

Analysis on the Feasibility of Offering the B.S. Industrial Engineering Program at Bataan Peninsula State University

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Abstract. The viability of offering the B.S. Industrial Engineering (BSIE) Program in Bataan Peninsula State University (BPSU) has been investigated. The primary activities include identifying CHED requirements for the BSIE Program including curriculum, facilities, faculty, etc, and assessment if BPSU could comply with these requirements. Also, industry needs as well as marketability of the BSIE Program were determined. Assessment of facilities and manpower showed that BPSU is capable of offering the BSIE Program. From the survey, ~74% of high school student respondents would like to enroll in an engineering course, 98% of which would like to enrol in BPSU. If BSIE will be offered, 47% of respondents would like to enroll in the program. Bataan and its neighboring provinces are home to three Freeport areas with several hundreds of manufacturing companies and other businesses. ~93% of manufacturing companies surveyed would hire BSIE graduates in the future; and ~86% of manufacturing companies would accept student trainees from the BSIE Program of BPSU. The implementation of this program will have socio-economic effects by improving the academic, geographic, financial, and cultural accessibility of the BSIE Program to students. Taking all issues into consideration, the researcher recommends for BPSU to offer the BSIE Program.

Keywords: feasibility study, industrial engineering, marketability

1. INTRODUCTION

Higher Education Institutions (HEIs) need to provide relevant and quality education for the students to be competitive in the global workforce market. The Bataan Peninsula State University (BPSU) has been mandated to provide instruction, along with research, extension and production activities [1-2]. The Central Luzon Region, with its three large Freeport Areas housing several hundreds of industries engaged in manufacturing, will need a steady supply of highly qualified workforce. BPSU will play a vital role in the supply of manpower requirements of companies in the region. The main objective of this study is to gather and analyze data regarding the feasibility for offering a course in Bachelor of Science in Industrial Engineering (BSIE), specifically: a. To identify the requirements for the establishment of the BSIE Program; b. To determine the relationship and effect of the BSIE program on the strategic goals and mission of BPSU; b. To initially determine the industry needs for the BSIE Program; c. To initially assess the marketability of the BSIE program; d. To propose a BSIE curriculum fit for BPSU and Bataan; f. To assess if BPSU could comply the needed laboratories,

library materials, etc; g. To determine whether the proposed offering of the BSIE program is feasible.

2. MATERIALS AND METHODS

Documentary analysis was employed, documents analyzed include laws, CHED Memoranda, BPSU Code, etc. The information gathered from documentary analysis and interviews with university officials provided the internal aspect of the study, or that which BPSU has direct control. Questionnaire-Checklist floated to 4th year high school students was used to assess the demand, specifically the number of possible enrollees for the BSIE Program. Also, the Questionnaire-Checklist was utilized coupled with actual or phone interview to companies, in order to assess the demand for future graduates of the BSIE Program. With these studies, the researcher was able to analyze the external aspect of the study, or that which BPSU has no direct and absolute control. Lastly, phone or in-person interview of companies, universities, and government agencies have been conducted to gather additional information, specifically, AFAB, SBMA, and the University of the Philippines.

Table 1: Number of 4th year High School Students under DEPED-Bataan and DEPED-Balanga [3-4]

	Number of Students		
	Male	Female	Total
Public High Schools under DEPED-Bataan	4555	4440	8995
Private High Schools under DEPED-Bataan	947	1067	2014
Public High Schools under DEPED-Balanga City	653	727	1380
Private High Schools under DEPED-Balanga City	209	215	424
Total	6,364	6,449	12,813

2.1 Respondents

4th year high school students were the main target of the study. Bataan has 75 high schools (both public & private), which caters to 12,813 4th year high school students [3-4]. The researcher selected only ten (10) high schools with the largest population. The schools were considered to represent the whole batch of 4th year high school students of Bataan. These schools with 5,911 4th year high school students represent ~46% of the whole target population. Table 1 shows the total number of students in the private/public high schools in Bataan. Table 2 shows the Top 10 High Schools with the largest population as respondents of this study.

2.2 Documentary Analysis

The documents analyzed were Republic Act 9403, CHED Memorandum Order No. 25 Series of 2005 on Engineering Education [5] as well as CHED Memorandum Order No. 15 Series of 2008 for the degree of BS Industrial Engineering [6], CHED Memorandum Order No. 1 series 2014, and also the University Code which contains the vision, mission and goals of the University [7], the academic programs, faculty, and the data presented in the website [2], list of available resources in the library, and documents from the Human Resource Department and Physical Plant and Engineering Services of the University. The existing number of scholarship available to engineering students was also considered. All the relevant information from CEA, and BPSU as a whole were retrieved for analysis.

2.3 Data Gathering Tools

Several tools were employed in gathering the needed information in this research, which includes documentary analysis, questionnaire-checklist, and interview.

2.4 Preparation of questionnaires

The actual methodology used in conducting the survey was to build the survey instrument first. The researcher considered some reading materials, such as journal publications, theses, and other materials available on the internet to prepare the questionnaire-checklist for high school students and companies.

2.5 Validation of questionnaires

The questionnaires were validated by BPSU's Vice President for Academic Affairs and the Director for Research and Development. The purpose was to comment on the content, clarity, and format of the questionnaires. The questionnaires were then revised and simplified for ease of understanding and answering. The questionnaires were then reproduced for final distribution.

2.6 Administration of the questionnaire

The researcher distributed the questionnaires to the Department of Education (DEPED) Division offices. The Superintendents floated the questionnaires to students thru principals in their respective schools. In distributing the questionnaires, the following guidelines were taken into consideration: Whenever possible, the total number of questionnaires should be "equally distributed" to all sections. Whenever possible, the questionnaires should be "equally distributed" to male and female students in each section. The questionnaires should be "randomly distributed" to the students in order to prevent bias.

2.7 Analysis of the survey results

The data obtained were then tabulated, analyzed and interpreted. Table 2 shows the distribution of students who participated in the conduct of the study. In some instances for the companies, a personal interview was conducted to cross-examine some responses from the questionnaire.

Table 2. Top Ten (10) High Schools with the largest population as respondents of the study. [3-4]

Name of School	No. of Graduating Students	Percent Share (%)	No. of questionnaires
Bataan National High School	971	16.43	62
Mariveles NHS (Poblacion)	882	14.92	56
Limay NHS	776	13.13	49
Mariveles NHS (Cabcaben)	720	12.18	46
Orani NHS	468	7.92	30
Pagalanggang HS (Dinalupihan)	447	7.56	28
Pablo Roman HS	444	7.51	28
Hermosa NHS	410	6.94	26
COBHS	409	6.92	26
Luakan NHS	384	6.50	24
Total	5,911	100	375

2.8 Interview

The interview was employed as a technique in gathering data and information needed in this study. The researcher interviewed Labor Representatives from the AFAB and SBMA, as well as HRD Managers of manufacturing companies in these Freeport zones to get first hand information regarding the needed BSIE graduates. The Department Head of UP Diliman IE/OR Department was also interviewed. BPSU officials were also interviewed on current and proposed university facilities among others.

2.9 Statistical Treatment of Data

The following statistical tools were used in this study:

1) Slovin's Formula was used to determine the sample size for the population.

$$n = N / (1 + Ne^2)$$

(where: n = number of samples; N = total population; e = margin of error)

2) Percentage was used to determine the sample units of the population per school. Percentage was also used in projecting the number of enrollees for the BSIE Program.

3) Simple Average was used to determine the average age of students as well as the income of their parents.

4) Mode was used to determine the preference of respondents in some of the questions in the survey-questionnaire.

3. RESULTS AND DISCUSSIONS

3.1 Requirements for the B.S. Industrial Engineering Program

Background on Industrial Engineering. The BSIE program is intended to prepare students for a professional Industrial Engineering Career including a leading role in the design, improvement and installation of integrated systems of people, materials, information, equipment, and energy. Graduates of the program must have specialized knowledge and skills in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems.

3.1.1 Faculty Members Needed for the BSIE Program

Faculty for all subjects being taught in colleges/universities should hold a degree at least one level above that of the program in which they are teaching, and therefore the faculty for the Basic Engineering Courses, Allied Courses, and Professional Courses should at least have M.S./M.A. degrees in their field of specialization [5].

3.1.2 Facilities needed for the BSIE Program

Classrooms, Laboratory Rooms, Laboratory Equipment, Library, and Library Books

3.1.3 Curriculum mandated by CHED for the BSIE Program

The curriculum mandated by CHED for the BSIE Program has a total of 185 units. The technical courses have five (5) subdivisions, namely, Mathematics, Natural/Physical Sciences, Basic Engineering Sciences, Allied Courses and Professional Courses. Reference 12 lists the complete subjects per semester for the BSIE Program [6]. Also, two (2) units of foreign language courses have also been mandated by CHED to be included in the program. Further, a three (3) – unit competency enhancement course is mandated for the BSIE Program.

3.1.4 Laboratories needed for the BSIE Program

Chemistry, Physics, Computer, Industrial Materials and Processes, Methods Study, and Ergonomics

3.1.5 Library Books needed for the BSIE Programs

Books for the General Engineering Courses as well as Allied Courses are currently and sufficiently available in the Library. However, for the implementation of the BSIE program the following books for the Professional subjects should be provided by the university, especially books for core subjects, specialization, and electives,

3.2 Internal Aspect

3.2.1 Mandate, Vision, Mission and Goals

BPSU has been mandated by law as follows: “The University shall primarily provide advanced instruction and professional training in education, engineering, science and technology, arts and humanities, computer and forestry, and other relevant fields of study. It shall also undertake research, extension services and production activities in support of the socioeconomic development of Bataan, and provide leadership in its areas of specialization” [1]. The following summarizes BPSU’s Vision: A university of excellence acknowledged in the country and the Asia-Pacific Region for quality graduates and knowledge responsive to socio-economic needs. BPSU’s Mission: Provide quality and relevant education that will develop highly qualified and competitive human resources responsive to national and regional development [2].

3.2.2 The SWOT Analysis

A simple SWOT Analysis based on documents and discussions with university officials is hereby presented.

Strengths

Level 2 Accredited. The BSME, BSEE, and BSCE programs have already passed Level 2 Accreditation from the Accrediting Agency of Chartered Colleges and Universities in the Philippines (AACCUP), Inc, while the BSECE has already passed Level 1 Accreditation. Currently, the college has adequate facilities, faculty for the general engineering courses, faculty for the allied subjects. The college administration personnel are with appropriate educational qualifications.

Location. BS Industrial Engineering graduates are in demand in the country and abroad due to needs of the manufacturing and service sectors. The Central Luzon Region is home to several Freeport Areas, namely, the AFAB in Mariveles, Bataan, SBMA in Zambales, and Clark Economic Zone in Pampanga. With its bustling regional economy, Region 3 is home to hundreds of manufacturing companies which house thousands of employees. Bataan alone has ~100 such companies, ~70 of which are located at the AFAB. It is in these settings where BSIE graduates are thriving and much needed. Industrial engineering graduates would be an integral part for the growth and success of these companies.

Weaknesses

Number of Classrooms. The College may need additional classrooms due to the influx of students enrolling in its engineering programs.

Faculty. With the influx of students, the College lacks qualified instructors to teach general engineering and allied courses. Lastly, the alignment of faculty members may be a problem because some faculty members do not have master degrees aligned with their bachelor degrees.

Opportunities

The City of Balanga’s vision is “Balanga City University Town 2020: The Emerging Hub For Knowledge-Based Businesses In The Philippines”. With this, students in the main campus will expect the support of the City Government of Balanga in terms services and ordinances aimed at providing a better atmosphere for studying to all [8]. BSIE graduates would contribute to this vision, as IEs are also involved in product research and development, operations research, systems simulations, information systems, logistics, supply chain, etc.

The Bataan Provincial Government has the following vision: “By 2020, Bataan province will be the preferred location of Eco-Industrial Investments leading to the Highest Human Development Index in the Philippines”[9]. With this vision, the students of the BSIE program from BPSU will expect to have greater chances of being employed by large corporations, comparable only to very few provinces in the Philippines.

Table 3. Estimated number of BSIE graduates that they will hire every year.

	2015	2016	2017	2018	2019
Essilor Manufacturing Philippines, Inc.	2	2	2	2	2
SU Style Inc.					
Tai-Tan Packaging of the Philippines, Inc.				1	
Trans-Am Waste and Rags Philippines, Inc.					
Universal Weavers Corp.	1				
MMA Competent Manpower & General Services, Inc.	5	5	5	5	5
Ko Ree Plastics Corporation	2	2	3	2	2
Kirubai Carton Packaging & Metal Fabrication					
JPN Coiltech Inc.					
Dynamic Multipurpose Cooperative					
Dunlop Slazenger Philippines, Inc.	1	1	1	1	1
Edge Soft Good Solution, Inc.	15	20	25	30	35
Dong-In Sunbirds Corporation	15	20	25	30	35
Desktop Bags Philippines Inc.	1	1	1	1	1
Polarmarine Inc.		1	1		
Hitachi Terminals Mechatronics Phils. Corp.	2	2	2	2	2
Nicera Philippines, Inc.	13	14	16	18	20
Total	57	68	81	92	103

Threats

One possible threat is the possible offering of BSIE Programs of Colleges/Universities in Bataan.

3.2.3 Existing Faculty Members of the College

CEA has faculty members which could handle Professional and Allied Courses. The College of Arts and Sciences (CAS) will handle general engineering and other required subjects. Faculty members have either Doctoral or Master degrees in engineering and other allied courses. Additional faculty will be hired if needed.

3.2.4 Existing and Proposed Laboratories, Facilities, Equipment and Materials

The BSIE Program will be housed at CEA which has 35 rooms. The new science building has 8 classrooms. A small library cum reading room is housed in the College with collection of books, references, journals, publications, etc. Also, internet service is available to faculty members of

the College. In addition, BPSU main campus houses the following: BPSU Main Library, the New Science Building, Computer Laboratory, Drawing Rooms, Physical Education Facilities, Conference Rooms. CEA should dedicate one large laboratory room for the Methods Study Laboratory. BPSU will procure the materials/equipment needed as indicated in the CMO. In the future, it is recommended that BPSU invest in new facilities and equipment for the BSIE Program, especially for the Industrial Materials and Processes, Methods Study and Ergonomics Laboratories.

3.2.5 Source of Funding

The BSIE Program will initially be self-sustaining, i.e., funding will be sourced from tuition fees. After institutionalization of the BSIE Program, funding will then be from MOOE of GAA. For the implementation of the BSIE Program, the College, which has a lot of enrollees annually, is financially stable and can sustain and maintain its operation. With these, it can be said that offering the BSIE program will be financially feasible.

Table 4. Estimated number of BSIE students companies will accept for OJT

	Will they accept OJT students	Number of OJT students to accept per year
Essilor Manufacturing Philippines, Inc.	Yes	10
SU Style Inc.		
Tai-Tan Packaging of the Philippines, Inc.	Yes	
Trans-Am Waste and Rags Philippines, Inc.	No	
Universal Weavers Corp.	Yes	5
MMA Competent Manpower & General Services, Inc.		
Ko Ree Plastics Corporation	Yes	2
Kirubai Carton Packaging & Metal Fabrication	Yes	
JPN Coiltech Inc.	No	
Dynamic Multipurpose Cooperative		
Dunlop Slazenger Philippines, Inc.	Yes	7
Edge Soft Good Solution, Inc.	Yes	30
Dong-In Sunbirds Corporation	Yes	10
Desktop Bags Philippines Inc.	Yes	
Polarmarine Inc.	Yes	2
Hitachi Terminals Mechatronics Phils. Corp.	Yes	
Nicera Philippines, Inc.	Yes	10
Total		76

3.3 External Aspect

3.3.1 The Demand and Supply of BSIE graduates

On Demand for BSIE graduates. The employment opportunity of the graduates of the course was determined through survey-questionnaire and interviews with some companies located in AFAB and SBMA. The data obtained revealed that there is a demand for graduates of BSIE. Table 3 shows the list of companies from AFAB and SBMA initially surveyed for the study. Fourteen (14) companies are from the AFAB. On the other hand, three (3) companies from SBMA obliged to answer the survey form. It should be noted that the questionnaires have been distributed through the respective labor departments of these Freeport zones. The respondents have been divided into two business sectors, namely, manufacturing and service sectors.

On the perception of employers on the offering of the BSIE program: 15 of the 17 company respondents answered Yes. Meaning they are saying that they think that

the BSIE course should be offered by BPSU.

On industry employability: 13 out 14 (or ~93%) manufacturing company respondents will hire BSIE graduates in the future. Table 3 shows the estimated number of BSIE graduates that they will hire every year. Even with the small sample size, the number of students that will be hired is enough to accommodate 1 section (~50) of BSIE graduates. This number increases every year, and indicates that at least 100 students of BSIE students may be hired within Bataan. BSIE graduates are expected to be highly employable not only in the manufacturing sector but also in the services sector as well. Also, they are expected to not only be employed in Bataan but also in other provinces, regions, countries. Some companies did not say how many BSIE graduates they will hire.

On the apprenticeship/OJT of BSIE students. As the Industrial Engineering program is highly dependent on industries, linking with companies is very important. 12 out of 14 (~86%) the manufacturing companies surveyed

will accept OJT students from the BSIE Program of BPSU. At least 76 students, which is more than 1 section (~50 students), may be absorbed by these companies to have OJT in their companies. The sample size may be small, however with their response, it can be said that BPSU will not have a hard time sending BSIE students for their OJT. Also, the locators in AFAB is steadily increasing every year, and that there is no problem for BPSU students to be accommodated. Table 4 shows the estimated number of BSIE students companies will accept for OJT. Some companies did not indicate the number of students they will accept OJT students.

On schools offering the BSIE Program. There are two (2) schools in Bataan currently offering the BSIE Program. Letran College offers the BSIE Program, however, with the expensive tuition fees, high school students do not consider enrolling in the said program. Additionally, the Polytechnic University of the Philippines Branch in Mariveles also offers the BSIE Program, but due to distance (1hr travel from the City of Balanga) high school students also find it quite unattractive. If the BSIE course will be offered in BPSU, then students could easily attend their classes because BPSU's Main Campus is located in Balanga City (where the CEA is located) is at the center of the province.

Proposed Curriculum for the BSIE Program of BPSU. For the proposed curriculum, the BSIE Program of BPSU will have 190 units instead of 185 units as mandated by CHED in [6]. The following lists the main difference: A three (3) – unit competency enhancement course will be added. And two (2) foreign language courses will be added; 1 Asian, and 1 European; each will have 1 unit.

The Viability of Offering the Program. When the survey-questionnaire was collected, a total of 366 out of 375 survey-questionnaires were returned, which translates to 97.6% retrieval rate. 51% are female and 49% are male, which is very close to the designed number of respondents of 50% male and 50% female. The average family size is 5 members. Most parents of these students have operative jobs, for example: Machine Operators, Drivers (taxi, truck, tricycle), Sewers, Machinists, Welders, etc. Almost 70% have income below Php 20,000.00.

On Enrollees: 262 out of 352 (or ~74%) high school student respondents would like to enroll in an engineering course. 256 out of these 262 (or 98%) students would like to enroll in BPSU. Among the current course offerings of the CEA, majority would like to enroll in Civil and Mechanical Engineering. If B.S. Industrial Engineering will be offered, 121 out of 256 (or ~47%) would like to take it as their first choice. Further, more than 50% of those who did not choose BSIE as their first choice, would like to take the BSIE course as their second choice if they will not be accepted in other engineering programs. If that 47% will be projected to the total 4th year high school students of those

10 schools, then 47% of 5,911 students is ~2,778 students who are willing to enroll for the BSIE Program of BPSU. This may not be very accurate, but even if we just take ¼ of this number, BPSU may still open up to ten (10) BSIE sections for the coming AY 2015-2016. However, considering the quality and employability of BSIE graduates in BPSU, and the limited facilities of CEA, it is therefore recommended that an ideal number of sections be initially offered.

On the perception of Freeport Areas: Based on informal interviews, the Labor Departments of AFAB and SBMA said that many companies in their freeports need to hire Industrial engineers. They affirmed that the graduates of this course are in demand particularly that most companies located in their jurisdictions are into manufacturing.

3.3 Socio-Economic Benefits of Offering the BSIE Program

From the conducted survey-questionnaire and interview to high school students, future employers, and BPSU officials, it shows that offering this program is feasible and has the following socio-economic benefits for these stakeholders:

3.3.1 Benefits to students

The socio-economic benefits to students could be summarized by the word ACCESS. Access is usually linked to geography, economic and culture.

a. Geography / Proximity – The other government school offering the BSIE Program is PUP Bataan in Mariveles, again, students wanting to enroll in the BSIE Program in the said school will have to spend either for their daily commute or lodging. Further, BPSU has satellite campuses in Bagac and Dinalupihan which offer the first 2 years of the Engineering courses, which lessens the cost of transportation of students residing near these towns.

b. Economically accessible. Tuition fees in state universities are cheaper than private institutions. So, offering the BSIE program in BPSU could make it very much accessible for the people of Bataan, where many manufacturing industries are located. Currently, Letran Bataan offers the BSIE Program in the Town of Abucay, but the tuition fee is quite expensive.

c. Culturally accessible / Localization - It is also more culturally accessible to students, as students will be more comfortable attending classes here, because BPSU-CEA works hand in hand with the local government units and tends to be more sensitive to community needs and more responsive to them.

3.3.2 Benefits to employers

a. Ease of hiring – With the larger number of BSIE graduates in Bataan after 5 years, companies will have an easier time hiring qualified Industrial engineers fit for the job. As previously mentioned, the jobs that BSIE graduates are qualified to apply include the ff: systems engineer, methods engineer, operations research analyst, quality/production engineer, human resource staff, etc.

b. Cheaper workforce – If the companies located in Bataan would be able to hire Bataenos, then the asking price of job applicants would be much lower, as they will be able to stay in their own homes during the start of their professional working career.

3.3.3 Benefits to BPSU

a. Relevance – With the offering of the BSIE Program, then BPSU will continue to be true to its mandate and mission, and thus become more relevant for its course offerings.

b. Financial aspect – With the influx of enrollees who want to take the BSIE program, then BPSU will expect to reap profits from this program similar with other engineering programs.

3.3.4 Benefits to the local community

a. More attractive business location – As engineers with higher technical knowledge continue to increase, Bataan will be favored as a business destination to multinational companies.

3.3.5 Benefits to the country

a. Maintain highly-qualified workforce – As the ASEAN Integration draws near, the Philippines needs to have a more educated workforce who graduated from relevant and highly technical degree programs. If BPSU will offer the BSIE Program, then BPSU will contribute to the education of a workforce that can compete with the best of the ASEAN partner countries.

This research used as basis the following previous research studies [10] and [11], and the main difference with the previous research works were the programs/courses which will be offered, and to a lesser degree, the location where the programs will be offered.

4. CONCLUSIONS AND RECOMMENDATIONS

The study conducted shows that offering the BSIE Program is feasible. The internal and external aspects are

favorable to all stakeholders including the University, the people in the community, the businesses, and the local economy. Based on the data presented, the needed facilities and human resources are available. Initial survey demonstrates that many companies in Bataan could benefit if BPSU will offer the BSIE Program. Informal interviews show shortages in BSIE graduates in the community. There is also a great demand for the BSIE program from the high school student respondents. It was found out that BPSU would offer a much better geographic and financial access in offering the BSIE Program to the people of Bataan. It is recommended that BPSU offer the BSIE program. If the BSIE program will be offered, future works will include assessment of the course curriculum and syllabus, as well as employability, and job competitiveness of graduates.

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