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Status of the Program on Sustainable Agriculture and Development at Higher Educational Institutions in Thailand

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Sustainable agriculture is one of the major policy reforms that have transformed agricultural development in Thailand since the turn of the millennium. From the Seventh to the Tenth National Social and Economic Development Plans of Thailand (1992 to 2011), sustainable agriculture has been increasingly adopted and has gradually become the nation's most important reform agenda. In addition, Thailand's highly respected King has proclaimed the concept of "sufficiency economy", which integrates the new farming systems with the Buddhist concept of self-restraint. These impulses are behind the widespread acceptance of sustainable agriculture by Thai society. Thai agricultural education has been revised to better conform with the national reform plans. Higher education on sustainable agriculture and development has been initiated at many Thai higher educational institutions. For example, Kasetsart University offers an international master's degree program on sustainable agriculture. The Asian Institute of Technology has partnered with the Norwegian Government to offer a program called "Education for Sustainable Development" for students pursuing master's or doctoral degrees. Thammasat University has also developed a master's degree in sustainable agriculture. In northern Thailand, Chiang Mai University offers a joint master's degree program entitled "Sustainable Agriculture and Integrated Watershed Management" in partnership with Germany's Universitat Hohenheim. This program provides students with in-depth knowledge of the complexity of watershed agro-ecosystems, sustainable agricultural practices, and new pathways of integrated watershed management. The Faculty of Social Sciences at Chiang Mai University also offers a program on sustainable development. Despite this progress, the roles of Thai universities in developing these programs must be strengthened and further developed. Direct or indirect partnerships with other local educational institutions, their surrounding communities, and other stakeholders are the keys to successfully implementing sustainable agriculture and development programs both in Thailand and in the country's higher educational system.

Key words: educational program, sustainable agriculture and development, Thai university

Introduction

Sustainable development is one of the most important concepts in modern and future education, research, and development. It emphasizes successful resource management to cope with the changing needs of the people while conserving natural resources and enhancing or maintaining the quality of the environment (FAO, 1989). The concept of

sustainable agriculture is one example of sustainable development that has arisen from concerns over the negative impacts of modern agriculture, which has increased the economic insecurity of farmers, chemical pollution, environmental degradation, and the loss of biodiversity, among other adverse impacts (Amekawa, 2008).

Thailand has pursued agricultural development based on both modern and traditional practices

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since the 1960s. However, sustainable agriculture only emerged as a priority among Thailand's major reform policies around the turn of the millennium. The Seventh National Social and Economic Development Plan (1992 to 1996) was the first official effort to express Thailand's interest in sustainable agriculture (NESDB, 2010). The Eighth National Social and Economic Development Plan (1997 to 2001) transformed this initial national restructuring policy into a more practical goal by establishing the target of converting 20% of the national arable land into farmland managed using sustainable agriculture (NESDB, 1997; Vitoon, 2002). In addition, the Eighth National Plan divided sustainable agriculture into four main activity groups: natural farming, organic farming, integrated farming, and agro-forestry. The Ninth Plan (2002 to 2006) and the Tenth Plan (2007 to 2011) placed their emphases on people by promoting participation, self-sufficiency, poverty alleviation, and protection of the environment (NESDB, 2010).

Using the National Social and Economic Development Plans for guidance, the Thai Ministry of Education's Office of the Commission on Higher Education established the Higher Education Plan of Thailand with a focus on sustainable agriculture and development (OCHE, 2008). The ultimate goal of the Second 15-year Long Range Plan on Higher Education of Thailand, which covers the period from 2008 to 2022, is to develop graduates with a high quality of knowledge and innovation, whose life work will be to support Thailand's shift towards increasingly sustainable development (OCHE, 2008). Education on sustainable agriculture in Thailand has received increasing support due to the proclamation of a novel philosophy based on a "sufficiency economy" by His Majesty the King of Thailand. The central idea in this philosophy is to seek and practice the Buddhist middle path (i.e., to seek an ethical balance between extremes) in their daily livelihood, in conformity with the main principle of sustainable agriculture and development (Pookpakdi, 2006).

Thailand is located in the heart of Southeast Asia and is blessed with a generous endowment of natural resources. In the north of Thailand, most of the mountainous land contains lush forests. The northeast, where agriculture is the main economic activity, consists of a plateau bordered to the east by the

Mekong River. The center of the country, which is the most heavily populated region, is dominated by the flat Chao Phraya River Valley. The south consists of a long peninsula and a long coastline, with many islands. Each region represents a different combination of basic resources, natural features, and levels of social and economic development. A rich biodiversity is a pronounced attribute of Thailand. The combination of these natural characteristics with the aforementioned philosophical context means that sustainable agriculture and development have been steadily adopted by Thai society and incorporated into the Thai way of life.

This paper reviews the current educational programs on sustainable agriculture and development at higher educational institutions in Thailand, and especially those at Kasetsart University. In addition, we analyzed the achievements and the factors responsible for the success of these programs, in the hope that these results will provide an impetus to strengthen the implementation of programs on sustainable agriculture and development at higher educational institutions in Thailand.

Higher Educational Programs on Sustainable Agriculture and Development in Thailand

1. Kasetsart University

Kasetsart University is Thailand's third-oldest university and the first to focus on agriculture. Kasetsart University was established more than 60 years ago with the primary aim of promoting research and education on subjects related to agricultural sciences (Kasetsart University, 2009).

The international master's degree program on sustainable agriculture is offered by the Faculty of Agriculture's Office of Sustainable Agriculture at Kasetsart University's main campus in Bangkok (ISC, 2010). This program offers two study plans. Plan A is research-oriented program that entails a minimum of 36 credits to support the creation of a thesis, plus 2 seminar credits and 1 research methods credit. Plan B focuses on coursework, and students must take a minimum of 24 course credits offered by the nine departments of the Faculty of Agriculture (Agricultural Extension, Animal Science, Agronomy, Entomology, Farm Mechanics, Home Economics, Horticulture, Plant Pathology, and Soil Science) and a minimum of 12 additional credits to

Table 1. List of the courses required for the completion of the master's degree program on sustainable agriculture at Kasetsart University

1. Major courses (no less than 18 credits)	Courses	Credit numbers	Hours of lecture - hours of practice per week
1.1 Seminar 2 credits	1. Seminar (one credit course, but students need to register for two semesters)	2	1-0
1.2 Compulsory 4 credits	1. Sustainable Agriculture	3	3-0
	2. Research Methods in Sustainable Agriculture	1	1-0
1.3 Elective 12 credits	1. Integrated Pest Management	3	3-0
	2. Agricultural Pest Ecology	3	3-0
	3. Pesticides and Environment	3	3-0
	4. Sustainable Crop Production	3	3-0
	5. Sustainable Animal Production	3	3-0
	6. Soil Fertility and Organic Matter	3	3-0
	7. Selected Topics in Sustainable Agriculture	1-3	—
	8. Special Problems	1-3	—
2. Minor Courses (no less than 6 credits)	Selected (with consent from the student's advisor, the head of the department, and the dean) from upper-level courses offered through various departments and faculties at Kasetsart University	6	—
3. Thesis (12 credits)	Thesis	12	—

support the creation of a thesis. Table 1 presents the course list. Students who graduate from this program will be equipped with both theoretical knowledge and practical experience that integrates expertise from multiple disciplines, and they will thus be capable of assessing and improving the sustainability of farming systems. The breadth of their education also readies students to work in a wide range of careers.

Kasetsart University provides a multidisciplinary program called "Sustainable Land Use and Natural Resource Management" through the university's graduate school (Graduate School, 2010a). Master's degree students can select Plan A or Plan B (Table 2). The selected courses are designed to imbue graduate students with the concepts, methods, and

policies involved in natural resource management. This multidisciplinary program also encourages master's degree students to continue their Ph.D. studies in sustainable land use and natural resource management. Plan A (without coursework) and Plan B (with coursework) are offered to students who want to immerse themselves in more advanced perspectives and aspects of sustainable management of natural resources and land uses (Graduate School, 2010b). The courses required to complete this Ph.D. program (Plan B) are shown in Table 3.

Between 2009 and 2010, increasing numbers of M.S. and Ph.D. students enrolled in these programs. In 2010, the Sustainable Land Use and Natural Resource Management program accommodated 63 master's and 37 doctoral degree stu-

Table 2. List of the courses required for the completion of the master's degree program on sustainable land use and natural resource management at Kasetsart University (Plans A and B)

1. Major courses (no less than 8 credits)	Courses (Plan A)	Credit numbers	Hours of lecture - hours of practice per week
1.1 Seminar 2 credits	Seminar (one credit course, but students need to register for two semesters)	2	1-0
1.2 Compulsory 6 credits	1. Concept and Policy of Sustainable Land Use and Natural Resource Management	1	1-0
	2. Research Methods in Sustainable Land Use and Natural Resource Management	2	2-0
	3. Interdisciplinary Field Study	3	0-10
2. Thesis (at least 36 credits)	Thesis	36	--
1. Major courses (no less than 24 credits)	Courses (Plan B)	Credit numbers	Hours of lecture - hours of practice per week
1.1 Seminar 2 credits	Seminar (one credit course, but students need to register for two semesters)	2	1-0
1.2 Compulsory 18 credits	1. Concept and Policy of Sustainable Land Use and Natural Resource Management	1	1-0
	2. Research Methods in Sustainable Land Use and Natural Resource Management	2	2-0
	3. Interdisciplinary Field Study	3	0-10
	4. Land Use and Natural Resource Management at Community Levels	3	3-0
	5. Land Use and Natural Resource Management at National and Regional Levels	3	2-3
	6. Conflicts and Problems in Land Use	3	3-0
	7. Techniques for Investigating Land Use and Natural Resource Management	3	1-4
1.3 Elective (at least 4 credits)	1. Techniques in Land Use Planning for Sustainable Development	3	3-0
	2. Social Dimension in Land Use and Natural Resource Management	3	3-0
	3. Geo-Information Science for Sustainable Land Use and Natural Resource Management	3	2-3
	4. Selected Topics in Sustainable Land Use and Natural Resource Management	1-3	—
	5. Special Problems	1-3	—
2. Thesis (at least 12 credits)	Thesis	12	—

Table 3. Course requirements for completion of a Ph.D. (Plan B) in sustainable land use and natural resource management at Kasetsart University

I. Major courses (no less than 12 credits)	Courses	Credit numbers	Hours of lecture - hours of practice per week
1.1 Seminar 4 credits	Seminar (one credit course, but students need to register for four semesters)	4	1-0
1.2 Compulsory 3 credits	System Analysis and Integration Techniques in Sustainable Land Use Management	3	3-0
1.3 Elective (at least 5 credits)	1. Perspectives of Sustainable Land Use and Natural Resource Management	3	3-0
	2. System Analysis and Integration Techniques in Sustainable Land Use Management	3	3-0
	3. Biodiversity in Sustainable Land Use and Natural Resource Management	3	3-0
	4. Integrated Management Modeling in Sustainable Land Use	3	3-0
	5. Social Dimensions in Sustainable Land Use and Natural Resource Management	3	3-0
	6. Economic Dimensions in Sustainable Land Use and Natural Resource Management	3	3-0
	7. Spatial Modeling in Land Use and Natural Resource Management	3	3-0
	8. Advanced Research Methods in Sustainable Land Use and Natural Resource Management	2	2-0
	9. Selected Topics in Sustainable Land Use and Natural Resource Management	1-3	—
	10. Special Problems	1-3	—
2. Thesis (at least 36 credits)	Thesis	36	—

dents, versus 57 and 25 students, respectively, in 2009.

To play a more important role in increasing the awareness of environmental issues, Kasetsart University prides itself on having established an institution that focuses actively on environmental challenges. The College of Environment was established on 1 January 2000 by the Chancellor and

Board of Directors of Kasetsart University with the main vision of developing Thailand's human resources to create a group of professionals who are capable of dealing with the world's changing environment (College of Environment, 2010). These people will play an important role in resolving the environmental problems facing Thailand and South-east Asia. The College of Environment offers pro-

grams that let students work towards a master's or doctoral degree in environmental science. Although the College of Environment offers no course that contains "sustainable development" in its name, the courses nonetheless focus on environmental issues such as environmental impact analysis, biodiversity, and integrated natural resource management. In 2009, a total of 128 graduate students (81 M.S. and 47 Ph.D. students) enrolled in the College's various programs, and by 2010, the number had increased to 147 (101 M.S. and 46 Ph.D. students).

Currently, 454 programs and curricula are offered by the Kasetsart University System. This includes 154 undergraduate programs and 211 M.S. and 89 Ph.D. programs. However, only three programs (two for M.S. programs and one for the Ph.D. program) are available on sustainable agriculture and development. Consequently, the number of programs that focus mainly on the theory and applications of this discipline account for less than 1% of all the programs offered by Kasetsart University.

To consider the magnitude of Kasetsart University's efforts to prioritize education on sustainability, it's necessary to consider the number of courses or subjects in this area. In 2010, Kasetsart University offered 5008 undergraduate courses, of which only 17 focused on one or more aspects of sustainable agriculture and development. Table 4 summarizes the undergraduate courses offered through different faculties, departments, or programs at Kasetsart University that either comprehensively cover the essence of sustainable agriculture or that incorporate some aspects of this concept. One undergraduate course explores the techniques and concepts of extension (i.e., knowledge and technology transfer) for sustainable agriculture in some detail. Others comprehensively review the economics of sustainable agriculture and the philosophy of the sufficiency economy. The courses that only touch on the concepts of sustainable agriculture belong to the faculties of Agriculture, Humanities, Social Science, and Business Administration. Various faculties and departments also place some emphasis on sustainable development by incorporating the theories, policies, and approaches relevant to this discipline within their undergraduate courses (Table 5).

The education related to sustainable agriculture

and development at the graduate level is also limited to some faculties and programs. There are only 51 out of 4034 graduate courses that focus on this field, corresponding to slightly more than 1% of the total. Most of these courses are offered through the master's degree program on sustainable agriculture at the Faculty of Agriculture and through master's and doctoral degree programs in sustainable land use and natural resource management at the graduate school. Table 6 summarizes the faculties and programs that also provide graduate courses that incorporate aspects of sustainable agriculture and development. It is likely that the concepts of sustainable development have been broadly applied within the field of architecture, and subjects pertaining to forestry, fisheries, and social sciences also embrace knowledge of sustainable development.

In addition to pursuing educational activities for students, Kasetsart University has provided academic services to the public in the form of extension and training programs. From 1997 to 2004, a collaboration between Thailand and Japan organized an international training course on "Sustainable Agricultural Production in the Tropics", with assistance from the Thailand International Development Cooperation and the Japan International Cooperation Agency (OETK, 2010). Kasetsart University was the host institution and accommodated approximately 50 participants from the Kingdom of Cambodia, the Lao PDR, and Vietnam. Since 2004, the joint program has been developed into a second phase called "Sustainable Agricultural Production through Agricultural Extension Approaches". The objectives of the program are to offer opportunities to the researchers and scholars from African and Asian member countries to share and exchange their agricultural knowledge and experiences. In addition, the program intends to instill all participants with the knowledge and analytical skills required to achieve sustainable agricultural production.

2. Asian Institute of Technology

Since 2002, the Asian Institute of Technology has partnered with the Norwegian Ministry of Foreign Affairs to develop a joint study and research program leading to master's and doctoral degrees on sustainable development (SERD, 2010). The program is designed to focus on issues related to

Table 4. Faculties, departments, and programs that offer undergraduate courses that cover the concepts of sustainable agriculture or the sufficiency economy at Kasetsart University

Faculty, department, or program that offers undergraduate courses that mainly focus on sustainable agriculture or the sufficiency economy	Courses	Credit numbers	Hours of lecture - hours of practice per week
1. Faculty of Economics, Department of Agricultural and Resource Economics	Economics of Sustainable Agriculture	3	3-0
2. Faculty of Agriculture, Kampaengsan Campus, Department of Agricultural Extension	Extension of Sustainable Agriculture	3	3-0
3. Faculty of Natural Resources and Agro-Industry, Agro-Bioresources Program	The Philosophy of the Sufficiency Economy	3	3-0
Faculty, department, or program that offers undergraduate courses that partly cover sustainable agriculture or the sufficiency economy			
1. Faculty of Agriculture, Department of Soil Science	General Soil Science	3	3-0
2. Faculty of Social Sciences, Department of Geography	Agricultural Geography	3	3-0
3. Faculty of Education and Development Science, Program on Agricultural and Environmental Education	Introduction to Agricultural and Environmental Education	3	3-0
4. Faculty of Natural Resources and Agro-Industry, Program on Agro-Bioresources	Integrated Agricultural Systems	3	3-0
5. Faculty of Business Administration, Finance Department	Financial Management for Small and Medium Enterprises	3	3-0
6. Faculty of Humanities, Department of Philosophy and Religion	Philosophy of Sufficiency Economics and Buddhism	3	3-0

poverty alleviation, energy and environmental sustainability, natural resources management, and human rights and gender issues. The students, who are mostly staff members of public agencies, governmental departments and institutions, and universities, are from southern and southeastern Asia, and include natives of Afghanistan, Bangladesh, East Timor, Nepal, Pakistan, Sri Lanka, Vietnam, the Mekong region, the Lao PDR, and Cambodia,

as well as other developing countries. The program encourages participation by students with a strong academic background and experience in sustainable development and by people who have worked with universities or institutions that are actively studying sustainable development. The funding agency expects that upon successful completion of the program, the students will return to their countries to strengthen the implementation of sustainable devel-

Table 5. Faculties, departments, and programs that offer undergraduate courses that incorporate some aspects of sustainable development at Kasetsart University

Faculty, department, or program that offers undergraduate courses that mainly focus on sustainable development	Courses	Credit numbers	Hours of lecture - hours of practice per week
—	—	—	—
Faculty, department, or program that offers undergraduate courses that incorporate some aspects of sustainable development			
1. Faculty of Architecture, Department of Landscape Architecture	Landscape Architectural Design V	4	0-8
2. Faculty of Architecture, Department of Architecture	Sustainable Architecture	3	3-0
3. Faculty of Social Sciences, Department of Geography	Geography of Tourism Resources	3	3-0
4. Faculty of Agriculture, Kampaengsaen Campus, Department of Agricultural Extension	Environmental Planning for Agricultural Development	3	3-0
5. Faculty of Sciences, Department of Botany	Plants, Man and Environment	3	3-0
6. Faculty of Sciences, Department of Environmental Sciences	Principles of Environmental Management	3	3-0
7. Faculty of Economics, Department of Agricultural and Resource Economics	Agricultural Ecological Economics	3	3-0
8. Faculty of Social Sciences, Department of Sociology and Anthropology	Social Development	3	3-0

opment.

In addition to the abovementioned courses, graduate students have access to courses that focus on sustainable development, such as “Sustainable Development Theories and Practices” and “Gender Rural Livelihoods and Sustainable Development”, through the Asian Institute of Technology’s School of Environment, Resources, and Development (SERD, 2010). The students are introduced to the theory and dimensions of sustainable development in various fields so that they will develop an ability to analyze the sustainable development policies currently adopted by their countries.

3. Chiang Mai University

Chiang Mai University, which is located in a mountainous tropical watershed in Chiang Mai province of northern Thailand, is one of the country’s leading universities. Founded in 1964, Chiang Mai University offers a unique multi-cultural environment for teaching and research on agricultural science and natural resource management in the mountainous regions of southeast Asia. In addition, Chiang Mai University was selected as the one of the major study centers in the Greater Mekong Subregion. Thus, the university has become an educational hub where students from southern and

Table 6. Faculties, departments, and programs that offer graduate courses that incorporate knowledge of sustainable development at Kasetsart University

Faculty or program that offers graduate courses in which the concepts of sustainable development are applied	Courses	Credit numbers	Hours of lecture - hours of practice per week
1. Faculty of Architecture, Program on Urban and Environmental Planning	Studio in Environmental Impact Assessment for Sustainable Planning	3	2-3
	Socio-economic Analysis for Sustainable Development	3	3-0
	Sustainable Land Use and Infrastructure Planning	3	3-0
	Sustainable Housing and Real Estate Development	3	2-3
2. Faculty of Architecture, Program on Building Innovation	Sustainable Architecture and Environment	3	3-0
3. Faculty of Architecture, Program on Built Environment	Technology and Design for Sustainable Built Environment	3	3-0
4. Faculty of Education and Development Science, Program on Humanity and Community Resource Development	Local Wisdom for Sustainable Development	3	3-0
5. Faculty of Agriculture, Program on Plant Pathology	Sustainable Plant Disease Control	3	3-0
6. Faculty of Agriculture, Program on Soil Science and Management Technology	Nature and Sustainable Land Uses of Tropical Soil Resources	3	3-0
7. Faculty of Fisheries, Program on Marine Science	Sustainable Utilization of Marine Resources	3	3-0
8. Faculty of Forestry, Program on Social Forestry	Policy and Strategy in Sustainable Natural Resource Management	3	3-0
9. Faculty of Forestry, Program on Forest Resource Management	Sustainable Timber Management	3	3-0
10. Faculty of Engineering, Program on Civil Engineering	Sustainable Urban Development Planning and Analysis	3	3-0
11. Faculty of Sociology and Anthropology, Program on Applied Sociology	Environment and Sustainable Development	3	3-0
12. Multidisciplinary Program (Resource Management)	Economics for Sustainable Resource Utilization	3	3-0

southeastern Asia conduct research and develop experience in and knowledge of sustainable agriculture and natural resource management.

The sustainable agriculture component is represented by a 2-year program entitled “Sustainable Agriculture and Integrated Watershed Management”, which is a joint master’s degree program between Germany’s Universitat Hohenheim and Chiang Mai University (SAIWAM, 2010). The program offers an opportunity for students to learn about the problems of resource degradation, landscape instability, reduced biodiversity, rural poverty, and food insecurity in fragile watershed areas in northern Thailand, and encourages them to seek solutions. The students’ knowledge of sustainable agriculture, the complexity of watershed agro-ecosystems, and new approaches to watershed management will be strengthened and deepened by this academic program, which consists of four semesters (15 thematic modules and a thesis). The students undergo broad interdisciplinary training at Chiang Mai University for the first two semesters. Subsequently, they are guided to specialize in one of three fields at Universitat Hohenheim: agricultural economics and social sciences, natural resource management, and animal production systems. Thesis work can be conducted at either university. Table 7 summarizes the course work and other requirements of this program.

Chiang Mai University, through the Regional Center for Social Science and Sustainable Development, also offers graduate students a Master of Arts degree in sustainable development (RCSSSD, 2010). The program encourages graduate students to search for alternative policies and to promote sustainable development by integrating theory and social science disciplines (sociology, anthropology, political science, economics, and law) with the natural sciences. The program was also developed to enhance the ability of the students to analyze the complexities of development processes and the main problems that have occurred in the Mekong River region. This degree program requires no less than 36 credits for degree completion, consisting of 15 credits of compulsory courses, 9 credits of elective courses, and 12 credits related to the creation of a thesis. Table 8 summarizes the course requirements.

Established in 1998, the Regional Center for So-

cial Science and Sustainable Development (RCSD) is part of the Faculty of Social Science, Chiang Mai University, and has the mission of gaining a better understanding of sustainable development in the upper mainland of southeast Asia. The Center has utilized the information and expertise gathered at Chiang Mai University for more than 30 years in social sciences, resource management, highland agricultural systems, and the environment to guide the development of policies and practices. Using financial support from funding agencies that include the Ford Foundation, the Heinrich Böll Foundation, and scholarships for international graduate students, RCSD is striving to become the center for education and information sharing among students and scholars from Vietnam, China, Myanmar, and other countries in the Mekong Region in the areas of social sciences and development. The Rockefeller Foundation’s contribution to the Program on Knowledge and Educational Enhancement in the Mekong Region has allowed RCSD to promote better understanding and collaboration among partner institutions in the Mekong Region.

His Majesty the King of Thailand proclaimed the economic sufficiency philosophy in response to Thailand’s economic crisis in 1997. In response to the challenges arising from globalization and other changes, Chiang Mai University established the Institute of Sufficiency Economy Research and Promotion in 2008 based on this philosophy to guide the adoption of more resilient and sustainable practices by the Thai people and to thereby facilitate the implementation of sustainable development in Thailand, the Asian region, and the world (ISERP, 2010). The Institute also offers a Ph.D. degree in the sufficiency economy (an international program) to students who are inspired to explore and gain a comprehensive understanding of the theory and practice pertaining to this philosophy. Table 9 summarizes the course requirements for the degree.

4. Thammasat University

Thammasat University, founded in 1934, is Thailand’s second-oldest university, which was initially famous for its expertise in law and political science. The university has two campuses: Tha Phachan Campus and Rangsit Campus. At Thammasat University, the graduate programs on sustainable agri-

Table 7. List of courses that students must take to complete a M.S. degree on sustainable agriculture and integrated watershed management from the program jointly offered by Chiang Mai University and Germany's Universität Hohenheim

Semesters	Areas of Specialization	Modules	Courses
1+2	—	Compulsory Module (Six courses)	1. Soil, Water and Forest Resources
			2. Development Policies and Economic Strategies
			3. Sustainable Production of High Value Crops
			4. Sustainable Livestock Production Systems
			5. Watershed Ecology and Agro-ecosystems
			6. Ethnic, Cultural, and Social Aspects of Watershed Development
		Semi-elective Module (at least two courses should be selected)	1. Processing and Marketing of High Value Food Products
			2. Renewable Energy Sources for Mountainous Regions
3	Agricultural Economics and Social Sciences	Compulsory Module (Two courses)	1. Interdisciplinary Study Project: "Scientific Methodologies for Integrated Research"
			2. Rural Development Policy and Institutions
		Semi-elective Module (at least two courses should be selected)	1. International Food and Agricultural Trade
			2. Markets and Marketing of Organic Food
			3. Qualitative Research Methods in Rural Development Studies
		Elective Module	At least one course selected from the list of all specializations
	Natural Resource Management	Compulsory Module (Two courses)	1. Interdisciplinary Study Project: "Scientific Methodologies for Integrated Research"
			2. Spatial Data Analysis with GIS
		Semi-elective Module (at least two courses should be selected)	1. Field Course in Site Ecology with Seminar
			2. Crop Protection in Organic Farming
			3. Postharvest Technology and Food Quality
			4. Biodiversity, Plant and Animal Genetics Resources
5. Food Safety and Drinking Water Quality			
Elective Module	At least one course selected from the list of all specializations		
Animal Production Systems	Compulsory Module (Two courses)	1. Interdisciplinary Study Project: "Scientific Methodologies for Integrated Research"	
		2. Integration of Aquaculture in Agricultural Farming Systems	
	Semi-elective Module (at least two courses should be selected)	1. Integrated Agricultural Production Systems	
		2. Genetic Resources and Animal Husbandry Systems	
		3. Biodiversity, Plant and Animal Genetic Resources	
		4. Organic Livestock Farming	
Elective Module	At least one course selected from the list of all specializations		
4	Thesis	Thesis	Thesis

Table 8. List of courses leading to the master of arts degree in sustainable development at the Regional Center for Social Science and Sustainable Development, Department of Sociology, Chiang Mai University

Courses	Credits	Semester
Compulsory Courses:		
1. Theories and Concepts in Sustainable Development	3	1
2. Local Rights and Knowledge in Sustainable Development	3	1
3. Seminar: Special Issues on Sustainable Development in Southeast Asia	3	1
4. Conceptualization in Social Research	3	2
5. Seminar: Comparative Studies in Development Process	3	2
Elective Courses:		
1. Political Ecology	3	1
2. Advanced Population Geography	3	—
3. Politics of Ethnic Minorities	3	1
4. Social Ecology	3	1
5. Economic Sociology and Anthropology	3	1
6. Selected Topics in Sustainable Development: Cross-border studies: Boundaries, Identity, and Transnationalism in the Post-colonial Time of Southeast Asia	3	1
7. Selected Topics in Sustainable Development: Feminism and Nature	3	1
8. Indicator Organisms and Biomonitoring Techniques for Terrestrial Ecosystems	3	1
9. Analysis of Environmental Problems and Policies	3	2
10. Regional Development: Ecological Concepts and Planning	3	2
11. Current Geographic Problems of Countries in the Mekong Basin	3	2
12. Land Tenure Systems and Community Control of Resources	3	2
13. Social Development Theories	3	2
14. Selected Topics in Sustainable Development	3	1, 2, 3
15. Selected Topics in Sustainable Development: Globalization and Transnational Development	3	2
16. Analytical Techniques for Environmental Risk Assessment	3	2
17. Economics of Land and Water Resource Management	3	2
18. Social Context of Agricultural Systems Development and Management	3	2
19. Ecological Changes in Southeast Asian Agricultural Societies	3	—
Thesis:	12	3, 4

culture are offered through the Faculty of Science and Technology. The Department of Agricultural Technology, which is part of the Faculty of Science and Technology, administers a 2-year M.S. degree program on sustainable agriculture (Department

of Agricultural Technology, 2010). Two study options are available: Plan A requires 46 credits, all focused on the creation of a thesis, and Plan B requires 36 credits for course work and 12 credits focused on the creation of a thesis. Students can

Table 9. Courses requirements for completion of the Ph.D. degree in the sufficiency economy at the Institute of Sufficiency Economy Research and Promotion, Chiang Mai University

Courses	Credit numbers	Hours of lecture - hours of practice per week
1. Economics of Peace and Happiness in Different Philosophies and Religions	3	3-0
2. Advanced Microeconomic Theory for Balance Development	3	3-0
3. Quantitative Methods for Balance System	3	3-0
4. Advanced Macroeconomic Theory for Balance Development	3	3-0
5. Research Methodology for Balance Socio-Economic Development	3	3-0
6. Selected topics in Sufficiency Economy I	2	2-0
7. Selected topics in Sufficiency Economy II	2	2-0
8. Selected topics in Sufficiency Economy III	2	2-0
9. Seminar on Sufficiency Economy	1	1-0
10. Thesis	36	—

design a course of study to suit their interests from the wide range of courses that are available and that are related to sustainable agriculture. The university also provides undergraduate courses on sustainable agriculture. The Department of Rural Technology, also under the Faculty of Science and Technology, offers a multidisciplinary Bachelor's of Science degree in Sustainable Development Technology (Department of Rural Technology, 2010). The goal of this program is to open the minds of students by broadening their knowledge base, honing their intellectual and practical skills, and nurturing their sense of personal and social responsibility by encouraging critical thought about sustainable development. In addition to the basic scientific, mathematical, and economics courses (66 credits in total) required for regular undergraduate students, students must take an additional four sets of courses from the following clusters: engineering and technology (38 credits), agriculture (9 credits), geographic information and management (15 credits), or multidisciplinary technology (4 credits). The latter cluster includes courses on sustainable local development, a seminar in sustainable development technology, and research methodologies in sustainable development technology.

Conclusions

Technology has become a pivotal tool for in-

creasing agricultural productivity for more than 60 years, especially since the end of World War II. Mechanization, fertilization, and the application of agrichemicals are new technologies that have brought about remarkable increases in crop yields and livestock production, as well as more profits to farmers and better living conditions for people around the world. However, there have been significant cultural, environmental, and economic costs due to the adoption of these new technologies over a long period of time without careful management or rigorous consideration of the consequences. Prominent among these problems are increases in production costs, groundwater contamination due to careless use of hazardous chemicals, the decline of family farms, and the disintegration of socioeconomic conditions in rural communities.

The movement towards sustainable agriculture and development is gaining more support and acceptance because the main concepts of sustainability address both environmental and social concerns, and offer innovative and economically viable alternatives to growers, laborers, consumers, policymakers, and other stakeholders throughout the world's socioeconomic system.

Thailand is located in a region that is rich in natural resources and biodiversity. As a result, sustainable agriculture and development have drawn increasing amounts of popular and official attention

for a long time. However, the sustainability concept has never been effectively and efficiently implemented at a large scale. To permit such an implementation, Thailand's Office of the Commission of Higher Education has begun an initiative to develop nationwide plans to support the implementation of sustainable agriculture and development, and it is likely that this philosophy will become increasingly firmly and effectively rooted in the Thai higher educational system. More refinement of the strategic plans and of key activities conducive to implementation of sustainability is still needed. Educational programs at the undergraduate and graduate levels will be key tools for teaching students the concepts of sustainable agriculture and development and deepening their understanding of these issues. National institutes and universities will require the following mandates: administration of competitive research grants to focus on practices and systems for sustainable agriculture and development, and development of direct or indirect collaborations with the surrounding communities, local educational institutions, and other stakeholders for both short- and long-term activities related to researching and disseminating information on sustainable development systems via publications and on-site demonstration (i.e., extension), in both formal and informal educational settings, at all levels.

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