposal be approved, the Department of Plant Science or the Faculty of Science then proceed with the purchase procedure.

The laboratories and equipment at Faculty of Pharmacy are available for staff and students and are adequate and updated to support education and research. About 10 laboratory rooms are available; each laboratory has basic equipment for research in the field of sciences. List of overall laboratory equipment and maintenance activity of the program is available on the website at http://10.8.51.1/web/maintain.php.

For in vivo study, Faculty of Pharmacy has the animal rooms in the 8th floor of Theparat Building. After permission from the Faculty committee of animal use and care protocol, staff and students can order animals (rats and mice) from study and research. There is one staff to take care animals in general and one veterinarian to take care the animal health.

7.3 A digital library is shown to be set-up, in keeping with progress in information and communication technology.

Stang Mongkolsuk Library, located at the Faculty of Science, Mahidol University, can be considered the state-of-the-art science library in Thailand. The library contains more than 10,000 books both in the form of hardcopy and online resources.

Faculty of Pharmacy has a library with adequate and updated resources to support education and research. Staff and students of MUPY use the Pradit Hutangkula Library on the 2nd floor of Rajcharat building which has about 800 relevant textbooks and international pharmaceutical journal. The Faculty of Pharmacy Library is one of the branch libraries of MU and is connected to the main MU library by the computer data base MULINET.

In addition, together with Mahidol University, the library subscribes to major journals and online databases in science and medicine. With the emphasis on instilling 21st century skills in our students, online resources play very important roles in the teaching and learning processes of our graduate programs. The official web site of the Stang Mongkolsuk Library (https://stang.sc.mahidol.ac.th/en/index.php) provides online tools for students and staff to search an online database for literature in the form of eBooks or journal articles related to their own research area from anywhere. The web site also provides links to other main online resources that can be useful to teaching and learning processes. Students can even renew the loaned book from home. Moreover, the Stang Mongkolsuk Library also offers a "Journal on Demand Service" that helps students and staff obtain hard copies of the research articles unavailable via regular subscription at the library or Mahidol University within a few days. There is also a "Book Delivery Service," where students can ask the library to help loan the book from other libraries all over Thailand and have it ready for pick up at the Faculty of Science. The service quality of the library has been continuously evaluated. For complete archives of the satisfaction surveys conducted by the Stang Mongkolsuk Library, please visit https://stang.sc.mahidol.ac.th/survey/survey.php. Our graduate programs also asked our own students for their satisfaction toward the library resources, most students are satisfied with the library service offered by the Stang Mongkolsuk Library at the Faculty of Science, Mahidol University.

7.4 The information technology systems are shown to be set up to meet the needs of staff and students.

According to current situation where learning device is not limited to only computer, tablet, notebook, and even mobile can also be part of e-learning platform. Students can own themselves personal learning devices at reasonable price, however, additional supports are required. The resource provided by MU and SC for Operating system, software and applications are available to be downloaded, updated, and used with legal license (http://softwaredownload.mahidol/), such as Windows, anti-virus, Microsoft office, Endnote, WebEx, Zoom. Additionally, the G-suite and Office 365 are also provided to support learning from any mobile device. Moreover, Faculty of Science; Stang Mongkolsuk Library regularly sets up valuable special training programs for staff and students during the year. For example, they introduced how to use EndNote 20 software for collecting bibliography data from several famous research databases and PDF full text and how to use Full Text Access Tools: Unpaywall and EZProxy Redirect for using browser extensions to help access full-text research articles from open access or subscribed databases by the institution easily and quickly (https://stang.sc.mahidol.ac.th/training/v2). Staff and students can also suggest the training program they require to support their work and activities.

Faculty of Pharmacy provides computer services and internet connection for all staff and students through the MU infrastructure. Faculty of Pharmacy all provides PC clients system in the Information Technology unit, every department. Faculty of Pharmacy offers 4 personal computers for staff and student use in the computer room (7^{th} floor of Rajcharat Building). These computer rooms are used for practical teaching and use for special software for design, analysis and computation. The computer rooms open from 8.30 to 17.00 Monday to Friday for students to practice with software or to prepare their thesis. Information technology unit has a wireless network with 50 points in all area of the faculty. This network facilities online educational management and training services so the learning activities inside and outside the classroom are available all the times for students. Each student has a free account to access MU wireless network anywhere and able to send and receive learning materials. At the university level, MU provided the licensed software such as Microsoft office, Endnote, SPSS and etc. for all staff and student s which they can download to support teaching and learning activities and benefit to their research work.

7.5 The university is shown to provide a highly accessible computer and network infrastructure that enables the campus community to fully exploit information technology for teaching, research, service, and administration.

Internet access and electric sockets are also available around the campus. Free WiFi is available for students and is routinely upgraded. Currently, students and staff can use their university accounts to get WiFi for more than one device on any university campus. In addition, students can access the intranet and database from outside campus via VPN. In addition, a free mobile internet package was provided for all students during the COVID-19 pandemic situation.

7.6 The environmental, health, and safety standards and access for people with special needs are shown to be defined and implemented.

The Faculty of Science at Phayathai Campus is considered the green zone containing a lot of large trees and plants. Wheelchair access is possible through almost every part of the campus. Pray rooms are available for people with Islamic religion. The whole campus is also

a smoke-free zone. Safety is ensured by patrolling of security guard during day and night. To create a healthy lifestyle in the campus, several sport facilities, such as a football field, tennis courts, a large multipurpose gymnasium, a fitness center, and a swimming pool, are provided for students and staff. Should any students or staff have health issues, an infirmary room is available with medical doctor standing by during specific time of the day. For off schedule or severe health problems, Ramathibodi Hospital is right next to the campus and medical assistance is readily available. Medical insurance is also incorporated into the students' registration fee.

Since conducting research is a crucial part of our graduate programs, health and safety issues are of primary concern. To minimize such issues, all first-year students are required to attend a safety training (including biosafety, chemical safety, and fire safety) organized by the Faculty of Science. Fire alarm drill is also practiced every year. The Faculty of Science also arrange a warehouse for proper disposal of hazardous waste. All toxic and hazardous wastes must be deposited in the warehouse before further disposal by professional outsourced companies.

The University aims to instill the importance of safety and security in our researchers, lecturers, students, and personnel when using facilities on campus, especially research laboratories. Therefore, to raise and maintain standards, there is collaboration in the implementation of the Enhancement of Safety Practice of Research Laboratories (ESPReL) to achieve the following goals: to enhance the safety of students, faculty, and staff; to establish strict safety standards for all university laboratories; and to prioritize instilling a safety mindset in all students, faculty, and staff. One laboratory in the Department of Plant Science has passed the ESPReL criteria since 2022.

7.7 The university is shown to provide a physical, social, and psychological environment that is conducive for education, research, and personal well-being.

On the university's main campus, Salaya, there are facilities available to support both a physical and social environment, such as dormitories, sports facilities, a running track along the campus, a central library, a canteen, a coffee shop, a convenience store, a communal space, and many more. The concert and event, arranged by the students in another department, as well as the social club of students, are also provided. Occasionally, students can attend the orchestra concert at Prince Mahidol Hall for free or with a special discount. Free transportation is also available on campus or between campuses. The shuttle bus between Salaya and the nearby BTS station is also provided at a reasonable price.

For the Phayathai campus, MUSC provides a sports center for students and staff to do physical exercise, including fitness, a swimming pool, basketball, and a football field. Little gardens around campus are also available to offer a calm and relaxing environment. The security guards provided by SC offer help and a safe environment around the campus, especially during the night. For SCPL students, we have a common room and seating area for meals and socializing, as well as a meeting room for supporting students' activities.

7.8 The competences of support staff rendering services related to facilities are shown to be identified and evaluated to ensure that their skills remain relevant to stakeholder needs.

Besides academic staff, support staff are equally important to fulfill the educational goals of our graduate program. Department of Plant Science, Faculty of Science, or Department of Pharmaceutical Botany, Faculty of Pharmacy, Mahidol University together help monitor and make adequate plans regarding supporting workforces. Number and

competency of staff involved in each mission and plans are examined annually by both the HR Unit of the Administrative and Clerical Division, Faculty of Science and by individual units/departments including Department of Plant Science or Department of Pharmaceutical Botany. Table 15-18 below summarize the current numbers and competencies of supporting staff associated with key facilities that play important roles in operation of our graduate programs such as library, laboratory, IT and student services.

Table 15. Number of laboratory supporting staffs and their educational background at both departmental level and the Faculty of Science or Faculty of Pharmacy level along with their relevance toward the programs' teaching and learning approaches (TLA).

Affiliation of Laboratory Personnel	Highest Educational Attainment				Total	Relevance to Program TLA
	High School	Bachelor's	Master's	Doctoral		
Department of Plant Science	0	2	0	0	2	Student training, technical guidance, equipment custodian
Faculty of Science: Central Instrument Facility or CIF[1]	0	3	5	0	8	Equipment custodian, technical guidance, laboratory services
Faculty of Pharmacy	0	11	7	0	18	Scientist, research assistant, research officer

Source: http://www.sc.mahidol.ac.th/scre/cif/staff.htm for list of staffs at Central Instrument Facility

Table 16. Number of library supporting staffs and their educational background at the Library, Faculty of Science or Faculty of Pharmacy along with their relevance toward the programs' TLA.

Affiliation of Laboratory Personnel	Highest Educational Attainment				Total	Relevance to Program TLA
	High School	Bachelor's	Master's	Doctoral		
Stang Mongkolsuk Library	2	6	6	0	14	Book search and loan, journal and database search
Faculty of Pharmacy	0	11	1	0	12	Student service /educator

Source: https://stang.sc.mahidol.ac.th/about/staff.php for list of staffs at Stang Mongkolsuk Library

Table 17. Number of IT supporting staffs and their educational background at the Faculty of Science and Faculty of Pharmacy along with their relevance toward the programs' TLA.

Affiliation of Laboratory Personnel	Highest Educational Attainment				Total	Relevance to Program TLA
	High School	Bachelor's	Master's	Doctoral		
Stang Mongkolsuk Library[1]	0	4	2	0	6	Electronic resources and technical advices: eBooks, eJournals, eLibrary, eDatabase, software training, IT training and seminar
System Development and Technology Division[2]	0	4	4	0	8	Computer software and hardware technical services, network services, IT consultant, computer laboratory services
Faculty of Pharmacy	0	4	1	0	5	IT specialist, Audio-visual technique officer

Source: https://stang.sc.mahidol.ac.th/about/staff.php for list of IT staffs at Stang Mongkolsuk Library
http://science.mahidol.ac.th/sosd/index.php/en/2013-01-31-07-00-31/2016-03-14-08-31-13 for list of IT staffs at System Development and Technology Division

Table 18. Number of student affair personnel and their educational background at both the Department of Plant Science, Faculty of Science and Faculty of Pharmacy along with their relevance toward the programs' TLA.

Affiliation of Laboratory Personnel	Highest Educational Attainment				Total	Relevance to Program TLA
	High School	Bachelor's	Master's	Doctoral		
Department of Plant Science	0	2	0	0	2	One stop services (help facilitate processes and documentations with other responsible units i.e. Graduate Education Units, Faculty of Graduate Studies, Research Division, etc.)
Department of Pharmaceutical Botany	0	1	0	0	1	One stop services (help facilitate processes and documentations with other responsible units i.e. Graduate Education Units, Faculty of Graduate Studies, Research Division, etc.)
Faculty of Science: Graduate Education Unit[1]	0	4	4	0	8	Scholarship and financial support, teaching and learning of multidisciplinary courses, eLearning, student database, facilitating official documents and communication with Faculty of Graduate Studies, hosting chemical and biosafety training, students' feedback and evaluations

Source: http://www.sc.mahidol.ac.th/scmd/ for list of staffs at Faculty of Science: Graduate Education Unit

Department of Plant Science, which is the parental unit of our graduate programs, houses 4 supporting staff: 2 scientists and 2 administrative staff. Department of Pharmaceutical Botany, which is the parental unit of our graduate programs, houses 2 supporting staffs: 1 scientiss and 1 administrative staff. The scientist's main duty is to conduct research in association with the assigned research groups and to help teach in laboratory courses. As the skills and experiences of the scientists is generally more than the new entry students, these staff can also provide technical advises and training for new graduate students regarding equipment usage and research protocols. The administrative staff function as a one-stop service station that facilitates students' needs in terms of formal documentations and processes involving other regulating parties such as Faculty of Science, Faculty of Pharmacy, and Faculty of Graduate Studies. With these kinds of services, students do not need to run around contacting other units by themselves to resolve their specific needs. In addition to the needs of service on paperwork and formal processes with the regulating bodies, other types of key services such as library, IT, central instrument facility are provided by staff associated with the Faculty of Science or Faculty of Pharmacy.

For supporting staff to be recruited to the Department of Plant Science or Department of Pharmaceutical Botany, the departmental chairperson assigns a committee, usually includes the retiring staff in that position, to come up with the job description, exam questions (if applicable) and interview criteria. For supporting staff career progression, the Department of Plant Science, the Faculty of Science, Department of Pharmaceutical Botany, the Faculty of Pharmacy or both follow the regulations and guidelines of Mahidol University. Detail information about the regulation and guidelines are available at the Human Resource Division web site (https://op.mahidol.ac.th/hr/). Supporting staff can be promoted to more advanced position, for example from Practitioner to Senior Professional to Expert and to Advisory level, depending on the expertise and credentials.

7.9 The quality of the facilities (library, laboratory, IT, and student services) is shown to be subjected to evaluation and enhancement.

• Teaching and Learning Facilities

Classroom and its facilities are subjected to monitoring and maintenance by assigned support staffs from the Faculty. Instructor and students can also file a complaint to the Education Division if problem arises regarding lecture room facilities. Service personnel and backup equipment, LCD projector for example, are available for immediate repair and/or replacement in case one becomes nonfunctional. For departmental facility, a supporting staff is also assigned to do similar job as that of the Faculty of Science's level. In case of equipment replacement, the request goes through the departmental staff meeting for approval. Department of Plant Science and Department of Pharmaceutical Botany conduct a yearly survey on students' satisfaction level toward teaching and learning facilities. Major comments and feedbacks related to the common facilities responsible by the Faculty that need immediate attention are forwarded to the Education Division for further consideration.

• Library Resources

The Stang Mongkolsuk Library keeps track and listens to all aspects of feedbacks from its customers on a regular basis (https://stang.sc.mahidol.ac.th/survey/survey.php). Comments and feedbacks are taken into consideration by library staffs, under supervision of Deputy Dean for Student Affairs and Information, for action plan on quality improvement. Every year, the library send out the survey asking academic staffs in every academic program for suggestion of new books for acquisition and journal subscription required for research as

well as teaching and learning process for courses. Subscription to the unused journals may also be terminated so that the budget can be allocated to other in-demand journals.

At the library of Faculty of Pharmacy, staff of library keeps track and listens to all aspect of feedbacks from staff and students. One of the good examples of Faculty of Pharmacy, Pradit Hutangkula activity is the space design; the library set the comfortable and beautiful reading space on the floor with soft mattress and pillow for student to relax during stay in the library.

• Laboratory and Research Equipment

Laboratory spaces available at the Department of Plant Science is fixed and cannot be expanded. Due to the nature of graduate education in life science including our graduate program, laboratory spaces are not as essential as research equipment. Generally, laboratory space in our program and department is designed and managed to foster the collaborative interdisciplinary research. Student and staffs can report malfunctionality of each equipment for repair or maintenance. The maintenance plan is conducted by the staff committees in the program. Every year, the Department of Plant Science will conduct a survey on students' satisfaction toward the equipment facilities within the department. The survey and feedbacks had let to appropriate planning of equipment purchases. Machines that are in high demands get first priority for new purchase, providing the budget is granted from the government. At the Faculty of Science level, the CIF also conduct similar survey asking every academic staff for their need. Purchase plans for CIF usually cover more expensive equipment beyond the budget available at the departmental level. As most of the instruments at the CIF are top-of-the-line and very expensive, the Faculty of Science has assigned a set of well-trained technicians dedicated to individual equipment to help guide students and staffs for proper operation and to provide routine maintenance. Such dedicated custodians help minimize rates of equipment failure from inappropriate use.

Laboratory and research equipment at Faculty of Pharmacy, lab space in the 5 departments of the program is enough and available of students. Top line equipment allow student to conduct research under the supervision of their advisor. Sometimes, some equipment is out of order, students and staffs can report malfunction of each instrument for immediate repair or maintenance action plans.

• IT Facilities and Services

Similar to that of the teaching and learning facilities, the prompt assistance and maintenance are made available by the Faculty of Science and Mahidol University for IT services. The whole internet infrastructure, especially Wi-Fi services, and email accounts are maintained and regularly monitored by the Division of Information Technology, Mahidol University (MUIT). The Faculty of Science, on the other hand, takes care of the computer terminals for hardware maintenance. Requests for technical help or maintenance service can be filed to the IT staffs at either MUIT, the System Development and Technology Division and Stang Mongkolsuk Library. At least once a year, MUIT sends email to every internet user including students and staffs asking for feedbacks on service quality and areas for improvement. Appropriate action plans are made and implemented in the subsequent fiscal year. At the Faculty of Science level, both the System Development and Technology Division and Stang Mongkolsuk Library also consistently conduct satisfaction survey on students and staffs for quantity and quality of computer and software facilities. The comments are taken into consideration for future strategic plans on quality improvement.

IT facility at Faculty of Pharmacy, teaching and learning support services: IT and Audio-visual staff keep track and listen to all aspect of feedbacks from staff and students of MUPY [http://goo.gle/3v7EXw]. One of main feedbacks from staffs and students about IT

facility is the available computer is not up-date and not enough, less Wi-fi ability; the MUPY try to solve the problem. In 2017 IT unit received the government budget to buy more computers. Now the available computers for staff and students are located at

- 9 computers at library (2th floor of Rajcharat building) for staffs and students
- 30 computers for lecture rooms
- 49 computers in the computer room (8th floor of Rajcharat building) for staffs and students

8 OUTPUT

8.1 The pass rates, dropout rates, and average time to graduate are shown to be established, monitored, and benchmarked for improvement

As shown in Table 19, the pass rates and dropout rates are regularly monitored at the end on the secondary semester by program committee. The reason for dropout were analyzed and revealed the student background as a major issue. This information is used for future admission planning.

Table 19. Pass rates and dropout rates for M.Sc. Program in Plant Sciences.

Academic year		**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Student ID		**59xxx**	**60xxx**	**61xxx**	**62xxx**	**63xxx**	**64xxx**	**65xxx**
No. apply		6	6	8	7	1	2	3
No. interview		5	6	7	7	1	2	3
No. pass		5	6	7	7	1	2	3
No. registration		5	6	5	7	1	2	3
1st year	**Enter**	5	6	5	7	1	2	3
	Dropout	0	0	1	0	0	0	1
	Graduate	0	0	0	0	0	0	2
2nd year	**Enter**	5	6	4	7	1		2
	Dropout	0	0	0	0	0		0
	Graduate	0	1	0	0	0		0
3rd year	**Enter**	5	5	4	7			1
	Dropout	0	0	0				0
	Graduate	1	1	3				0
4th year	**Enter**	4	4	1				3
	Dropout	0	0					0
	Graduate	3	3					0
Over 4th year	**Enter**	1	1					2
	Dropout							
	Graduate							
Dropout total		0	0	1				1
Graduate total		4	5	4	6	5	3	10

Source; https://graduate.mahidol.ac.th/thai/prospective-students/

The average time to graduate is regularly monitored at the end on the secondary semester by program committee. The average time of graduation is demonstrated in Table 20. It is important to note that these are just averages, and the actual study time for individual students can vary based on a variety of factors, such as their program of study, research topic, research internship abroad or double degree program, funding availability, and personal circumstances. The monitoring results are used to improve the curriculum in order to improve the time to graduate. At-risk students are offered intensive supervision by major advisor and program committee. Thesis progress is encouraged by opened oral presentation every semester.

The expected time to complete the M.Sc. program is 2 years. Students can expedite the time frame if they have orientation for their graduation thesis early enough. In order to improve the average time to graduate, all students have to present their progress reports to the thesis advisory committee and publish report to the program committee at the end of every semester. The students who take longer than 3 years to graduate will have to meet the program committee with their major advisor to discuss the problems and find a solution together.

Table 20. Graduation statistics.

Academic year	Average year to graduate to program	Graduate total
2013	6.5	12
2014	3.5	6
2015	3.7	9
2016	3.3	5
2017	4	6
2018	3.3	6
2019	5.1	4
2020	3.5	6
2021	4	3
2022	5	2

Source: https://graduate.mahidol.ac.th/thai/prospective-students/

8.2 Employability as well as self-employment, entrepreneurship, and advancement to further studies, are shown to be established, monitored, and benchmarked for improvement.

The employability of the graduate is surveyed by personal contact with departmental general officer. The program plans to arrange excursion employers, such as NSTDA, DOA, and academic sectors, to enhance the employment opportunity. Current employability rate is 50% in 2022 as shown in Table 21.

Table 21. M.Sc. graduate employment rates.

Academic year	Number of graduates in each year	Employed within 1 year after graduation	Continue for higher education	Unemployed
2013	8	8	0	0
2014	10	7	3	0
2015	9	7	2	0
2016	6	4	2	0
2017	7	3	4	0
2018	6	0	3	3
2019	4	2	0	2
2020	6	2	4	0
2021	3	1	1	1
2022	2	1	0	1

Source: https://graduate.mahidol.ac.th/thai/prospective-students/

8.3 Research and creative work output and activities carried out by the academic staff and students, are shown to be established, monitored, and benchmarked for improvement

MU, MUSC, MUPY, SCPL and PYPB have always devoted attention to student research activities, as evident from the annual increase in research funding. All students in the first year start to work in laboratories and take part in scientific research guided by the department staff. Through solving practical problems during their thesis research, students acquire hands-on experience and research skills and mature into confident and well-prepared scientists after graduating from the program. This helps prepare the graduating students for the demands of their future career by equipping them with skills in systematic planning, quick problem solving, and effective communication. With their accomplishments in scientific research and theses, our students are strong candidates for job applications and scholarships for higher education, both domestic and international.

Research activity include attending national and international conferences and publications as in Table 22. Master student are encouraged, though not required, to have international publication.

Research internships as a student in Double Degree Program can be a valuable experience for M.Sc. students, providing them with opportunities to gain hands-on research experience, expand their knowledge and skills, build professional networks, and enhance their career prospects. There are four students who have been granted an internship as in Table 23.

Table 22. Research publication by M.Sc. graduate students.

Academic year	Number of national proceeding	Number of international proceeding	Number of national journal	Number of international journal
2013	0	0	0	1
2014	0	4	0	2
2015	0	0	2	6
2016	0	0	1	5
2017	0	0	0	7
2018	2	0	0	4
2019	0	0	2	5
2020	2	0	0	4
2021	1	0	0	2
2022	2	0	0	0

Source: https://graduate.mahidol.ac.th/thai/prospective-students/

Table 23. Research internship as Double Degree Student

Academic year	Number of Students	Institute
2019	1	Graduate school of Horticulture, Chiba University, Japan
2020	1	Graduate school of Horticulture, Chiba University, Japan
2022	2	Graduate school of Horticulture, Chiba University, Japan

8.4 Data are provided to show directly the achievement of the programme outcomes, which are established and monitored.

Student achievement and progress i.e. student grade, English proficiency score, profession and personal skills development (soft skills), Result and Detail on Qualifying examination, Proposal defense, Thesis progress, Thesis defense, and graduation status could be monitored through Information system for Faculty and Staffs provided by the Faculty of Graduate studies. This includes Program Director/Advisor System, Grad online system, Online Thesis Advisor System, and Grad-MIS system (https://graduate.mahidol.ac.th/inter/staff/).

8.5 Satisfaction levels of the various stakeholders are shown to be established, monitored, and benchmarked for improvement

Stakeholders' satisfactions toward our M.Sc. program are monitored by many channels depending on the different stakeholders.

Academic Staff within the Department of Plant Science or Department of Pharmaceutical Botany

Concerns, feedbacks, opinions, happiness toward the operation of our program and of the department as a whole are discussed regularly at the department meeting. The final

solution to any problem is made per a verdict from the meeting. Accordingly, discussions/solution include allocation of budgets and criteria for staff to attend national/international scientific meeting, teaching assignments, staff's performance evaluation criteria, equipment needs and maintenance, student intakes and admission criteria, students' problems, etc.

Current Students

Current students have many channels to express their dissatisfaction. First, all students have a chance to anonymously evaluate teaching and learning processes conducted in each course online (http://www.grad.mahidol.ac.th/Evaluation-index/) and by program survey questionnaire. Second, they can consult with their major advisor, program director and/or internal examiner (appointed by program director to observe with respect to the quality of the thesis) who can immediately help solve the problem or, in turn, report the situation to the monthly department meeting for solution seeking. The third, but perhaps the most effective channel for hearing of students' satisfaction/dissatisfaction is by the interview during the brainstorming event at the annual SCPL activity (Exhibit 8.1).

According to the responses, students felt that the courses in the program sufficiently provided fundamental and specialized knowledge, giving them an overview and details about plant sciences and related fields. The students were satisfied with the teaching methods in which lecturers instruct and direct students in self-study and literature research. The program helps students develop active and independent attitudes towards learning and improve their time management skills.

Alumni

We try to come up with a systematic approach to gather the alumni feedback including degree of their satisfaction/dissatisfaction toward M.Sc. program based on two criteria, including ELOs and Structure of the Program.

Employers

Once the graduates from the program are employed, the satisfaction level of the employers regarding their quality as employees is surveyed. On a scale of 1 to 5, the employers rate their satisfaction with the former students regarding their general and specialized knowledge, communication skills, problem-solving skills, teamwork, professional ethics, cooperative attitude at work, professional responsibility, and progressive attitude. From the results, the employers felt satisfied with the professional quality, manners, and morality of the students (Exhibit 8.2).

The questionnaires were distributed to the employers of the graduates by personal contact. The satisfaction level of employers for graduate are in the good ranges as shown in Table 24

Table 24. Satisfaction level of employers for M.Sc. graduates.

Academic year	Satisfaction level for employers (number of questionnaires)
2016	4.07 (9)
2020	4.43
2021	ND
2022	ND

Source: https://graduate.mahidol.ac.th/thai/prospective-students/

Note:

1= Excellent

2=Very good

3=Good

4=Moderate

5=Poor

SELF-ASSESSMENT SUMMARY

Criteria 1 – Checklist

1	Expected learning outcomes	1	2	3	4	5	6	7
1.1	The program to show that the expected learning outcomes are appropriately formulated in accordance with an established learning taxonomy, are aligned to the vision and mission of the university and are known to all stakeholders.			X				
1.2	The program to show that the expected learning outcomes for all courses are appropriately formulated and are aligned to the expected learning outcomes of the program.			X				
1.3	The program to show that the expected learning outcomes consist of both generic outcomes (related to written and oral communication, problem-solving, information technology, teambuilding skills, etc) and subject specific outcomes (related to knowledge and skills of the study discipline).			X				
1.4	The program to show that the requirements of the stakeholders, especially the external stakeholders, are gathered, and that these are reflected in the expected learning outcomes.			X				
1.5	The program to show that the expected learning outcomes are achieved by the students by the time they graduate.			X				
	Overall opinion			X				

Criteria 2 – Checklist

2	Program Specification	1	2	3	4	5	6	7
2.1	The specifications of the program and all its courses are shown to be comprehensive, up-to-date, and made available and communicated to all stakeholders			X				
2.2	The design of the curriculum is shown to be constructive aligned with achieving the expected learning outcomes.			X				
2.3	The design of the curriculum is shown to include feedback from stakeholders, especially external stakeholders.			X				
2.4	The contribution made by each course in achieving the expected learning outcomes is shown to be clear.			X				
2.5	The curriculum made by each course are logically structured, properly sequenced (progression from basic to intermediate to specialized courses) and are integrated.			X				
2.6	The curriculum to have option(s) for students to pursue major and/or minor specializations.			X				
2.7	The program to show that the curriculum is reviewed periodically following an established procedure and that it remains up-to-date and relevant to industry.			X				
	Overall opinion			X				

Criteria 3 – Checklist

3	Teaching and Learning Approach	1	2	3	4	5	6	7
3.1	The educational philosophy is shown to be articulated and			X				

3	Teaching and Learning Approach	1	2	3	4	5	6	7
	communicated to all stakeholders. It is also shown to be reflected in the teaching and learning activities.							
3.2	Teaching and learning activities are shown to allow students to participate responsibly in the learning process.			X				
3.3	Teaching and learning activities are shown to allow students to participate responsibly in the learning process.			X				
3.4	The teaching and learning activities are shown to promote learning, learning how to learn, and instilling in students a commitment for life-long learning (e.g., commitment to critical inquiry, information-processing skills, and a willingness to experiment with new ideas and practices).			X				
3.5	The teaching and learning activities are shown to inculcate in students, new ideas, creative thought, innovation, and an entrepreneurial mindset.			X				
3.6	The teaching and learning processes are shown to be continuously improved to ensure their relevance to the needs of industry and are aligned to the expected learning outcomes.			X				
	Overall opinion			X				

Criteria 4 - Checklist

4	Student Assessment	1	2	3	4	5	6	7
4.1	A variety of assessment methods are shown to be used and are shown to be constructively aligned to achieving the expected learning outcomes and the teaching and learning objectives.			X				
4.2	The assessments and assessment-appeal policies are shown to be explicit, communicated to students, and applied consistently.			X				
4.3	The assessment standard procedures for student progression and degree completion, are shown to be explicit, communicated to students, and applied consistently.			X				
4.4	The assessments methods are shown to include rubrics, marking schemes, timelines, and regulations, and these are shown to ensure validity, reliability, and fairness in assessment.			X				
4.5	The assessment methods are shown to measure the achievement of the expected learning outcomes of the program and its courses.			X				
4.6	Feedback of student assessment is shown to be provided in a timely manner.			X				
4.7	The student assessment and its processes are shown to be continuously reviewed and improved to ensure their relevance to the needs of industry and alignment to the expected learning outcomes.			X				
	Overall opinion			X				

Criteria 5 – Checklist

5	Academic Staff Quality	1	2	3	4	5	6	7
5.1	The program to show that academic staff planning (including succession, promotion, re-deployment, termination, and retirement plans) is carried out to ensure that the quality and quantity of the academic staff fulfil the needs for education, research, and service.			X				
5.2	The program to show that staff workload is measured and monitored to improve the quality of education, research, and service.			X				
5.3	The program to show that the competences of the academic staff are determined, evaluated, and communicated.			X				
5.4	The program to show that the duties allocated to the			X				

5	Academic Staff Quality	1	2	3	4	5	6	7
	academic staff are appropriate to qualifications, experience, and aptitude.							
5.5	The program to show that promotion of the academic staff is based on a merit system which accounts for teaching, research, and service.			X				
5.6	The program to show that the rights and privileges, benefits, roles and relationships, and accountability of the academic staff, taking into account professional ethics and their academic freedom, are well defined and understood.			X				
5.7	The program to show that the training and developmental needs of the academic staff are systematically identified, and that appropriate training and development activities are implemented to fulfil the identified needs.			X				
5.8	The program to show that performance management including reward and recognition is implemented to assess academic staff teaching and research quality.			X				
	Overall opinion			X				

Criteria 6 - Checklist

6	Student Quality and Support	1	2	3	4	5	6	7
6.1	The student intake policy, admission criteria, and admission procedures to the program are shown to be clearly defined, communicated, published, and up-to-date.			X				
6.2	Both short-term and long-term planning of academic and non-academic support services are shown to be carried out to ensure sufficiency and quality of support services for teaching, research, and community service.			X				
6.3	An adequate system is shown to exist for student progress, academic performance, and workload monitoring. Student progress, academic performance, and workload are shown to be systematically recorded and monitored. Feedback to students and corrective actions are made where necessary.			X				
6.4	Co-curricular activities, student competition, and other student support services are shown to be available to improve learning experience and employability.			X				
6.5	The competences of the support staff rendering student services are shown to be identified for recruitment and deployment. These competences are shown to be evaluated to ensure their continued relevance to stakeholders needs. Roles and relationship are shown to be well-defined to ensure smooth delivery of the services.			X				
6.6	Student support services are shown to be subjected to evaluation, benchmarking, and enhancement.			X				
	Overall opinion			X				

Criteria 7 - Checklist

7	Facilities and Infrastructure	1	2	3	4	5	6	7
7.1	The physical resources to deliver the curriculum. Including equipment, material. And information technology, are shown to be sufficient.			X				
7.2	The laboratories and equipment are shown to be up-to-date, readily available, and effectively deployed.			X				
7.3	A digital library is shown to be set-up, in keeping with progress in information and communication technology.			X				
7.4	The information technology systems are shown to be set up to meet the needs of staff and students.			X				

7	Facilities and Infrastructure	1	2	3	4	5	6	7
7.5	The university is shown to provide a highly accessible computer and network infrastructure that enables the campus community to fully exploit information technology for teaching, research, service, and administration.			X				
7.6	The environmental, health, and safety standards and access for people with special needs are shown to be defined and implemented.			X				
7.7	The university is shown to provide a physical, social, and psychological environment that is conducive for education, research, and personal well-being.			X				
7.8	The competences of support staff rendering services related to facilities are shown to be identified and evaluated to ensure that their skills remain relevant to stakeholder needs.			X				
7.9	The quality of the facilities (library, laboratory, IT, and student services) is shown to be subjected to evaluation and enhancement.			X				
	Overall opinion			X				

Criteria 8 - Checklist

8	Output	1	2	3	4	5	6	7
8.1	The pass rates, dropout rates, and average time to graduate are shown to be established, monitored, and benchmarked for improvement			X				
8.2	Employability as well as self-employment, entrepreneurship, and advancement to further studies, are shown to be established, monitored, and benchmarked for improvement			X				
8.3	Research and creative work output and activities carried out by the academic staff and students, are shown to be established, monitored, and benchmarked for improvement.			X				
8.4	Satisfaction levels of the various stakeholders are shown to be established, monitored, and benchmarked for improvement			X				
	Overall opinion			X				

The assessment of the quality of a program is done on a 7-point scale as follows:
1 = absolutely inadequate; immediate improvements must be made
2 = inadequate, improvements necessary
3 = inadequate, but with minor improvements will make it adequate
4 = adequate as expected
5 = better than adequate
6 = example of good practice
7 = excellent

III STRENGTH AND WEAKNESS ANALYSIS

Upon Program's view finding, strengths, weakness and improvement plans could be:

Summary of Strengths

1. The Program is well equipped with facilities for research and teaching compared with the most equivalent graduated program in other university in Thailand.
2. The faculty members of the Program have long experiences in teaching and doing research in the area of Plant Science and Pharmaceutical Botany (mostly more than 10 years).
3. The faculty members of the Program are active in research and mostly publish their research in the national and international journals every year.
4. Coursework were delivered by using the online platform during University closure due to the COVID-19 pandemic.

Summary of Weaknesses

1. The "international environment" of the program still need to be improved in terms of the English language skills of students and supporting staffs and number of international students.
2. Delay and difficulties to carry out thesis research work during University closure due to the COVID-19 pandemic. Under this situation, it also causes damage on living plant materials prepared for analysis.

Improvement Plans

1. In term of increase number of international students – Mahidol University and the Faculty of Graduate Studies have recently announced a policy to increase number of international students. Various supporting mechanisms are being planned such as increased international student grant.
2. The English language skill of students might be improved by encouraging them communicate in English and providing them more English training courses.
3. According to supporting staff English competency, English communication training will be arranged regularly by the Faculty of Science.
4. The program communicated and provided support and facilitate students to overcome difficulties under the restricted period and after University re-opened.

IV. APPENDICES

Exhibit 1.1	The official TQF2 document on Curriculum Development that program's ELOs as well as program specification were drafted by taking into consideration all feedback from stakeholders
Exhibit 2.1	The official TQF2 document
Exhibit 2.2	Graduate Student Guide for M.Sc. Program in Plant Science
Exhibit 2.3	TQF 3
Exhibit 2.4	TQF 5
Exhibit 4.1	Course Specifications / Course syllabus
Exhibit 4.2	Timeline as well as guidelines for non-coursework assessments
Exhibit 5.1	FTE calculation: Academic Staff and students
Exhibit 6.1	A rubric scale
Exhibit 8.1	Students' satisfaction survey
Exhibit 8.2	Employers' satisfaction survey