Increasing Productivity in Garments Manufacturing through Time Standardization and Work Measurement

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Abstract

Process improvement among industries results to increased worker efficiency as most labor enterprises utilize the improvement of each process done in the garments production. Productivity can be obtained through utilization of the available resources, a factor to speed production of goods. In this study, workers experienced delays on the sewing process of square pants garments due to inefficient worker production and the absence of time standards. These problems cause 12.62% of idle time and 5.08% unnecessary motions encountered in the production incurring Php 63,600.00 total income loss per month. Through work sampling, creating a production standard could serve as a basis for the worker performance in eliminating the unnecessary hand and body improvements which workers' performance can significantly improve to 19.05% in the workers' productivity. Recommendations such as implement strict company rules, improvement in the production floor layout, rewards and incentives, provide trainings among workers, and new time standardizations can expectedly improve the whole sewing process by at least 15-20%.

Keywords
Garments, Manufacturing, Increasing Productivity, Layout, Time Standards, Quality

1. Introduction

One of the world's largest trades is the garments and apparel industry, with most items being produced out of developing countries. In the Philippines, garments and apparel started as a small industry in the 1950s. Bolstered by skilled and educated workers, innate creativity and favorable legislation, the industry grew rapidly in the intervening decades until it peaked in the 1990s . In 2012, market demand on the Philippines clothing market was approximately 7.1 billion U.S. dollars. The apparel and textile industries have always been constantly changing, in line with new fashion trends. And because of this, problems may occur at some of the business aspects such as inventories, demands and forecast of sales. Advancement in technology during 1980s resulted to a new trend called the lean retailing. This led the researchers to the realization that this industry might be one of the possible career choices so it would be a great help if the researchers can learn about its works, the production, and what innovation can the researchers give to the fashion world.

The main problem of most companies is the lack of time standardization of the operation process that lowers the productivity of the workers thus, slows down the production and result to High Operating Cost. This research aims to establish time standards to minimize the idle time and unnecessary motions such as excessive chit chatting, use of phones, reaching excessive distances when taking components and tools and then eventually reduce the cost of operations.

2. Literature Review

Performance in a production of apparel industry can be done better by group or the system called modules compared to the usual bundle system. It has been seen that through the modules system there was a huge improvement when it comes to quality, costs and the responsiveness of the workers. It is needed for the operations to meet the challenge of delivering products to the customers in a minimum time, Time Minimization Transportation Problem (TMTP) provides a powerful framework to determine the better ways to deliver products to the customer. Comparative study is accomplished between the presented procedure and the other existing procedures in virtue of sample examples which demonstrate that the presented procedure requires less number of iterations to reach the optimal transportation time.

It is important that the product development team understand how their design decisions affect manufacturing system performance. Having this feedback early in the design process avoids rework loops needed to solve problems of manufacturing capacity or cycle time. The team can incorporate this information and associated costs into a design decision problem aimed at choosing the best possible product design Reducing manufacturing cycle time has many benefits, including but not limited to lower inventory, reduced costs, improved product quality, faster response to customer orders, increased flexibility and a reduced time-to-market. Manufacturing strategy research aims at providing a structured decision making approach to improve the economics of manufacturing and to make companies more competitive. The overall objective is to investigate how manufacturing companies make use of different manufacturing practices or bundles of manufacturing practices to develop certain sets of capabilities, with the ultimate goal of supporting the market requirements.

3. Research Design and Methodology

In this study a descriptive-observational research for collecting necessary data was conducted. The researchers are collecting data and details from the company's background history and the process in making the square pants through the use of interviews to the people in the production company, observations and through other resources.

3.1 Conceptual Framework

The figure below shows the Input-Output (IPO) Model used by the researchers in conducting this study. This served as the guide to the researchers as they carry out the study through its completion.

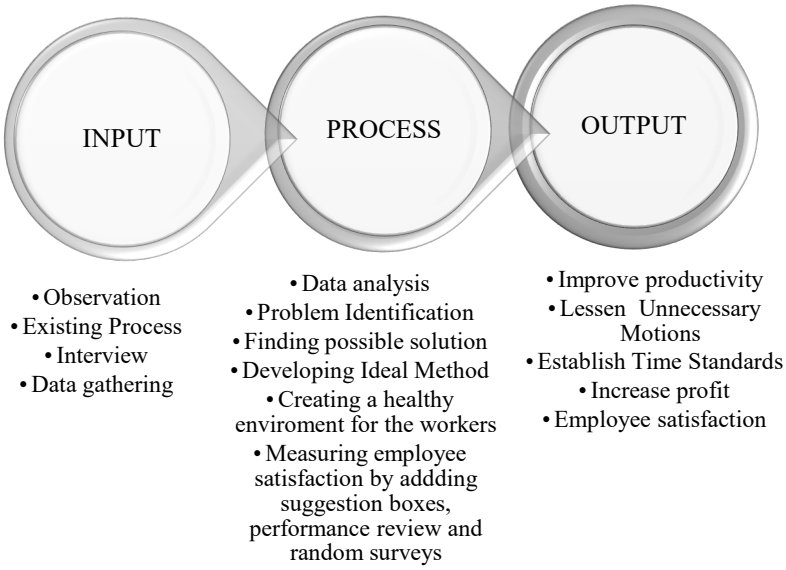

Figure 1: Conceptual Framework

3.2 Procedural Flow Chart

The figure below is the Procedural Flow Chart which shows the overall process of how square pants are made.

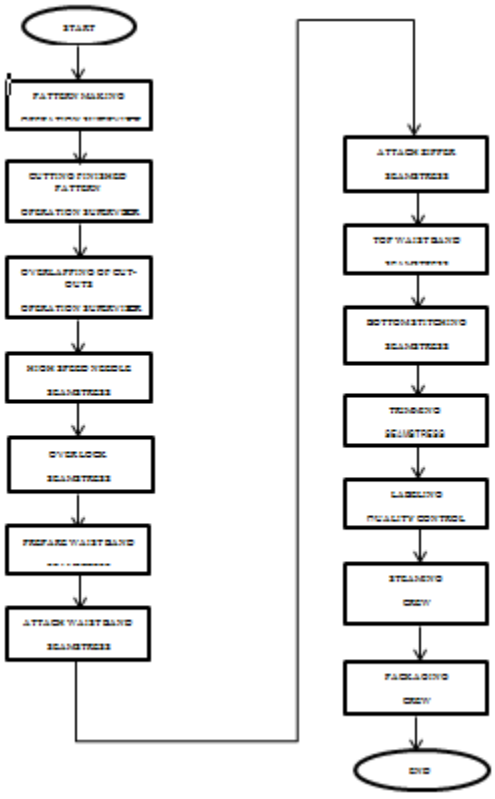

Figure 2: Procedural Flow Diagram

3.3 Work Sampling

Work sampling is a method used with less time and less cost in determining the process of machines and workers through a large number of observations taken at random intervals. This method used to identify how the machines and workers will be managed using the productive and unproductive works of workers.

Equation 1: Formula of Work Sampling

$$\boldsymbol{n = \left(\frac{z}{e}\right)^2 p(1-p)}$$

Wherein:

e = maximum error
z = number of standard deviations needed to achieve desired confidence
p = sample proportion (percentage of idle time)
(1-p) = percentage of working time

n =sample size

The pie chart shows the work percentage breakdown for the regular working hours and the overtime work. Based on the data gathered, the researchers got a 71.98% productivity work rate for the 8-hour shift and 76.09% for the added 3 extra hours which shows a difference of 3.29% productivity increase for overtime shift.

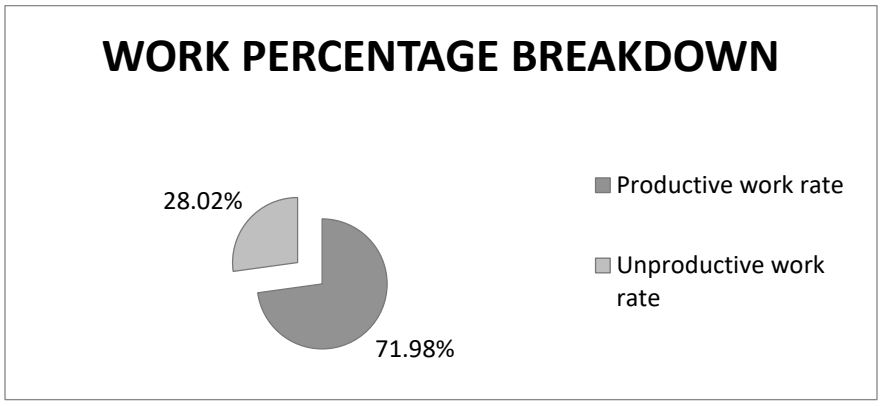

Figure 3: Chart: Normal Working Hours (8 hours)

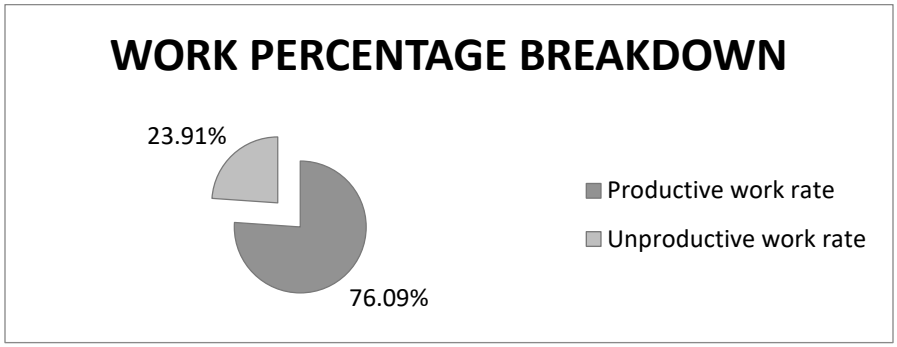

Figure 4: Chart: Extended Working Hours (3 hours)

4. Results and Discussion

As the researchers discovered and analyzed the underlying processes for production of the company, the researchers will create a proposed structure using the different tools such as Operation Process Chart, Flow Diagram, in order to develop a new system that can minimize the delays and help increase in the productivity of the workers that leads to high production cost of the company.

4.1 Operation Process Chart

This figure shows the proposed operation process chart based on the company's proposed time standard. It shows that they have 14 operation process and 6 inspection process with 78.14 minutes and 3.5 minutes respectively. In this operation, the company has 95.71% productivity and 4.29% unproductivity.

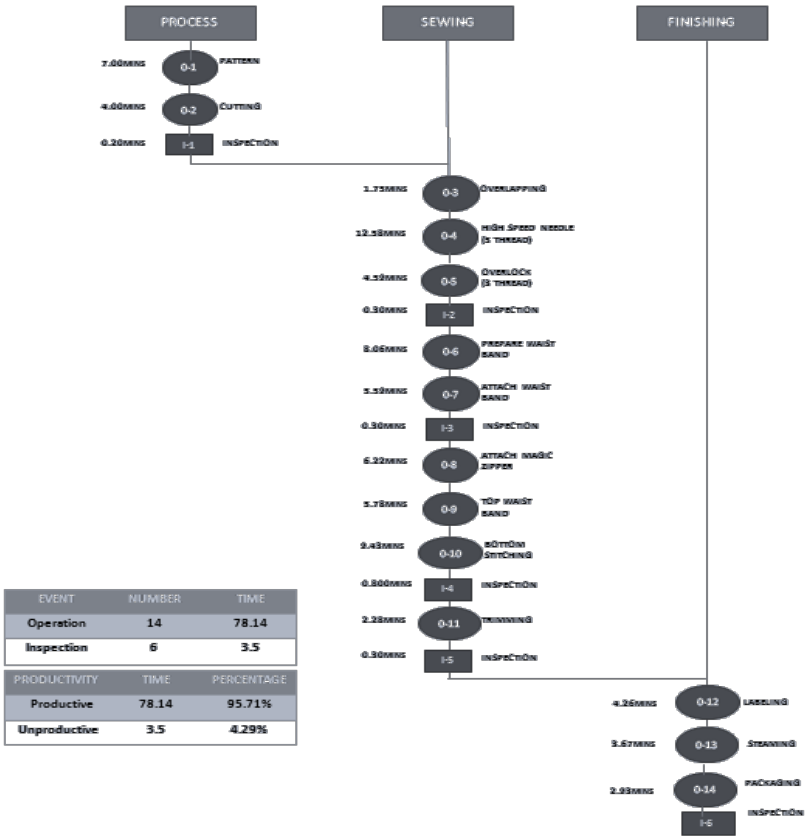

Figure 5: Operation Process Chart

This table shows the present and proposed normal and standard time that was observed and calculated by the researchers. The present method has 106.02 minutes normal time and 117.34 minutes standard time while the proposed method has 78.14 minutes normal time and and 97.69 minutes standard time with a difference of 27.44 minutes garnering a 23.39% decrease in the time of operation. The allowance used in the proposed standard time is 25% based on the ILO 2011 Table of Allowance.

Table 1: Summary of Present and Proposed Normal and Standard time

No	Operation	Present (mins)		Proposed (mins)		Savings	
		NT	ST	NT	ST	Diff	% Diff
O-1	Pattern Making	7	7.77	7	8.75	0	0%
O-2	Cutting Finished Pattern	6	6.66	4	5	1.56	33.33%
O-3	Overlapping of Cut –outs	1.98	2.20	1.75	2.18	0.23	10.45%
O-4	High Speed Needle	23.63	26.23	12.58	15.73	11.05	42.13%
O-5	Over Locking	5.45	6.05	4.59	5.74	0.86	14.21%
O-6	Prepare Waist bands	9.96	11.06	8.06	10.08	1.90	17.18%
O-7	Attach Waist bands	6.75	7.49	5.59	6.99	1.16	15.49%
O-8	Attach Zipper	7.32	8.13	6.22	7.78	1.1	13.53%
O-9	Make Top Waist Bands	6.85	7.60	5.78	7.23	1.07	14.08%
O-10	Stitch Bottom	12.18	13.52	9.43	11.79	2.75	20.34%
O-11	Trim	3	3.33	2.28	2.85	0.72	21.62%
O-12	Labeling	5.9	6.20	4.26	5.32	1.64	26.45%
O-13	Steam	5	5.55	3.67	4.59	1.33	23.96%
O-14	Packaging	5	5.55	2.93	3.66	2.07	37.30%

	Total	**106.02**	**117.34**	**78.14**	**97.69**	**27.44**	**23.39%**

4.2 Flow Diagram

This figure shows the proposed Flow Diagram which shows the location of the step by step process of operation, the researchers included a strategic planning for the floor plan to prevent delays in the operation.

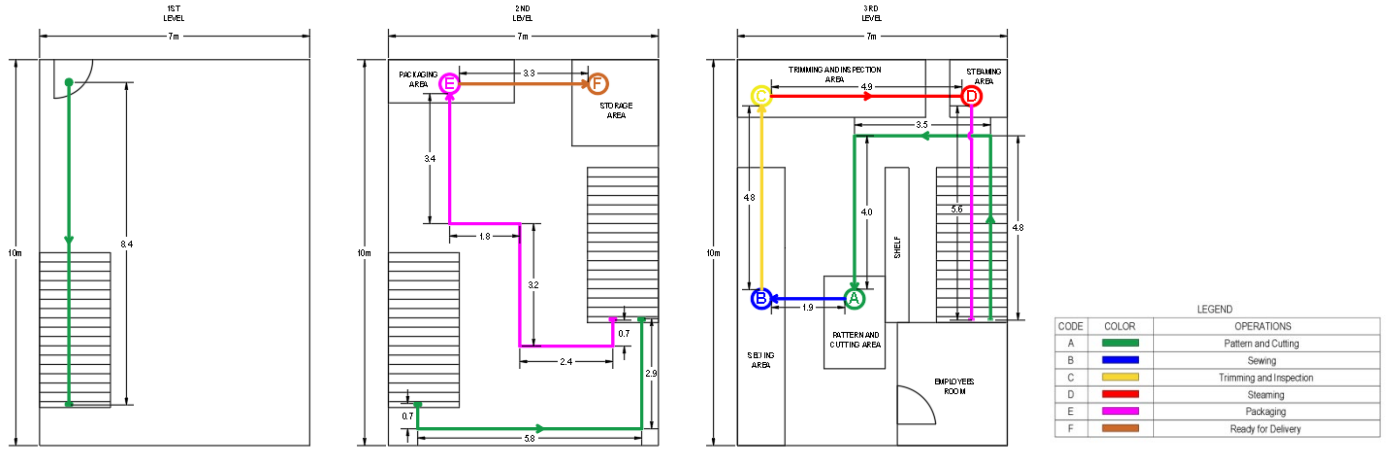

Figure 6: Proposed Flow Diagram

4.3 Relationship Chart

The figure shows the relationship between the different stages of the processes inside the production area. There are Two (2) Absolutely Necessary Process, Two (2) Especially Important processes, Four (4) Important processes, Three (3) Ordinary Process three (3) unimportant processes and One (1) Undesirable process.

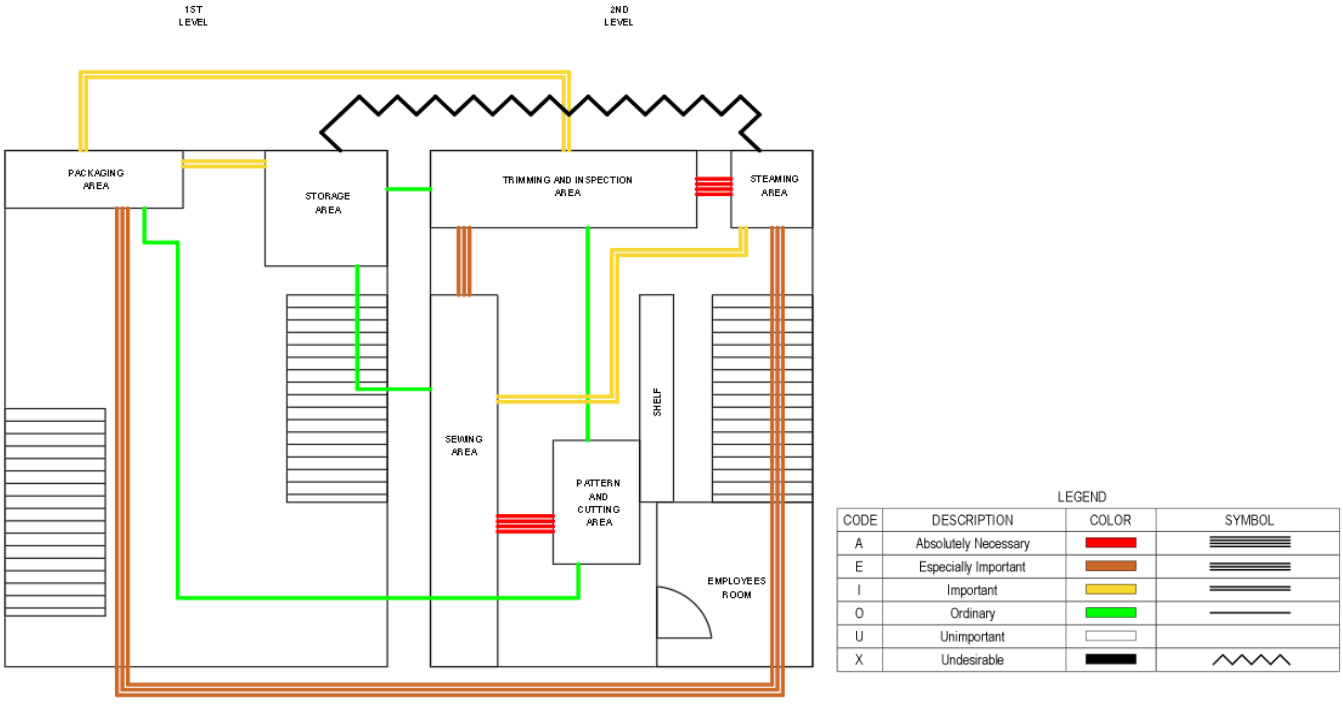

Figure 7: Proposed Relationship Charts

5. Conclusion

The researchers were able to address the existing problems which are extension of working hours, idle time and unnecessary motions through setting time standards in each process of operation. The researchers were able to establish a much suitable working area by proposing a better floor plan that will result in maximizing the available space that later on affects the increase in the productivity of the workers. The researchers were able to reduce the 3 additional working hours to only 1 by increasing the productivity of each worker by cutting down the idle time and unnecessary motions such as chit-chatting, phone usage, waiting for next batch and procrastination. Based on the results, the proposed method has a 19.05% increase in the productivity and 26.46% decrease of the time of operation. It also shows that the new layout has a 9.60% decrease for the distances of each station. The researchers were able to reduce the operating cost from Php 259,598.88 to Php 227108.88 which shows a 12.52% or Php 32,490.00 less from the previous expense, this result to an increase from Php 160,401.12 to Php 192, 891.0 with a 20.26% or Php 32,490.00 additional for the company's profit. Lastly, the researchers also conclude that it is more economical to have additional working hours even with their present productivity than to hire more workers based since they will only need an hour of additional work.

6. Recommendation

6.1 Controls

To lessen the laziness and tardiness, the company should strictly implement the rules and regulations such as salary deduction for late comers and absentees. The researchers also recommended updating their house rules such as giving warnings, memorandum and stern sanctions but still in compliance with the labor code in order to avoid encouraging the employees to misbehave. For increasing the productivity the company should prohibit phone usage, too much chit chatting and other unnecessary things whilst outside break schedules. To avoid unorganized work station and production floor the company should provide proper storage for personal things and work related supplies. To benefit the workers, the researchers proposed to the company to give rewards and incentives to aid the lost over time pay of the workers due to the new time standards. Aside from this overtime pay, holiday pay, 13th month pay and other bonuses should be given to the workers to increase morale and satisfaction. The researchers also suggested having the workers trained to learn basic troubleshooting of sewing machines to avoid unwanted delays in the production.

6.2 Future Study

Future researchers can work on moving the storage area closer to the stairs to lessen time distance travelled. Data from this research paper can be used for future study about the expansion of the company. Future researchers can also work on proposing safety measures for the company such as fire exits, fire extinguishers, fire alarm, smoke detectors, sprinklers and others.

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Biographies

Valerie B. Peralta is currently an Industrial Engineering student at Technological Institute of the Philippines – Quezon City and an undergraduate of Electronics and Communications Engineering. She studied Practical and Industrial Electronics at MFI Polytechnic Institute Inc. She is a proud member of Orients (Organization of Industrial Engineering Students), PIIE (Philippine Institute of Industrial Engineers) and ORSP (Operations Research Society of the Philippines) and a previous member of IECEP (Institute of Electronics Engineers of the Philippines). She started her career as a Quality Analyst in a Business Process Outsourcing Company and is a volunteer for the Philippine Red Cross and partaken in various Outreach Programs. She participated in several research projects about Ergonomics Usability, SWOT Analysis, Increasing Productivity, Manufacturing, Research, Lean Six Sigma Application and DMAIC Approach and Optimization for Operations.

Palma, Patrick James M. is an Industrial Engineering Student at Technological Institute of the Philippines, Quezon City. He is currently a member of Orients- Organization of Industrial Engineering Students and also a member of Philippine Institute of Industrial Engineers. He also participated in Science Technology Fair 2019 as one of the representative of his department, conducted in Technological Institute of the Philippines Quezon City during the celebration of its Foundation Day.

Lara Carissa A. Fernandez is a 5th year Industrial Engineering student at Technological Institute of the Philippines. She is one of the authors of Establishing Time Standards in the Production Area of a garment manufacturing company, a Methods Engineering study an entry for the 2019 IEOM. She is also one of the authors of CANEPI: All Organic Pesticide, a Feasibility Study, which was an entry for Startupper of the Year by Total in the Philippines

Cohesir V. Sims is a student in Technological Institute of the Philippines taking up Bachelor in Science in Industrial Engineering. He formerly represented Industrial Engineering in Interdepartmental Science Quiz bee and also a former officer in Citizen Army Training in which he joined various outreach and seminars. He is a member of ORIENTS (Organization of Industrial Engineering Students), PIIE (Philippine Institute of Industrial Engineers) and ORSP (Operations Research Society of the Philippines).

Jerran R. Del Mundo is an Industrial Engineering student of Technological Institute of the Philippines. Previously, he was an Electronics and Communication Engineering student on Far Eastern University Institute of Technology from year 2014 to 2016 and shifted to TIP as Industrial Engineering student. In school year 2017 to 2018, he was elected as the secretary of Campus Christian Fellowship, a Christian organization affiliated in Inter-Varsity Christian Fellowship and in year 2018 to 2019, he was elected as the president of the same organization. He is a member of Organization of Industrial Engineering Students (ORIENTS) TIP-QC. He underwent a two-week-long training program on discipleship and leadership organized by IVCF Metro Manila Regional Unit.

Bert Regin S. Santiago is a former student of Concepcion Integrated School in Marikina city where he also a member of Boy Scout of the Philippines in which he got a rank of Pathfinder. In that time he also joined to a camping in Los Banos, Laguna, and Mt. Makiling Forest Reserve. He is also a member of Red Cross of the Philippines Marikina city chapter. He is now studying in Technological Institute of the Philippines, Quezon City in which he is an active of member of ORIENTS (Organization of Industrial Engineering Students), PIIE (Philippine Institute of Industrial Engineers) and ORSP (Operation Research Society of the Philippines). He is also a participant of "ECE Road show Collision 2018 in DTTB" seminar.

Engr. Juan Miguel N. Dinglasan is an instructor at Technological Institute of the Philippines – Quezon City, where he also took his bachelor's degree. He is currently pursuing his master's degree in Industrial Engineering and Management at Polytechnic University of the Philippines – Manila. He has taught courses in Methods Engineering, Operations Research, Industrial Materials and Processes, and Technopreneurship among others.