

Developing Technology Entrepreneurship Subjects: A Four-Year Evaluation

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Abstract—The growth in the number of technology-based start-ups in Indonesia has increased significantly compared to last decade. One of the key factors in increasing the number of technology-based entrepreneurs is a carefully designed education system based on the dominant factors influencing one's success to be a technology-based entrepreneur. The Information Technology (IT) sector has been long recognized favorite sectors to start because of the low barriers to entry factors. The approach required to develop students' entrepreneurship skills in the IT field requires different methods compared to other sectors. This study briefly describe and evaluate the methods implemented by Informatics Engineering department at Ciputra University since 2013 in order to share a premature approach on Technopreneurship subjects. A SWOT analysis of four-year evaluation result along with SWOT strategies are exhibited as the main topic of discussion.

Index Terms—Curriculum, project based learning, SWOT, technology entrepreneurship.

I. INTRODUCTION

Entrepreneurial activity can help reduce poverty is not a new thing, and reflects the assumption that entrepreneurial activity related to economic growth (Schumpeter as cited in Alvarez & Barney) [1]. This last decade, interest in entrepreneurship provides a mechanism to reduce the level of poverty that occurs across countries [2]. Hence, in order to be a prosperous nation, entrepreneurship is very important and one of the major determining factors in the increase in the number of entrepreneurs is well designed education system through proper analysis of the strengths, weaknesses, opportunities and challenges faced by educational institutions in Indonesia.

In order to promote entrepreneurial activity, many universities have invested substantially in entrepreneurship education. This has led to a scientific interest in the outcome of the effort. Most studies have found a positive effect of entrepreneurship education on entrepreneurial intentions [3]. Ciputra University (UC) is the first university in Indonesia with entrepreneurship theme. Founded in 2006, UC is the passion and dreams of its founder, Dr. Ir. Ciputra who wants to share his entrepreneurial spirit to Indonesian. He believe that modern entrepreneurs are those who have balanced soft and technical skills, as well as intuition, entrepreneurial spirit, and proper education. Entrepreneurship without modern

concept of education will not last long. He aspires to nurture the spirit of entrepreneurship as early as possible and in conjunction with Ciputra School network, UC is built to achieve this goal. UC goals are to create future better nation by educating true entrepreneur with faculty supported by a combination of the Entrepreneurs in Residence, Professionals, Academics and Researchers. Ciputra University applies the principles of Entrepreneurship education on every course where the educational process focuses to nurture graduates with competencies as an entrepreneur in accordance with the expertise of each study course.

School of Entrepreneurship and Humanities (SEH) is a special school at Ciputra University who do not have any courses, but opening enrollment to all students at the Ciputra University. SEH, in addition also responsible for providing general courses or also known as Liberal Arts, cross-disciplinary with all courses at Ciputra University. Since 2013, there are compulsory Entrepreneurship subjects need to enroll by students regardless their courses are (1) E1: The Groundbreaker, (2) E2: The Business Model Creator, (3) E3: The Executor, (4) E4: The Innovator, (5) E5: The Global Player. Description of the entrepreneurship subjects are listed in Table I below.

Furthermore, in semesters 4 and 5, students can choose entrepreneurship in accordance with the specific study guilds. Study guilds are industry-specific class such as (1) Corporate Entrepreneurship, (2) Family Business, (3) Fashion, (4) Interior Architecture, Construction and Engineering (INACE), (5) Marketing and Visual Communication (MVC), (6) Personal and Professional Development and Service (PPDS), (7) Social Entrepreneurship, (8) Technology, (9) Tourism Hospitality and Culinary (THC), and (10) Trading. Study guilds in practice not only represents entrepreneurship classes but also forms communities, networks, research group, and center of excellence[4].

In addition to organizing public lectures above, SEH also held a variety of training to strengthen entrepreneurship knowledge and skills from various fields such as public speaking, negotiation, business data analysis, etc.

Informatics Engineering Department at Ciputra University is one of the excellent courses at the Ciputra University, which has two courses, namely Information and Multimedia Technology (IMT) and Management Information Systems (MIS). Unlike Informatics Engineering Program at other universities which focus on teaching technical aspects, in Informatics Engineering Program at Ciputra University students will be equipped with entrepreneurship programs so that when they graduate, most of students are ready to run their technology based new venture. It was constructed in accordance with the vision of the University founder.

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TABLE I: ENTREPRENEURSHIP SUBJECTS

Subjects	Description
E1	The Groundbreaker is the earliest stage of changing the mindset of Ciputra University students through excavation of entrepreneur story, self-introduction and acting in real projects within the community / market through personal selling or partnership with various kind of suppliers or other parties.
E2	The Business Model Creator is the second stage of entrepreneurship, as students try to create a business model for the venture that will run and test the market acceptance. Various tools will be introduced to the students, whether it is design thinking, lean startup, bootstrapping the startup, or business model generation variant born through the consumer collaboration of the digital media revolution.
E3	At the stage of The Executor, the emphasis of student learning exists on the execution and operation of the business model created and seeks its development efficiently and effectively in creating a strong market. Students are expected to innovate the process through a strong team, supply chain management, and implementation of operations management to produce a solid venture.
E4	At The Innovator stage, the emphasis on learning on innovation from vocational students accompanied the development of existing markets / communities. Innovation involves product, market, network, process, finance, business model, brand or other accompanied by complete permit and legal status needed to reach Global Player stage.
E5	During Global Player stage, the student-formed venture must be able to respond to global challenges, with expanded markets and networks including export, product diversification or expanded venture networks. The emphasis at this stage lies in sustainability in the global arena as well as network expansion.

II. LITERATURE REVIEW

Studies related to defining basic terminologies used in the study are discussed first. This is followed by an overview of the nature of recent studies on project-based learning and technology entrepreneurship (technopreneurship). These previous studies were influential in exploring teaching & learning methods which will be discussed in section 3.

The concepts such as entrepreneur, entrepreneurship, and entrepreneurial all continue under active conversation [5]. Researchers and academics have long debated about the definition of entrepreneur. Many entrepreneurship researches also provide slightly different perspective of the word entrepreneur. The Schumpeterian lens of entrepreneur [6] as creating value by making new combinations causing discontinuity to the current environment and enable innovation within entrepreneurial family SMEs, which is the most widely used definition offered in the last 50 years. Subsequently, Bull & Willard [7] offer the following tentative theory of entrepreneurship, anecdotes and observations taken from the existing literature, in the hope that they will better explain in defining an entrepreneur as a person who will perform the new combination, causing a discontinuity, in condition-related to task motivation, skills, expectations of personal gain, and supportive environment.

The vision of the technologist who dreams to become entrepreneur is nothing new. The world of science and engineering has faced evolution in becoming more entrepreneurial nowadays, we can witness the success of the founders of Google, Microsoft, Facebook, etc. To extend the

success story in Indonesia, a list of Unicorn Company such as Tokopedia, Traveloka, and Go-Jek proof the idea of technology based entrepreneurship. Most of them were science or engineering students who experience the transition from technical disciplines to entrepreneurial attitude. Entrepreneurs, unlike pure scientist or engineers are not bound by formulas, rules, and linear patterns of thinking. They also have strong internal locus of control, which means that they believe they are in charge of their destiny, consequently they tend to take responsibility for both their successes and their failures rather than attributing them to some other source [8]. Scientists and engineers who commercialize their products are gradually called technology entrepreneurs or technopreneurs in short. Table II below will explain each word relates to entrepreneurship.

TABLE II: TERMINOLOGY AND DEFINITION

Terminology	Definition
Entrepreneur	Individual
Entrepreneurship	Process
Entrepreneurial	Attitude, Skills, Mindset
Technopreneurship	Technology Entrepreneurship

Integrating the project into the curriculum is fairly common in the world of higher education. Project-based Learning as part of Experiential Learning has received great attention from academia, especially when the purpose of the course is able to put into practice a specific competence, in which students are required to complete a complex task and sustain in real life situation. Experiential Learning designed to encourage students to explore issues in greater depth [9] and the daily reality-based contextual to the needs of the surrounding community. A study conducted by Thomson [10] stated that the ability of students to acquire new understanding are enhanced when they are connected to meaningful problem-solving activities, and when students are helped to understand why, when, and how to use the relevant facts and skills.

Project-based learning is a form of active student-centered instruction which is portrayed by students' autonomy, constructive investigations, goal-setting, collaboration, communication and reflection within real-world practices [11]. It has also been explored in various contexts and in different phases of schooling, from primary to higher education. Benefits of the project-based learning model includes increasing interaction, growth in self-reliance, improved attitudes toward learning process, greater responsibility and sense of ownership among participants [12]. Another intangible benefit is the exposure to higher-order thinking, problem-solving, collaborating, and communicating ideas

III. CURRICULUM STRUCTURE AND TEACHING LEARNING METHODS

Informatics engineering department's goal is to produce entrepreneurs in the field of Information Technology. The approach used is to use specific curriculum structure and project-based learning where students are obligated to start new IT venture. Through this kind of learning, it is expected

that students are accustomed to running their business at the end of their study period. The curriculum structure of IMT program is illustrated in Fig. 1 below.

Technopreneurship 3					
Technopreneurship 2					
Technopreneurship 1					
E5: The Global Player					
E4: The Innovator					
E3: The Executor					
E2: The Business Model Creator					
E1: The Groundbreaker					

Fig. 1. IMT curriculum structure.

As we can see from Fig. 1 above, the left most column is the list of subjects related to entrepreneurship, where Entrepreneurship 1 to Entrepreneurship 5 are offered by the School of Entrepreneurship and Humanities from semester 1 to 5, followed with three technopreneurship subjects in subsequent semester, namely Technopreneurship 1 (New Venture Creation), Technopreneurship 2 (Startup Internship), and Technopreneurship 3 (Final Project). The curriculum structure combines guidance from ACM-IEEE Computing Curricula 2005 and Ciputra University local context of Entrepreneurship Education

A. Technopreneurship 1

This subject is a continuation of the five Entrepreneurship subjects held by the Faculty of Entrepreneurship and Humanity, where in this subject the opportunity recognition is more specific to the Information Technology based new venture creation (i.e.: IT Consulting Company, Web & Mobile Application Company, etc.). After the completion of this subject, students are expected to make a realistic business plan and company profile for their new IT venture based on three approaches as suggested by Barringer & Ireland [13] which are trends, problem solving, and filling the market gap.

This subject includes an introduction to Technopreneurship, opportunity analysis, the feasibility analysis of the products or services (market feasibility, organizational feasibility, and financial feasibility), visual prototyping, technology commercialization, new business leadership, legal aspects of technology invention and the formulation of a technology based business plan. Each student is assigned a mentor for their new IT venture based on his or her typical IT field and expertise. Students need to attend at least four consultation sessions before their final exam, which is also their Technopreneurship Project proposal defense.

B. Technopreneurship 2

The technopreneurship 2 gives the opportunity to intern for 8-10 weeks (fulltime) or 1 semester (part-time) at reputable established IT company in accordance with the business plan submitted on Technopreneurship 1 (i.e.: Mobile Apps new IT venture will take internship at establishes Mobile Apps

company). Students must provide weekly reports (weekly report) and sent to their mentor for progress monitoring purpose. Internship period is completed within 50 days of work, with alternative patterns as follows:

- Pattern 1: Fulltime Internship in the company with 6 working days (Monday-Saturday) equals to 8 weeks + 2 days.
- Pattern 2: Fulltime Internship in the company with 5 working days (Monday-Friday) equals to 10 weeks.
- Pattern 3: Part-time Internship during a semester until a total presence of 50 working days.

By the end of Technopreneurship 2 period, students are also required to make final report and presentation submitted to the internship coordinator.

C. Technopreneurship 3

The last phase of three Technopreneurship subjects, students are expected to focus on their business execution (or commercialization) of their new IT venture. With the appropriate internship experience, students are expected to have more experience in running their new IT venture. Students are required to perform a minimum of 10 sessions consultation with their mentors, which may be cross mentor. Students who have met the target of the project proposal submitted on Technopreneurship 1 are allowed to register for the Final Project defense.

D. Technopreneurship Project Types

The type of technopreneurship projects that can be executed by students is categorized into two kinds, based on the orientation of creating product for Future Use (Type 1) and Product / Service Implementation with orientation on current use (Type 2). The fundamental difference between Type 1 and 2 lies in the Timely factor of Opportunity Analysis, where in Type 1 this opportunity will be required in the near future so that the approach is more on product push, consequently Type 1 does not require a real client. In Type 2 project undertaken is the real current needs of a client so the approach is more on the market pull, therefore Type 2 requires real clients who have specific requirements. Table III will show the summary of the differences between Type 1 and Type 2.

TABLE III: SUMMARY DIFFERENCES BETWEEN TYPES

Differences	Type 1	Type 2
Focus	Products for future use	Products/Services for current use
Client	Novelty	Real
Approach	Product Push	Market Pull
Prerequisites	Mass product or Implementing sophisticated algorithm	Small to Medium scale project with at least IDR 20,000,000 valuation
Final Deliverables	Working product and commercialization plan	Project specification, report and payment receipt

E. Business Model Canvas

Business Model Canvas (BMC) allows students to freely map their business concept in an easy to manage platform. This platform was introduced by Osterwalder & Pigneur [14] as a tool to systematically reflect business model and easily updated whenever pivot happens. The BMC contains nine

business model building blocks within four perspectives which are Infrastructure perspective (Key Activities, Key Resources, and Key Partners), Offering perspective (Value Proposition), Customers perspective (Customer Segments, Channels, and Relationship), and Financial perspective (Cost Structure and Revenue Streams). The common BMC can be seen in Fig. 2 as follows.

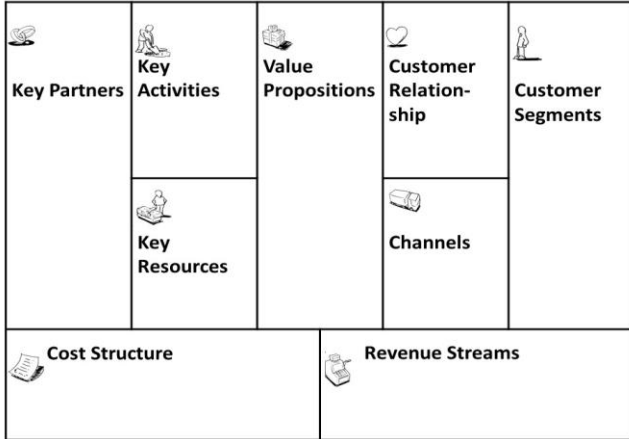


Fig. 2. Business model canvas.

IV. SWOT ANALYSIS

To measure the internal and external environment with the intention of better recognizing Technopreneurship 1-3 subjects the SWOT analysis will be used. The SWOT analysis has been long used by many analysts to identify internal strengths in order to take advantage of external opportunities and prevent external threats, while addressing weaknesses. Performing as strategic management tool, the SWOT analysis consists of four building blocks, namely strengths, weaknesses, opportunities, and threats.

The SWOT analysis is useful for formulating strategies based on the combination the four building blocks. The strategies can be categorized into (1) SO strategies to use strengths to take advantage of opportunities, (2) ST strategies to use strengths to avoid threats, (3) WO strategies target to reduce weaknesses to open new opportunities, and (4) WT strategies are defensive plan to reduce weaknesses and avoid threats. The SWOT analysis and strategies of Technopreneurship 1-3 subjects by far is listed in table IV and Table V below.

TABLE IV: THE SWOT ANALYSIS

<p>Strengths</p> <ul style="list-style-type: none"> • Strong support from University level • Most students' parent are business man • Solid entrepreneurship foundation from semester 1-5 • Guild systems started earlier in semester 4 greatly helps entrepreneurship focus • Mentors have sound practical background as well as academic experiences 	<p>Weaknesses</p> <ul style="list-style-type: none"> • The approach of technopreneurship 1-3 are still premature • Some mentors are still too focussed on product/services features rather than commercialization process • It's tough to commercialize type 1 project, especially game in Indonesian context
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<ul style="list-style-type: none"> • Support from both local and international board for technology entrepreneurship 	
<p>Opportunities</p> <ul style="list-style-type: none"> • Working closely with media to spread the news • Partnering with investors to help initial funding • Getting support from Government • Affiliating with established IT vendor • Big corporations started to invest in start-ups • Business incubations and co-working spaces are available 	<p>Threats</p> <ul style="list-style-type: none"> • Similar approach is rapidly followed by larger and more established universities • People's mind-set about entrepreneurship are still equal with SME • IT Adoption in SMEs are still in the early stages • Most of small business still take too lightly on students' new IT venture

TABLE V: SWOT STRATEGIES

SO Strategies	<ul style="list-style-type: none"> • Initiating collaboration with prominent media such as Tech in Asia which focussed on Technology Entrepreneurship • Involving students' parents as angel investors • Allow larger network of partners by utilizing mentors' network, particularly with Government officials and investors • Pushing more mobile applications, especially Android platform to get more media attention
ST Strategies	<ul style="list-style-type: none"> • Registering patent for Technopreneurship curriculum • Bridging IT products from personal use to SME use with proper adoption strategy • Holding seminars or conferences among SMEs to encourage higher IT adoption rate • Trying different revenue models for type 1 projects
WO Strategies	<ul style="list-style-type: none"> • Reviewing Technopreneurship 1-3 approach and teaching methods with help from Government and established IT vendors • Empowering mentors with commercialization skills and exposures
WT Strategies	<ul style="list-style-type: none"> • Working with limited number of SMEs as pilot project and write their success story • The type 1 project need to research more on market needs due to the nature of dynamic growth of technology

V. CONCLUSION

This article has briefly described and evaluated the methods implemented by Informatics Engineering department at Ciputra University since 2013 in order to share a premature approach on Technopreneurship subjects to article readers. As the first exploratory study of Informatics Engineering curriculum evaluation, it is strongly recommended that the study is supported with finding antecedents influencing success factors of Informatics Engineering students in starting their new IT venture.

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