A methodology to analyze undergraduate engineering student’s campus start-up activities and its scope of B2C companies

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Abstract. Business is passion for the educated youth in the current global market scenario. Youth have a vision on Business-to-Consumer venture for their profit growth. This is achieved by the acceptance and utilization of technology trends and are handled by engineering students. Curriculum projects of engineering students should be converted into useful products for the society through the business model. Innovative projects are happening in the campus, but scope of these projects scaled up into prototypes and its development into marketable products is minimal. Most of these markets are in the electronics and information sciences arena. Mechanical Engineering stream has a huge potential that is waiting to be explored. The aim of this paper is to enhance discussion on the entrepreneurial inquisitiveness of mechanical engineering students to campus start-up and its possibilities for a Business-to-Consumer model.

For that, final year undergraduate mechanical engineering students across Kerala, India has been selected. SEM was applied to a sample of 392 students from the APJ Abdul Kalam Technological University, across Kerala, India. The findings highlight the participation of mechanical engineering students on campus start-ups and its support from various organizations. The scope of start-up products from business to consumer is positively accepted.

Key words: - Campus Start-up, B2C, Mechanical engineering students, University

1. Introduction

Millennials are ready to embrace this brave new world by being part of the start-up ecosystem. Engineering students are pursuing this path by immersing themselves into emerging technology trends and their market potential. Most of these markets are in the electronics and information sciences arena. Mechanical Engineering stream has a huge potential that is waiting to be explored. At this juncture, the success rate of student start-ups in the Mechanical Engineering stream is relatively less when compared to the ones spawned by other engineering streams(Kerala Start-up Mission, 2019). Kerala serves as a great sample to explore the campus start-up ecosystem in a developing country as it represents the epitome of entrepreneurial vision with the enormity of resources and accomplishments in this area. The engineering students have start-ups during their studies but the start-ups from mechanical engineering stream is a minimum. The possibilities for the exposure of mechanical based products faced a lot of barriers. To overcome these barriers state government agencies like Kerala Stat-up Mission (KSUM) and Innovation and Entrepreneurship Development Centre (IEDC) in the campus works together and gives financial and technological support to the students.
Products from the start-ups can be marketed directly to the consumers all over the world without an intermediate person for the growth of business. Social media and other related technologies are mostly handled by the educated youth. The profound knowledge in the use of social media for communication gives impetus to the marketing strategies of the students. The widespread use of social media in business markets has triggered the restructuring of business models. To make an online business successful, a company has to attract customers willing to shop online, deliver products to these customers, and receive payments from the customer (Yu, 2006).

This paper is based on the literature screening of key contributions highlighting campus start-ups by the undergraduate Mechanical Engineering students by evaluating their entrepreneurial inquisitiveness in campus activities on the one hand and theoretical underpinning of Business-to-Consumers (B2C) marketing trends on the other. B2C, is the process of selling products and services directly to end consumers.

2. Literature

Entrepreneurship is a creative process which stimulates innovation and economic growth (Lewis, 2013), (Verspagen, 2009). A start-up is an entrepreneurial experiment and small beginning enterprise that provides a space for self-realization, an opportunity to develop and implement unusual and risky ideas. The engineering students are confronted with entrepreneurship as available alternative to other forms of career paths. (Carayannis et al., 2003). Choosing the right curriculum project for a campus start-up is something that nobody can suggest except yourself (Fukugawa, 2018). Start-up contains the potential for exceptional growth but also unforeseen and repeated failures (Olugbola, 2017). These losses will pull back the students from entrepreneurship. It will lead to unemployment of educated youth thereby uncertainty in the country. Central and state government are withdrawing their role as employers but are supporting the youth to go for entrepreneurship.

In the state of Kerala, University has a policy to develop an entrepreneurial eco system in the engineering students during their studies. Government agencies like Kerala Start-up Mission (KSUM) and Innovation and Entrepreneurship Development Centre (IEDC) in the engineering colleges provides financial assistance and knowledge support to develop start-up eco system in the campus. It is intuitively appealing to think that the trainings, workshops and hackathons offered by universities, KSUM and state government is driving the students to do start-up activities in their campus (Student Start-up Policy, 2015). IEDC in the campus takes the major role to develop knowledge-based activities and networks between students of different disciplines in the campus and off the campus spread around 180 engineering colleges across Kerala. (Kerala Start-up Mission, 2019). These network among students will lead to the establishment of wonderful campus start-ups. (Berglund & Wennberg, 2006). All these start-up products have to be reached directly to the consumer (B2C) through latest marketing methods. In developing countries lack of internet infrastructure and qualified staff, and skill among consumers, delayed product delivery are the challenges in this sector (Hawk, 2004). In commercial market, online shopping has become an important purchasing method for consumers (Wang et al., 2005). The consumer preferences and concerns may have a complex relationship and these has to be analyzed by the start-up for their B2C venture. (Rajagopalan & Deshmukh, 2005). An extensive social interaction is necessary to transcribe knowledge and information sharing (Ghahtarani et al., 2020) (Matricano & Sorrentino, 2020). B2C organization needs good products and marketing methods as well as a very good culture of continuous improvement and excellence. The online purchase of a consumer can be referred to as B2C marketing (Drigas & Leliopoulos, 2014).

Even though the students and colleges receive support from the government agencies, there is a deficiency in student’s start-ups. The barriers to student’s start-up are the dark side of entrepreneurship. From the literature, entrepreneurial inquisitiveness of engineering students can be analyzed by evaluating the following factors like Attitude of student, Involvement in campus activities, Government policies, Support from University, effectiveness of IEDC. The scope of B2C marketing of these campus start-up products is discussed.
3. Research Objectives and Hypothesis
Based on the literature the Objectives and Hypothesis are formulated, it can be seen that
Entrepreneurial inquisitiveness of mechanical engineering students can be found out by their
participation in Campus Start-up activities. Factors on EI is selected based on the literature. Here the
analysis made only on their entrepreneurial inquisitiveness and scope of B2C marketing is discussed.

3.1 Objectives
The following objectives were taken into consideration after literature review for the evaluation of
entrepreneurial inquisitiveness of mechanical engineering students.
1. To analyze the role of following factors on Entrepreneurial inquisitiveness. (EI)
   ▪ Attitude of mechanical engineering students towards EI
   ▪ Policy of KTU and colleges affecting engineering students towards EI
   ▪ Influence of government and its organizations on engineering students towards EI
   ▪ Barriers on IEDC activities of engineering students towards EI
2. To examine IEDC and its campus activities to develop entrepreneurial Inquisitiveness.
3. To know the scope of start-ups in B2C companies by the engineering students

3.2 Hypothesis
H1: Attitude of mechanical engineering students towards campus start-up has a positive impact on EI
H2: Involvement of mechanical engineering students in campus start-up has a positive impact on EI
H3: Policy of KTU and college has an positive impact on EI
H4: Influence of government and its organizations has an positive impact on EI
H5: Barriers on IEDC activities has a negative impact on EI

4. Research design and methodology
Various engineering colleges under APJ Abdul Kalam Technological University, Kerala, India are
considered and a sample of 392 final-year under graduate mechanical engineering students spread
across Kerala were chosen as they are more aware about the activities happening in campus. Data
collection was done using a questionnaire that was eventually refined based on literature, feedback and
market research and is analyzed using a statistical tool named “Statistical Package for Social Science”.
Data collected from the final year mechanical engineering students across Kerala through online and
direct method. The study uses 7-point Likert scale ranging from 1-strongly disagree to 7-strongly
agree. IBM AMOS is used to test the study hypothesis because this study involves large sample size.
Maximum likelihood estimator is used as the data analysis technique through structural equation
modelling (SEM) (Kline, 2004). Around 392 students were participated and 380 students’ responses
were used as final data after error checking.

5. Results and Analysis
The study applied the data analysis in three sequential stages. In the first stage, it examines the
dimensional structure of the scales used using Exploratory Factor Analysis (EFA). In addition to this,
an assessment on the reliability of the scale using internal consistency measures was made. Further,
the validity and reliability of the scale was checked using Confirmatory Factor Analysis (CFA).
Followed by this, in the last stage, as part of testing the study hypothesis, applied Structural Equation
Modelling (SEM) and Regression Analysis were made.

To measure the variables the survey instruments must have sufficient normality (p>0.01),
reliability and validity (Hair et al., 2010). The internal consistency reliability can be estimated by
Cronbach’s alpha with consistency between 0.60 to 0.90 (Nunnally and Bernstein, 1994). EFA and
CFA are conducted to reduce a pool of items into subset of components/factors (Matsunagea, 2010).
As part of CFA, goodness-of-fit indices Table:1 examines the goodness of fit of the data with the
model, Figure 1 measurement model. From the analysis, it was observed that the overall correlated
CFA model indicated a good fit ($\chi^2 = 676.119$, df = 644, $\chi^2$/df = 1.05, CFI = .996, SRMR = 0.033,
RMSEA = 0.011). All these directed the study that the scale used to measure different dimensions are valid and reliable, therefore, proceed for hypotheses testing.

**Table 1.** Fit indices

| Measure     | Estimate | Threshold | Interpretation |
|-------------|----------|-----------|----------------|
| CMIN        | 676.119  | --        | --             |
| DF          | 644.000  | --        | --             |
| CMIN/DF     | 1.050    | Between 1 and 3 | Excellent |
| CFI         | 0.996    | >0.95     | Excellent      |
| SRMR        | 0.033    | <0.08     | Excellent      |
| RMSEA       | 0.011    | <0.06     | Excellent      |
| P Close     | 1.000    | >0.05     | Excellent      |

In the measurement model the factors such as attitude is measured with seven variables, policy of university is measured with seven variables, influence of government organization is measured with four variables, barrier factors are measured with six factors, involvement of ME students in campus activities is measured with five factors and entrepreneurship inquisitiveness is measured with four factors. The relationship and impact over the EI were measured.

**5.1. Structural Equation Modelling (SEM)**

SEM can handle large no of endogenous and exogenous variables as well as unobserved variables simultaneously (Golob, 2003).
Table 2. Goodness of fit indices of the SEM model

| Measure   | Estimate | Threshold | Interpretation |
|-----------|----------|-----------|----------------|
| CMIN      | 504.814  | --        | --             |
| DF        | 490.000  | --        | --             |
| CMIN/DF   | 1.030    | Between 1 and 3 | Excellent |
| CFI       | 0.998    | >0.95     | Excellent      |
| SRMR      | 0.042    | <0.08     | Excellent      |
| RMSEA     | 0.009    | <0.06     | Excellent      |
| P Close   | 1.000    | >0.05     | Excellent      |

Maximum Likelihood Estimation is employed and all proposed relationships in the hypothesized model is tested simultaneously to find data consistency (Byrne, 2001). (Golob, 2003; Schermelleh-Engel et al., 2003). As shown Table 2 the study found a satisfactory fit of the structural model \[\chi^2 = 504.814 \text{ (df= 490), } \chi^2/\text{df} = 1.03; \text{CFI} = .998; \text{RMSEA} = .009\].

5.2 Hypothesis test results

First, the results reported Table 3, a significant path estimates from ATTD to EI (\(\beta = 0.193, p < 0.01\)), supported a statistically significant relationship. Similarly, the results also supported that PUC has a positive impact on EI (\(\beta = 0.382, p < 0.01\)). Further, the results linking the relationship between BAF to EI also supported a statistically significant relationship (\(\beta = -0.305, p < 0.01\)). Further, the study examined the relationship between CD to the outcome variables. The results supported that INVCA has an effect or impact on EI (\(\beta = 0.257, p > 0.01\)).

Table 3. Unstandardized Regression Weights

|                | Estimate | S.E. | C.R. | P   | Label |
|----------------|----------|------|------|-----|-------|
| EI <--- ATTD   | 0.193    | .047 | 4.140 | *** | Par_28 |
| EI <--- PUC    | 0.382    | .061 | 6.279 | *** | Par_29 |
| EI <--- BAF    | -0.305   | .051 | -6.009 | *** | Par_30 |
| EI <--- INVCA  | 0.257    | .048 | 5.366 | *** | Par_31 |
| EI <--- KGOV   | 0.281    | .056 | 5.039 | *** | Par_32 |

At the same time, KGOV has also reported a statically significant impact on EI (\(\beta = 0.281, p < 0.05\)). In addition to this, the study also analyzed the standardized regression estimates to analyse the relative impact of all these independent variables on dependent variable. The results revealed PUC on EI carry highest influence in comparison with other independent variables. Figure 2 gives the total result of SEM analysis.

On the other hand of this research the scope of start-ups into B2C companies is highly acceptable by the mechanical engineering students. From the sample of 380 responses it is seen that 80 percent of them are aware of online money transactions and are interested to do product marketing. The remaining are much interested in traditional product purchase and business methods.
6. Conclusion

The substantial contribution of this research is the development of a new model for measuring entrepreneurial inquisitiveness through campus start-up activities of mechanical engineering students. The government supports self-employment activities to fight against unemployment. Decentralization of industrial activities will create employment opportunities for the students. The campus start-up activities are supported by the IEDC which acts as a catalyst for the growth of nascent entrepreneurship. KSUM, KTU, and Government are promoting their technological skill through different workshops and hackathons. The barriers in student’s attitude can be changed by the networks between students of different engineering disciplines and financial support from the agencies.

One of the big challenges for first-time entrepreneurs like start-ups is getting an enough credibility and visibility to have discussion with stakeholders. B2C entrepreneur should be familiar with the intricacies faced by people in the market. It is impossible to get referrals without actual purchase. E-commerce efforts in developing countries are the lack of telecommunication infrastructure, qualified staff to develop and support e-commerce sites, skill among consumers which leads to delayed delivery of physical goods. Faculty members can play a major role in creating start-ups in the campus. They identify the potential students with an entrepreneurial attitude and culture by organizing different entrepreneurial activities for the students. They require organizational support during the innovation process.

In the future, the survey has to be extended to all the engineering discipline and all the products. Also find different marketing techniques to get an easy catch to the consumers. In this paper primarily we are focusing on the possibilities of campus start-up by the mechanical engineering students in their campus and secondly, the possibilities to scale up these campus start-ups into a B2C venture. The products developed as campus start-ups must be scale up as a marketable product and it has to be marketed through online methods. This is the importance of B2C marketing.
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