Engineering Education, Profession and Employer:
Perception of Engineers in Electronic Sector

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Abstract: The field of Engineering has advanced rapidly in the last decade. However, despite of the needs of engineering resources to keep up with the challenges in the engineering world, Malaysia is experiencing the shortage of engineers towards realizing the dream of Malaysia Vision 2020. Engineering education needs to undergo dramatic changes in order to keep up with a demanding society and declining student enrollment. The purpose of this study is hereby to see the perceptions of engineers towards engineering education, profession and employer by (i) Identifying the education and working background of engineers in the electronic sectors (ii) Determining the different perceptions towards engineering education, profession and employer based on engineer’s education and working background and gender and (iii) Determining the level of agreement towards the factors related to engineering education, profession and employer. A survey was done on engineers working in two multinational electronics companies in Malaysia. The collected data were analyzed using descriptive statistics techniques such as frequency, percentage and comparable mean. The independent-sample t test analysis and one way ANOVA analysis were applied to identify the significant difference in variable mean. This study will reveal the education, working and demographic background of the engineers in electronic sectors. The difference perceptions and level of agreements on related factors towards engineering education, profession and employers are also revealed. The results of this study shall be used to provide valuable inputs towards the improvement of the engineering education, engineering profession and employer.

Key-Words: engineering education; engineering profession, employer, electronic sector, perception.

1 Introduction
The field of engineering has advanced rapidly in the last decade. The diverse range of engineering advancement and increased competition from globalization makes dynamic, creative, experts and innovative engineering resources a necessity. However, the rapid development of the engineering world was not inline with the engineers that had been produced all over the world. According to [1], a study conducted by the National Science Foundation predicts that the USA will be short of some 275,000 engineers by 2011. According to Datuk Ir. Keizrul Abdullah, Malaysia currently having only 50,000 engineers and at least 200,000 engineers are needed to help building Malaysia to achieve the status of Industrial Nation by 2020 [2]. This scenarios produce questions on how far engineering profession and engineering education are able to attract any individual to be part of engineering world.

In order to improve the engineering education most of the studies focused on the perception and employer feedback on the skill of the engineers [3], [4] and perception of students and alumni towards engineering education [5], [1], [6], [7]. None of the prior research actually combining the perception of engineers towards the engineering education, engineering profession itself and their employers. Author believes that to understand the perception of engineers towards engineering education, their perception towards profession and employer also need to be understood. Thus, the purpose of this study is to see the perception of engineers towards engineering education, their perception towards profession and employer by (i) identifying the education and working background of engineers in electronic sector (ii) determining the different perception based on the
education background, working background and gender and (iii) determining the level of agreement towards factors related to engineering education, profession and employer.

Engineers who hold at least a Bachelor degree in any of the engineering discipline and work at two multinational electronics companies were chosen as the respondents of this study. The two multinational companies are Samsung SDI (M) Malaysia, Negeri Sembilan and Freescale Semiconductor (M), Petaling Jaya, Selangor. They are chosen in this study due to their reputation as the leader in the electronic sector and winner of many prestigious awards both from the Malaysian government and public sectors. Time limitation and the busyness of the engineers who work in the electronic sector were the major obstacles for the author to conduct the best comprehensive study. Therefore, the results of this study are limited to this case study only.

2 Literature Review

Engineers are individuals who apply science, mathematics, and economics to meet the needs of humankind. The root of the word engineer derives from engine and ingenious both of which come from the Latin root “in generare” meaning “to create” [8]. According to the book titled “Foundation of Engineering” nearly all disciplines are thought to have evolved from civil engineering. Among known engineering disciplines are civil engineering, mechanical engineering, electrical engineering, chemical engineering, industrial engineering, aerospace engineering, materials engineering, agricultural engineering, computer engineering, nuclear engineering, biochemical engineering and biomedical engineering. The history of engineering ascended from the Late Stone Age, around 3400 B.C where the ancient Egyptians started to build pyramid and manipulated Nile River for agricultural and commercial purposes. Today, the nature of engineering is changing dramatically from sub-microscopic to mega projects and from the interior of the human body to the remotest regions of the world and beyond to the surface of the Moon and Mars [9].

Previous researches produce many different perceptions on engineering education, engineering profession and employer. According to [10], engineering education and research on engineers have overlooked the impact of organizational change on engineering work. A recent study of engineering graduates perceptions on how well they are prepared for work in industry reveals that one of the key weaknesses areas in their preparation is the ability to work in multidisciplinary teams. According to [1], lecturing is still preferred and prevalent style of teaching in most college classroom. Even though the new ideas, products and concepts are created everyday, yet, engineering education has not had any dramatic changes within the past 25 years, if not longer. [11] suggested that although women are attracted to engineering, their experiences in higher education (HE) discourage them from pursuing engineering as their chosen career path. According to [6] it is imperative to look into the present continuing trends in engineering education to ensure its quality and utility to face the challenges that the 21st century will provide in the wake of the globalization. In terms of engineering profession, [12] suggested that entry level salary for engineers is too low. According to [9], engineers are not appreciated and adequately recognized by our society for their contributions to our standard of living. In terms of perceptions towards employer, [13] suggested that organizational effectiveness will increase if the employer can create a condition where employees can become highly involved in the organizations and work hard to accomplish its goal.

In summary, some conclusions can be made from a review of the relevant literature. In this study, for the perceptions towards engineering education, the author will focus on the perception of the engineering education meeting the needs of the industry, relevant courses needed in the engineering programs and relevant skills that needed to be taught in the engineering education. In terms of the perception towards the engineering profession, the author will focus on the aspects of salary, job satisfaction and nature of engineering jobs. In terms of perception towards the employers, the author will focus on the aspects of motivation, education and training and involvement of people in the organization.

3 Research Methodology

This study made use of primary and secondary data. The secondary data were collected through resources such as journals, text books, thesis, conference paper etc. and presented as literature review in this article. The primary data were
collected through a questionnaire. The questionnaire was developed through the literature review, focus group study and pilot study. The questionnaire was divided into four sections written in English.

Section I consist of questions related to the respondents education and working background such as the respondents highest qualification, year of graduation, university where degree was obtained, discipline of engineering, CGPA, company, years of commencing job, working experience and latest position in working environment. Section II consist of questions related to the engineer’s perception towards engineering professions and their employer. Questions in Section II were adapted from [14] done in Australia. Section III consist of questions related to engineer’s perception towards the engineering education. Questions in Section III were adapted from the earlier works done by [4], [15], [16] and [17]. Section IV sought information related to engineer’s demographic information such as gender, monthly income, age, race, marital status, experience in separation scheme and likeness towards engineering profession. However, questions from the previous research have been modified to suit the environment of the current study by taking into consideration the feedback received from the focus group. Basically engineers were asked to answer multiple questions and rated the factors they agreed on Likert 5-point scale ranging from strongly disagree (1) to strongly agree (5). The questionnaire was tested prior its delivery.

Data collected was analyzed by using the SPSS package. Descriptive statistic techniques such as frequency, percentage and comparable mean were applied. The independent-sample t test analysis and one way ANOVA were also applied to identify the significant difference in variable mean.

4 Results and Discussion
4.1 Education Background of the Engineers in Electronic Sector
The majority of the engineers in electronic sectors were having Bachelor degree (91.5%) as their highest qualification compared to Masters Degree (8.5%). This figure shows that Masters Degree is not the requirement to be an engineer in electronic sector. As for the years of graduation most engineers graduated around 1990 to 2000 (67%) and only 33% graduated around 2001 to 2008. Based on the university where degree was obtained 56.9% degree was obtained in Malaysia, 17.7% obtained from United Kingdom, 14.6% obtained from United States of America and the rest are from Canada, Singapore and New Zealand. The majority of the engineers in the electronic sectors hold a degree in electrical, electronic and mechanical engineering (64.6%). However degree from other engineering disciplines such as civil engineering, computer engineering, petroleum engineering and material engineering also get a place in electronic sector. Based on the CGPA, most of the engineers earned CGPA around 2.7 to 3.66 (98.1%) meaning that employers had a very high expectation on the engineering graduates and only the best and excellent graduate will be hired in the electronic sectors.

4.2 Working Background of the Engineers in Electronic Sector
As for the working background, both companies have an equal number of respondent; Samsung SDI (M) (53.1%) and Freescale Semiconductor (46.9%). Based on the years of commencing job majority of the engineers commenced work around 1990 to 2000, (67%). This is because around the year of 1990 to 2000 Malaysian economy was at its overwhelming state where many giant electronic companies and new industrial areas have been established. Majority of the engineers in electronic sectors has a working experience around 6 to 15 years (69%) indicated that engineers in electronic sectors are very experienced and employees who passed the five years of working in certain company will be comfortable and loyal to the same company.

4.3 Demography of Engineers in Electronic Sector
As for the demography information most of the engineers in the electronic sectors were men (70.8%) compared to female (29.2%). Majority of the engineers aged around 31 to 40 years of age (68.5%) and earned around RM2501 to RM5000 (64.6%). As for the racial status, 56.2% were Malay, 32.3% were Chinese, and 10.8% were Indian. Most of the engineers have not experiencing the separation scheme or work termination (86.9%) compared to those who had experience the separation scheme (13.1%). Based on the likeness towards the engineering career, 76.5% of engineers like their career whereas 28.5% do not like their career. This scenario indicates that many people still regards engineer as a very reputable profession but lost their interest once they experience the burden and pressure in engineering world.
4.4 Difference of Perception Based on Education Background, Working Background and Gender of Engineers.

Hypothesis has been done to see the difference perception towards engineering education, profession and employer based on several factors. These factors are highest qualification, year of graduation, university where the degree was obtained, engineering discipline, CGPA, company, working experience in engineering discipline and gender. The independent sample t test and one way ANOVA were used to identify the significance difference in a variable mean. Hypothesis analyses revealed that there is no significance difference on perception towards engineering education, profession and employer based on highest qualification, university where degree was obtained, type of engineering discipline, working experience in engineering discipline and gender. However, significance difference can be seen on perception towards profession and employer based on year of graduation, CGPA and employer. The significance difference can also be seen towards the engineering education based on the company. These are because of the changes in the syllabus of engineering education and working experiences were different among the respondents.

4.5 Perception Towards Engineering Education.

The responses of 16 factors were ranked based on the engineer’s perception towards engineering education. Their responses were ranked and analyzed based on the mean of each factor. The results from the respondent showed that the top five most agreed factors are shown in Table 1.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Engineering course should include communication skill.</td>
<td>4.38</td>
</tr>
<tr>
<td>2. Engineering course should include leadership and management skill</td>
<td>4.33</td>
</tr>
<tr>
<td>3. Someone who wants to become engineer must have interest to do engineering jobs</td>
<td>4.23</td>
</tr>
<tr>
<td>4. Engineering course should include basic awareness of engineering professions</td>
<td>4.22</td>
</tr>
<tr>
<td>5. Engineer able to communicate effectively with all people and level from other discipline</td>
<td>4.18</td>
</tr>
</tbody>
</table>

On the other hand, the engineers least agree that engineering course structures are geared towards the needs of industry. They also least agree that they have deep technical knowledge and experience in their engineering specialty and also least agree that degrees with an industry-based learning/industrial training component improves job prospect.

4.6 Perception Towards Engineering Profession

The responses of 9 factors were also ranked based on the engineer’s perception towards engineering profession. Their responses were ranked and analyzed based on the mean of each factor. The results from the respondent showed that the top five most agreed factors are shown in Table 2.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Mean</th>
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<tbody>
<tr>
<td>1. English is a medium of communication and success in Engineering profession.</td>
<td>3.99</td>
</tr>
<tr>
<td>2. Engineering jobs are tough and give a lot of pressures.</td>
<td>3.96</td>
</tr>
<tr>
<td>3. Engineers were given little or no recognition for overtime worked</td>
<td>3.82</td>
</tr>
<tr>
<td>4. Engineers are underpaid relative to level of responsibility</td>
<td>3.79</td>
</tr>
<tr>
<td>5. Engineers do not enjoy the status they deserve</td>
<td>3.69</td>
</tr>
</tbody>
</table>

4.7 Perception Towards Employer

The responses of 10 factors were also ranked based on the engineer’s perception towards employer. Their responses were ranked and analyzed based on the mean of each factor. The results from the respondent showed that the top four most agreed factors are shown in Table 3.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Mean</th>
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<tbody>
<tr>
<td>1. Employers need to be more aware of award entitlement for staff</td>
<td>3.99</td>
</tr>
<tr>
<td>2. Employers lack structured training program for new engineers.</td>
<td>3.96</td>
</tr>
<tr>
<td>3. Employers expect long hours from engineers for little or no rewards.</td>
<td>3.82</td>
</tr>
<tr>
<td>4. Companies do not invest enough in ongoing training for their engineers.</td>
<td>3.79</td>
</tr>
</tbody>
</table>
5 Conclusion

In conclusion, the objectives of the study which have been set at the early establishment of the study have been achieved. These objectives were achieved through the literature review and questionnaire sent to the engineers in the study. For further study, the author suggests that next researcher uses the same study design to study the other profession or programs such as Masters Degree in quality and productivity. Apart from that, the author suggest that further study been done on the perception of female engineers toward engineering education and engineering profession. The author also suggest that separate study been done to see the perception of engineers towards engineering education, engineering profession and employer so that comprehensive and accurate results can be obtained.

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References: