Assessment of Engineering Entrepreneurial Intentions Among Engineering Students of Osun State University, Nigeria

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Abstract—Entrepreneurship is a major solution to the problem of unemployment resulting from multifaceted socio-economic challenges in the developing world. If engineers become entrepreneurs, it will create jobs, promote technological development, and enhance sustainable national economic growth. The process of entrepreneurship begins with the development of the intention to engage in such an enterprise; therefore, this study assessed the entrepreneurial intentions of university engineering students. To accomplish this task, Ajzen's theory of planned behavior is applied. A survey was conducted at the Faculty of Engineering, Osun State University, Osogbo, Nigeria, using a structured questionnaire administered to 470 engineering students in 2021. The collected data were analyzed using Statistical Product and Service Solutions (SPSS) version 20. The SPSS results of the descriptive and regression analyses show that entrepreneurial intentions could be studied statistically using Ajzen's theory. The results revealed that personal attitude, subjective norms, and perceived behavioral control were statistically significant in determining engineering students' entrepreneurial intentions, while education level was not significant. Based on these results, the study recommends that engineering and entrepreneurship educators develop an integrated program to bridge the gaps between the engineering program and entrepreneurship education. It also recommends that engineering faculty leaders collaborate with entrepreneurial engineers who have successfully promoted entrepreneurship development in higher education institutions. Most importantly, the government is advised to provide loans and other structural incentives to assist young entrepreneurial engineers who wish to do so.

Keywords—engineering, entrepreneurial intention, unemployment, planned behavioral theory

1 Introduction

Entrepreneurship has been recommended as an ideal solution to the growing unemployment rate and as the most effective way to enhance the economic status of a country [1], [2]. Similarly, [3] lists the gains of entrepreneurship: job creation, economic success, globalization, innovation and renewal, joy, engagement and creativity, and societal challenges. The Nigerian government has adopted various strategies to encourage its youth to opt for self-employment rather than seek low-paying jobs in the public and private sectors. One of the strategies adopted has been the introduction of entrepreneurship education in university curricula to impart entrepreneurial skills to undergraduate students, with the belief that this will help stimulate the economy and contribute to job creation through new start-ups [4]. However, current statistics show that the majority of these young people prefer paid jobs to self-employment, and even those who eventually entered entrepreneurship did so as "entrepreneurs by necessity" [5], i.e., they entered entrepreneurship not out of passion but because of the lack of paid jobs.

Entrepreneurship education, according to [3] and [6], should make learners aware of the entrepreneurial career option, instill a mindset, develop knowledge, skills and abilities to identify, evaluate and exploit market opportunities, which ultimately facilitates the formation of an intention to start a business.

Intention is a personal prediction to engage in a particular behavior [7]. Parker [8] considers it to be the specific propensity of an individual to perform an action, derived from a conscious thought that directs behavior. Several studies have supported the idea that intention is the best single predictor that determines actual behavior [9–11]. Entrepreneurial intention can then be described as a conscious passion or desire to own or create a business. Bird [12] defines it as the state of mind that directs an individual's attention and action toward self-employment rather than organizational employment. Thompson [13] describes it as "a person's self-proclaimed belief that he or she intends to create a new business and consciously plans to do so at some point in the future." Since intention is a predictor that determines actual behavior, as stated earlier, understanding entrepreneurial intentions will allow stakeholders in entrepreneurship education to formulate appropriate policies that will foster the process of enterprise creation.

Entrepreneurial intention is determined by multiple factors [14], and a considerable amount of research has been conducted using different models to determine the main influencing factors of entrepreneurial intentions [15–21]. However, Ajzen's theory has been used primarily by entrepreneurship researchers to test students' intentions when deciding to become an entrepreneur. This theory has proven to be the best theory for predicting entrepreneurial intentions of university students [1].

Ajzen's theory posits that "intentions to perform behaviors of different types can be predicted with high accuracy from attitudes toward the behavior, subjective norms, and perceived behavioral control; and these intentions, along with perceptions of behavioral control, account for considerable variance in actual behavior" [7]. The three main variables that have a significant impact on entrepreneurial intentions, according to Ajzen, are: personal attitude (PA), subjective norms (SB) and perceived behavioral

control (PBC) (see Figure 1). Each of these variables, as discussed in [1] and [19], is presented below:

- Personal attitude (PA) consists of an individual's emotional and evaluative deliberations about a behavior. Emotional deliberations reflect the extent to which an individual likes or dislikes a behavior. In contrast, evaluative deliberations reflect an individual's perception of a behavior in terms of its merits or demerits.
- Subjective norms (SNs) refer to the professed social force for performing or not performing a specific behavior. They indicate an individual's perception of approval or disapproval of a behavior by friends and influential family members.
- Perceived behavioral control (PBC) refers to the apparent ease or difficulty for an individual to perform a given behavior. An individual is likely to perform a specific behavior when he or she believes that the behavior is feasible.

This study adopted Ajzen's variables to determine the factors that impact engineering students' entrepreneurial intention.

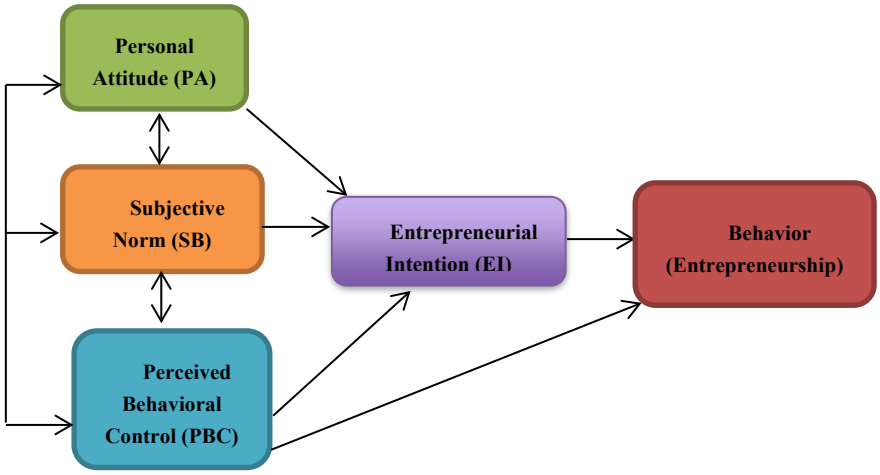

Fig. 1. Components of Ajzen's planned behavioural theory [7]

It is undeniable that engineering and technology play a crucial role in job creation and serve as an impetus for the growth and development of a nation. Yet, engineering students are, more often than not, indifferent to the idea of starting their own business after graduation. Those who engage in entrepreneurship are most often involved in less technical activities or businesses that do not have a direct correlation to their engineering profession [22, 23]. This attitude is related to the fact that traditional undergraduate engineering courses develop problem-solving skills involving physical properties and fundamental mathematical principles, without an emphasis on innovative and marketable products [24, 25]. Thus, the importance of engineering entrepreneurship cannot be overstated. If engineers could understand business principles in the spirit of engineering entrepreneurship, it could lead to more

technological innovations that would ultimately create jobs and promote national prosperity [26].

In the entrepreneurship literature, little attention has been paid to what affects the entrepreneurial intention of engineering students. Most existing work focuses on business, humanities, and social science students [1, 20, 27–28, 30]. In the field of engineering entrepreneurship, most efforts focus on: methods for integrating entrepreneurship into engineering [30–33], appropriate pedagogies for teaching entrepreneurship to engineering students [25, 34–38], and the development of case studies and curricula for instilling entrepreneurship in engineering students [23, 39–45], leaving out the study of factors that affect engineering students' entrepreneurial intention. The authors of this study consider it necessary to complement the efforts of researchers in the field of engineering entrepreneurship by empirically studying the factors that determine engineering students' entrepreneurial intentions. Through the results of this work, appropriate attention could be given to how to influence engineering students' preferences to opt for engineering entrepreneurship after graduation.

The structure of this article is as follows. Section 2 presents the methodological aspects of the study. The main results obtained are analyzed and discussed in Section 3. Section 4 presents the main findings of this work and its limitations.

2 Methodology

This section explains the methodology for the study, which includes model and hypotheses, population and sampling, data collection, and data analysis.

2.1 Model and hypotheses

The intention-based model employed in this study is derived from Ajzen's theory of entrepreneurial intention. Three significant factors determining relationship and effects on entrepreneurial intention were considered, along with the students' level of study.

In other to test the entrepreneurial intention model developed for this study, the following hypotheses were formulated:

- H1: There is no significant relationship between the personal attitude (PA) of the engineering students and their entrepreneurial intention.
- H2: There is no significant relationship between the subjective norm (SB) of the engineering students and their entrepreneurial intention.
- H3: There is no significant relationship between the perceived behavioural control (PBC) of the engineering students and their entrepreneurial intention.
- H4: There is no significant relationship between the level of study (LS) of the engineering students and their entrepreneurial intention.

2.2 Population and sampling

The population of this study consists of 345 engineering students at Osun State University in the first semester of the 2020/2021 academic session. Among them, 170 students completed and submitted the online survey questionnaires. Therefore, the response rate was 49.28%.

2.3 Data collection

Data was collected using a structured online survey questionnaire adopted from the validated EIQ of [46] and [1]. Data collection was done through an online survey questionnaire using a google form survey hyperlink and sent to five (5) WhatsApp messaging platforms of engineering students. There are 345 students on these platforms.

2.4 Data analysis

Data analysis was done using Statistical Product and Service Solution (SPSS) version 20, and the statistical technique used was Descriptive analysis and Multiple Regression.

2.5 Defining the variables

Dependent variable. The dependent variable is the Entrepreneurial Intention (EI) which is the intention of an engineering student to engage in engineering entrepreneurial activities. It is measured with five items using the Likert scale. This measure is adopted from [1] and [46].

Independent variables. For this study, the independent variables are:

- Personal Attitude (PA): PA is an individual judgement that could be positive or negative for becoming an engineering entrepreneur. This variable was measured with 5 items using the Likert scale.
- Perceived Behavioral Control (PBC): PBC is the view of an individual related to starting engineering entrepreneurship. This variable was measured with 5 items using the Likert scale.
- Subjective Norm (SB): SB is a variable related to the influence of social pressure (family, friends, etc.) on becoming an engineering entrepreneur. This variable was measured with 5 items using the Likert scale.
- Level of Study (LS): LS is a variable that considers the level of study of an individual on how it affects becoming an engineering entrepreneur.

3 Main results and discussion

This section presents the analysis of the results, which includes: a descriptive analysis and a regression analysis. SPSS version 20 was used to perform the analysis.

3.1 Descriptive analysis

Level of Study (LS). Considering the level of study of the respondents, the results show that 60.6% of the respondents are in the first year, 15.9% in the second year, 10.0% in the third year, 7.1% in the fourth year and 6.5% in the fifth year, as shown in Figure 2.

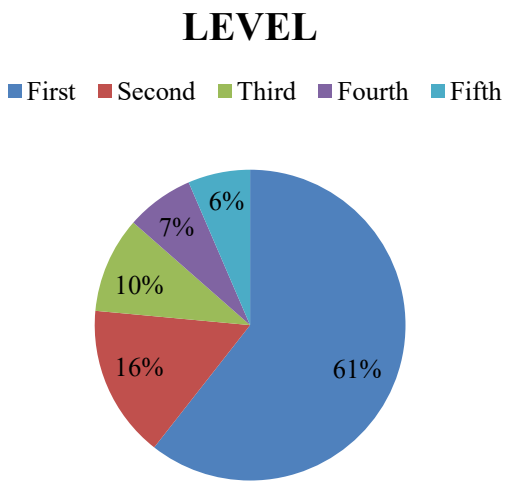

Fig. 2. Percentage distribution of respondents based on level of study

Gender. Respondents were 92% male and 8% female. This proportion of males and females reflects the gender distribution of admitted students in the faculty of engineering. Traditionally, the engineering field is considered a masculine profession [47] and globally, the female enrolment is lower than that of males. Madara and Cherotich [48] reported 9% in the UK, 11% in the USA, 14% in Australia. Also, according to the National Bureau of Statistics [49], about 22% was reported for females in Nigeria.

Model predictive power. Pseudo R-square is usually used to measure how well variables of the model explain some phenomenon. According to [20], R^2 values of 0.75, 0.50 and 0.25 for the dependent variables are considered substantial, moderate and weak, respectively. The results of the Pseudo R-square for this study are shown in Table 1.

Table 1. Analysis of the pseudo R-square values

Cox and Snell	0.687
Nagelkerke	0.693
McFadden	0.245

Using the Nagelkerke value, Table 1 shows that 69.3% of the changes in EI result from LS, PA, PBC and SB. This value is higher than the 64.9% reported by [1] and 68.0% reported by [20].

Non-parametric correlation. Nonparametric correlation tests are distribution-free hypothesis tests. They are used when samples are drawn from an unknown or non-normal distribution [50]. Some of the most commonly used nonparametric tests include the chi-square test, Spearman's rank correlation test, and Wilcoxon's one-sample signed ranks test. In this study, Spearman's rank correlation test was used. Spearman's correlation coefficient measures the strength and direction of the association between two ranked variables when the data are measured on ordinal, interval, or ratio scales [50]. The results of the nonparametric test for this study are presented in Table 2.

Table 2. Correlations: Spearman's rho

		EI	**LS**	**PA**	**PBC**	**SB**
EI	Correlation Coefficient	1.000	−0.075	0.772**	0.628**	0.569**
	Sig. (2-tailed)		0.329	0.000	0.000	0.000
	N	170	170	170	170	170

** Correlation is significant at the 0.01 level (2-tailed).

Table 2 shows that PA, PBC and SB are statistically significant with a p-value of 0.000 while LS is not statistically significant ($p = 0.329$). There is a strong positive correlation between EI and PA (0.772), a moderate positive correlation between EI and PBC (0.628) and SB (0.569). At the same time, there is a very weak negative correlation between EI and LS (-0.075). With this result, hypotheses H1, H2 and H3 were rejected while H4 was confirmed.

To sum up, the purpose of this study was to evaluate the effects of personal attitude (PA), subjective norm (SB), perceived behavioral control (PBC), and level of education (LS) of engineering students at Osun State University (Osogbo) on their entrepreneurial intentions (EI). The results of the study revealed that EI had a statistically significant relationship with PA, SB and PBC. These results suggest that engineering students' entrepreneurial intention could be influenced by peer groups, family influence, personal interest, motivation, and exposure to engineering-entrepreneurship education, among others.

The results of this study agree with the position of [7], who believes that planned behavior can be used to evaluate programs aimed at changing entrepreneurial intention. Some researchers have reported a non-significant relationship between subjective norm, perceived behavioral control and entrepreneurial intention, such as [51], [52]. However, significant research findings have argued that entrepreneurial intention can be influenced by personal attitude, subjective norm and perceived behavioral control [1, 53, 54]. The implication of this finding for engineering and entrepreneurship

educators is to draw their attention to the need to collaborate and formulate an integrated entrepreneurship program that will influence the mindset of engineering students to intend to become entrepreneurial engineers after graduation. This program could include a variety of teaching methods such as case studies, internships, lectures, external reviews of students' work by entrepreneurial engineers as suggested by [55].

The study also found a non-statistically significant relationship between entrepreneurial intention and students' education level. Although we could not find any study that directly examines the effect of students' education level on entrepreneurial intention, our results contradict the hypothesis of [15] that older students are more likely to engage in entrepreneurial thinking. Based on the results of this study, it could be suggested that entrepreneurship education can be introduced to students at any level of study.

4 Conclusions

The consequences of unemployment have hampered Nigeria's socio-economic development, and the government has used various strategies and policies to address them. Among these policies is the introduction of entrepreneurship education in the curriculum of higher education institutions. The effect of this policy is barely felt, especially among engineering graduates, due to the alarming rate at which these graduates seek gainful employment or opt for non-engineering entrepreneurship as a last resort. These choices are counterproductive when considering the socioeconomic and technological gains associated with the creation of small engineering firms in the country. This study examines what might determine the entrepreneurial intentions of engineering students at institutions of higher education.

The study specifically examines the effects of personal attitude (PA), subjective norms (SB), perceived behavioral control (PBC), and level of education of engineering students at Osun State University, Osogbo on their entrepreneurial intentions. The study revealed that PA, SB, PBC have statistically significant correlation with entrepreneurial intention, but students' level of education has no statistically significant relationship with entrepreneurial intention. These results will serve as an indication to engineering and entrepreneurship stakeholders to develop an integrated engineering entrepreneurship program that will promote positive engineering entrepreneurship intention among engineering students.

The major limitation of this study is the method of data collection which excluded students who were not on the WhatsApp messaging platforms of engineering students in Osun State University, Osogbo at the time of data collection.

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