An Investigation into the impact of techno-entrepreneurship education on self-employment

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An Investigation into the Impact of Techno-Entrepreneurship Education on Self-Employment

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***Abstract*—**Research has shown that techno-entrepreneurship is economically significant. Therefore, it is suggested that teaching techno-entrepreneurship may be important because such programmes would prepare current and future generations of learners to recognise and act on high-technology opportunities. Education in techno-entrepreneurship may increase the knowledge of how to start one's own enterprise and recognise the technological opportunities for commercialisation to improve decision-making about starting a new venture; also it influence decisions about capturing the business opportunities and turning them into successful ventures. Universities can play a main role in connecting and networking techno-entrepreneurship students towards a cooperative attitude with real business practice and industry knowledge. To investigate and answer whether education for techno-entrepreneurs really helps, this paper choses a comparison of literature reviews as its method of research. After reviewing literature related to the impact of techno-entrepreneurship education on self-employment 6 studies which had similar aim and objective to this paper were. These particular papers were selected based on a keywords search and as their aim, objectives, and gaps were close to the current research. In addition, they were all based on the influence of techno-entrepreneurship education in self-employment and intention of students to start new ventures. The findings showed that teaching techno-entrepreneurship education may have an influence on students' intention and their future self-employment, but which courses should be covered and the duration of programmes, needs further investigation.

***Keywords*—**Techno-entrepreneurship education, training, higher education, intention, self-employment.

I. Introduction

TECHNOLOGICAL entrepreneurship, also known as technology entrepreneurship or techno- entrepreneurship is defined as setting up a new technology venture [1] or ways in which entrepreneurs draw on resources and structures to develop technology opportunities [2]. Techno-entrepreneurship can be viewed as an investment in a 'project' that gathers specialised individuals to create and capture value for firms. In addition, techno-entrepreneurship can be distinguished from other entrepreneurship types such as social entrepreneurship and small business management due to its collaborative investigation which can be turned into new products and features relating to advances in scientific and technological knowledge and the firm's asset ownership rights [3], [4]. Moreover, techno-entrepreneurship has an impact on individuals, firms, regions, and nations. [5], [6] mention that techno-entrepreneurship impacts on growing firms and local economic enlargement by providing the innovation value chain of global enterprises. Furthermore, regarding the growing economy and firms, [7] mention that where the objectives of techno-entrepreneurship achieve sustained industrial development, then this improvement is leading to regional growth. Therefore, as technological entrepreneurship is being seen to be essential for firms, then teaching technological entrepreneurship to prepare current and future generations of learners to recognise and act on high-technology opportunities, also needs academic attention [8]. In addition, techno-entrepreneurship has the potential to educate managers from non-business disciplines such as engineering and science, and this includes providing entrepreneurs with the transferable skills and appropriate tools to take ideas to market. [3] illustrate that techno-entrepreneurship education brings knowledge into the area of management and entrepreneurship with the aim of introducing global standards and education to preparing a business in a technology field, delivering strategies and approaches and bringing together new high technology (tech) products into the market [4]-[9]. Teaching provides and insight into how to manage innovative new product and service development alongside an awareness for the transfer of this knowledge into a new business, whilst also introducing strategies for sustainable growth and development in the market is also part of techno-entrepreneurship [3]-[10].

The aim of this research is to investigate the possible effect of today's higher education on techno-entrepreneurship by considering entrepreneurial behaviours and the intentions of students or prospective entrepreneurs. As a first step, to achieve the purpose of this research, this study involves comparing literature reviews of the current academic literature related to techno-entrepreneurship education which examines and reviews the role of education in finding and recognising the existing opportunities in society for techno-entrepreneurs. This would possibly enable a better understanding of the theories and to investigate how and what features are needed for techno-entrepreneurship education to enable entrepreneurs to better recognise new venture opportunities. To address these objectives, firstly the questions of this systematic literature review will be presented. Then the methodology section with the aim of comparing the literature reviews will be discussed. After that, trying to answer why techno-entrepreneurship is important will be deliberated on, followed by an investigation into techno-entrepreneurship in education

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and training. Next, the role of universities in offering techno-entrepreneurship education will be discussed. Afterwards, the paper will try to answer whether higher education has an influence on techno-entrepreneurs' skills and impact on students' self-employment. Later, the findings of the comparison of the selected literature reviews and gaps and limitations of the current research will be discussed. Finally, the conclusion will be presented.

II. Review Questions

For the purpose of this research the subject of techno-entrepreneurship education and self-employability has been narrowed down to three review questions. The leading questions of this research are shown below:

1) How does involvement in the subject of techno-entrepreneurship influence students' perceived desirability of self-employment?
2) Does techno-entrepreneurship education interest students in entrepreneurial self-efficacy and help them in reaching self-employment goals?
3) Does students' perceived desirability of self-employment and interest in entrepreneurial self-efficacy affect their self-employment purposes?

III. Methodology

To meet the aims of this research, this article offers further support for previous techno-entrepreneurial intention studies as well as adding to the current literature with a better understanding of factors, which influence techno-entrepreneurship. This research chose a systematic literature reviews for its methodology. Reference [11] refers to a systematic literature review as providing an in-depth summary of current literature that is relevant to research questions. Then, to address the systematic literature review, the writer needs to search through the literature for relevant papers. Moreover, [12] mentions that a systematic literature review uses an objective and transparent method to minimize bias in the research. A systematic literature review focuses on the research question with the aim of identifying, selecting, and synthesizing close and similar relevant research to that question. In addition, [13], [11] highlight that a systematic literature review brings up multiple reviews addressing the same key questions. Thus, as a result, the current research used the systematic literature review because this methodology is based on identifying relevant studies and can provide information about the effects of the phenomenon across a wide range of settings and empirical methods. Then, for the purpose of the current research, after searching Google Scholar on "technology entrepreneurship education" the results showed 97 relevant articles in this area. To reach the aim of this study and answer the questions, by reviewing the search in Google Scholar it was narrowed down to technology entrepreneurship education and its impact on self-employment, yielding 41 peer-reviewed articles. However, from 41 results, only 32 were readable. Some came up in the search engine as a fault and were not relevant to the topic; some were deleted from the search engine but their name still remained in Google Scholar, and also some were repeated and were published in different journals. This is why the first search showed 41 relevant articles for "technology entrepreneurship education" but the real result was 32 articles. The founded articles then added to Table I as coming up later in this paper. They set up in orders in Table I as found in Google Scholar. However, it was decided to be selective and choose those articles that specifically focused on the related topic of the influence of techno-entrepreneurship education on students and their self-employability in the future. So, to justify a comparison of literature reviews, only among 41 articles 6 of them were found similar and using the same key words and same objectives as this study. In addition, the literature reviewed was selected based on it being close to the aim of this research and all articles examined the influence of techno-entrepreneurship education on students' perceived desirability about the self-employment and interest of students in entrepreneurial self-efficacy after passing the techno-entrepreneurship subject.

The following sections will give the background first on why techno-entrepreneurship education is significant. Then, techno-entrepreneurship in training will be discussed, followed by the role of higher education in introducing techno-entrepreneurship. After that, the influence of techno-entrepreneurship education on self-employment will be discussed. It needs to be mentioned that these discussions will be determined and explained based on those 97 and the narrowed down 32 articles. Afterwards, in the section on the comparison of literature, only the 6 selected from the 32 articles are discussed in detail. Those 6 were chosen since their aims, objectives, and keywords are closer to the current study. In the comparison, those 6 will be discussed and compared together.

Table I shows what has been found from Google Scholar based on searching for technology entrepreneurship education. As seen from Table I only 32 articles were mostly relevant to the aim of this research. However, they cover different areas and subjects in entrepreneurship and technology entrepreneurship education, often agreeing that entrepreneurship education and technology are increasing, as well as their demand. The higher education systems need to update themselves and provide technology and introduce technology courses for their students, since the pedagogical system for teaching technology entrepreneurship is no longer suggested by textbooks and other books. Thus, the results of 32 different articles in Table I show a clear agreement that techno-entrepreneurship is vital and the next section will explain why this is important.

TABLE I
THE SEARCH RESULTS FROM GOOGLE SCHOLAR SEARCH ENGINE USING "TECHNOLOGY ENTREPRENEURSHIP EDUCATION"

Author/s	Overview
[14]	Focusing on the requirements for an industry sector approach to entrepreneurship education regarding the information and communications technology (ICT) sector. This paper modified a framework regarding entrepreneurship education in ICT. Some of the primary approaches for the ICT framework are realized as inputs, process and content, assessment and outputs. These targets have been known as relevant approaches for entrepreneurship education courses to create an entrepreneurial mind-set for graduates in this sector. The ICT framework can be modified to suit courses focusing on other industry sectors.
[15]	Focusing on a general strategic approach which could increase the entrepreneurial culture. This perhaps helps students to understand the feasibility of technology enterprises, which could help them to establish and manage supportable ventures and accelerate commercialization of technologies developed on campus.
[16]	Entrepreneurship Education (E-ed) will affect personal characteristics, networks, and E-self efficacy. The technology entrepreneurship will create promise in new firms, new jobs, and economic growth, and pedagogy matters. Technology entrepreneurship could introduce some andragogical approaches such as applied, relevant, problem-centred learning as opposed to the conventional lecture and case-based pedagogical approach. Also, it could be said that technology entrepreneurship accelerates the entrepreneurial behaviours, activities, and enterprises that produce economic impact.
[17]	Related to teaching technology entrepreneurship, some key points such as, introducing a framework of stringency training and having pedagogical instruments from textbooks to simulate are vital; however, introducing techno-entrepreneurship may be different in different countries and their universities since it comes from the culture of that country. Thus, there are different concepts for the role of technology entrepreneurship education.
[18]	There is an influence of entrepreneurship programme/course on entrepreneurial self-efficacy (ESE) students. The result indicates that the entrepreneurship programme is effective in enhancing ESE students. The entrepreneurship course affects the start-up behaviours of students.
[19]	Entrepreneurship education programmes are being established to increase the knowledge and competency of students to create economic value and jobs. Entrepreneurship education programmes create positive outcomes for students. Some approaches need to be considered in entrepreneurship education pedagogies for instance, reaching a consensus on learning outcomes, knowing what approaches need to be taught, and understanding what resources are initiatives and the need to be sustained long term. Moreover, involving faculty in the programme to create incentives and opportunities for more assessment-related research and scholarships within the field.
[20]	Introducing a framework for a project named 'Technological Entrepreneurship at the Free University of Brussels (Vrije Universiteit Brussel, VUB)' based on overviewing the bio-entrepreneurship education programme. The bio-technology programme was accomplished to teach to bio-entrepreneurship master's students in business and bio-engineering at the university. It was discovered that there is a need for a set of integrated and interdisciplinary courses among business and bio-engineering students. Then, it was suggested it is necessary to increase the number of such programmes across European universities.
[21]	There is an innovative education model named Graduate Student Company (GSC) which has an aim to teach entrepreneurship competencies based on the learning-by-doing methodology. Based on this model, students operate a mini-company and there are some members who operate as buyers of shares in the company. During the process of learning, educators face the whole company life cycle from establishment to closure. It has been discovered that the learning-by-doing methodology can be seen as a key success factor in teaching entrepreneurship. The way of practice encourages involvement and then mentorship on the part of the business with the aim of improvement in the learning environment and entrepreneurship ecosystem, the successful methodology of GSC.
[22]	What the challenges are for Faculty of Mathematics and Informatics (FMI) of Sofia University have been asked and how the university can introduce a practical way to solve specific problems to make better decisions and resource allocation choices for FMI. It has been using different methods and techniques in strategic management for modelling, design and implementation in the education and research environment to find an answer. Then it was understood that the FMI needs to keep its position as a leading research and education centre in ICT in Bulgaria and compete in the global educational environment. Also, the staff of FMI can take strategic management decisions to focus on their efforts to become creative and competitive in education in their research environment.
[23]	The research is narrowed down into introducing a framework of educational objectives which relates to the technology entrepreneurship and MBA courses. It was discovered that it may no longer need to use textbooks and handbooks to teach entrepreneurship. Also, there is relevance between culture and content in an integrated way and teaching entrepreneurship can be different in different cultures such as with the different pedagogies in the USA and Europe.
[24]	It was discovered that in Malaysia, trends and changes in the demand for entrepreneurship education are increasing and this led to globalization. Thus, the research investigated what the impact of globalization for business and entrepreneurship education is besides entrepreneurial skills in Malaysia. Afterwards, from the results it can be seen that there is a growing demand for entrepreneurship education and entrepreneurial skills, indicating that globalization has impacted towards the increasing demands of entrepreneurship education and entrepreneurial skills among graduates.
[25]	It has been shown that the research engineering entrepreneurs programme has an influence on engineering students to become entrepreneurs. They offered a three-course sequence with engineering graduates who have pioneered successful companies. Then, the assessments showed a positive correlation between programme participation and entrepreneurial action.
[26]	The research presents a framework of the outcomes of entrepreneurship education (EE) at educational and socio-economic levels. The research introduces a framework for entrepreneurial learning and justifying a scientific identification for its performance. This framework makes a link between the association of employability, entrepreneurship and venture creation for measuring the impact of entrepreneurship education.
[27]	Small and medium enterprise administration (SMEA) in Taiwan is increasing and today their incubation centres (ICs) for facilitating start-ups and innovation have reached 79 ICs in total and interestingly, 65 out of 79 ICs are established in universities and colleges. The ICs within universities offer engineering education (EE) besides engineering technology education (ETE) courses and also perform well in technology entrepreneurship.
[28]	The study explains that a university setting can impact students identifying existing opportunities and their entrepreneurial intentions. The research perceived that the impact of entrepreneurship education, entrepreneurship support programmes and industry connections on students' entrepreneurial intentions influence students' intentions and their entrepreneurial behaviours. Findings suggest that academic entrepreneurs are more likely to come from universities having intensive industry ties than from other institutions.
[29]	It has been recognized that one of the weaknesses of Nigeria's education system can be because of the failure to prepare graduates for self-employment and business entrepreneurship. In Nigeria, graduates follow the tradition of job seeking which is mostly with the government and not jobs in the private sector. Then, because of economic crises in Nigeria, the public sector is diminishing in job creation and enterprises are being privatized. Therefore, universities play a significant role in acquisition of supporting its integration into the curriculum of entrepreneurship as a panacea for self-reliance.
[30]	This study focuses on undergraduate entrepreneurship students who live together in a residential hall to become experts and have a strong entrepreneurial spirit. Besides living together, they were learning the entrepreneurial process and then how to start and operate their companies.
[31]	The study introduces three patterns for lecturers and university managers to guide the creation of Master of Science (MSc) programmes in engineering and science. The first is the technology entrepreneurship and innovation (TEI) curricula which provide various computational courses for students. The second is the TEI MSc programme to create and show a road map for the successful implementation of technology

Author/s	Overview
	entrepreneurship graduate education; and the third is the teachers' TEAM to guide teachers with the stress on attracting and retaining the best professionals in the field. The final outcome was that the technology entrepreneurship curriculum should be designed for university master's level teaching and to use a mix of methods and observation techniques with the aim of assessing the feasibility and applicability for developing the winning strategy for both graduates and lecturers.
[32]	The study shows that students need to be able to move from a fundamental understanding of their subject and then turn their knowledge into some expertise to be an entrepreneur. There is an existing gap for technology and entrepreneurship (T&E) for women. However, women who are innovative and creative and also capable of working with computers can be recognised and then invited into technology entrepreneurship in society; they will then train with risk management, decision-making, create opportunities, and solve problems.
[21]	The Graduate Student Company (GSC) seems to be an innovative educational model which is based on learning-by-doing. This research reviews the observation of European and global practices related to the field of entrepreneurship education and focuses on what can be a more practical performance for the Junior Achievement –Young Enterprise (JA-YE) methodology for the Graduate Student Company. The result shows that the learning-by-doing methodology is a key success factor in teaching entrepreneurship. The good patterns for entrepreneurship education are the practice of encouraging involvement and mentorship on the part of the business community from university and encouraging the graduates to take a role in doing business, then trying to improve the learning environment and entrepreneurship ecosystem.
[33]	Technology entrepreneurship graduates have technical expertise which can lead them towards creativity and producing innovative products. This mixture of competencies would enable the graduates and make them ready to develop new technologies whilst also having the mind-set to commercialize them.
[34]	Empirical learning can be seen as a considered premier for entrepreneurial education. In the USA, technology entrepreneurs are considered an element of economic growth, job creation and global competitiveness. This study introduces a model for Accelerating Collegiate Entrepreneurship (ACE) which shows a link between the theories of technology entrepreneurship creation to the curricula and pedagogical inputs. Some results show that engineering students tend towards long-term entrepreneurial intent and are still taught and followed the traditional education system and this system may not prepare and encourage students for the technology management. A longitudinal study is needed to change and make some effective changes to the curriculum and pedagogy in a manner that helps accelerate the creation of successful technology entrepreneurs.
[35]	This study focuses on economic and entrepreneurship in China and tries to reach a sustainable economic growth model. Within China, the economy can cause many problems, the same as in the other global areas and this would cause puzzling problems in China's economic growth. In China, the growth-oriented projects are found in both private and state-owned enterprises. To have and maintain a successful growing country, this study suggested that China needs to reduce wasteful distortions in resource allocation across firms, higher educations, and industries and eliminate counterproductive discriminating policies.
[36]	This research, introduces a systematic design for innovative talent among higher educators. In this regard, the study suggested the objectives of innovative venture education as a starting point and destination, then performing the innovative education venture as the core and key of such innovative venture education. Thus, this research is seen as establishing an operation mechanism model of innovative venture education in institutions of higher learning.
[37]	The University of Singapore re-launched a master's of science programme in the management of technology and this brings a new opportunity to refresh the programme and introduce management of technology (MOT) courses. These courses include Intellectual Property Management, Management of Industrial Research and Development, Systems Architecture, and Systems Engineering. Moreover, the study suggested a possible approach for completing MOT programmes into the core engineering curriculum as a way to enhance the value of traditional professional degrees.
[38]	Entrepreneurship is growing in importance and introducing new opportunities with the aim of presenting a good career moment for engineering students. The study suggested that engineering schools need to imbue an understanding of entrepreneurship knowledge; then come to an agreement to answer why entrepreneurship is important, and a sense of how students might go about pursuing it.
[39]	This study, with the aim of promoting equal rights and opportunities for the world's women, created a Platform for Action that focused on the following 12 critical areas of concern: women and poverty, education and training of women, women and health, violence against women, women and armed conflict, women and the economy, women in power and decision-making, institutional mechanisms for the advancement of women, human rights of women, women and the media, women and the environment, and the girl child. In each area, serious barriers to the well-being, equal treatment, and advancement of women still exist worldwide. The results related to women's contributions to science are contributing to: the ethics of science; institutional barriers to advancing women; accountability in the use of resources for women's advancement; changes in science education, and the need for dialogue among those with differing perspectives on the role of science and technology in the advancement of women.
[40]	This study recognised that universities know that the isolation of universities from the private sector could potentially set a big problem for a sustainable university system. Also, this isolated environment could lead to the disappointed regional universities not building the capacity to manage technologies. The research result shows that developing e-learning course for increasing the awareness and knowledge of students besides building the competence of university officials and managers to manage university partnership and introducing technology to entrepreneurship students is important because of raising awareness among students.
[41]	This study argues that while there is an agreement on the need for entrepreneurship to promote economic growth, there is a lack of support on how entrepreneurship can be developed. The research accepts that there is a debate on whether entrepreneurs are born or made. The truth of the matter seems to lie between these two extreme positions. The results show that entrepreneurship education brings some certainty such as new ideas and support to new firms, government policy on new firms, government programmes for new firms, education and training support, research and development transfer, and commercial and legal and professional infrastructure.
[42]	This study evaluates some efforts on developing and conducting projects which is done by the co-operation of entrepreneurial undergraduate students. The students are from multiple universities and some are overseas. The aim of this project is to emulate the global engineering teams that develop complex, multidisciplinary designs while targeting market-related constraints such as price, reliability, size and ease-of-use.
[43]	This study shows the development and increasing of entrepreneurial capacity within the university system and then hypothesizes that entrepreneurship education (EE) programmes can play a role in developing this capacity. This paper investigates four fields of EE programmes: first, to determine whether or not there are perceived advantages to collaboration between EE programmes and technology transfer departments; second, to identify specific factors that impact the perceptions of entrepreneurs; then, to ask for relevant academics for perceived barriers to collaboration; and finally, to identify whether collaborations already exist and categorise them.
[44]	The study shows educational orientation based on e-learning. Information technology and communications make some change in the culture of learning, especially in teaching and learning. Some universities and institutions administer the distance with the help of ICT. This is known as e-Education, e-Learning, e-Campus, e-digital, and Tele-Education. These e-education types have also provided digital libraries and offer e-books. Benefits of information technology for education include: Management Information System, E-learning, Learning Media, Life Skill Keywords: Learning, Vocational Education, ICT, E-Learning.

IV. Why Is Techno-Entrepreneurship Important?

Reference [8] highlights that technological entrepreneurship is significant because it is based on recognising society's prospective, technology-concentrated commercial opportunities, gathering resources and organising speedy growth, as well as recognising the significant risk with the final target to achieve those opportunities for value creation. Moreover, with respect to development of economies and helping firms, techno-entrepreneurship seems to play a significant role [45]; these roles could be defined as interactions between academia and industry to exchange experiences besides sharing ideas, and for developing new technology to transfer it to the end-users through firms. In addition to this, it can be said that inventions and technological progress are both vital for manufacture and competitiveness and [46] says that techno-entrepreneurship is significant since it is helping companies to reach higher technology preparation levels and have a better chance of getting products to market. Reference [47] states that techno-entrepreneurship is the transformation of existing technologies into value and this point is the view highlighted by manufacturing firms.

With reference to technology firms, [48], [49] report that technologies produce greater value when they are converted into new products and will provide returns for enterprises, investors and payments for designers as well as generate benefits for the whole society. Furthermore, [50], [51] illustrate that techno-entrepreneurship is important, since it brings advances in scientific and technological knowledge to create and capture value for a firm. Techno-entrepreneurship is explained as collaborative invention based on a shared vision of future changes in technology [52].

In addition, [53] mentions that techno-entrepreneurship is not only important for society and manufacturers, but it is also significant for individuals. Technological entrepreneurship involves the combination of behaviours, capabilities, and actions of entrepreneurs. This means that the techno-entrepreneur needs to have capabilities and a vision of the future to recognise techno-opportunities within the society and try to act at the right time to identify prospects in the techno-market. Regarding the enterprise's capabilities, [53], [50] mention that some sensitivity in the initiative is needed to improve compelling value propositions and then make the business models with the aim of exploiting the existing opportunities. Reference [46] states that these capabilities can be referred to as techno-entrepreneurship capabilities.

With regards to techno-entrepreneurship capabilities, researchers such as [54]-[56] point out some elements of the technological entrepreneurship capabilities. They highlight that individual personality behaviours are important since they can impact entrepreneurs' intentions to start a business. The ability to recognise and exploit technological opportunities which will create new or improved products and effectively commercialise them can be seen as techno-entrepreneurship capabilities. Therefore, with an understanding of why techno-entrepreneurship is vital, some researchers such as [56] suggest that teaching techno-entrepreneurship is also important because it would prepare current and future generations of learners to recognise and act on high-technology opportunities and thus it also needs academic attention [8]. Moreover, [57], [58] anticipated that techno-entrepreneurship education would be needed to create future entrepreneurial leaders in our nation's emerging knowledge-based and technology-oriented economy. In addition, techno-entrepreneurship education may be significant since it can contribute to the development of entrepreneurial skills and potential for business start-ups [51].

V. Techno-Entrepreneurship in Education and Training

Recent research identifies that techno-entrepreneurship in education and training can be introduced to both theoretically and practically oriented students [57], [58]. References [59], [60] point out that training in techno-entrepreneurship within universities can be organised as a separate subject or can be incorporated as a way of working within other subjects. Moreover, [61] mention that techno-entrepreneurship in higher education can be introduced as a tool and a working method to motivate learning in different subjects.

It is considered that techno-entrepreneurship in education and training may perhaps develop the personal characteristics and attitudes of students since [8] suggests that the training of techno-entrepreneurship may increase the knowledge of how to start one's own business and help students to recognise how to become innovative, and then lead to ground-breaking processes in existing enterprises.

In addition, [62] mentions that personality traits regarding techno-entrepreneurship education within universities by partly developing the innate nurturing and socialisation among entrepreneurship students. Universities and the educational system in general play a vital role in predicting and developing entrepreneurial traits. Despite university syllabuses for techno-entrepreneurship education needing to focus on encouraging independence, innovation, creativity and risk taking, the pedagogical approach should inspire students to make decisions, accept mistakes and learn from them [63].

VI. Role of Universities in Offering Techno-Entrepreneurship Education

In the past two decades, entrepreneurship education has seen significant growth [64]-[66], and investment in techno-entrepreneurship programmes seems to be increasing within universities. [67: 382] states that this growth "can be seen as indicative of widespread governmental belief in the positive impact that entrepreneurship can have on the socio-economic and political infrastructure of a nation". Besides increasing attention towards techno-entrepreneurship, some points can be suggested which should be of concern to universities and institutions when offering techno-entrepreneurship courses:

- The programmes may contain an introduction to techno-entrepreneurship with focuses on identifying the background of technology firm formation. Furthermore, the aims of the programmes need to be precisely defined,

the objectives explained and their related outcomes [69],[68].

- There should be a balance between the theoretical and practical aspects, for example, trying to make interactive and pragmatic methods; education through projects and learning by direct experience with the aim of learning when, how, and why techno-entrepreneurship affects the socio-economic development of a region; active self-learning and methods for self-development and self-assessment; also action-oriented pedagogy, group working and student-centred methods, and attention to understanding which mechanisms are needed to motivate students at a high level [70].
- Organising students' ability to work in a group and aimed at building a team spirit among techno-entrepreneurship students is vital since these would develop networks and spot opportunities for them to build up their own business [69], [70].
- Introducing and inviting guest lecturers are important, since this can develop a relationship with the local entrepreneurial environment and educators can also be a part of the relevant networks [68]. It has been stated that this brings a cooperative attitude with real business practice and industry (guest lecturers can be selected from patent law or company financing or any other discipline). Also, techno-entrepreneurs can be invited to guest lecture, with the aim of introducing techno-business to students and mentioning that techno-entrepreneurship is intricately linked to scientific advancements and technology; and the basis is on cooperative investigation and the production of new products that brings new assets and attributes into a firm.
- Practical experience through students collaborating with enterprises and being occupied on existing enterprise projects should be a concern for universities [69], [71].
- Universities need to highlight that techno-entrepreneurship may involve projects which search for problems or claims for a particular technology, introduce new applications and launch new ventures, and achieve opportunities that may need to be achieved from scientific and technical knowledge, provided that their ultimate outcome is to create and capture value [67], [68], [72].

In addition, [73] mentions that the influence of universities in offering techno-entrepreneurship education for students is noticeable and that the students' attitudes and their perceptions and views towards entrepreneurship and their self-employment intentions after passing these courses cannot be ignored. However, attention should be paid to the individuals' behaviour and their past experiences which could shape the universities' attitudes and intentions toward developing entrepreneurs who start a new business [74], [75]. On the other hand, [72], [68] claim that techno-entrepreneurship education seems to be an encouraging tool which is available to increase an individual's central approach, awareness and perception as well as their intent towards self-employment.

VII. Does Higher Education Influence Techno-Entrepreneurs' Skills and Support in Self-Employment?

Some researchers such as [76]-[78] argue that achieving and experiencing higher education in becoming a techno-entrepreneur may not have an influential role. In addition, [79]-[82] raise two arguments in support of this position: i) degrees and qualifications could deliver prestige or position rather than skills; and ii) higher education for entrepreneurs can be a form of 'credentialism' that might be a requirement point for companies and show the productivity of the employees, but having a higher education in techno-entrepreneurship may not necessarily increase or influence the capabilities and change the behaviour of entrepreneurs. On the other hand, [83], [84] claim that receiving higher education for techno-entrepreneurs is essential, since higher education can bring a vision and mission to entrepreneurs and also increase the provision of managerial roles for them. Moreover, the [85] state that universities should introduce different courses such as problem solving, risk taking, leadership, team-working, business planning, and entrepreneurship skill development to educate students to recognising opportunities. Therefore, it has been suggested that higher education could reduce market failings in students' understanding of techno-entrepreneurship [10]. References [83], [85] suggest that higher education can have a significant role in improving self-employment results with the provision of support. In addition, access to informal networks positioned among their families and friends may be valuable to the graduate [86], [87]. Even so, higher education would provide them with access to other informal sources of support, for instance, meeting academics and learning from them, besides formal sources of support such as career advisory services. In addition, as mentioned previously, higher education can impact on techno-entrepreneurs' skills in self-employment [88] claim that institutions should first meet criteria with respect to how to express good practice in delivering techno-entrepreneurship education for educators; then, focus on how to teach entrepreneurship to be effective and have an applied influence in concrete terms. Only after this, can institutions introduce effectiveness and success in implementing techno-entrepreneurship education programmes. In this regard, [89] indicates that universities should pay attention to the way that entrepreneurship teaching needs to be delivered by focusing on "how to teach", and not the specific content of the teaching. Moreover, to impress the university's role on techno-entrepreneurs' self-employment, [90], [69] mention that researchers and educators, policymakers, and business owners suggest that a business can be highly successful if different levels of business experience besides entrepreneurial experience are found to be analytical or predictive within an early entrepreneurial intention. These varieties of involvement and experiences can be found as a basis for modifying explicit educational programmes targeted at students to increase the prospect of distinguished new venture creation [91].

VIII. Comparison of Literature Review

As mentioned earlier this research compared the relevant literature to the aim and objective of this research and from Google Scholar and other search engine only 32 articles found relevant to this study (in Table I part one, two and three all the 32 articles reviewed). Now after looked inside the 32 articles 6 out of them had similar details, aims, objectives, and keywords and were closer to the current study. Thus, this section looked closely inside those 6 articles. These 6 particular articles have been chosen because: i) their research area was similar to the aim of the current study; ii) their objectives were close to the current research; iii) they mentioned some existing gaps which are relevant to the existing gaps and limitations in this study which are being discussed later on this paper; iv) their keywords were closer and more relevant to the current research, and vi), overall the above papers have been chosen since they were all selected in a search based on the influence of techno-entrepreneurship education on self-employment and the intention of students, besides an investigation on the desirability of self-employment and interest in entrepreneurial self-efficacy.

TABLE II
Comparison of Different Literature Reviews Regarding Techno-Entrepreneurship Education

Author	Journal	Approach	Dependent Variable	Methodology	Research Gap	Level	Sample Size	Result
[69]	*European Economic Review*	Students' interest in entrepreneurial self-efficacy and help them on reaching self-employment goals	Students' entrepreneurship skills and motivation	Use of quantitative (analysis, questionnaires and observations), qualitative (interviews)	Did not examine what courses could be more effective on techno-entrepreneurship students to capture their attention and intention about entrepreneurship.	University	104	Effect on students' self-assessed entrepreneurial skills is insignificant and the effect on the intention to become an entrepreneur is negative.
[92]	*Journal of Economic Behaviour & Organization*	Techno-entrepreneurship subjects influence students' perceived desirability of self-employment	students' entrepreneurship skills, intention	Use of quantitative (discourse analysis), qualitative (interviews)	This study did not examine that what courses could be taught to techno-entrepreneurship students to increase their intention. Also, this study did not track the stability of entrepreneurial intention.	University	196	Intentions decline, positive effect on self-assessed entrepreneurial skills.
[93]	*Journal of Enterprising Culture*	Students' perceived desirability of self-employment and interest in entrepreneurial self-efficacy affects their self-employment purposes	Students' entrepreneurial inclination	Use of quantitative (open-ended questions, content analysis, discourse analysis), qualitative (interviews)	Did not track techno-entrepreneurship graduated students to analyse whether they start-up their new businesses or not; and did not investigate the impacts of duration techno-entrepreneurship education courses.	University	119	Participation in the entrepreneurship course has no significant effect on start-up inclinations.
[94]	*Journal of Business Venturing*	Involvement in techno-entrepreneurship subject influence students' perceived desirability of self-employment.	entrepreneurial attitudes, intentions	Use of quantitative (questionnaires and observations), qualitative (interviews).	Did not investigate how long techno-entrepreneurship coursers should be taught to enterprise students; also did not track whether the achieving intention and the impact of techno-entrepreneurship is stable or whether the intention can be lost after graduating.	University	124	There is a link between entrepreneurship education and entrepreneurial attitudes and intention and inspiration is the programme's biggest benefit.
[95]	*Entrepreneurs-hip Management*	Students' perceived desirability of self-employment and interest in entrepreneurial self-efficacy effect on their self-employment purposes.	entrepreneurial skills	Use of quantitative (semi-structured, content analysis), qualitative (interviews).	This study did not investigate how universities can improve their taught lessons for techno-entrepreneurship education for bringing the attention to all entrepreneurship students.	University	307	Only half of the students perceived their skills to be improved.
[96]	*Education + Training*	Students' interest in entrepreneurial self-efficacy and helping them on reaching self-employment goals.	quality of business start ups	Use of quantitative (questionnaires and observations), qualitative (interviews),	Did not examine what courses may be needed to be taught to techno-entrepreneurship students to get their intention; also did not analyse how long techno-entrepreneurship courses should be taught for their impact on entrepreneurship students.	University	210	Effect of entrepreneurship education will be long-term.

As shown in Table II, each research study has its own particular dependent variable, methodology, gaps and results. Since the method of choice for this research is comparing literature reviews, then the aim of this section is to compare the selected literature based on their approaches, methodology, gaps and results in the area of techno-entrepreneurship education.

As seen in Table II in the approach column, the selected literature has similar objectives to the current research. The articles all mention the main subject of techno-entrepreneurship and its encouragement for students' perceived desirability of self-employment, with investigations on techno-entrepreneurship education and the impact of this subject on students' self-efficacy and help for participants to reach self-employment goals.

The methodology in the selected literature is both qualitative and quantitative approaches. The quantitative methodology consisted of strategic analysis, questionnaires, observations, discourse analysis, open-ended questions, content analysis, and semi-structured interviews. The qualitative methodology used was interviews among university students who have taken techno-entrepreneurship subjects. Furthermore, as seen from Table II in the level column, the selected literature used samples from universities. Moreover, the sample size column in Table II shows that the number of participants who had a role and were interviewed for the respective research. Moreover, as shown in Table I there are some gaps in the selected literature. The indicated gaps were about existing limitations which the chosen studies did not focus on. For instance, some literature mentioned a gap as the lack of investigation into how long techno-entrepreneurship courses should be taught to enterprise students. Also, there is a gap in tracking whether the increasing new venture creation intention by students and the impact of techno-entrepreneurship is stable or whether the intention is then lost after graduating. In addition, some of the selected literature highlighted a gap in higher education not examining what courses could be taught to techno-entrepreneurship students to increase their intention, and a lack of tracking on the stability of entrepreneurial intention to create new ventures, after graduation. Besides, other chosen literature noted the lack of tracking techno-entrepreneurship graduated students to analyse whether they start-up their own new businesses or not; and an absence of an investigation into the impact of the duration of techno-entrepreneurship education courses for techno-entrepreneurship students. Furthermore, some studies mentioned the gap as the absence of an examination as to what courses may need to be taught to techno-entrepreneurship students to get their intention; besides, some others noted the gap as the lack of analysis on techno-entrepreneurship courses which should be taught and for how long in order for it to have an impact on techno-entrepreneurship in students. It seems from Table II that most of the chosen articles have some similarities in their gaps and limitations. In addition, as seen in Table II, the results from the chosen literature differ. Some of the researchers concluded that techno-entrepreneurship education has an influence on students and their future self-employment; other researchers noted that techno-entrepreneurship education stimulates students' interested then increases their entrepreneurial self-efficacy alongside helping them to reach their self-employment goals. However, some researchers from Table II argue that techno-entrepreneurship education may not encourage students in their entrepreneurial self-efficacy or effect their self-employment purposes. The next section explains further what the findings of this research are.

IX. Overview of Impact of Studies on Techno-Entrepreneurship

As seen from Table II, there are different views based on whether techno-entrepreneurship education influences the self-employment and self-efficiency of students and their future goals. Reference [97] illustrates that most of the self-made techno-entrepreneurs have agreed that entrepreneurship can be taught; however, entrepreneurship professors and students who join their entrepreneurship classes around the world will most probably have a different point of view. References [54], [61] mention that higher education in techno-entrepreneurship in general has a positive impact on entrepreneurship and there is a relationship between education and the probability of becoming an techno-entrepreneur and the possibility of having achievement as an entrepreneur.

The findings from the selected literature review show that there are different thoughts regarding the answer in: i) whether techno-entrepreneurship education interests students in entrepreneurial self-efficacy to start-up their own business; ii) whether the techno-entrepreneurship education subject would influence students to realise the desirability of self-employment; and iii) whether techno-entrepreneurship education interest perceived students as having a greater length of time in business. Table II provides an overview of the selected literature categorised which answers the above questions, based on the significant and positive impact of techno-entrepreneurship and those who agreed to any significant effect of techno-entrepreneurship education. In the following table, the above questions from selected literature reviews are gathered.

TABLE III
Overview of the Selected Literature Based Positive and Negative Views on Influence of Techno-Entrepreneurship Education

STUDIES REPORTING NEGATIVE IMPACT OF HIGHER EDUCATION REGARDING TECHNO-ENTREPRENEURSHIP			
[69], [92], [93]	Unimportant impact of techno-entrepreneurship education on students self-efficiency to start-up their businesses	Insignificant influence of the techno-entrepreneurship education subject on students to recognize the desirability of self-employment	Ineffective of techno-entrepreneurship education on perceiving students on having a greater length of time in business
STUDIES REPORTING POSITIVE IMPACT OF HIGHER EDUCATION IN TECHNO-ENTREPRENEURSHIP			
[94], [95], [96]	Importance of the impact of techno-entrepreneurship education on students' self-efficacy to start-up a business	Significant influence of the techno-entrepreneurship education subject on students to recognize desirability of self-employment	Effective of techno- entrepreneurship education on perceiving students on having a greater length of time in business

As seen in Table III, there are positive and negative points of view on the answers to whether techno-entrepreneurship education brings an interest to students regarding self-efficacy to start their own business, and whether the techno-entrepreneurship education subjects could create some encouragement in techno-entrepreneurship students to recognise the desirability of self-employment, besides the impact on interest perceived students on having a greater length of time in business.

Some literature such as that from [92], [93], [70] found that teaching techno-entrepreneurship education has an insignificant and unclear effect on students and their self-employment in the future. On the other hand, other researchers, for instance, [94], [95], [96] and discovered that teaching techno-entrepreneurship has some possible impact based on students self-assessment and self-employment to reach their future goals and start-up their new businesses. The next section analyses the findings of the selected literature based on Tables II and III.

X. Findings

As seen from Tables II and III, some of the researchers such as [70], [92], [93] found that teaching techno-entrepreneurship education has an insignificant and unclear effect on students and their self-employment in the future. On the other hand, other researchers, for instance, [94]-[96] discovered that teaching techno-entrepreneurship has some possible impact based on students self-assessment and self-employment to reach their future goals and start-up their new businesses. The next section analyses the findings of the selected literature based on Tables II and III. conclude that techno-entrepreneurship education may not be effective for students and does not help them in their future self-employment. They claim that the basis for teaching techno-entrepreneurship could have an effect on students' self-assessment; however, it may not play a significant role on students' intentions to become an entrepreneur in the future. The mentioned studies of [69], [92], [93] are interesting because their research outcomes seem to contradict all other previously conducted research studies. In this regard, the completed studies by these researchers conclude that the negative impact of techno-entrepreneurship education on students' intentions to become an entrepreneur in the future is possibly related to the programme design at the universities. They provide two explanations for the negative result. First, the introduced programmes for techno-entrepreneurship education may have been ineffective. Second, participation in the entrepreneurship education programme could have been compulsory, possibly making students feel forced into it. References [69], [92], [93] note that compulsory courses are offered to both entrepreneurial-minded and non-entrepreneurial-minded students in the group of participants which they interviewed. Therefore, being obliged to take the course reduced students' motivation and their intention for such a course. However, [98] argues that the decline in entrepreneurial intention could possibly be related to a socially required effect as participants on the techno-entrepreneurship course may discover that they have no aptitude for an entrepreneurial career and change course; thus, the decline in students' intention may not necessarily be related to the failure of the programme. Moreover, [94]-[96] and determine that techno-entrepreneurship education can bring an interest in entrepreneurial self-efficacy and help students in reaching self-employment goals, besides increasing students' perceived desirability for self-employment and having an effect on interesting students' in entrepreneurial self-efficacy and their self-employment purposes. In addition, it was illustrated that techno-entrepreneurship education increases the intention in students and [94], [95] point to the intentions as specified by attitudes. These attitudes are mentioned as perceived behavioural control, targets for start-up activities, and study programmes which are related to independent variables, for example, learning, motivation and consumption of resources. Furthermore, [94]-[96], [99] suggest that techno-entrepreneurship education introduces some perspectives to students such as the advantage of a pool of resources which can help participants to estimate their business ideas and then try to develop their thoughts into planning and venture. Besides this benefit of access to resources, [100], [101] also highlight that participants have a chance to join a group of entrepreneurial-minded fellow students to build a team. Then, during the business-planning activities, students can get advice from lecturers, technology transfer officers, and their colleagues and use a business plan competition to test their venture. Also, participants can operate networking events to access recruitment along with receiving advice and getting referrals to investors.

Alongside investigating the impact of techno-entrepreneurship education programmes from reviewing the literature, some issues were mentioned as an agreement for the efficiency of techno-entrepreneurship education within universities [94]-[96], [99] these were;

- the overall impression of length of entrepreneurship education on entrepreneurial intention [69], [93].
- steadiness and permanence of techno-entrepreneurial intention after the end of the techno-entrepreneurship education programme
- linking and trying to make connections between entrepreneurial intention and venture creation [70], [92].
- Meanwhile, [92], [95], [96] note that the duration of techno-entrepreneurship education is significant since longer programmes can bring a chance for participants to understand what underpins the offered courses. Also, they would have a chance to find connections and do some networking among entrepreneurs and business owners.

Furthermore, there were some gaps in the selected literature reviews. References [95], [96], [69] in their investigation on the influence of teaching techno-entrepreneurship among university students did not examine what courses could be more effective for techno-entrepreneurship students to capture their attention and intention about entrepreneurship. Besides, [92], [96] have some gaps in their research about a lack of examination on what courses could be taught to techno-entrepreneurship students to increase their intention and also, these studies did not track the stability of entrepreneurial

intention among techno-entrepreneurship students. Moreover, a gap in the [93] study was the absence of tracking techno-entrepreneurship graduated students to analyse whether they had started up their new businesses or not. Additionally, some researchers such as [93], [94], [96] had a similar gap in their research. These papers did not investigate the impact of duration on techno-entrepreneurship education courses on techno-entrepreneurship; they did not examine how long techno-entrepreneurship courses should be. Also, in [96], the authors did not examine what courses may need to be taught to techno-entrepreneurship students to get their intention for start-up a new businesses.

In summary of the findings, the selected literature followed similar objectives and approaches. They were all searched based on examining whether techno-entrepreneurship education interested students in entrepreneurial self-efficacy and helped them in reaching self-employment goals, besides investigating how involvement in the techno-entrepreneurship subject influences students' perceived desirability of self-employment. However, the selected literature is close to the aim of this current research and they have some gaps and limitations in their findings. They did not investigate what courses could be more suitable specifically for teaching techno-entrepreneurship education and how long these courses should take and be taught to techno-entrepreneurship students. In addition, the chosen studies have some gaps in the absence of tracking techno-entrepreneurship graduated students to analyse whether they have their new venture or not.

After analysing the above findings, it can be concluded that:

- Teaching techno-entrepreneurship education has an influence on students' intention and their future self-employment; however, what courses need to be covered and the duration of the subjects may need to be considered by universities.
- There is a link between techno-entrepreneurship education and entrepreneurial attitudes and students' intention; even so, there is a gap on tracking whether the gaining intention and the impact of techno-entrepreneurship is stable or whether the intention can be lost after graduating.
- Techno-entrepreneurship courses may not have a significant effect on students' self-assessed entrepreneurial skills; nevertheless, there are some gaps in the investigation of how universities can improve their taught lessons for techno-entrepreneurship education to bring their attention to all entrepreneurships and improving self-assessment in techno-entrepreneurship students.

XI. Limitations of This Study

There are some limitations in the current research. Since time was short, the researcher did not have enough time to gather more data from other literature reviews. Thus, that has made the current research narrow in its comparison of 6 articles. Moreover, regarding the time, the researcher did not have enough time to expand her research and look into more sources from different search engines. Searching for the current research is mostly based on Google scholar, the Emerald search engine, and some management and entrepreneurship education journals. Therefore, time constraints brought some limitations into this study.

Although the area of research of the current study offers great research opportunities, it would be more manageable to define a context and then investigate that specific background. In the current research, the researcher could not select and search based on a significant context because of time constraints.

There are some relevant questions with regards to the aim and objectives of the current research, for instance, the best time to learn techno-entrepreneurship, what the impact is on the duration of techno-entrepreneurship courses, and what the role of techno-entrepreneurship educator behaviours on their self-employment is after graduation, which were not taken into account separately as an individual objective in this current study.

XII. Suggestions for Future Research

The field of techno-entrepreneurship education research is a new area to investigate; therefore, it would be beneficial for further research in the following areas:

- What modules or programmes of techno-entrepreneurship education need to be offered to students?
- Teaching techno-entrepreneurship education is useful for which kind of groups of participants? In other words, how can we understand which kind of programme is most suitable to offer and with which target group? (There is a need to consider the content, design and delivery of lessons for the target group.)
- Finally, how can we be selective in offering subjective programs to participants for techno-entrepreneurship education and how should programme leaders recognise which objectives of techno-entrepreneurship education can be more appropriate for school students versus university students versus mature adults?

XIII. Conclusion

In conclusion, it has been recognised that techno-entrepreneurship is economically significant. It helps to develop and improve the economy as it has been seen to be essential for start-ups and growing firms. Techno-entrepreneurship is significant since it brings inventions and technological progress into the market by introducing technological products with the aim of adding value into manufacturing and competitiveness. Since techno-entrepreneurship is important, techno-entrepreneurship education and training in this new subject to students also needs to be considered. Techno-entrepreneurship educates managers, engineers, and scientists and this includes providing entrepreneurs with the tools to take ideas to market. Thus, as a result, teaching technological entrepreneurship to prepare current and future generations of learners to recognise and act on high-technology opportunities also needs academic attention. Moreover, techno-entrepreneurship is important in

education and training because it is suggested that it develops the personal characteristics and attitudes of students.

In teaching techno-entrepreneurship education, universities play an important role. In this regard, they need to know and be trained about what modules are significant and more effective for techno-entrepreneurship students and how tutors can be trained in transferring the knowledge to participants. Within universities, techno-entrepreneurs can be invited as guest lecturers and then present techno business to students; also universities can make a link between students and techno-entrepreneurs with the aim of helping techno-entrepreneurship educators to become familiar with the real business world, besides introducing new networks.

The method of choice for the current research was a comparison of different literature reviews together. The researcher selected 6 articles to compare them based on their dependent variables, methodology, gaps and results. The papers were chosen because of their research approaches and their aims were close to the purpose of the current research as they were investigating what the impact of techno-entrepreneurship education on self-employment. The selected articles all mention the techno-entrepreneurship subject and its encouragement for students' perceived desirability of self-employment, with investigations into techno-entrepreneurship education and the impact of this subject on students' self-efficacy and help for participants to reach self-employment goals.

From the selected literature, [92], [93], [69] argued that techno-entrepreneurship education may not be effective for students and help them in their future self-employment. These researchers state that the basis for teaching techno-entrepreneurship could have an effect on students' self-assessment, but it may not play an important role in students' intentions to become an entrepreneur in the future. On the other hand, [94]-[96] claim that techno-entrepreneurship education can bring an interest in entrepreneurial self-efficacy and could also help participants in reaching self-employment goals. They highlight that techno-entrepreneurship education may increase students' perceived desirability for self-employment and that this then has an effect on interesting students' in entrepreneurial self-efficacy and their self-employment purposes. There are some gaps in the selected literature, for instance, the absence of an investigation into what courses need to be taught in techno-entrepreneurship education and how long the duration of those offered courses should be. Also, the chosen studies have some gaps about tracking techno-entrepreneurship graduates to analyse whether they have started their new business or not.

In summary, participation in a techno-entrepreneurship education programme increases the probability of becoming self-employed; in other words, techno-entrepreneurship education has an influence on students' intention and self-employment. However, there is a need for further research for universities to investigate what courses are applicable to techno-entrepreneurship participants. The duration of offered subjects may also need to be considered by universities. Moreover, techno-entrepreneurship education and entrepreneurial attitudes are bound together in students' intentions, but researchers need to track the intention of the techno-entrepreneurship students and examine the stability of this intention after graduation.

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