SUSTAINABLE ENTREPRENEURSHIP EDUCATION IN ENGINEERING CURRICULUM

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ABSTRACT
Transforming the higher education delivery system towards a flexible and entrepreneurial, in nature, is a long term process and progression in order to create a global, holistic and well balanced with entrepreneurship mind-set graduates who are able to be a *job creator* rather than job seeker. Therefore, this paper aims at evaluating the Higher Education Institutions Entrepreneurship Action Plan 2016-2020 in delivering a sustainable entrepreneurship education in engineering curriculum. This study builds on existing literatures, selected reports, journals, and websites and employing content analysis method to derive the outcome. The finding shows positivity and optimistic of the Action Plan. Further investigation demonstrate graduates from intake Year 2015 and Year 2016 were the most influenced by the plan. This paper concludes that having a sustainable entrepreneurship education in the engineering curriculum development plays a very crucial role in ensuring a successful and conducive entrepreneurship ecosystem in realisation Malaysia's dream as 'Entrepreneurial Nation'. Some recommendations for future research to increase the sustainability of the entrepreneurship education in engineering curriculum were proposed.
Key words: Sustainable, Entrepreneurship Education, Engineering Curriculum, Malaysia

INTRODUCTION
Since early 2010, The Malaysia's Ministry of Higher Education (MOHE) is committed to compete in the global economy by establishing a higher education system that is recognised as the world's leading education system. Major changes to the higher education system and operation of the Ministry have been proposed in multiple action plans. The latest Malaysia Education Blueprint 2015/2025 (Higher Education) (MEB(HE)) outlines 10 transformations that will drive continued excellence in the higher education system and address systemic issues in terms of quality and efficiency and global trends that disrupt the landscape of higher education [1]. Instilling entrepreneurial mind-set throughout the higher education system is one of the main shift in the MEB(HE), developing them to be a young, holistic, entrepreneurial and balanced graduates as well as moving them as job seekers to job creators. In line with this, the Entrepreneurship Action Plan for Higher Education Institutions 2016-2020 (EAPHEI) was developed to further thrust the entrepreneurship education in higher education institutions The objective of this paper was to examine the outcome of the EAPHEI that were launch in 2016 and how it has affected the first degree and specifically the engineering students. This paper adopted data analysis and statistical review from the Graduate Tracer Study Report from year 2014 – 2019. Annually, first degree graduates stood the largest pool of graduates in all public universities (UA) [3- 8]. Hence, the graduates of the first degree will be deliberated and discussed in this paper, henceforth, the term 'graduate' refers to the first degree graduates.

The indicator of effectiveness of the entrepreneurship action plan will be based on the graduate employment and unemployment rates. Nyström [9] suggested that employment rate as one of the commonly used measurement to improve economic growth and entrepreneurship. Unemployment rates may stimulate entrepreneurial activity such as self-employment and on the other hand, higher entrepreneur start-up rates, may facilitate industrial restructuring and renewal, decreasing unemployment in subsequent periods [10].

As MOHE realises that it is indeed an important competency for graduates to acquire these entrepreneurial abilities and skills, hence has mandated a compulsory entrepreneurship subject(s) in all UA [11]. Higher Education Institutions (HEI) is considered the main factor in imparting the necessary entrepreneurship education programme. Many scholars have agreed on similar understanding as it is one of the ways to encourage students' entrepreneurial intention and motivation. They believe that entrepreneurship education will significantly influences students' mind-set towards entrepreneurial intention [12-17].

A detailed UA unemployment review with referencing to EAPHEI will also be addressed together with its issues and challenges in developing the entrepreneurship education into engineering curriculum.

ENTREPRENEURSHIP ACTION PLAN FOR HEI 2016 – 2020

Entrepreneurship Action Plan for HEI 2016 – 2020 (EAPHEI) was introduced after the successful implementation of HEI Entrepreneurship Strategic Plan 2013 – 2015, with the aim to transform higher education ecosystem. With this, HEIs need to be

proactive in transforming their delivery systems to be more flexible and entrepreneurial as well as meeting local needs with global thinking in nature. This will create a higher education system capable of producing a holistic, balanced and entrepreneurial mindset that can act as job creators. This EAPHEI programme is structured to provide students with the opportunity to generate income during their studies while also enhancing their employability. Meanwhile, entrepreneurial ideas and business plans generated through the collaboration between students, lecturers, industries and target groups under the social entrepreneurship programme have the potential to empower local economies and local communities. Designed based on previous achievements, challenges and needs, this action plan focuses on 4- key initiatives based on the 2 strategies under the MEB(HE) with their respective measurement and target mechanisms for the period 2016-2020. In this EAPHEI (referring to Table 1) comprises two distinct strategies i.e. the 'Strategy A' was to develop a holistic and integrated curriculum whereby targeting 100% of all HEI students will gain exposure to the culture and attributes of entrepreneurship. Meanwhile, 'Strategy B' is strengthening the learning support system through three initiatives. These initiatives were 1) implement a job creation framework, 2) improve the ecosystem that supports student entrepreneurship activities, and 3) strengthen the competency of the entrepreneurial lecturers and mentors. The goals of each initiatives were to have five percent (5%) of graduates taking entrepreneurship as a career, fifteen percent (15%) of HEI students engaged in business activities ,while studying, and 1500 educators have entrepreneurial expertise respectively **Table 1.** 4-Key Initiatives of EAPHEI [2].

STRATEGY A: DEVELOP A HOLISTIC AND INTEGRATED CURRICULUM	**STRATEGY B:** STRENGTHENING THE LEARNING SUPPORT SYSTEM		
INITIATIVE 1 To implement high impact education practices (HIEP) by incorporating entrepreneurial elements across curriculum and fields of study	**INITIATIVE 2** To implement a job creator framework	**INITIATIVE 3** To improve the ecosystem that supports student entrepreneurship activities	**INITIATIVE 4** To strengthen the competency of the entrepreneurial educators
GOALS			
100% HEI students gain exposure to the culture and attributes of entrepreneurship	**5%** Undergraduate students make entrepreneurship a career	**15%** HEI students engaged in business activities while studying	**1500** Educators must have entrepreneurial expertise

THE GRADUATE TRACER STUDY

The Graduate Tracer Study was initiated in 2002 by the Economic Planning Unit (EPU) in the Prime Minister's Department in collaboration with the Ministry of Education (MOE), then by Ministry of Higher Education (MOHE). It was the first national survey using a standard and uniform questionnaire involving public universities and polytechnics [18]. The aim was to study graduates' employability and marketability. The respondents involved are graduates who have completed study and successfully qualified to receive the scroll. The study involved all higher education institutions (public and private) and is conducted every year during the convocation. In 2006,

it was revised and conducted through online to increase participation rate and increase efficiency. The system was then renamed as 'Sistem Kajian Pengesanan Graduan' (SKPG) [18]. The system is open two to three weeks before convocation and closes one week after the convocation. It will covers all graduates of all levels from post-graduate, first degree and diploma..

The survey ask graduates about their socioeconomic background such as age, marital status, family income, disability; academic and technical skills; educational experiences in institution of higher learning such as type of institution, university name, course, field of study, and industry training, financial support; job information such as job status, reasons for unemployment, type of organisation, income, industry, part-time job, job level, job placement and other assessment questionnaires: retrospective questions about satisfaction with university facilities, the environment and quality of graduate teaching.

The main purpose of Graduate Tracer Study is to gather data and information from graduates. Referring to Figure 1, these data would enable MOHE to execute the planning and development of human capital and provide feedback on higher education programmes for improvement and development to meet the industry needs.

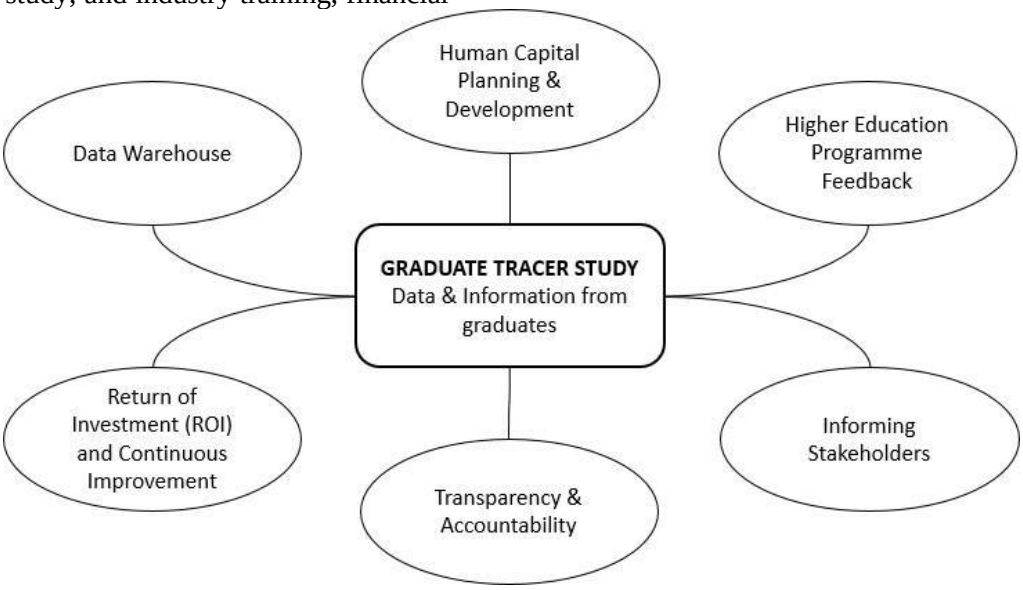

Figure 1 Graduate Tracer Study [18].

Apart from that, the information collected will enable various stakeholders to understand the current situation, plan for continuous improvement, and strategise for future roadmap. More transparency and accountability are appreciated with the information being able to share across the board. Respective stakeholders would be able to use and check these data for the return of investment. Lastly, this Graduate Tracer Study will be a comprehensive Malaysian graduate data warehouse for continual studies on graduate employability and marketability, and will be used to propel the next course of action.

With successful implementation of this system, a second system - 'Sistem Kajian Pengesanan Graduan II' (SKPGII) was developed in 2008 to further understand how graduates develop their career over a longer period and a more comprehensive view of the industry demand and dynamic of the job market [19]. Hence, it is an effective tool for understanding the graduate state of affairs after their completion of study.

CONCEPT OF SUSTAINABLE

For the purpose of this paper, it is necessary to make an attempt at distinguishing between these two words, sustainable and sustainability. This is because both words have been used inter- changeable by many authors, researchers, and practitioners universally and widely used in environmental related matters. The meaning, usage and context are intertwined. These words gain traction after the United Nation's World Commission on Environment and Development (WCED) published the report "Our Common Future" in 1987, also known as Brundtland Report [20].

The basic definition of sustainable is able to be maintained at a certain rate or level or over time [21] whereas sustainability is defined as the ability to exist constantly or generally refers to the capacity for a balance economic, environmental and social factors in equal harmony [22, 23]. Since the Brundtland Report was published, usage of these words have been expanding its boundaries from environmental to processes, products and services [23].

In the context of this paper, sustainable may refers to

all necessary actions required to keep existing entrepreneurship education to be continuously effective and relevant in order to successfully meet its set objective. Hence, sustainable entrepreneurship education can be described as the actions planned to meet the operational and performance readiness in shaping future entrepreneurs or graduates with entrepreneurial mindset and attitude.

The Malaysia government has made a commitment to adopt the United Nation's Transforming Our World: The 2030 Agenda for Sustainability Development based on three goals, namely, economy, social and environment [24]. Mirroring the sustainable development goals (SDG) with its own 11th Malaysia Plan through the new economic model of high income, inclusivity and sustainability, one of the strategic thrust is to accelerate human capital development for an advanced nation. The key initiatives under this thrust are focus on cradle-to-grave talent development and lifelong learning will improve labour productivity, deliver a higher-skilled workforce, and create a virtuous cycle of job creation, growth and social development [25]. Thus, it is imperative that integrating a sustainable entrepreneurship education in the higher education curriculum will provide a long term goal in achieving the government's agenda.

RESEARCH METHOD

Source of data

A non-probability, convenience sampling technique were used in data collection. Data were collected from the Graduate Tracer Study Report (GTSR). A six years of historical data from 2014 to 2019 pertaining to employability and marketability for first degree graduates, were manually tabulated. All data collected were in percentile. The first part of data were collected based on the overall public universities Malaysian graduate employment status. The second part of data were tabulated from unemployment status according to the field of studies between engineering and arts and social science. Only the comparison of engineering and arts and social science were taken as both its graduate population stood among the highest. Engineering-related studies were grouped in the technical main study field in the GTSR. The third and last sampling of data were taken from sub-field of studies in technical group. Basically, there were seven sub-field in the technical group. Only four sub-field data were taken in this study. They were civil, chemistry, electrical and mechanical engineering. These are the four most important and popular engineering degree. Simple control methods were used to eliminate duplication or error of the data.

Statistical methods

Simple statistical techniques were used to tabulate the results of this study. The primary data were analysed using simple table of comparison using Microsoft Excel spreadsheet. The graduate employment data were manually transferred into the table by cross reference with year. The unemployment data were deduced by deducting the employment data with 100%. Similarly, the subsequent results of the unemployment status by field of studies were manually transferred into a table and a graph was plotted to better illustrate the outcome. Data collection and analysis were carried out simultaneously until the end of the research process.

Limitation

This study may be limited through the use of a non-probability, convenience sampling method as a data collection instrument. The Graduate Tracer Study sample for the study was chosen for its actual graduate feedback and convenience purpose. It may not be representative of the total population of graduate employment rate. Care should be taken when generalising these findings to the entire population. Finally, the use of simple statistical techniques may introduce an element of subjectivity into the interpretation and analysis of the data. All attempts have been made to minimise the effects of these limitations on the study FINDINGS

The findings are presented in three sections according to the following characteristics: oveall employment rate in UA, unemployment rate comparison between engineering graduates and arts and social sciences graduates, and unemployment rate among engineering sub-field graduates.

Employment Rate in UA

As shown in Table 2, the public universities graduate employment rate in 2014 was 67.5% and it gradually increased to 83.7% in 2019 with a slight dropped in 2017. The average employment rate is 74.1% while the average unemployment rate is 25.9%.

Table 2. UA Employment Rate.

	2014	2015	2016	2017	2018	2019

Employment (%)	67.5	71.1	74.4	73.3	74.7	83.7
Unemployment (%)	32.5	28.9	25.6	26.7	25.3	16.3

Unemployment Rate in Engineering and Arts & Social Sciences Graduates

Figure 2 displayed a tremendous drop of unemployment for engineering graduates from 33.8% in 2014 to 11.4% in 2019. The average unemployment for engineering graduate stands at 25%. For Arts and Social Sciences unemployment rate was 34% in 2014 and gradually reduced to 27.8% in 2019 meanwhile the average unemployment stood at 31.7%. Nevertheless, there was a slight increase of unemployment rate in 2015.

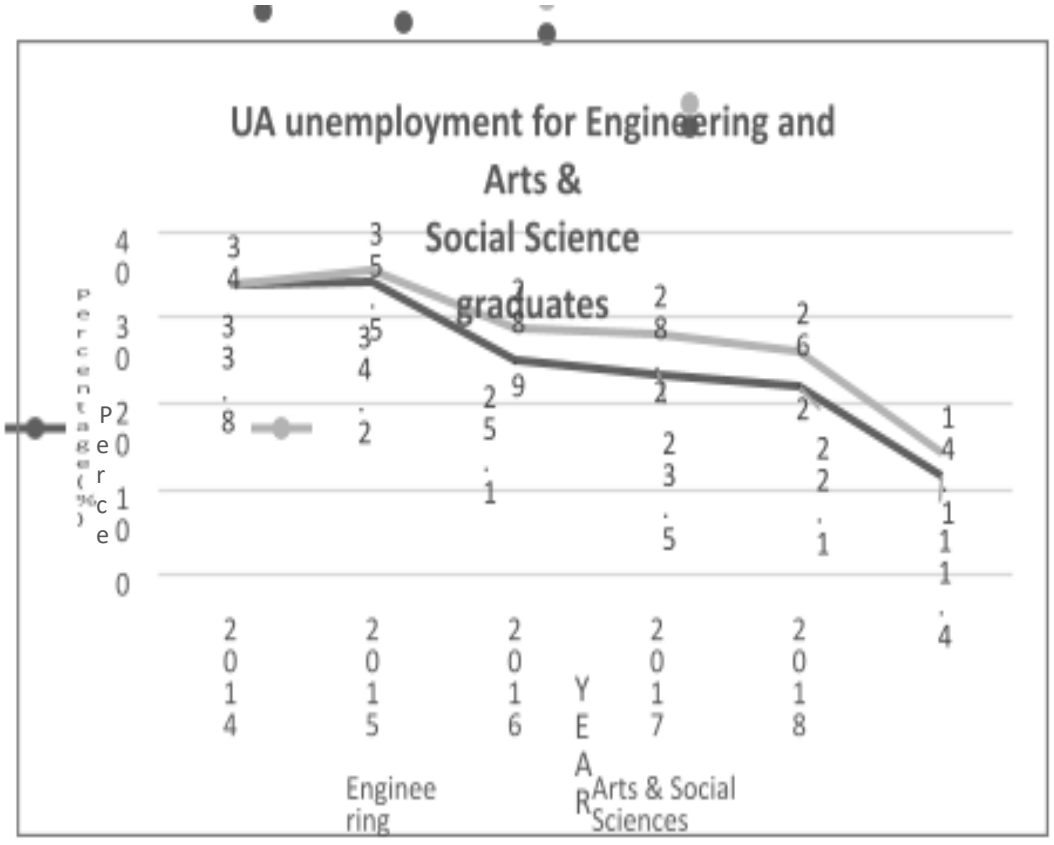

Figure 2. UA Engineering and Arts & Social Sciences Unemployment Rate.

Unemployment Rate by Engineering Sub-field Studies

Highest recorded unemployment by sub-field of engineering studies was chemistry engineering in 2014 with 41.7% (Figure 3). Meanwhile, the lowest recorded unemployment was civil engineering with 7.9% in 2019. All sub-field recorded drastic drop in unemployment in 2019. Electrical engineering shown the largest improvement with 11.1% (2019) from 37.5% (2014) i.e. a difference of 26.4%. Civil engineering appeared to be the least improved with 7.9% (2019) from 29.9% (2014) with a variance of 22%. On average, mechanical engineering has the highest unemployment rate with 29%.

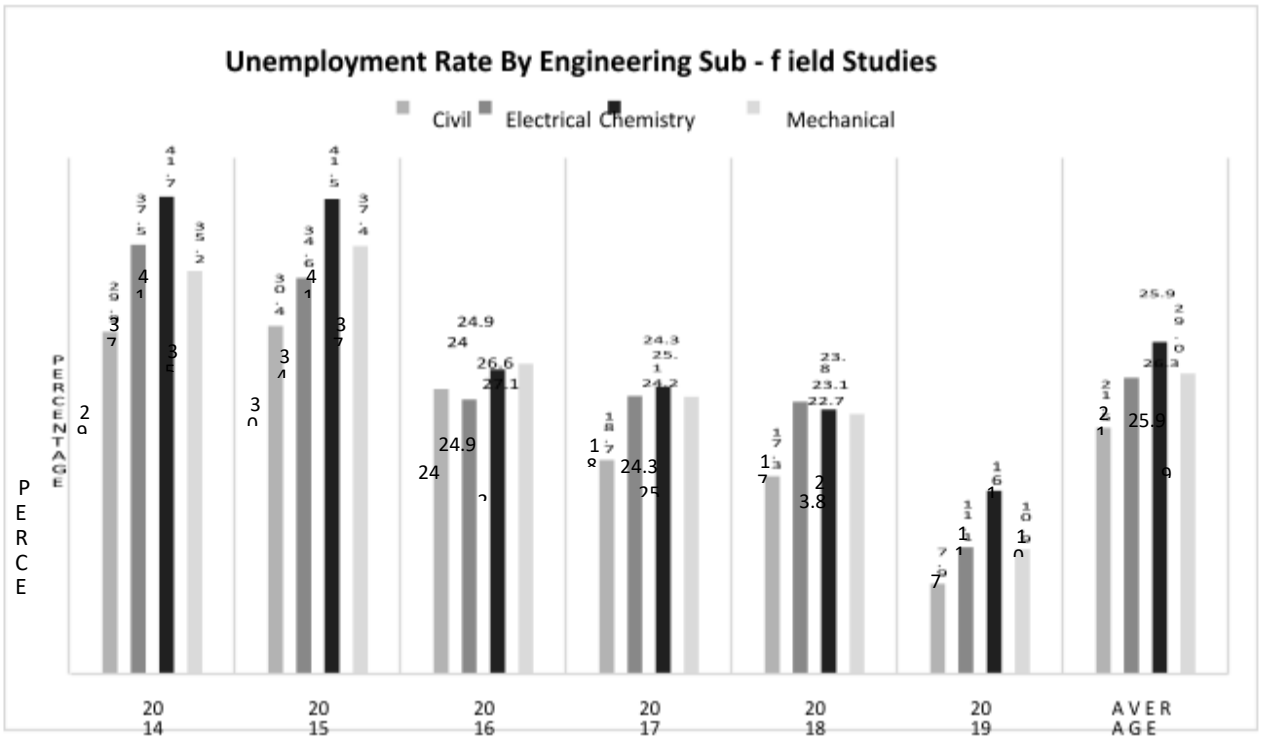

Figure 3 Unemployment rate by engineering sub-field studies.

DISCUSSION

As shown in Table 2, the six years of results indicated that the employment rate of graduates has been steadily improving which is a good indicator for the Malaysia's unemployment challenges. While Figure 2, exhibit a steady drop of unemployment rate among both UA engineering and arts and social science graduates. Engineering graduates performed better than the arts and social science.

This significant improvement somehow indicated that the EAPHEI is on the right track. From the observation, the graduates from intake Year 2015 and Year 2016 (for 4- and 3-year undergraduate degree) has been mostly impacted by the implementation of EAPHEI. Obviously, the strategies and initiatives implemented from EAPHEI has been influencing to the positive of the employment rate.

CONCLUSION

Clearly, this indicated that the entrepreneurship education is partly contributing to this success factor. It is suffice to conclude from this brief yet significant insight in warranting the sustainable entrepreneurship education in the higher education curriculum especially the engineering curriculum. With these great deal of initiatives and policies in hand from MEB(HE) and EAPHEI, the 'entrepreneurial nation' will be achieved very soon.

However, See [26] indicated that the priority of the UA towards offering entrepreneurship courses in engineering curriculum are still low. Hence, the entrepreneurship education at UA need to be culminated and updated regularly to ensure students are nurtured and interest are created for entrepreneurial effectiveness. Therefore, some future potential research area worth exploring is analysis of the entrepreneurship education in the respective engineering field of studies, and development of an effective yet efficient entrepreneurship education which can promote interdisciplinary learning and delivering relevance of study. This would be the critical success factors as well as developing a holistic entrepreneurship education in the engineering curriculum, which will definitely assist in achieving the Ministry of Higher Education mission in producing more *'jobs creator'*.

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