

The Entrepreneurial Motivations of Engineering Students: Case of a Small Island Developing State from the Caribbean

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(Received 22 June 2016; Revised 09 June 2017; Accepted 06 July 2017)

Abstract: Studies on entrepreneurial motivations conducted in the Caribbean and globally, have considered factors such as parents' occupations, business ownership by parents or relatives, sex and ethnicity. This exploratory study focused on the entrepreneurial motivations of more than 200 engineering students and recent graduates in Trinidad and Tobago (T&T), to gauge whether, among this group, some of these traditional factors are associated with higher order or 'pull' entrepreneurial motivations such as taking advantage of market opportunities, the need for control and independence, and desire for a challenge. A comprehensive self-reporting questionnaire tool was electronically distributed and results coded and analysed using the IBM SPSS Statistics 24 software. It was found that the respondents primarily displayed higher order 'pull' motivators for entrepreneurship with eighty-four percent (84%) identifying welcoming a challenge, controlling their future or taking advantage of opportunities as potential motivators. The study revealed no statistically significant correlation between entrepreneurial motivation of the respondents and ethnicity, sex, parents' occupation, or training. Age of first exposure to assisting in a business also had no significant impact on the entrepreneurial motivation of the engineering student or graduate. Birth order and actual experience running or managing a business were in fact, the only intrinsic characteristics discovered to have a statistically significant impact on the nature of the entrepreneurial motivation of the students and graduates. 'Middle born' and 'only' children crave independence. Fifty percent (50%) of middle born and 52% of 'only' children would start businesses to take more control of their lives. 'Last borns' expressed the highest order 'pull' motivations in that forty-five percent (45%) were most likely to become entrepreneurs to take advantage of an opportunity in the marketplace. Not surprisingly, 'first born' and 'only' children were the most motivated to follow family traditions for entrepreneurship. Further studies would be useful to establish a typology for engineering entrepreneurs from T&T and other small island developing states. This exploratory study, conducted in T&T, suggests that engineers may exhibit different entrepreneurial patterns to the rest of the population or to engineers in larger economies. Further exploration of this knowledge may be useful in supporting students and graduates of engineering programmes.

Keywords: Entrepreneurial motivation, engineering students, Trinidad and Tobago, SIDS

1. Introduction

The countries within the Caribbean region are all challenged by factors affecting small island developing states such as extreme vulnerability to economic and environmental shocks and lack of economies of scale. In addition, the islands' economies remain largely undiversified with continued heavy reliance on natural resources and tourism (Ramkissoon-Babwah, 2013). Auty (2017) argues that government policies may drive sustainable growth despite the inherent characteristics of small island states, comparing the case of Trinidad and Tobago (T&T) with its unsustainable hydrocarbon resource wealth, to resource poor Mauritius, which achieved economic sustainability through diversification based on manufacturing for export. Danns (1994) and Ramkissoon-Babwah (2013) postulate that throughout the history of the Caribbean, entrepreneurial activity has focused on the exploitation of natural resources and the retail of imported goods as opposed to creating value

through intellectual property and higher order value adding activities.

The history of entrepreneurship within the Caribbean region, however, is quite interesting. A study by Danns (1994), which has been cited over 400 times, defined five (5) types of traditional Caribbean entrepreneurs. Danns' (1994) iconic study appears to insinuate that large sections of the population have traditionally been discouraged from engaging in entrepreneurship through lack of access to knowledge or finance, by design of the 'ruling' classes. In spite of the fact that large numbers of entrepreneurs exist in Danns' Type 3, Type 4 and Type 5 categories, their sustainability and capacity to impact the economy is limited by factors such as education, technology and finance (Danns 1994). These types of entrepreneurs, prevalent in the Caribbean Community (CARICOM), lack the innovation and knowledge to become serious contributors to their countries' economies.

2. Entrepreneurial Motivation

Khadan (2016) argues, the current entrepreneurs are not suitable for the task of economic diversification, citing factors such as the age of the enterprises, structure, family ownership, lack of innovation and poor export readiness, as responsible. According to Khadan (2016), 23% of enterprises in T&T are declining, 59% are stagnant and just 18% are expanding with 41% of the enterprises in T&T naming their number one obstacle to be an inadequately educated workforce. This is just slightly more than in the rest of the commodity-dependent small economies in world where 39% of enterprises list the education of the workforce as not suitable. Danns' typology is shown in Figure 1, with a brief synopsis of their characteristics, in each case.

Type 1 English colonisers
•Remote management which nonetheless succeeded in creating the 'worker' culture and discouraging entrepreneurship among the residents.
Type 2 Local Chinese, whites, light skinned
•Merchandisers engaging in non-value adding activities.
Type 3 Local families
•Local family-owned businesses limited by finance, technology and know-how
Type 4 Individuals engaging in the informal sector
•Large group and important for job creation but no access to funding from banks and non-taxpaying
Type 5 Government supported or sponsored
•Cottage industries

Figure 1. Danns' Historical Typology for Caribbean Entrepreneurs
Source: Adapted from Danns (1994)

2.1 'Push' vs 'pull' factors

Entrepreneurial motivation is important because it influences the type of enterprise formed, its sustainability, and potential for growth and impact. A comparison of the "push" vs "pull" factors which motivate potential entrepreneurs is therefore imperative. Individuals sometimes start a business because there is no other way of adequately meeting their financial needs (Mohan, Strobl, and Watson, 2017 and Dawson and Henley, 2012). Generally, the factors that lead a person to start a business due to necessity which may include job loss, a dismal job market or inadequacy to meet financial needs even when fully employed, as opposed to opportunity are called 'push' factors (Mohan, Strobl, and Watson, 2017). Persons who experience difficulty when seeking employment because of immigration status, a prior conviction in the court, lack of skills or poor education may also become entrepreneurs based on 'push' factors. Low on motivational drive, 'lifestyle' entrepreneurs are happy to eke out a basic living, without plans for growth or expansion, once their general financial and lifestyle goals are being met.

Conversely, 'pull' factors include taking advantage of opportunities in the marketplace, acting on a desire to

solve a problem or effect a change in the world or pursuing a dream to create something new or make a lot of money (Dawson and Henley, 2012). Individuals exhibiting 'pull' motivational factors are highly driven entrepreneurs who aim for continuous improvement and growth in their enterprises. In their research on 101 Spanish entrepreneurs, Barba-Sánchez and Atienza-Sahuquillo (2012) found that the ability to self-manage or earn money did not adequately explain why people chose to be in business. A depiction of 'push' and 'pull' motivators separating internal and external causes is shown in Figure 2.

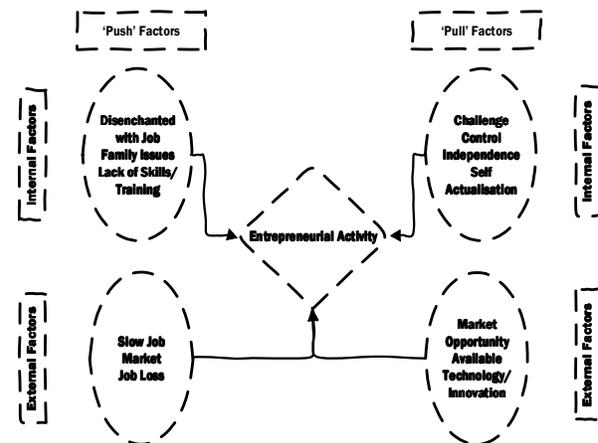


Figure 2. Motivational factors of Entrepreneurs
Source: Adapted from Dawson and Henley (2012)

2.2 Entrepreneurial motivations of students

A number of studies have been conducted on the entrepreneurial motivations of students. Tong et al (2011) cited previous studies which concluded that: i) African-American students were highly motivated to be entrepreneurs because of the desire for independence and ii) entrepreneurial fathers had a strong influence on students in Australia and Singapore. Their study of 196 students in Malaysia, however, did not identify the need for independence as a motivator. Instead, they discovered that among these students, a family history of being in business, as well as social pressure and the need for achievement were the strongest entrepreneurial motivators (Tong et al, 2011).

Jin et al. (2015) argued that gender was a significant factor in the entrepreneurial intent of students, with female students being less interested in being entrepreneurs and assessing their abilities in the area lower than that of males. Corroborating this, were Yeng Keat and Ahmad (2012) who found that gender and birth order significantly influenced the entrepreneurial intentions of university students in Malaysia, and business experience did not.

While these authors have indicated that entrepreneurial motivation may be linked to factors such

as gender, parental occupation or influence, perceived social pressure, a need for achievement, birth order, the need for independence or autonomy and the desire for eking out a subsistence living, an empirical study is necessary to determine which, if any, of these factors may exist among a different demographic of students.

There are however, two (2) major types of entrepreneurial engineers. The first, are those who would conceptualise and initiate their own enterprises, taking satisfaction in the challenge or feeling of control. The second type of entrepreneurial engineer favours the contribution of his entrepreneurial expertise as a team member in an existing establishment. Concerning the latter, Dabbagh and Menascé, (2006) argues that students exposed to training in engineering entrepreneurship become more valuable professionals than those who were not, as they are better able to contribute to the success of their organisations by identifying and realising opportunities in the marketplace.

The modern engineering graduate seeking employment in existing firms, is therefore now expected to have an 'Entrepreneurial Mindset', where he is able to be creative and skilled at recognising opportunities for company growth (Bodnar, Clark and Besterfield-Sacre, 2015; and Byers et al, 2013). Feedback from industry generally expresses satisfaction with the technical competencies of engineering graduates, concerns are usually expressed about the ability of these engineers to function effectively in devising innovative solutions in response to the needs of customers.

2.3 Engineering Entrepreneurship in a Developed Economy – Case of the United States

In the case of the United States of America (U.S.), Pistrui et al, (2011) and Byers et al (2013), maintain that national competitiveness depends on the creation of

innovative, entrepreneurially minded engineers. Jin et.al (2015) and Bodnar, Clark and Besterfield-Sacre (2015) further contend that universities in the U.S. have made a concerted effort to offer entrepreneurial training within their engineering programmes based on this general recognition of the critical role that engineering graduates play in the creation of new enterprises and the sustainability of existing ones. This is in contrast to traditional engineering programmes which have focused on teaching logical thinking in technical areas while placing less emphasis on the creative and critical thinking skills (Pistrui et. al., 2011).

The case of the U.S. is used to demonstrate aspects of engineering entrepreneurship programmes. An investigation of the top 15 engineering programmes offered in the United States (US) shows that they all offered entrepreneurship training to students. These programmes consist of courses as well as other activities such as start-up weekends, incubators and accelerators, business plan competitions and entrepreneurship boot camps. Engineering undergraduates are able to access these within the engineering college, within the university, or both.

Table 1 shows a summary of the investigation. The information was gleaned from the respective websites of the various universities. While the 15 top colleges all have entrepreneurship programmes, 13 execute these programmes within their engineering departments and four (4) feature centres for entrepreneurship within the university that may be accessed by engineering students.

The top ranked engineering school, California Institute of Technology or Caltech, features an entrepreneurship club which provides support to students and alumni in starting their technology-based businesses (CIT, 2015). Activities within the entrepreneurship club centre around mentorship, guidance and knowledge

Table 1. Engineering Entrepreneurship in the U.S.

U.S. RANK	WORLD RANK	NAME OF INSTITUTION	ENTREPRENEURSHIP PROGRAMME	
			ENG DEPT	UNIVERSITY
1	1	California Institute of Technology		
2	2	Stanford University	√	
3	4	Massachusetts Institute of Technology	√	√
4	6	Princeton University	√	
5	10	University of California, Berkeley	√	
6	13	University of California, Los Angeles		√
7	13	Georgia Institute of Technology	√	
8	15	Carnegie Mellon University	√	√
9	16	University of Illinois at Urbana-Champaign	√	
10	17	University of Michigan-Ann Arbor	√	
11	21	Northwestern University	√	
12	22	Cornell University		√
13	24	University of California, Santa Barbara	√	
14	25	University of Texas at Austin	√	
15	26	Columbia University	√	

centre around mentorship, guidance and knowledge transfer toward creating new businesses. Businesspersons are brought in to mentor the club members, venture capitalists are solicited, and start-up support is provided. Support is also provided through the Office of Technology Transfer and Corporate Partnerships (OTTCP). This assistance is provided for high-technology start-ups.

Second ranked Stanford University features, within its School of Engineering, the 'Stanford Technology Ventures Program' (STVP). This is a holistic combination of university courses and support activities toward the development of extraordinarily powerful technology-based businesses (Stanford University, 2017). Massachusetts' Institute of Technology (MIT), ranked 3rd in the U.S., and 4th in the world, introduces students to working with industry partners to create products aimed at solving problems. The MIT Innovation Initiative (MITii), is a campus wide movement to encourage this type of creative problem solving throughout the university. Recently, in 2016, the School of Engineering and Sloan School of Business, teamed up to offer a joint minor in Entrepreneurship.

University of California's Berkeley Campus (UC Berkeley) uses a multi-faceted approach to produce entrepreneurial engineers. Academics, research, incubators, industry partnerships and mentoring are some of the methods employed by the Center for Entrepreneurship and Technology which is based in the US Berkeley College of Engineering (UCB, 2017).

2.4 Engineering programmes in the Caribbean

In the anglophone CARICOM region, this study identified a number of engineering programmes with the programme at The University of the West Indies, St. Augustine Campus (UWISTA), instituted in 1961, being the oldest. The University of the West Indies in Jamaica (UWIMONA), The University of Trinidad and Tobago (UTT), the University of Technology in Jamaica (UTECH) and the University of Guyana, also offer Bachelor of Science degrees in engineering. The Engineering Department at the University of Belize offers associate degrees in engineering. Despite the fact that the UTT, established in 2004, is the newest of all the universities mentioned, it was the first to establish a business incubator, named the UStart Incubator in support of its entrepreneurial mission (UTT, 2017). The UTT describes itself as an entrepreneurial university in its mission statement. In fact, this institution appears to provide the most entrepreneurial support to its students. This support is university-wide, and not concentrated in the engineering programmes.

The study specifically focuses on the entrepreneurial motivations of students and recent graduates from engineering programmes. This paper reports on a study conducted in the SIDS of T&T where participants from

UWISTA and UTT participated in an empirical study conducted over a period of six (6) months. As with other studies among different demographics cited in this paper, participants were considered highly motivated if they were motivated by 'pull' rather than 'push' factors.

3. Research Method

This study was conducted between October 2015 and March 2016 and involved 250 respondents who were citizens of the Small Island Developing States of the Caribbean and current students or graduates of engineering programmes in two T&T universities, namely, The University of the West Indies, St. Augustine Campus (UWISTA) and The University of Trinidad and Tobago, O'Meara and San Fernando Campuses (UTT). The participants had graduation years ranging from 2010 to 2019. This study is an exploratory study which is really the first part of more extensive research on the potential for engineering entrepreneurship in the SIDS of the Caribbean and the Pacific Islands.

The Faculty of Engineering at UWISTA has been delivering engineering degree programmes since 1961, which is longer than any other institutions in the English-speaking Caribbean. As such, it was deemed appropriate to start this study with students from this institution. Ease of access and convenience were also considered in the decision to conduct this pilot study with students from UWISTA and also from engineering programmes within the relatively new, but entrepreneurial university, UTT, established in 2004. This study therefore covers the main engineering programmes within T&T.

A comprehensive self-reporting questionnaire tool was developed and electronically distributed. Two hundred and fifty responses were received. These responses were culled for missing sections and the result was the removal of twenty (20) questionnaires from the final sample. Responses were coded and the tau-equivalent reliability, more commonly referred to as Cronbach's alpha statistic (Cronbach's alpha), was calculated for the study. A Cronbach's alpha of 0.65 to 0.7 or higher is considered acceptable as a measure of reliability of the dataset. In this case, the Cronbach's alpha was 0.827, which exceeded the minimum requirements.

The data was then analysed using descriptive statistics, correlations and crosstabs in the IBM SPSS Statistics 24 software. The students' sex, ethnicity, parents' occupations, business experience, age of first introduction to business, entrepreneurial knowledge and entrepreneurial training were all investigated for correlations with entrepreneurial motivation. Initial areas investigated are shown in Table 2.

The questionnaire had been designed to determine whether students were motivated to be entrepreneurs and whether their motivators were 'pull' motivators such as taking advantage of an opportunity or 'push' motivators

Table 2. Areas Investigated

Key	Description
School	UWISTA, UTT
Graduation	2010-2019
Major	BSc or BAsC in any Engineering discipline
Age	Under 15, 15-17, 18-20, 21-24, 25-29, 30-34, 35-40, 41-50, 51-60, Over 60
Sex	Male or Female
Ethnicity	African Descent/Black, Asian, Caucasian/White, East Indian/South Asian, Hispanic/Latino, Middle Eastern, Mixed.
MrOccupation	Mother’s Occupation – Public Service, Private Sector, Entrepreneur/Self Employed, Other
FrOccupation	Father’s Occupation - Public Service, Private Sector, Entrepreneur/Self Employed, Other
BirthOrder	First Born, a Middle Child, Last Born, Only Child
BusExperience	Business Experience YES/NO
FBusExperience	First Business Experience NEVER, <5, 5-12, 13-19, 20-25, 25-30, >30
ENTKnowledge	Entrepreneurial Knowledge – Scale of 1-5 where 5 is highest
ENTTraining	Entrepreneurial Training
ENTMotivation	Entrepreneurial Motivation i) My family is in business ii) To take advantage of an opportunity iii) For the challenge iv) To be my own boss/control my life and future v) because the job market is dismal vi) If I get laid off from my job vii) I will NEVER start a business.

such as being forced to enter business because of a dismal job market or job loss. Where significant correlations were found, further investigation was done using the crosstabs function in descriptive statistics in SPSS.

4. Findings and Analysis

4.1 Participants

This study was limited to engineering students or graduates only with graduation dates from 2010 to 2019. A total of two hundred and fifty (250) engineering students and graduates participated in the study conducted over a period of approximately six (6) months. Twenty (20) survey returns were discarded due to incomplete sections of the questionnaire. The first two (2) sections out of three (3) form the basis of this study so incomplete survey responses were culled where necessary to ensure that a proper representation of the population was used. Two hundred and twenty-seven (227) responses were needed for a 90% confidence level with a margin of error of 5%, and this figure was exceeded.

4.2 Descriptive Statistics

There were sixty-three percent (63%) male respondents and thirty-seven percent (37%) female. The majority of participants, eighty-seven percent (87%), were from UWISTA and thirteen percent (13%) were from UTT. All of the students had gained or were pursuing either a Bachelor of Science or Bachelor of Applied Science Degree with forty-four percent (44%) representing Mechanical Engineering, twelve percent (12%) Civil Engineering, eleven percent (11%) Electrical Engineering and nine percent (9%) Manufacturing Engineering (see Table 3).

Ninety-three percent (93%) of the respondents were

between the ages of 18 and 29, as follows: 18-20; 26%, 21-24; 57% and 25-29; 11% (see Figure 3).

Table 3. Degree Specialisation

Degree Specialisation	Response Percent
BSc Chemical Engineering	7%
BSc Civil Engineering	12%
BSc Electrical Engineering	11%
BSc Geomatics	6%
BSc Industrial Engineering	7%
BSc Land Management	1%
BAsC Manufacturing Engineering	9%
BSc Mechanical Engineering	44%
BSc Petroleum Geoscience	2%

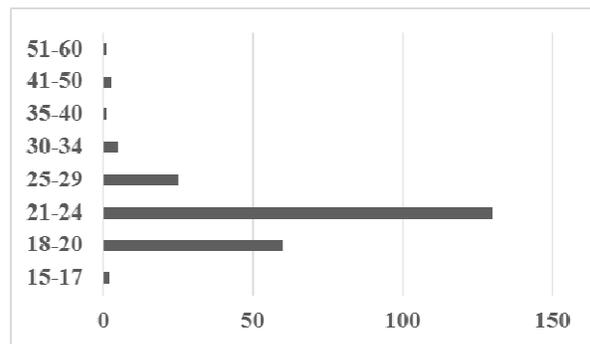


Figure 3. Age of respondents

Furthermore, 80% had graduation dates between 2016 and 2018 as follows: 38% in 2016, 25% in 2017, 17% in 2018. Ethnicity of the respondents was also recorded, as the literature identified links between ethnic origin and entrepreneurial motivations. In this case, the

majority of the engineering students and graduates in the study were of East Indian/South Asian descent (40%), followed by African descent/black (30) and mixed (25). These three (3) categories represent 95% of the respondents (see Table 4). Regarding birth order, eleven percent (11%) of participants were ‘only’ children, thirty-one percent (31%) were ‘first’ borns, forty-one percent (41%) were ‘last’ borns and seventeen percent (17%) were ‘middle’ borns (see Figure 4).

Table 4. Ethnicity

Degree Specialisation	Response Percent
African Descent Black	31%
Asian	1%
Caucasian White	0%
East Indian/ South Asian	40%
Middle Eastern	1%
Mixed	26%
Other	1%

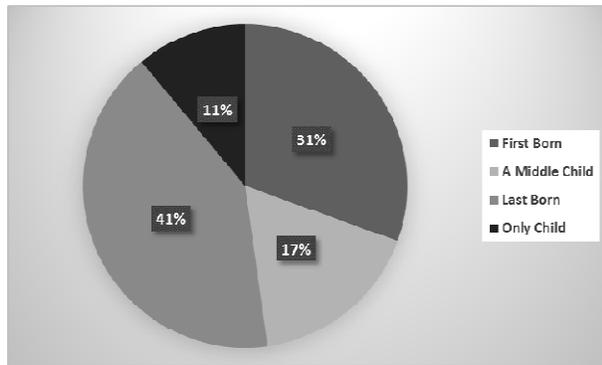


Figure 4. Birth order of respondents

The occupations of the parents of the respondents are shown in Table 5. Thirty-four percent (34%) of survey participants had experience on running a business and sixty-six percent (66%) had never run or assisted with managing a business. The age of first exposure to running or helping in a business is shown in Figure 5.

Table 5. Parents' occupations

Description	FrOccupation	MrOccupation
Public Service	28%	38%
Private Sector	40%	26%
Entrepreneur/ SE	16%	11%
Homemaker		15%
Other	16%	9%

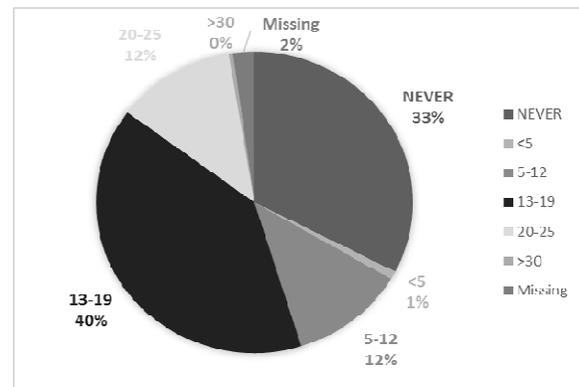


Figure 5. Age first exposed to running/helping in a business

Participants were asked to rate themselves regarding their knowledge on entrepreneurship. They were asked “On a scale of 1 to 5, where 1 is lowest and 5 is highest, how would you rate your skills and knowledge regarding entrepreneurship and what it entails? The responses are shown in Figure 6. The respondents also indicated their formal training in entrepreneurship, shown in Table 6.

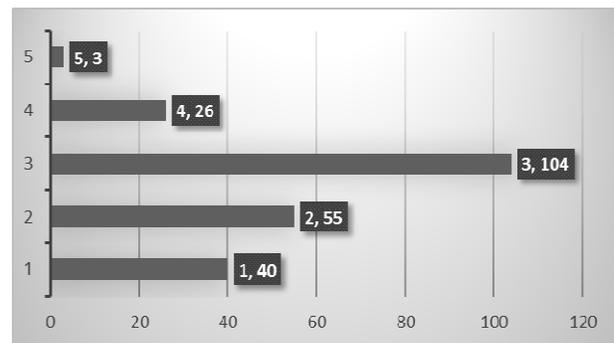


Figure 6. Entrepreneurial Knowledge

Table 6. Formal Training in Entrepreneurship

Details	Percent
No - none that I can remember at all	31%
No - and it was barely mentioned at University	20%
Yes - some basic training at University	19%
Yes - but not at the University	7%
Yes - for a semester or more at University	13%
Yes - both at the University and elsewhere	9%

The students and graduates indicated the reasons why they would start a business and the most frequent answers were “To be my own boss/control my life and future” (41%) and “To take advantage of an opportunity” (37%). These are both “pull” factors for entrepreneurship with the first being internal motivation and the second, external motivation. Few respondents cited push factors such as being downsized (2%) or a dismal job market

(5%) as the main reason why they would start a business (see Table 7).

Table 7. Entrepreneurial Motivation

Description	Percent
I will NEVER start a business	1%
If I get laid off from my job	2%
Because the job market is dismal	5%
My family is in business	8%
To be my own boss control my life and future	41%
For the challenge	6%
To take advantage of an opportunity	37%

4.3 Correlation Analysis

Interesting correlations were identified when the data was processed. Unlike the other studies cited in this paper, sex, ethnicity and parents’ occupation were not significantly correlated with entrepreneurial motivation. Birth order and business experience were found to be the only factors in this study correlated with the entrepreneurial motivation of the engineering students. Statistically significant correlations included:

1. Birth order (BirthOrder) and entrepreneurial motivation (ENTMotivation) (Corr 0.162)
2. Business experience (BusExperience) and entrepreneurial motivation (ENTMotivation) (-0.176)
3. Birth order (BirthOrder) and business experience (BusExperience) (Corr 0.160)
4. Birth order (BirthOrder) and first business experience (FBusExperience) (Corr -0.137)
5. Sex (SEX) and first business experience (FBusExperience) (0.137)
6. Business experience (BusExperience) and entrepreneurial knowledge (ENTKnowledge) (-.313)
7. First business experience (FBusExperience) and entrepreneurial knowledge (ENTKnowledge) (0.295)
8. Entrepreneurial training (ENTTraining) and entrepreneurial knowledge (ENTKnowledge) (0.196)
9. Ethnicity (ETHNICITY) and entrepreneurial knowledge (ENTKnowledge) (0.138)
10. Ethnicity (ETHNICITY) and entrepreneurial training (ENTTraining) (0.142)

Birth order was correlated with entrepreneurial motivation (Corr 0.162) whereby more than 50% of the ‘middle’ born and ‘only’ children reported wanting to

start businesses for the independence and control it offered. Among the ‘last born’ siblings, 45% would engage in entrepreneurial activity to take advantage of an opportunity. This potentially makes them the most progressive entrepreneurs since their entrepreneurial motivation, based on pull factors, was mainly based on the potential for a product or service in the marketplace. This suggests that last born engineering students may prove to be the ones who would have the most impact on economic development since they should be able to respond most decisively to opportunities within the market.

First borns were most likely to enter business because the family was in business (14%). This was not surprising, as first born children are often expected to accept the responsibility of managing the family business after the parents have died or retired. The ‘only child’ was 2nd in reporting that their motivation for making a career in business was the fact that the family was in business. This was somewhat expected, since like the first born, the expectation of continued family ownership would fall on this individual (see Table 8).

Apart from birth order, business experience was the only other factor in this study which correlated significantly with level of entrepreneurial motivation. Engineering graduates with no business experience were more likely to become entrepreneurs than those with actual business experience (8% vs 2%). Similarly, none of the respondents with business experience reported that they would consider becoming entrepreneurs as a response to being laid off from their job. In contrast, three (3) percent of the engineering graduates with no business experience would consider entrepreneurship when laid off from their job.

Eighty-nine percent (89%) of the engineering students and graduates who had prior experience managing or assisting in running a business exhibited higher order ‘pull’ motivations, both internal and external. Eighty-three percent (83%) of the respondents with no business experience would be motivated by ‘pull’ factors (see Table 9). These results are quite interesting. They run true to the major conclusion that the respondents were strongly motivated by ‘pull’ factors. The small number of respondents motivated by push factors are not really dedicated to the idea of being

Table 8. BirthOrder * ENTMotivation Crosstabulation

		ENTMotivation						
		I will NEVER start a business	If I get laid off from my job	Because the job market is dismal	My family is in business	To be my own boss control my life and future	For the challenge	To take advantage of an opportunity
BirthOrder	First Born	2%	4%	8%	13%	38%	6%	29%
	A Middle Child	0%	3%	3%	0%	50%	9%	34%
	Last Born	0%	0%	6%	5%	36%	6%	45%
	Only Child	0%	0%	0%	10%	52%	5%	33%

Table 9. BUExperience * ENTMotivation Crosstabulation

		I will NEVER start a business	If I get laid off from my job	Because the job market is dismal	My family is in business	To be my own boss control my life and future	For the challenge	To take advantage of an opportunity
BusExperience	Yes	0%	0%	2%	9%	38%	9%	42%
	No	1%	3%	8%	6%	43%	5%	35%

entrepreneurs and, should conditions change, would be tempted to pursue other interests involving full time employment.

First borns were most likely to have had experience (45%) managing or assisting in a business. This may have occurred as a result of parents’ ‘grooming’ them for eventual ownership of the family business. Even though the ‘only child’ was the second (2nd) most likely to enter the family business, they were most likely to not have early business experience (see Table 10). This was an unexpected result and could be further investigated in a subsequent phase of this study.

Table 10. BirthOrder * BusExperience Crosstabulation

		BusExperience	
		Yes	No
BirthOrder	First Born	42%	58%
	A Middle Child	34%	66%
	Last Born	30%	70%
	Only Child	24%	76%

Even though the ‘only child’ was least likely to have business experience, the first business experience was earlier in life with 24% gaining this experience by age twelve (12), inclusive of four percent (4%) by age five (5). As with business experience, attribution cannot be immediately determined regarding the observation of the case of ‘only child’. Among all age ranges, however, the first business experience most typically occurred during the teenage years, between 13 and 19 (see Table 11). Note that the overall figures for business experience differ because respondents would not have considered childhood ventures.

Table 11. BirthOrder * FBusExperience Crosstabulation

		FBusExperience					
		NEVER	<5	5-12	13-19	20-25	>30
Birth Order	First Born	25%	1%	10%	47%	15%	1%
	A Middle Child	32%	0%	16%	32%	21%	0%
	Last Born	39%	0%	10%	43%	8%	0%
	Only Child	40%	4%	20%	24%	12%	0%

Respondents who were exposed to business before age twelve (12), were more likely to report higher levels of entrepreneurial knowledge than those whose first business experience occurred at a more advanced age.

Though the quantity of respondents was smaller for these categories, fifty percent (50%) of those exposed to business before age five (5) and thirty-three (33) percent of those whose first experience occurred between ages five (5) and twelve (12), scored themselves four (4) on a scale of one (1) to five (5) for entrepreneurial knowledge. In contrast, only thirteen (13), seven (7), and zero (0) percent respectively, of respondents in later age ranges rated themselves a four (4) or five (5) on entrepreneurial knowledge (see Table 12).

Table 12. FBusExperience * ENTKnowledge Crosstabulation

		ENTKnowledge				
		1	2	3	4	5
FBusExperience	NEVER	28%	33%	35%	3%	1%
	<5	0%	50%	0%	50%	0%
	5-12	15%	11%	41%	33%	0%
	13-19	11%	22%	54%	11%	2%
	20-25	18%	21%	54%	7%	0%
	>30	0%	0%	100%	0%	0%

East Indians, African descent/black and mixed race individuals constituted the majority of respondents for the study. Of these, East Indian engineering students and graduates scored evaluated their entrepreneurial knowledge highest, with 65% scoring themselves three (3) or higher. Mixed race (60%) and African descent/black (48%) followed (see Table 13).

Table 13. Ethnicity * ENTKnowledge Crosstabulation

		ENTKnowledge				
		1	2	3	4	5
Ethnicity	African Descent/Black	20%	31%	41%	7%	0%
	Asian	100%	0%	0%	0%	0%
	Caucasian White	0%	0%	100%	0%	0%
	East Indian	15%	20%	55%	9%	1%
	Middle Eastern	0%	0%	50%	50%	0%
	Mixed	14%	26%	36%	21%	3%
	Other	33%	0%	67%	0%	0%

5. Discussion

The main finding from this study was the fact that engineering students and graduates from a society not traditionally known for producing highly entrepreneurial engineering graduates, actually exhibit high-order entrepreneurial motivation factors. The desire to be the ‘boss’ in the enterprise or challenge themselves could be

described as internal ‘pull’ factors while responding to a need or opportunity in the environment would be an external ‘pull’ factor. In no case would circumstances force these respondents into entrepreneurship. This was even more impactful considering that, unlike other studies cited in this paper, no significant correlation was found between entrepreneurial motivation and factors such as sex, age, ethnicity or parents’ occupations.

These results cannot be extended to include university students and graduates from other disciplines or other individuals within the society. Also, a clear distinction must be made between the terms entrepreneurial motivation, entrepreneurial intention and entrepreneurial behaviours. The latter two (2) point to decisive action impending, or executed. These respondents completed the questionnaire in such a manner as to leave no doubt as to the terms and conditions under which they would pursue entrepreneurial activity. It does not mean that they intend to pursue such activity or ever would. In fact persons with low level ‘push’ entrepreneurial motivations may be more likely to be entrepreneurs if conditions demand. Individuals motivated by ‘push’ factors such as job loss or a dismal job market are, however, likely to abandon the entrepreneurial journey when conditions change.

The conditions under which the majority of the respondents could be motivated to create enterprises could form the basis for another study on entrepreneurial intentions. This study would be descriptive as opposed to explorative as it would require in-depth analysis of the behaviour of engineering students and graduates. The two factors that correlated significantly with level of entrepreneurial motivation, namely birth order and business experience could also be further explored.

It was interesting to discover that engineering graduates with actual business experience were less likely to be ‘pushed’ into creating businesses because of a poor job market or job loss. Their motivations are based on their own desires for independence and control or favourable factors within the environment. Training in business was one of the factors explored in this study but this was found to have no significant influence on the entrepreneurial motivation of the respondent. Regarding birth order, middle born and only children were more likely to desire a business for independence and control of their destiny while last born children identified taking advantage of an opportunity as their motivation. Somewhat expected, was the fact that first born participants were more likely than any other groups to indicate their entrepreneurial motivation as joining the family business. This study did not determine whether this was seen as a welcome opportunity or an expected but unwelcome duty.

This study was an exploratory study, seeking to understand the latent potential motivators for entrepreneurship among students and graduates not typically noted for participating in entrepreneurial activities. A further longitudinal study would be useful to

define the archetypes for Caribbean engineering entrepreneurs. Furthermore, since the study seems to suggest that entrepreneurial engineers are not born, but ‘made’, and are highly motivated, this knowledge may be useful in supporting graduates of the regional engineering programmes.

6. Conclusion

Engineering students and graduates in T&T who participated in this study, overwhelmingly display high-order entrepreneurial motivational factors such as the need for control or desire to respond to opportunities within the environment. Unlike other entrepreneurship studies, no significant correlation was found between the entrepreneurial motivation of the respondents and ethnicity, sex, parents’ occupation, or training in entrepreneurship.

Entrepreneurial motivation was, however, significantly correlated with birth order and experience running or assisting in managing a business. Further studies are proposed to better understand the factors which could affect the entrepreneurial intentions or behaviour of engineering students and graduates.

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