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Factors influencing engineering students for choosing techno-entrepreneurship as a career: An implication for better learning

Zachariah John A. Belmonte[1,2], Pamela Eyre Victoria R. Lira[3]
[1]Mechanical and Allied Department, Technological University of the Philippines Taguig Campus, Taguig, Philippines
[2]Office of the Assistant Director for Academic Affairs, Technological University of the Philippines Taguig Campus, Taguig, Philippines
[3]National Institute of Geological Sciences, College of Science, University of the Philippines, Diliman Quezon City, Philippines

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ABSTRACT

Techno-entrepreneurship is critical to the growth of society as a useful technique for overcoming youth unemployment. However, the growth of techno-entrepreneurship has been limited with the end outcome being less than satisfying. Hence, the purpose of this study was to determine the factors that influence the possibility of choosing techno-entrepreneurship as a profession among engineering students in the Philippines. There were 200 engineering students selected by stratified random sampling and the significance of the factors was then determined using Pearson correlation analysis. Based on the findings, students' likelihood of choosing techno-entrepreneurship as a career was not influenced by their equipment availability but by their e-commerce experience, geographical location, and internet ability. This implies the need for academic personnel and instructors teaching techno-entrepreneurship courses to guarantee students have relevant technopreneur knowledge, skills, and competencies that value students' creativity and innovation to encourage techno-entrepreneurship as a profession.

Corresponding Author:

Zachariah John A. Belmonte
Faculty of Mechanical and Allied Department, Technological University of the Philippines Taguig Campus
S Luzon Expy, Taguig, 1630 Metro Manila, Philippines
Email: zachariahjohn_belmonte@tup.edu.ph

1. INTRODUCTION

Techno-entrepreneurship or technology-based entrepreneurship plays an essential developmental role in society as the process of combining technology understanding with successful entrepreneurial skills and abilities. It is an operation of people who cooperate to solve problems as any techno-entrepreneurship start-up involves the collaboration of a group of devoted individuals with diverse skill sets and resources such as creativity and innovation in tackling organizational difficulties [1]. Although techno-entrepreneurship is important in the future competitive landscape, many people still regard it as a new breed of entrepreneurship, which raises many challenges, especially in the training and development of entrepreneurship [2], [3].

Techno-entrepreneurship as a career is an excellent way to improve our state of life and advance our economy, especially with the demand for technology in today's businesses as a part of our needs [4]. Techno-entrepreneurship may aid in increasing one's knowledge of technology and therefore entail a significant impact on engineering students who mostly rely on their knowledge of computers and software for their courses [5], [6]. Besides, techno-entrepreneurship has also been posed as a solution to unemployment. In India, the government has begun to teach their youth techno-entrepreneurship as a strategy to address unemployment [7]. As urged by Otamiri and Ogwe [8], youths have been advised to create small-scale technology-based startups on their own than relying on government jobs. Despite the government's numerous

encouragements, the number of students who became technopreneurs remains minimal which may imply students' disinterest in pursuing a career as a technopreneur a matter that needs further investigation.

For Filipino students, developing a techno-entrepreneurial attitude early on might be beneficial to fill the gap in the lack of investment possibilities, especially in provinces where there are security concerns, a lack of infrastructure, and unsuitable geographic locations [9]. However, techno-entrepreneurship is not heavily dependent on the prior reasons. Thus, encouraging techno-entrepreneurship among students would be an efficient method to bring economic growth to areas with limited investment options.

Intention is a key factor in pursuing a career as a technopreneur [10], [11]. Similarly, this applies to the likelihood of choosing techno-entrepreneurship as a career as well. However, research on entrepreneurial intention toward techno-entrepreneurship is limited due to a majority of entrepreneurial intention studies focusing on traditional entrepreneurship. Consequently, research on techno-entrepreneurship as a career option among university students is scarce and clarification of factors such as skills and attitude toward entrepreneurial intent is lacking [12].

This absence of studies has created a gap in the entrepreneurship literature, and with the significance of techno-entrepreneurship and minimal engagement of students in entrepreneurial activities, there is a need to evaluate students' perceptions of choosing techno-entrepreneurship as a career. Therefore, the following objectives were established for this study: i) To determine the significance of factors influencing the likelihood of choosing techno-entrepreneurship as a career among engineering students; ii) To implicate a better learning process for the students taking techno-entrepreneurship.

2. RESEARCH METHOD

2.1. Research method

A quantitative approach and Pearson correlation analysis were used to assess the relationship between variables. The authors employed a survey questionnaire to get the information from first-year to third-year engineering students enrolled at the university in the Philippines selected through proportionate stratified sampling. The respondents were requested to fill out self-administered questions via Google Forms. Out of the 300 questionnaires distributed, a total of 200 viable responses were received.

The questionnaire was divided into five sections with a total of 25 questions adapted from previous studies to ensure the items' reliability and validity [13]–[16]. Then, it modified to fit the respondents' cultural backgrounds. Through the closed questions, respondents had to express their level of likelihood on a seven-point Likert scale (1=very unlikely, 2=unlikely, 3=somewhat unlikely, 4=neutral, 5=somewhat likely, 6=likely, and 7=very likely).

2.2. Hypothesis development

If the students have available equipment, then it will help them decide to choose techno-entrepreneurship and may turn this opportunity into a career [13]. Next, if the participants are computer and internet literate, then they will have an idea of how to use it as an advantage once they choose to pursue techno-entrepreneurship as a career [14]. If the student's geographical location has more access to techno-entrepreneurship-related opportunities, then it will impact their pursuit of techno-entrepreneurship as a career [15]. Lastly, if they have a great e-commerce experience, then it will have a significant influence on choosing to pursue techno-entrepreneurship as a career [16]. Based on existing studies, the researchers were able to come up with the hypotheses from each literature respectively: i) Equipment availability significantly affects the likelihood of choosing techno-entrepreneurship as a career (H_1); ii) Internet ability significantly affects the likelihood of choosing techno-entrepreneurship as a career (H_2); iii) Geographical location significantly affects the likelihood of choosing techno-entrepreneurship as a career (H_3); iv) E-commerce experience significantly affects the likelihood of choosing techno-entrepreneurship as a career (H_4).

2.3. Research instruments

Using the research framework provided as seen in Figure 1, the researchers created a series of self-administered questionnaires to collect data on the factors influencing the likelihood of choosing techno-entrepreneurship as a career among mechanical engineering students at the Technological University of the Philippines Taguig campus. It is divided into five sections: the independent variables, i) Equipment availability; ii) Internet ability; iii) Geographical location; iv) E-commerce experience; and the dependent variable, v) Likelihood of choosing techno-entrepreneurship as a career as seen in Table 1. A 7-point Likert scale was used to identify the extent of the likelihood of each factor as summarized in Table 1.

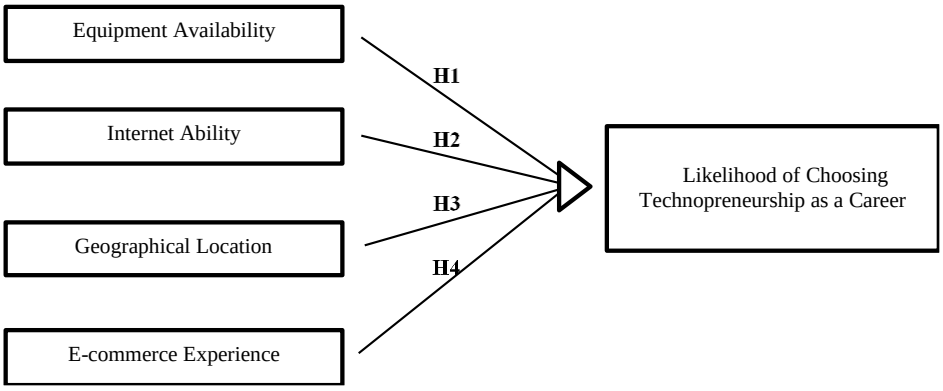

Figure 1. Research framework

Table 1. Research instruments

Factors	Items	Measures	Source
Equipment availability	EA01	I believe that the availability of gadgets (personal computers, mobile phones, and tablets) at hand is necessary.	[13]
	EA02	I believe that having internet-capable with my gadget (personal computers, mobile phones, and tablets) at hand is necessary.	
	EA03	I think that Wi-Fi with a fast and stable internet connection is important.	
	EA04	I believe that the specification(specs) of a gadget is an important aspect.	
	EA05	I feel that having a working space or a computer room is significant.	
Internet ability	IA01	I believe that my ability to use a search engine tool to get the information I need from the internet is an advantage.	[14]
	IA02	I believe that my skills using purchasing/shopping platforms proficiently are an edge.	
	IA03	I think knowing how to find different information from different websites to make a new product is important.	
	IA04	I believe that my capability to make/construct typewritten files quickly and easily would be of great help.	
	IA05	I think being good at judging information from a website is true or false is a big help.	
Geographical location	GL01	I believe that the type of area where I live is a significant factor (Urban, suburban, rural)	[15]
	GL02	I believe that good internet reception is essential.	
	GL03	I think that the accessibility of fast transportation is important.	
	GL04	I believe that technology will make communication easier, faster, and more effective.	
	GL05	I think that possible investors and opportunities in business are important.	
E-commerce experience	EE01	I feel that I can use e-commerce platforms if I become a technopreneur.	[16]
	EE02	I feel that I can easily get an investor through social media.	
	EE03	I feel that e-commerce allows small businesses to reach a broad range of consumers.	
	EE04	I feel that e-commerce offers an easier and more convenient platform for future consumers.	
	EE05	I feel that e-commerce gives new businesses the ability to reach more customers than the traditional marketing strategy.	
Likelihood of choosing techno-entrepreneurship as a career	LIK01	I think that my willingness to pursue techno-entrepreneurship is a significant factor.	[16]
	LIK02	I believe that with my experiences, I can be a technopreneur.	
	LIK03	I feel that being aware of what a technopreneur is, is an advantage.	
	LIK04	I believe that my inquisitiveness to learn more about how to be a technopreneur will be of big help.	
	LIK05	I believe that if I pursue techno-entrepreneurship, it will be beneficial to my well-being.	

3. RESULTS AND DISCUSSION

3.1. Descriptive and Pearson correlation analysis

Table 2 shows the descriptive, reliable, and Pearson correlation analysis summary of the gathered data. The Cronbach's alpha (α) results varied from 0.218 for equipment availability to 0.869 for internet ability. The internal consistency, apart from the equipment availability factor, has been demonstrated by the fact that the items were reliable. According to the descriptive analysis, the mean values for internet ability (m=6.068) were the lowest, and geographical location (m=6.338) was the highest.

In Pearson's correlation analysis, most of the pairs in independent variables, except for EA-GL and IA-GL, have shown positive and significant correlations. The coefficient of correlation (r) went from lowest (EA-GL; r=0.08) to highest (EA-EE and IA-EE; r=0.28). In addition, IA, GL, and EE independent variables were also related favorably and considerably with the dependent variable LIK. A high link between EE and LIK was discovered (r=0.31), meanwhile EA and LIK were the weakest (r=0.13) as summarized in Figure 2.

Table 2. Descriptive, reliability, and Pearson correlation analysis summary

	Cronbach's alpha	Mean	Standard deviation	Equipment availability	Internet ability	Geographical location	E-commerce experience	LIK
Equipment availability	0.22	6.08	1.16	1				
Internet ability	0.87	6.07	1.27	0.20**	1			
Geographical location	0.70	6.33	0.88	0.08	0.10	1		
E-commerce experience	0.83	6.09	0.95	0.28**	0.28**	0.26**	1	
LIK	0.84	6.15	0.92	0.13	0.27**	0.27**	0.31**	1

LIK: likelihood of choosing techno-entrepreneurship as a career; ** Correlation is significant at a 0.01 level (2-tailed).

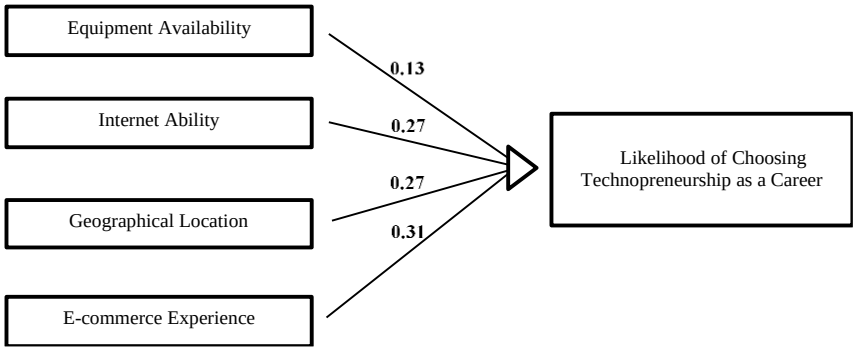

Figure 2. Statistical descriptive results

3.2. Discussion and recommendation

The findings revealed that e-commerce experience, geographical location, and internet ability are acceptable factors that positively and significantly affect intention toward techno-entrepreneurship and that students are most likely influenced by these factors in pursuing techno-entrepreneurship as a career. Equipment availability, on the other hand, was found to be less likely to impact an individual's decision on the matter. According to Hidayat and Yunus [17], internet ability and technology literacy are inextricably linked to techno-entrepreneurship as it aids technopreneurs to prepare for the fourth industrial revolution (IR 4.0), which highly demands the use of technology in the workplace. As a result, students with strong technological and business abilities are more likely to become technopreneurs in the future.

Furthermore, techno-entrepreneurship is strongly linked to information and communications technology (ICT) and multimedia [2]; which implies a pique in students' interest in pursuing techno-entrepreneurship given their experience with e-commerce, which can be substantial in their career. These findings are also consistent with earlier research [18]–[21] which showed students initially assumed to possess specific individual technopreneurs traits such as risk-taking, inventiveness, and proactiveness. It also stated cultivating individual technopreneurs' skills and mindset in technical and business knowledge was critical in the future development of a larger number of technopreneurs [22]. A good education system is integral to building an effective techno-entrepreneurship course. According to Amante and Ronquillo [23], students that participated in a techno-entrepreneurship course shifted their way of thinking from being an employee to employer and consequently, changing pioneers into technopreneurs which further justifies techno-entrepreneurship orientation as a great service for the welfare of future generations [7].

This research recommends that academic personnel and instructors who teach techno-entrepreneurship courses should use unique and engaging teaching techniques in ensuring students have up-to-date technopreneurs' knowledge, skills, and competencies that value creativity and innovation. With the importance of technology in the era of IR 4.0 [17], allowing students to become familiar with high-end technology like robotics, the internet of things, work automation, and smart technology could be an effective way of preparing students to be competitive technopreneurs. Access to more state-of-the-art technology infrastructure, such as high-speed Internet, Wi-Fi coverage, and advanced wireless and mobile technologies aids the growth of e-commerce in urban areas. As a result, students who live in urban areas with e-commerce exposure are more likely to become technopreneurs. The government must also assist in funding matters, especially in remote rural areas since the government's involvement in promoting and sustaining Techno-entrepreneurship must be factored in [24], [25]. Among the suggestions of Lakitan was for the government to develop favorable rules and policies, as well as risk capital and enabling infrastructure [26]. Electricity, telecommunications, and the internet should all be updated and improved and support services, such as techno-entrepreneurship training and development programs must also be available [27], [28].

3.2.1. Theoretical contribution

This study advances our understanding of techno-entrepreneurship, particularly the factors influencing it as a career option among engineering students in the Philippines. The following factors were identified to influence the student's likelihood of choosing techno-entrepreneurship as a career: equipment availability, internet ability, geographical location, and e-commerce experience. The findings strengthen further related studies in identifying indicators that are needed to effectively encourage techno-entrepreneurship as a profession [29], [30].

3.2.2. Practical implication

Techno-entrepreneurship allows students to build up one's creativity and innovation, which is why this study has practical implications for engineering students involved in business-related activities but are still indecisive about their careers. After identifying the factors which affect the likelihood of choosing techno-entrepreneurship as a career, the researchers suggest that students and techno-entrepreneurship instructors need to be attentive to equipment availability, internet ability, geographical location, and e-commerce experience to improve their pedagogy of techno-entrepreneurship. In practice, the government plays a significant role in promoting techno-entrepreneurship growth in the country by offering relevant techno-entrepreneurship education, developing technological infrastructure, increasing energy resources, and giving techno-entrepreneurship assistance [30].

4. CONCLUSION

The main objective of this study was to determine the factors that influence the likelihood of engineering students in the Philippines choosing techno-entrepreneurship as a career. Data interpretation from descriptive, reliability and Pearson correlation analysis revealed equipment availability had no impact on a student's decision to pursue techno-entrepreneurship as a profession while e-commerce experience, geographical location, and internet ability, on the other hand, all play a significant role. This implies a need to improve the pedagogy of techno-entrepreneurship courses such as academic personnel and instructors securing up-to-date techno-entrepreneurial knowledge, skills, and competencies for students to enhance their creativity and innovativeness to encourage techno-entrepreneurship as a career.

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REFERENCES

[1] S. Muthusamy, "Conceptual framework on technopreneurship," *SELP Journal of Social Science*, vol. 7, no. 27, pp. 92–97, 2016.
[2] M. A. Jusoh and H. A. Halim, "Role of technopreneurs in Malaysian economic," *Journal of Global Business Management*, vol. 2, no. 2, 2006.
[3] W.-L. Tan, K. Egge, and O. Mohamed, "National venture competition and technopreneurship development in Malaysia," *Journal for International Business and Entrepreneurship*, vol. 11, no. 2, pp. 69–81, 2010.
[4] A. A. Abbas, "The bright future of technopreneurship," *International Journal of Scientific & Engineering Research*, vol. 9, no. 12, pp. 563–566, 2018.
[5] R. A. Fowosire, O. Idris, and O. Elijah, "Technopreneurship: a view of technology, innovations and entrepreneurship," *Global Journal of Research in Engineering*, vol. 17, no. 7, pp. 41–46, 2017.
[6] H. Hamzah, Z. Yahya, A. G. Sarip, and Y. Mohd Adnan, "Impact of entrepreneurship education programme (EEP) on entrepreneurial intention of real estate graduates," *Pacific Rim Property Research Journal*, vol. 22, no. 1, pp. 17–29, Jan. 2016, doi: 10.1080/14445921.2016.1158897.
[7] C. Paramasivan and M. Selladurai, "Technopreneurship education: teach and train the youths," *Asian Journal of Management*, vol. 8, no. 4, p. 1173, 2017, doi: 10.5958/2321-5763.2017.00178.0.
[8] S. Otamiri and C. G. Ogwe, "Technopreneurship and youth empowerment in rivers state, Nigeria," *Journal of Research in Business and Management*, vol. 8, no. 5, pp. 23–32, 2020.
[9] R. Phillips, "Why do so few university graduates start their own businesses?" The Guardian, Dec. 2018. [Online]. Available: https://www.theguardian.com/education/2018/dec/14/why-do-so-few-university-graduates-start-their-own-businesses
[10] C. Henry, F. Hill, and C. Leitch, *Entrepreneurship education and training: The issue of effectiveness*. London: Routledge, 2017. doi: 10.4324/9781315197227.
[11] F. Liñán and Y. Chen, "Development and cross–cultural application of a specific instrument to measure entrepreneurial intentions," *Entrepreneurship Theory and Practice*, vol. 33, no. 3, pp. 593–617, 2009, doi: 10.1111/j.1540-6520.2009.00318.x.
[12] A. S. M. M. Hoque, Z. Bin Awang, and B. A. Siddiqui, "Technopreneurial intention among university students of business courses in Malaysia: a structural equation modelling," *International Journal of Entrepreneurship and Small & Medium Enterprise*, vol. 4, pp. 1–16, 2017.
[13] K. Aesaert, J. Voogt, E. Kuiper, and J. van Braak, "Accuracy and bias of ICT self-efficacy: An empirical study into students' over- and underestimation of their ICT competences," *Computers in Human Behavior*, vol. 75, pp. 92–102, Oct. 2017, doi: 10.1016/j.chb.2017.05.010.

[14] Y.-T. Wu and C.-C. Tsai, "University students' internet attitudes and internet self-efficacy: a study at three universities in Taiwan," *Cyber Psychology & Behavior*, vol. 9, no. 4, pp. 441–450, Aug. 2006, doi: 10.1089/cpb.2006.9.441.
[15] W.-L. Koe, N. E. Alias, N. H. Marmaya, I. A. Majid, M. Mohamad, and M. Mohamad, "Likelihood in choosing technopreneurship as career among undergraduate students," *International Journal of Academic Research in Business and Social Sciences*, vol. 10, no. 5, May 2020, doi: 10.6007/IJARBSS/v10-i5/7241.
[16] W.-L. Koe, M. H. Mahphoth, N. E. Alias, R. Krishnan, and A. F. Arham, "Factors influencing intention towards technopreneurship among university students," *Journal of Educational and Social Research*, vol. 11, no. 1, p. 162, Jan. 2021, doi: 10.36941/jesr-2021-0016.
[17] M. Hidayat and U. Yunus, "The entrepreneurship learning in industrial 4.0 era (case study in Indonesian college)," *Journal of Entrepreneurship Education*, vol. 22, no. 5, pp. 1–15, 2019.
[18] M. A. Abdulgani, J. M. Mantikayan, and M. S. Islam, "Factors that affect technnopreneurship: A meta analysis," *1st International Conference on Global Business, Entrepreneurship and Creative Industry (ICGBEC 2016)*, 2016.
[19] D. Langkamp Bolton and M. D. Lane, "Individual entrepreneurial orientation: development of a measurement instrument," *Education + Training*, vol. 54, no. 2/3, pp. 219–233, Apr. 2012, doi: 10.1108/00400911211210314.
[20] E. S. Yurtkoru, P. Acar, and B. S. Teraman, "Willingness to take risk and entrepreneurial intention of university students: an empirical study comparing private and state universities," *Procedia - Social and Behavioral Sciences*, vol. 150, pp. 834–840, Sep. 2014, doi: 10.1016/j.sbspro.2014.09.092.
[21] N. A. Che Embi, H. B. Jaiyeoba, and S. A. Yussof, "The effects of students' entrepreneurial characteristics on their propensity to become entrepreneurs in Malaysia," *Education + Training*, vol. 61, no. 7/8, pp. 1020–1037, Aug. 2019, doi: 10.1108/ET-11-2018-0229.
[22] T. Wiradinata, "Insights from technopreneurship subjects: the case of informatics engineering department," in *International Conference on Entrepreneurship Education*, 2014, pp. 87–94.
[23] A. D. Amante and T. A. Ronquillo, "Technopreneurship as an outcomes-based education tool applied in some engineering and computing science programme," *Australasian Journal of Engineering Education*, vol. 22, no. 1, pp. 32–38, Jan. 2017, doi: 10.1080/22054952.2017.1348186.
[24] R. V. Dolatabadi and M. R. Meigounpoory, "Effective determinants of corporate nano-technopreneurship process in active technological knowledge base firms," *International Journal of Academic Research in Economics and Management Sciences*, vol. 2, no. 5, Nov. 2013, doi: 10.6007/IJAREMS/v2-i5/350.
[25] Bernama, "More student entrepreneurs by 2020", The Star, 2017. [Online]. Available: https://www.thestar.com.my/news/education/2017/05/07/more-student-entrepreneurs-by-2020.
[26] B. Lakitan, "Technopreneurship as a Strategic Mechanism for Commercializing University-created Technology," in *Technopreneurship Seminar*, Lampung University, 2013.
[27] S. J. M. Khan, N. S. M. Noor, and A. R. Anuar, "Performance of youth entrepreneurs in Malaysia micro small and medium enterprises," *International Journal of Economics and Financial Issues*, vol. 6, no. S7, pp. 86–91, 2016.
[28] Z. J. A. Belmonte *et al.*, "A determination of playtime and Satisfaction during Covid-19 of Filipino generation Z on league of legends: Wildrift using structural equation modelling (SEM)," *Asian Journal of Research in Education and Social Sciences*, vol. 3, no. 2, pp. 202–211, 2021.
[29] Z. J. A. Belmonte, R. J. Decapia, K. E. Tu, M. J. Lavado, M. N. Junio, and P. E. V. Lira, "Impact of information and communications technology on technopreneurial intention among engineering students," *International Journal of Information and Education Technology*, vol. 12, no. 8, pp. 756–761, 2022, doi: 10.18178/ijiet.2022.12.8.1681.
[30] J. Mariano, M. Liao, and H. Ay, "Performance evaluation of solar PV power plants in Taiwan using data envelopment analysis," *Energies*, vol. 14, no. 15, p. 4498, Jul. 2021, doi: 10.3390/en14154498.

BIOGRAPHIES OF AUTHORS

Zachariah John Aviles Belmonte is currently a faculty member of the Mechanical Engineering & Allied Department under the Nondestructive Testing Technology Section in the Technological University of the Philippines (TUP). He received his Diploma in Non-destructive testing Engineering Technology & an undergraduate degree of Bachelor of Engineering major in Manufacturing and Production from TUP. He took his Master of Science and currently taking his Doctorate Degree at the College of Industrial Engineering and Engineering Management at Mapúa University- Manila, Philippines. At Present (2021) Mr. Belmonte is a member of the TUP Board of Regent, the governing body of TUP, and part of the Quality Assurance Center under the TUP Taguig Campus Academic Affairs Office. He can be contacted at email: zachariahjohn_belmonte@tup.edu.ph.

Pamela Eyre Victoria R. Lira is currently a 3rd-year student at the University of the Philippines Diliman taking up a Bachelor of Science in Geology. She graduated high school with High Honors and as a scholar at Philippine Science High School – Eastern Visayas Campus where she was also a consistent Director's Lister. She is a resident member of the UP Geological Society, UP Sidlangan, and Maroon FM and a nuclear energy advocate. Her knack for writing has made her garner awards in National Press and Media Competitions, and research competitions in the Philippines and recognized as a youth panelist at two IAEA conferences in Vienna, Austria. She can be contacted at email: prlira@up.edu.ph.