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Entrepreneurial Mindset for Engineering Undergraduates

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Abstract - *Engineering leverages engineering knowledge and is able to bring real value to the global marketplace, particularly in the area of creative and disruptive technology capable of improving the lives of others on the global marketplace. New product development creates both jobs and revenue for companies in the technology field; it is also the engine that maintains the country's leading role in the world's economy. Engineering education, therefore, must teach engineers-to be how to be entrepreneurially minded so they can be key influencers in creating new products. This new educational paradigm must include not only instruction in the technical fundamentals of engineering, but also incorporate insight into the importance of customer awareness, an introduction to business principles, as well as a focus on societal needs and values. These precepts need to be integrated into curricular as well as co- and extra-curricular activities. The purpose of this literature review was to explore the importance of entrepreneurial mindset for engineering undergraduates to develop their entrepreneurial intention.*

Key words- *Entrepreneurship, Mindset, Engineering Undergraduates*

I. INTRODUCTION

Entrepreneurship for engineers is not new to the world. Recent changes in the world and engineering present both challenges and opportunities to engineering education. Engineering education is changing to meet these challenges. More and more engineering programs attempt to include entrepreneurship and innovation [1]. Instilling an entrepreneurial mindset in undergraduate engineers is essential if we want the bright young talent to innovate and then productize those innovations to better mankind. An entrepreneurial mindset applies to all aspects of life, beginning with curiosity about our changing world, integrating information from various resources to gain insight, and identifying unexpected opportunities to create value. An engineer equipped with an entrepreneurial mindset is able to create extraordinary value within any type of organization. Universities and other administrative parties who are responsible for the higher education of the country needs to identify, nurture, and develop entrepreneurially minded engineers who will contribute to our national economic prosperity and secure individual fulfillment through a lifetime of meaningful work. Entrepreneurial engineers not only need a rigorous engineering education, but also need to understand the elements of entrepreneurship. Young entrepreneurial engineers must know how to take advantage of the knowledge in our market place, and how to create new value [2]. The development of entrepreneurial engineering talent's ability has played an important role in the modern higher engineering educational reform, in building an innovative country, and enhancing overall national strength and competitiveness.

II. BACKGROUND

Entrepreneurship is commonly taught to business students at undergraduate level. However, in the recent years, many education institutes start offering this module to engineering students. There are various reasons why engineering students should take entrepreneurship subject. One of the reasons is because engineering students who aspire to become entrepreneurs must have core competencies in order to be successful in business. A core competency can be viewed as a complex harmonization of individual technologies and skills. Engineering students who take entrepreneurship subject will have an integration of strong technical capabilities (the engineering part, and not in itself necessarily core) with the ability to advance new business opportunities (the entrepreneurial part, and also not in itself necessarily core), and thereby displays the complex harmonization characteristic of a core competency [3]. Another reason is that because in Sri Lanka, there is a growing concern that technical students do not have sufficient entrepreneurial skills to venture in business particularly running small and medium enterprise (SME) set-ups. There are comments that these students have narrow business perspectives, less flexible to branch in other working areas and foresee themselves as only job seekers and not job creators. This spells the need for universities to introduce entrepreneurship subjects to non-business disciplines [4]. Goldberg (2006) as cited by Weaver and Rayess (2011) proposes that entrepreneurial should be included in engineering programs. He said that strong technical skills are not enough and that engineers should have an ability to communicate effectively, sell ideas, manage time, and recognize and properly evaluate opportunities. In order to contribute and compete in today's entrepreneurial economy; an engineering graduate need to be an entrepreneur in the sense of starting one's own business.

Our civilization is technology based. Its sustainability, economic development and growth are highly dependent on technological development. In order to maximize benefits from new and existing technologies our society is adapting its organizational form to the permanent changes of technology. In such a world, technology-intensive industries play an increasingly important role, innovation is key process for long-run economic growth, and entrepreneurial thinking and creativity are crucial personal competences for success. Creativity is playing an ever more important role in the success or failure of organizations in the global competitive economy. The field of engineering is no exception. The profession of engineering demands that engineers recognize, validate, and solve problems on their own or through team work. More importantly, they should demonstrate original and critical thinking, and creativeness and innovativeness in their methodologies. In short, engineers need a creative mind to meet the advancing goal of the engineering profession—to design new products or systems and improve existing ones for the benefit of humankind.

In Sri Lanka, however, there is a huge vacuum for innovation and entrepreneurs. Since Sri Lanka is developing country, it has a great potential to develop further with these engineering entrepreneurs. Therefore, the engineering graduates must have an innovative mindset, with practical knowledge in order to suit with the requirements of the modern world. Technical understanding is essential to engineering. But engineers find success and personal fulfillment when they couple these skills with a mindset to create extraordinary value for others. The key is an entrepreneurial mindset. And it can be integrated into any subject, including engineering.

III. ENTREPRENEURIAL MINDSET FOR ENGINEERS

McGrath and MacMillan (2000) defined mindset as the inclination to discover, evaluate and exploit opportunities. A mindset is defined by Merriam-Webster as a "mental attitude or inclination." As further elaborated upon by Thum (2012), Carol Dweck (2006) acknowledges that a mindset can be fixed or growth oriented. While a fixed mindset assumes your talents and abilities are set, the growth mindset believes your talents and abilities can be developed.

According to Yemini and Haddad (2010), Technological development in the last twenty years has been described as a revolution, whether in microelectronics, bio- and nanotechnology, materials science, computer science, medicine or other high technology disciplines. At the same time, the boundaries between the engineering disciplines are disappearing as engineering itself becomes more interdisciplinary in order to solve increasingly complex problems [5] [6]. These changes demand urgent modifications in engineering education to make it applicable to the needs of the twenty-first century. The environment for engineering will continue to undergo significant transformations, driven by global competition in high-tech markets, the outsourcing of production and services, the explosion in the information technology sector, the cross-fertilization among traditional engineering disciplines, and the complicated issues associated with environmental protection and sustainable development [7]. Today, the field of engineering lies in the forefront in the development and marketing of advanced technologies. For this reason, across the globe, governments have acknowledged the importance of motivating individuals (human capital), businesses and related stakeholders to perceive and develop new technology intensive opportunities that can promote positive changes and economic growth [8]. The rapid resolution of urgent challenges affecting societies (e.g. security, sustainable mobility, energy, health care, education, etc.) [9] is more than before a core prerequisite for Engineering graduates. It is becoming more commonly understood and accepted that engineers need business, social, and interpersonal skills to operate effectively in the organizational environments in which they work [10]. In addition to the technical skills required to design and build bridges, cars, and cities, engineers need to work with people in other disciplines, who have different perspectives and responsibilities, to get those products accepted, implemented, and used. An engineer must also understand the interaction among technology, organization, and people critical to successful implementation of innovation. Being able to communicate with other professionals and with business and civic leaders is a key to successful engineering innovation and practice. An important business skill set is having the motivation and capabilities to be entrepreneurial. Entrepreneurship, for some, is considered in the narrow sense of creating and selling new ideas and building new businesses. Seminal theories in the field of entrepreneurship [11] [12] and recent research alike [13] have emphasized the notion that entrepreneurs have distinct ways of thinking which increase their likelihood of identifying opportunities and developing new ventures to exploit those opportunities. Moreover, this "entrepreneurial mindset" is thought to be not only distinct, but also learnable and able be developed with by deliberate practice [14].

IV. CONCLUSION

Entrepreneurial mindset is at the root of entrepreneurial behavior and it is the true engine of value creations of each and every individual [15]. According to the education system in Sri Lanka, most of the graduates who obtained engineering degrees, they prefer to work as an employee than employer. Having an engineering degree will provide many different job opportunities. One of those career possibilities includes becoming an entrepreneur. Starting a new business can be quite challenging. However, an engineer possesses a few characteristics that will make the transition a bit easier.

Engineers are trained to think logically and to follow a methodology to uncover useful solutions. This is how engineering bring value to consumers. This is the basis of a successful business. An engineer always thinks positively and will persevere until a problem is solved. Mentioned characteristics are essential to become as an entrepreneur for engineering graduates.
According to Baherathan B. (2014). "Engineers show a moderate interest in working with people and this might create a problem in running a business. Engineers are found to be weak in business skills and this can be identified as a major barrier. It is a widely accepted fact the level of entrepreneurship should be improved among engineers to develop the country in the current situation"
So, the mindset is the most important for the decision on entrepreneurs. Different factors cause to the mindset and decisions of individuals.

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