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A Concept of Engineering Education Program to Improve the Competitiveness of Human Resources in Agroindustry

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Abstract: The current globalization has led to intense competition among countries, both in the provision of goods, services and professionals. At the regional level, the ASEAN countries have agreed on the implementation of free market in the ASEAN region. The establishment of a free market termed as the ASEAN Economic Community (AEC) enables one country to sell goods and services easily to other countries throughout Southeast Asia. AEC not only opens the flow of trade in goods or services, but also the professional labor market, including professional in field of agroindustry. The AEC requires the abolition of rules that previously hindered the recruitment of foreign workers, especially in the professional workforce sector, resulting in a more intense professional labor competition. This paper presents the concept of academic and professional education programs for the field of agro-industrial engineering applied at IPB, in an effort to improve the quality and competitiveness of its graduates. The analysis and discussions include background, relevance, needs of agroindustry engineers, and the concept of education program paths along with graduate profiles, learning outcomes, and curriculum to meet the objectives.

Keywords: agroindustrial engineer, global competition, professional program

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1. Background

1.1. Challenges to Improve Competitiveness of Human Resources in Agroindustry

The agricultural sector plays an important role in Indonesia's economic development as it contributes to 13% of national GDP and exhibits 85% of SMEs in Indonesia (Wijono, 2005) that is proven to survive during economic crisis (Pakpahan et al., 2005). Improvements in this sector will lead to an increase in Indonesia's GDP. Improvements can be made by increasing the added value of agricultural commodities, which is the main role of agro-industry. At present, the agro-industry in Indonesia is dominated by small and medium-sized businesses with 49% operating in agriculture, livestock, forestry, fisheries and 6% operating in processing. To increase GDP, it is necessary to increase economies of scale, and more importantly, increase competitiveness through the use of knowledge and technology. Thus, this effort needs to be supported by human resources who are able to provide solutions to the problems of SMEs such as limited access to capital, markets, raw materials, technology and innovation. (Radnor dan Barnes, 2007; Hadiyati 2010; Eravia *et al.,* 2014). The availability of competitive human resources is a must if we want to improve the performance of agro-industry and this is the main task of higher education.

Higher education is obliged to provide graduates that are capable of designing, managing and improving the competitiveness of agroindustry. To be able to provide this much needed human resources in agro-industry, higher education faces two main challenges. The first challenge is related to external pressure, namely the global community, and the second is related to the internal education system.

The current process of globalization causes very tight competition among countries in the supply of goods, services and professionals. At the regional level, ASEAN countries have agreed on the implementation of free markets in the ASEAN region. This is done to improve ASEAN's competitiveness and to attract foreign investment for increasing employment and community welfare in the region. The establishment of a free market that is termed as the ASEAN Economic Community (AEC) allows one country to sell goods and services easily to other countries throughout Southeast Asia. AEC not only opens the flow of trade of goods or services, but also the professional workforce market. EAC requires the elimination of rules that previously prevented the recruitment of foreign works forces especially in the professional works forces. In the era of cross-country works force mobility, the need for providing competitive engineering professionals at the international level is increasingly urgent [1,2].

Internal challenges are related to the ability to meet the demands of agroindustry human resources both in quantity and quality. As reported by PII (2011) there is a shortage in the number of engineers which is estimated to be around 15.000 per year. PII (2011) projected that the demand of agroindustrial engineers is 4.438 in 2015, 6.968 in 2020 and 10.040 in 2025. In the education sector, the projected demand of engineers is 588 in 2015, 922 in 2020, dan 1.750 in 2026. This number is quite high and if the higher education cannot provide the needed engineers, they would be fulfilled by professional engineers from abroad.

Besides, quality of human resources in agroindustry is of another concern. The free mobility of human resources across countries, demands those with a comparable competence at the international level. International standard of engineering education and profession is important to consider. The main competencies that are considered important for agro-industries need to be acquired, such as the ability in information technology, motivation to excel, lifelong learning, creativity to provide solutions, and teamwork. Based on a survey conducted by PII, improvements need to be made on several competencies, especially in the ability to work in teams, problem solving, oral and written communication, and professional commitment. It can be concluded that in addition to knowledge, there are two important dimensions of competence needed, namely skills (hard and soft skills) and attitudes. These three dimensions are needed for graduates to properly function in societies [3].

Improving the competitiveness of human resources in agroindustry, thus, requires improvement on engineering knowledge competences, skills, and attitudes. Engineering knowledge competences requires students to master their abilities to apply mathematics, science, and engineering principles to solve complex engineering problems. This knowledge to be complemented with skills to apply knowledge to problem analysis and formulation, conduct investigation and experiment, as well as skills to creatively design and develop solutions to engineering problems (IEA, 2014; SNPT, 2015). Considering the complexity of the engineering problems, students need to improve their collaboration and communication skills. These knowledge and skills are initial assets that need to be nurtured by themselves to tackle future challenges. To be able to continuously develop their knowledge and skills, they need to have professional attitudes, ethics and responsibilities and empathetic to societal and environmental values, and shows motivation to excel and the important of lifelong learning.

1.2. Agroindustry Higher Education

Agroindustry Higher Education in Indonesia began in 1981, marked by the establishment of the Department of Agroindustrial Technology, Faculty of Agricultural Technology, Bogor Agricultural University (IPB). The rationale for its establishment is to support and enhance the role of the agricultural sector in advancing national development through increasing the added value of agricultural products by providing input on process technology and industrial system engineering. The difference from similar study programs, such as the Agricultural Product Processing Study Program - which has been there before, mainly lies in educational goals and learning outcomes, as well as orientation and approaches to achieving the objectives of the study program. The Agroindustrial Technology Study Program is oriented towards industrial businesses using an industrial system engineering approach and process engineering in increasing the added value of agricultural resources or biological resources in a sustainable manner.

The specificity of the agro-industry study program curriculum is to prepare graduates with the ability to design, develop, implement, control, evaluate and improve the performance of sustainable agro-industrial systems, through an integrated approach to aspects of process technology, system engineering, industrial management, and the environment to increase added value agricultural / biological resources and derivatives (Communication Forum for Indonesian Agroindustry Study Programs, 2018).

In accordance with the Decree of the Minister of Research, Technology and Higher Education No. 257 / M / KPT / 2017 concerning the Nomenclature of Study Programs in Higher Education, Agro-Industrial Technology and Agro-Industrial Engineering study programs are included in the engineering study category. Graduates of these study programs have a Bachelor of Engineering (ST) (Indonesian National Qualification Framework / level 6 KKNI) that can proceed to postgraduate (master and doctoral) programs (Level 8 and 9 KKNI) or continue their studies into engineering professional education programs (KKNI Level 7) with the title of Engineer (Ir.). In professional societies, engineers play a role primarily in design and development, while technologists and technicians play more roles in manufacturing and production lines [4].

The agroindustry study programs continue to experience growth, seen from the number of study programs, lecturers, students, and levels of education degrees (Table 1). Student body for undergraduate program (S1) reaches 6335 students. Not only nationally, higher education in agro-industry is also increasingly found abroad. Table 2 shows the agroindustry engineering study program abroad.

Table 1. Agroindustrial study program, number of faculties, and number of students at various levels

Educational level	Number of study program	Number of permanent faculties	Number of active students
D3	7	50	741
D4	3	32	549
S1 (undergraduate program)	31	287	6,335
S2 (magister program)	10	56	258
S3 (doctoral program)	2	10	87
Total	53	435	7,970

* Source: Higher education data base, report year 2017/2018

Table 2. Agroindustrial engineering study programs in some countries

No	Agroindustry Higher Education
1	American Andragogy University, Hawaii, United States (https://www.aauniv.com/)
2	ASSUMPTION UNIVERSITY OF THAILAND, Thailand (http://www.au.edu/index.php/)
3	Chiang Mai University, Thailand (https://www.cmu.ac.th)
4	College of Higher Study AQUINAS, Sri Langka http://www.aquinas.lk/degree-programs/bsc-hons-in-agro-industry-management/
5	Kasesart University, Thailand (http://www.agro.ku.ac.th)
6	King Mongkut's University of Technology, North Bangkok, Thailand (https://sites.google.com/a/sci.kmutnb.ac.th/bachelor-of-science-agro-industrial-technology/)
7	National University of La Rioja, Argentina, http://studyargentina.com/agro-industrial-engineer-national-university-la-rioja.html
8	Salliman University, Philippine (https://su.edu.ph/schools-colleges/school-of-agro-industrial-and-technical-education/)
9	The College of Engineering and Agro-Industrial Technology (CEAT), UPLB, Philippine (http://uplb.edu.ph/academics/college-of-engineering-and-agro-industrial-technology-ceat/)

Table 2. Agroindustrial engineering study programs in some countries (continued)

No	Agroindustry Higher Education
10	The University of Guanajuato, Mexico (http://www.ugto.mx)
11	Universidad de la Costa, CUC, Colombia (https://www.cuc.edu.co/en/)
12	Universidad San Ignacio de Loyola (USIL), Peru (http://www.usil.edu.pe/en/about-us/universidad-san-ignacio-de-loyola)
13	Universidade Nova de Lisboan, Portugal (https://www.fct.unl.pt)
14	University Niccolò Cusano, Italy (https://www.unicusano.it)

Various changes in the external (national, international) and internal environment of the university have been and are happening. These include globalization, MEA, industrial era 4.0, knowledge-based competition, international standards of education and professional competence, implementation of national standards (Higher Education Standards, Indonesian National Qualifications Framework / KKNI, Study Program Nomenclature), government policies on increasing agro-industry competitiveness and added value of agricultural products, changes in stakeholder needs (21st century competencies), and changes in university vision. Considering the rapid changes in the external and internal environment, universities must adjust their study programs and graduate profiles to have the ability to adapt to these conditions. This adaptation ability must be cultivated and sharpened through various learning strategies to improve knowledge, skills and attitudes which are three important components of competence, so that graduates can function in society significantly [3].

Based on the above rationale, this paper presents and discusses the concept of developing the pathway of academic and professional education programs in agro-industry implemented at IPB, which is expected to be useful as a reference for study programs in the field of agroindustrial engineering or similar study programs in improving the competence of their students..

2. The role of Higher Education and Paradigm Shift in Higher Education

Responding to the demand for competitive human resources in the field of agro-industry, universities should improve their education quality and accountability. They have to shift from focus on input and process towards outcomes so that can be recognized by and clearly benefit stakeholders, namely professional community, users, and society in general. Universities should also move from the old orientation of producing job seekers towards the new paradigm of generating technopreneurs.

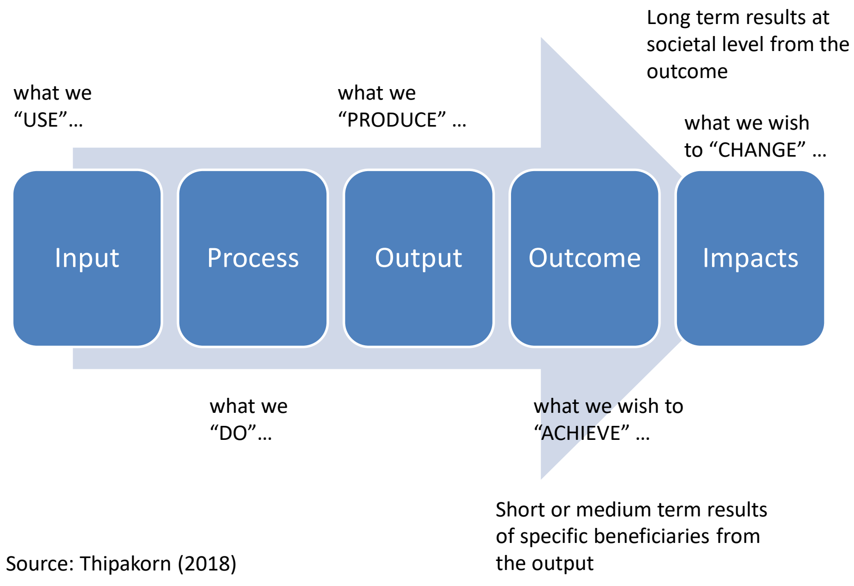

Figure 1. Outcome-based education system

In the Outcome-Based Education (OBE) system, the focus of attention is given to the outcomes or even to the impacts of education so as to ensure the accountability. The OBE system focuses on learning (not teaching), students (not faculties), and outcomes (not input and capacity). In the OBE system, it is important that "It's not only what you have but what you do with it". Figure 1 shows an illustration of the OBE system. Outcomes may be the results or changes due to educational efforts, relating to changes in knowledge, skills, concerns, attitudes, behavior, opinions, aspirations, decision making, social action, conditions or status. Outcomes can be short-term, medium-term or long-term. Outcomes may be expected or unexpected; positive or negative. The OBE system is a platform that allows study programs to be accountable to guarantee the learning process [5]. Quality and accountability can be assessed through an accreditation program.

3. A concept of Engineering Education for Agroindustry

In the context of global competition, Indonesia's readiness to provide professional workforce is a crucial theme in the development of higher education. Author [6] entitled "Putting Higher Education to Work" identifies the existence of typical weaknesses in the form of unconnected in the education system, namely (a) the unconnected relation between the characteristics of higher education institutions (curriculum, and degree) and the expertise required by the user (employment provider); (b) Weak linkages between higher education institutions and industry as end users from the results of education and research; (c) Unconnected relation between higher education institutions and research institutions; (d) Weak coordination and integration between higher education institutions and between higher education institutions and training providers; and (e) Unconnected vertical relation between higher education with junior and senior high schools.

This situation has caused the relatively low competitiveness of university graduates in Indonesia compared to graduates from other countries. The alternative to overcome the above mentioned conditions and to improve the quality and competitiveness of graduates is the effort to provide a pathway that improves the quality and accountability of undergraduate study programs and professional education programs that meet international standards.

3.1. Curriculum Development

The path towards professional engineers that are capable of providing their engineering services to the improvement of agroindustry competitiveness start with accredited engineering education programs as shown in Figure 2. Graduating from accredited programs, graduates may improve their competences through training and experiences which will help them to meet standard for professional competencies.

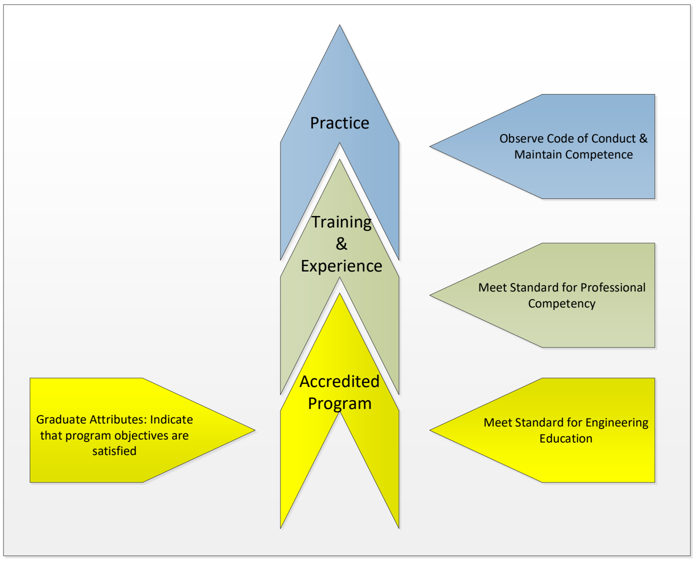

Figure 2. First steps to professional engineers in agroindustry

Based on the above path, education process that meet engineering education standard is a must. The education process to produce graduates as a whole person certainly requires the involvement of various stakeholders [7] and needs to consider various factors in the development of curriculum [8]. Author [9] introduce an integrated approach for curriculum development which includes graduate competency factors, external and internal environmental variables, pedagogical strategies (student-centered and teacher centered) and leadership of educational institutions. Therefore, the curriculum needs to be developed systematically. The logic flow behind the design of professional engineer education program curriculum in relation to the program objectives, achievement of student learning outcomes, and student input is schematically shown in Figure 3.

The curriculum is developed in accordance with the institution vision, mission and needs of constituents, the education objectives (graduate profiles) and student learning outcomes (SLO) of the engineer professional education program. Furthermore, based on the program educational objectives and the graduate learning outcomes that will be achieved by the program, the curriculum of the program is formulated. The curriculum is a set of guidelines in planning and setting strategies to achieve the student learning outcomes, and thus the education objectives. The curriculum includes the structure of courses, learning materials, learning processes, assessments, monitoring and evaluation.

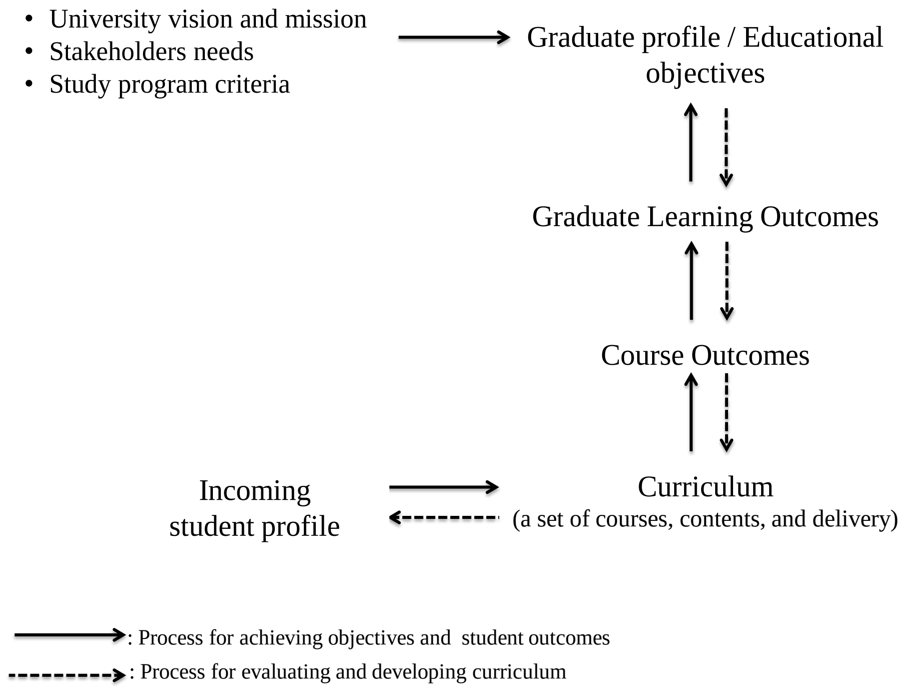

Figure 3. A schematic diagram of curriculum design

In accordance with the intended SLO, the curriculum of the engineer professional education program is emphasized on providing the experience of engineering practices in agro-industry in addition to strengthening the content of professionalism, ethics and work health and safety. The role of professional communities is important. Professional community is an important partner in the development and implementation of the engineer professional education program. In the development and implementation of the agroindustrial engineer professional education program, the Agroindustry Chapter of the Institution Engineers Indonesia is collaborating synergistically with the Communication Forum of Indonesian Agroindustrial Study Programs (FKPSIP), Indonesian Agroindustry Association (AGRIN), Agroindustrial Technology Professional Association (APTA), Forum of Engineer Profession Program Organizer (FPPPI), Indonesian Accreditation Board for Engineering Education (IABEE) and other Chapters of the Institution of Engineers Indonesia. The Agroindutry Chapter of the Institution of Engineers Indonesia carries out engineering service activities to support the government and other parties in the development of agroindustrial sector and other relevant sectors, supporting the implementation of the agroindustrial engineer professional education program, Engineer Registration Certificate and Professional Engineer Certification, Continuous Professional Development, development of Standard of Engineer Services; consultation, community empowerment, Training, Focus Group Discussion (FGD); and National and International Seminars organization.

Quality and accountability of the program is assured trough the implementation of Internal Quality Assurance System (SPMI) and External Quality Assurance System (SPME) as mandated by the Law No. 22/2012 on Higher Education. These quality assurance systems are tools to improve the quality of higher education and accountability to the constituents by applying outcome-based education. SPMI is developed, monitored and evaluated by the university. SPME is done through accreditation. National accreditation is done by National Accreditation Board for Higher Education (BAN PTBAN-PT developed the 2018 version of the Study Program Accreditation Instrument (IAPS), which was briefly written as IAPS 4.0. IAPS 4.0 is more focused on aspects of the process, output and outcome, while the previous instrument measured more aspects of input. External quality assurance can also be done according to international standard. For Engineering Education, this accreditation can be done in accordance to Washington Accord for Engineering Education, Sidney Accord for Engineering Technology, and Dublin Accord for Technician. The international accreditation body in Indonesia for engineering education is Indonesian Accreditation Board for Engineering Education (IABEE).

3.2. Agroindustrial Engineering Education Program (AEEP)

Agroindustrial Engineering Education Program (AEEP) is designed to provide graduates that will directly contribute as change maker in agroindustry sectors. The scope of competencies of agroindustry profession is as follow:

> "Able to design, develop, implement, control, evaluate and improve performance of sustainable agroindustry through integrated approach of process, system, industrial management, and environmental aspects to increase the added value of agricultural resources and its derivatives" (Communication Forum of Indonesian Agroindustrial Study Programs, 2017)

Referring to this definition and scope of agroindustrial competencies as well as the inputs from the professional communities, the professional profile of agroindustrial graduates is as follow:

"After several (3-5) years in a professional career, graduates of agroindustrial engineering program are able to apply their knowledge from their academic program to:

41) Solve agroindustrial engineering problems, as quality engineers, productive and sensitive to the ethical and professional consequences of their works.
42) Develop themselves through postgraduate studies
43) Become a technopreneur
44) Play a role and communicate effectively as individual and in multidisciplinary team, and
45) Continue lifelong learning activities"

In order to achieve these graduate profiles, the curriculum should be formulated so that students will achieve student learning outcomes as shown in Table 3.

Tabel 3. Student Learning Outcomes of Agroindustrial Engineering Program

NO	STUDENT LEARNING OUTCOMES
1	Able to identify, analyze and solve problems in agroindustry that cover aspects of process technology, industrial management, systems engineering, and environmental engineering and management by applying knowledge of mathematics, science, engineering and information technology using modern engineering tools.
2	Able to design an agroindustrial system/component, process and product to meet the desired needs within realistic constraints
3	Able to design and conduct scientific and engineering experiments and analyze and interpret the resulting data
4	Able to recognize the needs and have the ability to be involved in lifelong learning

Tabel 3. Student Learning Outcomes of Agroindustrial Engineering Program (continued)

NO	STUDENT LEARNING OUTCOMES
5	Able to communicate in writing and oral effectively
6	Able to function effectively within multidisciplinary and multicultural teams
7	Able to understand the application of ethics and professionalism in solving engineering problems of agroindustry in the economic, environmental and societal contexts as well as other contemporary issues
8	Able to transform science and technology-based ideas into the concept of agroindustry business (technopreneurship)

The above student learning outcomes (SLO) consists of 8 graduate attributes that includes knowledge, skills and attitudes and referring to the international standard of bachelor engineering education [10] and considering the suitability to the national standard of higher education.

The SLOs are achieved through a sequence of courses. In the first year students will improve their knowledge of Mathematics, Science and General Knowledge. In the second year, students will follow basic engineering principles and information communication technology. The third and fourth year are designed to improve student's ability to apply and use their mathematics, science, engineering, and general knowledge to solve engineering problems. The structure of the courses is shown in Figure 4.

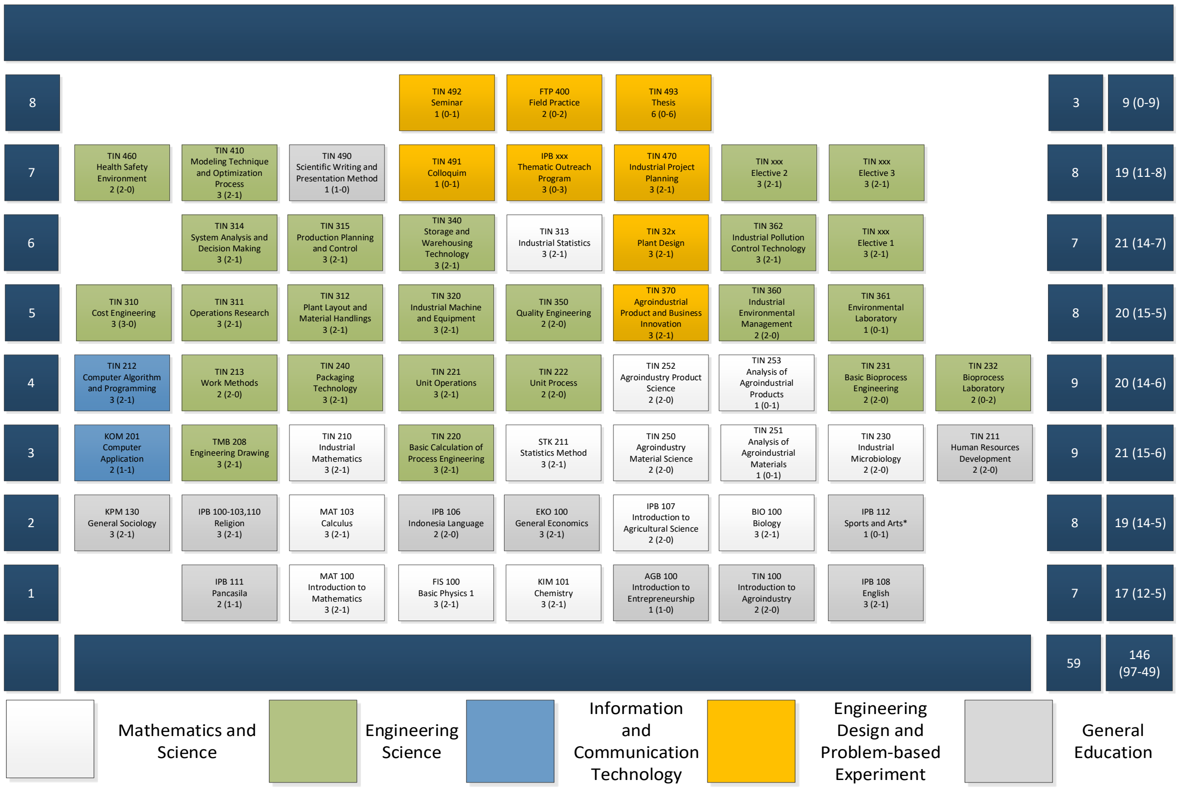

Figure 4. Course structure of Agroindustrial Engineering Program

The total credit for this curriculum is 146 units consisting of 137 units obligatory courses and 9 units of elective courses. This composition complies with the requirement of international standard of engineering education program as shown in Table 4.

Tabel 4. Mapping of courses according to the accreditation criteria of Indonesian Accreditation Body for Engineering Education (IABEE)

No.	Discipline	Required Load	Number of Courses	Load (units)	Load (%)	Remarks
1	Mathematics and Science	Min. 20%	14	34	23	Comply
2	Engineering Science and Technology	Min. 40%	24	63	43	Comply
3	Information technology and communication		2	5	3	Comply
4	Engineering design and problem-based experiments		7	22	15	Comply
5	General education	Max. 30%	11	22	15	Comply

3.3. Agroindustrial Engineer Professional Education Program (AEPEP)

Having completed the undergraduate program, graduates might continue improving their attributes through training and experiences. An engineer professional education program is designed to serve this need. This education program is designed to respond to the demands of global competition while fulfilling the mandate of the Engineering Law No. 11/2014. The law gives mandate to university to carry out engineer professional education which is defined as a higher education after an undergraduate program that prepares students for work with special skill requirements. The law also regulates the obligation of a professional engineer to register in Indonesia (including foreign engineers) so as to provide legal certainty for providers of engineering services, and legal protection for engineers and service users. As a realization of the implementation of the Engineering Law, the Government of Indonesia via the Ministry of Research, Technology and Higher Education (Kemenristekdikti), through a Decree of the Director General of Science, Technology and Higher Education Institutions (SK Ditjen Iptek dan Dikti) No. 682 / C.C4 / KL / 2016 has given a mandate to 40 universities which are considered meeting the requirements for carrying out the Engineer Professional Program.

The Engineer Professional Education Program (EPEP) is a higher education program after an undergraduate program to establish engineering competence. The program is held in collaboration with relevant ministries (whose duties, principal, and functions are related to engineering services), non-ministry state institution (*Lembaga Negara Non Kementerian*/LNNK), the Institution of Engineers Indonesian (*Persatuan Insinyur Indonesia/PII*), relevant industry, and/or professional organizations responsible for the quality of engineering professional services. The university that organizes the EPEP can provide an engineer degree (abbreviated as Ir.) for individuals who have passed all the requirements according to the established standards. The EPEP standard was set by the Minister of Research, Technology and Higher Education, which was formulated based on the recommendations of the higher education institutions in cooperation with ministers fostering the relevant engineering services and the Indonesian Engineers Council.

Figure 5 shows the position of the professional engineer program in producing professional engineers. EPEP graduates hold an engineer degree (Ir.) according to the Law No. 11/2014, Article 7 and 9 are expected to develop themselves continuously through further engineering practices in their career, so that they can practice as professional engineers (PE) who bear responsibility to community safety / security and environmental sustainability.

In the context of producing competitive human resources in agroindustry, the role of engineer profession program in agroindustry is very strategic. The Engineering Professional Education Program (EPEP) is developed to facilitate graduates of undergraduate programs (S1) in developing themselves to work as engineers. The missions of EPEP in IPB are (1) To carry out engineer professional education to produce competent, integrity and highly competitive engineers in the field of agriculture in a broad sense to advance civilization and community welfare, protect the interests of the community, and realize sustainable development, (2) to encourage technological development to increase added value, usability of agriculture-based resources, and (3) to disseminate technological developments to accelerate and expand the application of good engineering practices in agriculture in the broadest sense. The objectives are: (1) to produce competent, integrity and highly competitive engineers in the field of agriculture in the broadest sense, (2) to develop technology so as to increase added value, usability of agricultural resources for the welfare of society, and (3) to spread of technology and good engineering practices in the agricultural sector in the broadest sense.

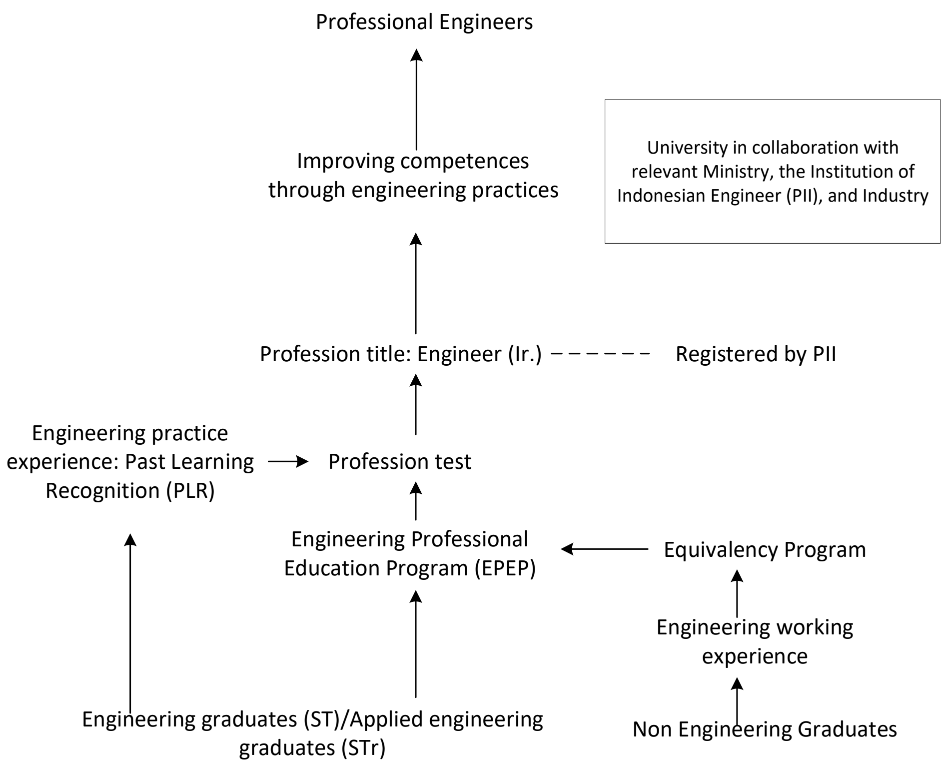

Figure 5. Position of Professional Engineer Education Program in producing professional engineers (Source: Extracted from the Law No. 11/2014)

For those graduated from agroindustrial study program or similarly name of engineering program, they may choose to develop their professional competencies in the scope of agroindustrial engineering services. These services cover the following areas (1) development of process technology and agroindustrial products, (2) Management of the agroindustry, (3) Agroindustrial system engineering, and (4) Industrial environmental engineering and management.

The graduate learning outcomes (GLO) in EPEP is designed to produce engineers who have the ability to:

46) Perform engineering planning by utilizing resources and conducting engineering evaluation in agroindustry comprehensively by utilizing science and technology,
47) Resolve engineering problems in agroindustry,
48) Design and conduct scientific and engineering-based investigation for strategic decision making in accordance with professional ethics and engineering standards, and
49) Implement sustainable development of professionalism through lifelong learning.

The curriculum is designed to fulfill graduate learning outcomes that cover knowledge, skill, and attitude required to perform engineering services as a professional engineer. It is prepared by considering the obligations of engineers according to the Engineering Law No. 11/2014, graduate attributes of engineering education from the International Engineering Alliance (IEA), and alignments with national interests. The course subjects are listed in Table 5. Each course subject is designed to contribute directly to one or more the GLOs. It has a total credit of 24 credits, consisting of 70% of industrial practices under the apprenticeship supervisor, and 30% of the theoretical content.

Table 5. Course subjects of EPEP IPB

No.	Course subject	Credit	
1	Code of ethics and engineering ethics	2	(1-1)
2	Professionalism	2	(1-1)
3	Work health & safety, and environment	2	(1-1)
4	Engineering practice	12	(2-10)
5	Case Study	4	(1-3)
6	Seminar	2	(1-1)
	Total	24	

EPEP curriculum can be grouped into knowledge of engineering ethics, professional competence, and work health & safety and environment; practical engineering skills and problem solving case studies; and soft skills which include communication, collaboration, leadership and management. Tables 6 and 7 are matrices that map the relationship between subjects and competencies to ensure that all learning outcomes can be met.

Table 6. Relative contributions of courses to aspects of student knowledge, skills and behavior

No	Course subject	Learning domain		
		Knowledge	Skills	Attitude
1	Code of ethics and engineering ethics	●	●	●●●
2	Professionalism	●	●●	●●●
3	Work health&safety and environment	●●	●●●	●●●
4	Seminar	●	●●●	●●
5	Engineering practice	●●	●●●	●●●
6	Case study	●●	●●●	●●●

Remarks: ●: medium contribution, ●●: high contribution, ●●●: very high contribution

Table 7. Relative contributions of courses in the graduate learning outcomes

No	Course subject	Graduate learning outcomes (GLO)*			
		1	2	3	4
1	Code of ethics and engineering ethics	●●	●●	●●●	●●
2	Professionalism	●●●	●●●	●●●	●●●
3	Work health&safety and environment	●●	●●	●●●	●●
4	Seminar	●	●●	●●	●●●
5	Engineering practice	●●●	●●●	●●●	●●●
6	Case study	●●●	●●●	●●●	●●

●: medium contribution, ●●: high contribution, ●●●: very high contribution

The program is conducted in two learning modes, namely the Regular Program and the Past Learning Recognition program (*Rekognisi Pembelajaran Lampau*/RPL). In principle, regular program is intended for practitioners who have not had sufficient experience in engineering practice, whereas the RPL program is for practitioners who have had sufficient engineering practice experience. Learning process in the regular program is carried out within 2 semesters that consists of face-to-face meetings, tutorials, focus group discussions, assignments, role plays, pre- and post-tests implementation of independent individual tasks and group assignments (eg. project / problem-based learning, and collaborative-based learning), involvement in scientific meetings, proposal writing and engineering project reporting, and oral presentations.

The RPL is an acknowledgment of learning outcomes obtained from formal, non-formal, informal, and/or work experience in the education sector and other sectors. It is opened for engineering or applied engineering graduates who are considered to have sufficient engineering practice experience (more than 2 years) or for science graduates and engineering education graduates who have fulfilled the equivalency requirements (equivalent to 3 years engineering practice) and possessed adequate engineering practice experience (more than 2 years). RPL is carried out through assessment and recognition of participant portfolios against the requirements of semester credit units (SKS). Credit shortages are then fulfilled through the implementation of the program's curriculum. Learning in the RPL program is carried out within 1 semester. The learning process, assessment and graduation requirements are basically similar as the processes and requirements in a regular program.

4. Concluding Remarks

The increasing number of qualified professional engineers through engineer professional education programs can reduce dependence on foreign engineers. As we all know, foreign investment is very encouraged. The availability of qualified Indonesian professional engineers will improve our nation's bargaining position on the use of foreign workers, especially in economic activities financed by foreign investment. The implementation of the 2015 ASEAN Economic Community (AEC) challenges Indonesian industry and workers. This challenge must be answered immediately by higher education by producing more graduates and professionals who have high quality. Global labor mobility also demands a quality and competitive workforce and is recognized globally. Engineering services are one area that will face very tight competition. This requires a level of competence that is equivalent to global standards. For this reason, improving the quality of technical education programs is considered an effective way to prepare the necessary workforce.

The path of academic education and the agro-industrial engineering profession described in this paper is one of the efforts of higher education to contribute in providing competitive human resources in the field of agro-industry. A quality and accountable education system that involves stakeholders and in accordance with national and international standards is expected to produce an adaptive workforce to develop sustainable agro-industries. Graduates of the academic education pathway are expected to have the competence to be able to design, develop, implement, control, evaluate and improve the performance of sustainable agroindustry integrated systems, covering aspects of the transformation process, system engineering, industrial management, and the environment, and able to work as professionals or technopreneurs through increased knowledge and ability in line with the development of agro-industry.

Graduates who continue on the engineering profession program are expected to meet the standards of professional engineer competence in the field of agro-industry. These professional agro-industry engineers are needed to improve the competitiveness of national agro-industries. They are eagerly awaited to take part in increasing the added value of tropical agricultural commodities, developing the capacity of knowledge and technology and providing innovative solutions in the community. As a university that focuses on providing human resources and science and technology in the field of agriculture in a broad sense, IPB is required to have a proactive role to produce agricultural engineers who are able to contribute in realizing the provision of food, energy and industrial products in a sustainable manner.

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