

A Study of Graduate on Time (Got) For Ph.D Students Using Analytical Hierarchical Process

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Abstract

Over the years, many people make up their minds to pursue postgraduate studies especially in Doctor of Philosophy (Ph.D) in order to prepare themselves to confront the demands and challenges of 21st century. However, the increment of Ph.D students causes both university and government bodies concern on the capability of the Ph.D students to accomplish the mission of Graduate on Time (GOT) that is stipulated by the university. As a result, this study aims to examine the factors that affect the Ph.D students' time frame in University Utara Malaysia (UUM) along their learning journey. According to the previous researches, the factors of student, children, supervisor, financial, employment, infrastructure, training, skills, project and peer have been identified as the elements that impact on the ability of the students to attain the GOT mission. A survey form has been distributed to thirty experts from three graduate schools of UUM to collect their opinions on the importance levels of each factor using Analytic Hierarchy Process (AHP) technique. The consistency degree obtained in this study is considered significant as it does not exceed 0.1. The outcome of this study could certainly assist the university to ameliorate the current situation based on the important level of factors hence boost the number of Ph.D students to accomplish GOT in the near future.

Keywords: Ph.D students; Graduate on time; Analytic hierarchy process.



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1. Introduction

In 21st century, education is vital to equip the individuals with various learning skills such as critical thinking skill, problem solving skill, social skill, communication skill, character trait and so forth to content the demands and challenges in the new era of globalization. Therefore, the importance of education has successfully attracted individuals' attention and interest to pursue their study in particular program in higher education in order to enhance their ability in various skills such as technical skills, soft skills, lifelong skills, and knowledge in a particular profession which could lead them to a better career opportunity. Apparently, there is a significant increase in the number of individuals who pursue their study in higher education, especially in doctorate degree.

From the statistics attained from Universiti Teknologi Malaysia (UTM), the number of Doctor of Philosophy (Ph.D) students have increased exponentially in the past decade, from nearly 4,000 in year 2002 to approximately 40,000 in year 2012 ([Education in Malaysia, 2016](#)). With the rapid growth of Ph.D students, the main concern is the ability of Ph.D students to complete their studies within four years from the date of registration. For instance, in year 2005, a Malaysian public university found out that the completion time of doctoral students (research and coursework) is within 4.84 years averagely ([Abiddin and Ismail, 2011](#)). It means that students tend to delay the time frame given causing them unable to graduate on time.

This study focusses on Universiti Utara Malaysia (UUM), a public management university in Malaysia. UUM offered variety of Ph.D program to equip students with the industry-ready skills since year 1992 and there were 6 candidates involved in the first enrolment. With the raising of awareness on the importance of education, the number of individuals who are pursuing their studies in doctorate program have been increasing year by year to the total number of 506 candidates in year 2014. However, as the number increase, the ability of Ph.D students to complete their studies according to GOT time frame has become a constraint and issue to the students, lecturers, supervisors, faculty, school and university ([Chin et al., 2017](#)).

In UUM, although the total graduates who are able to complete their studies on time had increased to 449 in year 2017, there are still 130 postgraduates fail to complete their study within 48 months from their registration date. This scenario is indeed worrying as the Ph.D students had lengthened the period of study. Therefore, the factors that influence of the duration of Ph.D studies must be identified so that effective and drastic solutions can be implemented by the university to boost the number of Ph.D students to complete their studies on time. In this study, Analytic Hierarchy Process (AHP) is used to rank the factors according to their level of importance so that better supports, action, policy and supervision can be carried out to leverage the students' performance.

Past studies showed that the impact of student, children, supervisor, financial, employment, infrastructure, training, skills, project and peer affected students' attrition rate and completion time. Student's factor plays an important role in impacting the completion time of doctoral degree. The time taken by female to complete their studies is approximately 11% longer than male (Jiranek, 2010). Besides, previous studies also found that the spouses could motivate them to complete their studies in a timely manner (Clark, 2011; Shariff *et al.*, 2015). Also, there are some researches stated that the international students usually complete faster than domestic students as the international students face the constraint of their student visa (Rodwell and Neumann (2005), Jiranek (2010) and Spronken-Smith *et al.* (2018). Besides, those who use English as their native language at home are more likely to complete their studies within the time frame given (Rodwell and Neumann, 2005). Children factor has also been discussed by Clark (2011) and the respondents claimed that having no support from their children could spoil their motivation in their study.

In addition, supervisor is also considered as another factor that affecting the student's completion time. The GOT-achievers indicated that supervisor who keeps holding the meeting with their supervisee for at least once a week and containing good characteristics such as intelligent, knowledgeable, experience, helpful and committed can certainly speed up their students' tasks and study (Pitchforth *et al.*, 2012). In fact, the relationship between supervisor and student are important as the result shows that supervisor who takes care of the student's difficulties by providing support and encouragement could make the progress smoother (Ngozi and Kayode, 2014). Conversely, if the supervisor could not provide any mental and physical support would possibly procrastinate the completion time.

Financial problem (Mohamed *et al.*, 2012; Sverdlik *et al.*, 2018), is another contribution in this issue. Financial difficulties are the most influencing factor that demotivates the Ph.D students in carrying out their studies (Myers, 1999; Shariff *et al.*, 2015). In fact, the financial stability of a Ph.D student could stimulate the student's motivation and determination to achieve the GOT mission (Poh *et al.*, 2001). Those who obtain the scholarship could complete their studies in 4.7 years averagely. On the contrary, those who do not obtain any scholarship support could delay their studies to around 6.1 years (Jiranek, 2010). Miller (2013), added that those who manage to get full financial support in their first-year studies will be having higher chances to achieve GOT.

The impacts of employment status and employment support have been examined by the previous researches. The finding shows that 73% of the respondents reported that job or professional responsibilities are the constraint to this issue (Myers, 1999). Besides, in the study conducted by Clark (2011), 75.0% of the participants are being employed during their final years with the average 31 working hours per week. About 41.0% of the participants indicated that employment status is also the positive factor that assists them in completing their thesis or project on time. However, there is 38.5% of the participants claimed that employment status has become the barriers to the timely completion of their thesis or project. Also, some studies insisted that changing in career or professional responsibilities during the studies period affect GOT as well Myers (1999) and Shariff *et al.* (2015).

Moreover, previous studies found that GOT can be affected by the resources of university such as library access, computer access and physical resources (car parks, lecturer halls, study space and etc) (Pitchforth *et al.*, 2012). Furthermore, through the research conducted by Ngozi and Kayode (2014), the respondents agreed that insufficient access to necessary equipment, materials, computing facilities and services could certainly procrastinate the thesis completion time of the postgraduate candidates. Apparently, effective resources and guidance that based on the needs and abilities of the students at different phases of their studies might be useful to their learning process (Hasnan *et al.*, 2015). Similarly, Shariff *et al.* (2015) also indicated that counselling, career support and sufficient services could also bring a huge positive impact to the students.

There is no denying that the training provided such as workshops, courses, talks, seminars and conferences play an important role in assisting the Ph.D students to achieve GOT. Mohamed *et al.* (2012), illustrated that communicating in writing, number of journal papers published, and number of conferences attended during doctoral studies are the important elements that lead to doctoral students of engineering to success in their studies. According to the statistics, 6.5% of the respondents in the research claimed that they had attended the writing course and 58.1% of them have published more than three journal papers.

Clark (2011), stressed on lacking interest and support of thesis adviser, personal motivation, personal tenacity and perseverance, availability of thesis adviser, and fellow classmates are the top five factors which have been identified as the barriers to the thesis or project. Besides, Mohamed *et al.* (2012) showed that the most important skills that doctoral students needed to achieve in their academic success is working independently and having good thinking skill. This idea is also supported by Shariff *et al.* (2015). In addition, Ngozi and Kayode (2014) proved that thesis completion time could be delayed due to poor skills in interpersonal relationship, data analysis and interpretation skill, writing skill, computer and browsing skill, time management and planning skill, and problem solving skill.

Several studies claimed that the students' interest in their research topic influenced the completion time of doctoral studies Myers (1999), Pitchforth *et al.* (2012), and Shariff *et al.* (2015). Likewise, Ngozi and Kayode (2014) insisted that the time frame for GOT should not be lengthened if the students have deep interest and positive predisposition in their research project. Moreover, numerous scholars indicated that literature search, effective resources and guidance are also the factors that affect the time frame allotted Ngozi and Kayode (2014), Hasnan *et al.* (2015), and Shariff *et al.* (2015). Besides, existence of classmates or researchers in the studies of Ph.D program is not only able to provide support and help in resolving academic and administration problem, they also assist the Ph.D students in personal issues (Pitchforth *et al.*, 2012). This finding is further supported by the studies of Clark

(2011) who indicated that 67.5% of the candidates declared that helps provided by the classmate could effectively speed up the learning process.

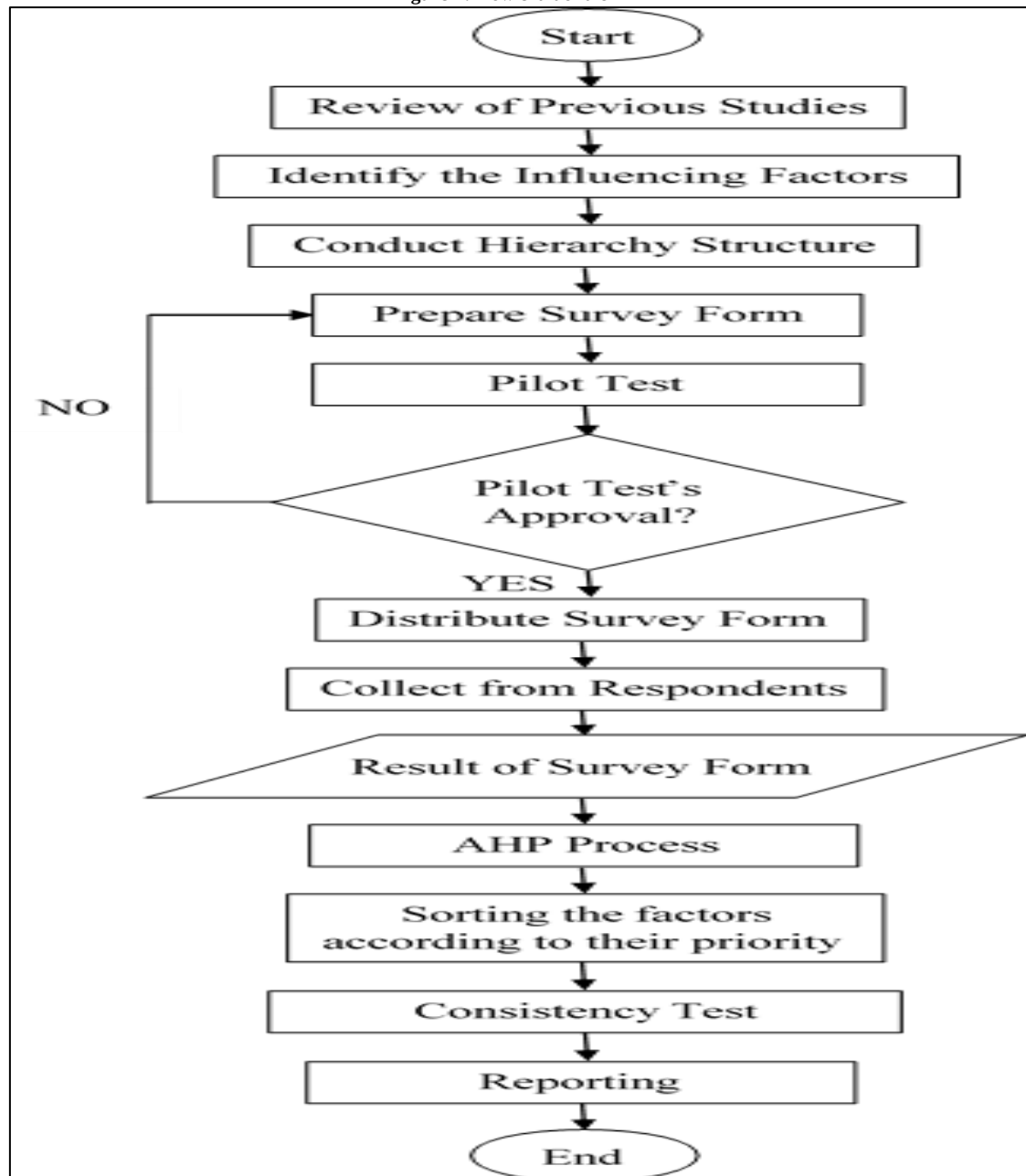
2. Analytical Hierarchical Process

Analytical Hierarchical Process (AHP) is a user-friendly and very practical approach that was used for multi-criteria decision making and analysis (MCDMA) which was developed by Saaty in late seventies. This method is capable to establish several hierarchical levels to structure the problem and later rank the degree of importance of every factor. Also, it can provide the preference of every respondent by quantifying the alternatives. According to as [16] cited in Sato (2009), AHP is able to express and transform judgements of respondents which on qualitative scale to quantitative measure through pairwise comparison. One of the advantages of using AHP approach is able to justify the weight and the priority of each criterion through pairwise comparison (Poh *et al.*, 2001). Besides, Sato (2007) defined that in the decision-making analysis process, respondents' preferences on the criteria can be transformed into a precise result by using AHP method. Saaty (1980), stated that although some inconsistency may occur due to the judgments of respondents that are not perfectly consistent; comparison between Consistency Index (CI) can be used to measure the inconsistency in order to improve the consistency of the judgements.

3. Methodology

This study is using a quantitative research design to determine and rank the important level of factors that affecting the Ph.D students in UUM to attain GOT by using AHP method. Figure 1 shows the flow chart of the whole process.

Figure-1. Flow chart of the AHP



4. Data Collection

The following four stages have been carried out to create the AHP survey form.

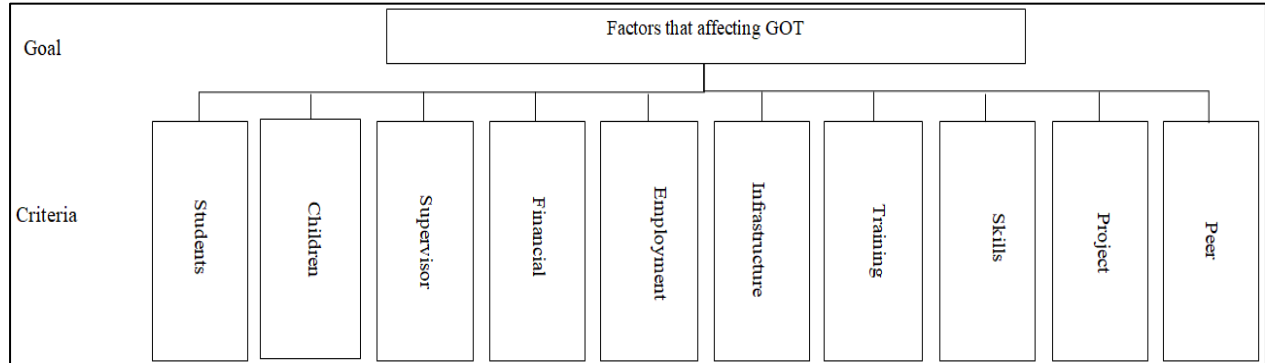
Stage 1: Define the problem and determine the criteria that affect the problem.

From previous study, the criteria such as students, children, supervisor, financial, employment, infrastructure, training, skills, project and peer have been determined as the factors in affecting the Ph.D students to achieve GOT.

Stage 2: Conduct a hierarchy structure.

A hierarchy structure has been conducted to tackle the problem of this study. Figure 2 Shows the hierarchy structure that comprises the criteria that affecting GOT.

Figure-2. Hierarchy structure of factors that influence the success of Ph.D students in achieving GOT



Stage 3: Design a survey form

A survey form is designed to collect the judgement of respondents on the importance of each criterion in influencing Ph.D students. Table 1 shows the intensity of importance between two criteria according to numerical scale from 1 to 9, where we assume that one criterion is equally or more important than the other criterion.

Table-1. Relative Scores for Importance of Factor that Influence GOT

Intensity of important	Definition	Explanation
1	Equal Importance	Both the criteria equally important to the goal.
3	Moderate Importance	Judgement on one criterion is slightly important compare to another one.
5	Strong Importance	Judgement on one criterion is strong important compare to another one.
7	Very Strong Importance	Judgement on one criterion is very strong important compare to another one.
9	Extreme Importance	Judgement on one criterion is extreme important compare to another one.
2, 4, 6, 8	Intermediate values	Judgement on the importance falls between the intensity (1, 3, 5, 7, 9) stated above.

Stage 4: Distribute AHP survey form

Once the AHP survey form has been gone through the pilot test, it is then distributed to thirty respondents (executive team, lecturers, supervisors, and current Ph.D students in UUM). The sample size was determined from the past research conducted by Sato (2005), Sato (2007) that has similar goal and objective as this study. Table 2 shows the number of respondents who take part in this AHP survey according to the ratio of Ph.D students' intake in 2014. As mentioned earlier, AHP survey form is designed to collect the judgements from the respondents where the numerical priorities are then computed. These numbers represent the alternative ability to achieve the decision goal and allow a straightforward consideration of the various course of action.

Table-2. Number of participants chosen in AHP survey based on three graduate schools.

Category of Respondents	Number of respondents			
	OYAGSB	AHSGS	GSGSG	Total
Dean	1	1	1	3
Deputy Dean	2	1	1	4
Lecturer	2	2	2	6
Supervisor	3	3	3	9
Student	4	2	2	8
Total	12	9	9	30

5. Method of Data Analysis

AHP method has been applied to rank the factors that influence the Ph.D students in achieving GOT according to its importance level by transforming the experts' opinions that collected from the AHP survey form. The following three stages have been carried out to study the importance of each factor and check for its consistency:

Stage 1: Rank the criteria by using Analytic Hierarchy Process

Geometric Mean, $\sqrt[n]{a_1 a_2 \cdots a_n}$ is computed, where $a_1 a_2 \cdots a_n$ is the product of the data and N represents the number of respondents. After a pairwise comparison matrix, M is developed from the Geometric Mean, normalized matrix for each criterion is computed in order to gain the row average, R . Row average is the preference vector for the criteria and the sum of all elements are equal to 1. The criterion with the highest value in row average is considered the most important criterion that influencing the Ph.D students in achieving GOT.

Stage 2: Conduct consistency test.

Consistency index (CI) is calculated from $\frac{(\lambda_{max}-n)}{(n-1)}$ to check for the degree of consistency in pairwise comparisons for the ten criteria where $\lambda_{max} = \frac{M \times R}{R}$. If $CI = 0$, the degree of consistency is considered perfect. Otherwise, consistency ratio, $CR = CI/RI$ will be used to define the acceptable level of consistency. Table of random-like matrix (RI) is shown in Table 3. The degree of consistency is acceptable if it does not exceed 0.1. However, if CR exceed 0.1, the pairwise comparisons are having serious inconsistencies and the AHP result may not be significant.

Table-3. Consistency indices for random index

n	5	6	7	8	9	10
$R.I.$	1.12	1.25	1.32	1.41	1.45	1.49

Stage 3: Interpretation of result

We interpret the result after gaining the level of importance for each factor. Then, consistency test is conducted.

6. Result

After collecting data from thirty respondents, Geometric Mean has been calculated whilst a pairwise comparison matrix has also been developed as shown in Table 4.

Table-4. Pairwise comparison matrix of factors

Factors	Student	Children	Supervisor	Financial	Employment
Student	1.0000	1.0604	0.6236	0.6595	1.1381
Children	0.9431	1.0000	0.5038	0.4972	0.7418
Supervisor	1.6036	1.9848	1.0000	1.3486	1.9295
Financial	1.5163	2.0114	0.7415	1.0000	2.2670
Employment	0.8787	1.3480	0.5183	0.4411	1.0000
Infrastructure	0.5810	1.1553	0.3125	0.3475	0.5150
Training	1.0203	1.5821	0.6581	0.6468	1.6404
Skills	1.7109	3.0177	1.4310	1.5537	2.9849
Project	1.2350	2.2215	0.5486	0.8291	1.0443
Peer	0.5264	0.9190	0.3016	0.4323	0.5702

Factors	Infrastructure	Training	Skills	Project	Peer
Student	1.7213	0.9801	0.5845	0.8097	1.8997
Children	0.8656	0.6321	0.3314	0.4501	1.0881
Supervisor	3.1996	1.5195	0.6988	1.8228	3.3154
Financial	2.8780	1.5462	0.6436	1.2062	2.3134
Employment	1.9418	0.6096	0.3350	0.9575	1.7537
Infrastructure	1.0000	0.3549	0.2924	0.5238	0.9148
Training	2.8176	1.0000	0.6235	1.0775	1.3814
Skills	3.4205	1.6039	1.0000	2.1451	3.7229
Project	1.9090	0.9281	0.4662	1.0000	3.4223
Peer	1.0931	0.7239	0.2686	0.2922	1.0000

The pairwise comparison matrix is used to evaluate two criteria at a time in term of their relative important. The range of index values are 1 to 9. If two criteria is exactly equal important, this pair receives an index of 1. Some interpretations of Table 4 that based on the explanation in Table 1 are shown below:

- Students is between equal important and moderate important than children.
- Training is between equal important and moderate important than infrastructure.
- Skills is between moderate important and strong important than peer.

Table-5. Normalized criteria comparison matrix

Factors	Student	Children	Supervisor	Financial	Employment
Student	0.0908	0.0651	0.0939	0.0850	0.0823
Children	0.0856	0.0613	0.0759	0.0641	0.0536
Supervisor	0.1456	0.1218	0.1506	0.1739	0.1395
Financial	0.1377	0.1234	0.1117	0.1289	0.1639
Employment	0.0798	0.0827	0.0781	0.0569	0.0723
Infrastructure	0.0527	0.0709	0.0471	0.0448	0.0372
Training	0.0926	0.0971	0.0991	0.0834	0.1186
Skills	0.1553	0.1851	0.2155	0.2003	0.2158
Project	0.1121	0.1363	0.0826	0.1069	0.0755
Peer	0.0478	0.0564	0.0454	0.0557	0.0412

Factors	Infrastructure	Training	Skills	Project	Peer	Row Average
Student	0.0826	0.0990	0.1115	0.0787	0.0913	0.0880
Children	0.0415	0.0639	0.0632	0.0438	0.0523	0.0605
Supervisor	0.1535	0.1535	0.1333	0.1772	0.1593	0.1508
Financial	0.1381	0.1562	0.1227	0.1173	0.1112	0.1311
Employment	0.0931	0.0616	0.0639	0.0931	0.0843	0.0766
Infrastructure	0.0480	0.0359	0.0558	0.0509	0.0440	0.0487
Training	0.1352	0.1010	0.1189	0.1048	0.0664	0.1017
Skills	0.1641	0.1620	0.1907	0.2086	0.1789	0.1876
Project	0.0916	0.0938	0.0889	0.0972	0.1644	0.1049
Peer	0.0524	0.0731	0.0512	0.0284	0.0480	0.0500

Table-6. The level of importance for each factor in influencing the Ph.D students to achieve GOT

Factor	Weight	Rank
Skills	0.1876	1
Supervisor	0.1508	2
Financial	0.1311	3
Project	0.1049	4
Training	0.1017	5
Students	0.0880	6
Employment	0.0766	7
Children	0.0605	8
Peer	0.0500	9
Infrastructure	0.0487	10

Table 5 shows the normalized criteria comparison matrix and the row average and the factors are ranked according to their weight or row average in Table 6. From the opinion and judgements from respondents, skills factor is the most influencing factor among all as it gained the highest weight with the value of 0.1876. Supervisor factor with the weightage of 0.1508 placed in second followed by financial factor (0.1311), project factor (0.1049), training factor (0.1017), student factor (0.0880), employment factor (0.0766), children factor (0.0605), peer factor (0.0500), and finally infrastructure factor (0.0487).

Then, the consistency degree of the study is computed. The consistency index (*CI*) and consistency ratio (*CR*) gained are 0.0167 and 0.0112 respectively. Since the *CR* does not exceed 0.1, the result of pairwise comparison is consistent and the AHP result is significant.

7. Discussion

Through the result obtained from the AHP survey form, the respondents justified that skill factor as the most influencing factor that affecting the Ph.D students to attain GOT mission. Important skills such as English language skill, writing skill, software skill, Mathematics skill, time management skill, research skill and soft skill have been determined as the skills needed to have along their studies. This result supports previous researches by Mohamed *et al.* (2012) and Shariff *et al.* (2015) which indicated that Ph.D students needed important skills such as technical writing skill, thinking skill, decision-making skill, interpersonal skill, oral communication skill and multi-tasking skill along their studies to success in achieving GOT. In addition, poor skills could procrastinate the completion time of thesis writing (Ngozi and Kayode, 2014).

Besides, supervisor factor is considered as the second important factor that affecting the completion time of Ph.D students. The supervisor's expertise and experience are important in assisting the Ph.D students to complete their studies. The supervisor is not only to have good relationship with supervisee and able to provide proper and timely guidance, they also need to deliver continuous, supportive and prompt feedback to accelerate the completion of Ph.D program (Ndayambaje, 2018). The respondents believe that supervisor who understands their difficulties and provide proper guidance and encouragement could speed up the duration of study. This findings match those

observed in earlier studies that mentioned supervisor with good characteristics could lead the Ph.D students to timely completion [Mohamed et al. \(2012\)](#), [Pitchforth et al. \(2012\)](#) and [Shariff et al. \(2015\)](#).

Moreover, the respondents claimed that support of financial aid are vital in lighten the students' burden when they pursuing their Ph.D studies. Financial support aid such as MyBrain15, Skim Biasiswa UUM (Master dan Ph.D), Skim Latihan Akademik Bumiputra (SLAB) and Skim Latihan Akademik IPTA (SLAI) acts as motivation factor to stimulate the Ph.D students to succeed in timely completion. In contrast, the Ph.D students without financial aid could face the financial problem which could become a barrier in their study.

The respondents perceived that the factor of project, training, student, employment, children and peer have less influence toward timely completion of their Ph.D studies. Interestingly, they evaluated infrastructure factor as the least important factor that influence the Ph.D students in achieving GOT mission. The respondents justified that physical resources such as library access, study location, computer access may not become the reason that affecting their completion time.

8. Conclusion

A good education plays a vital role as it could make the country's economy advancement and flourish. Therefore, Ministry of Higher Education Malaysia has targeted to produce 60,000 Ph.D graduates in Malaysia by 2020. Certainly, education and the development of graduates' quality act as a goal in order to drive Malaysia to achieve a high-income status by the year of 2020. However, as the number of students who are pursuing in Ph.D program increase, the ability of Ph.D students to complete their studies according to GOT mission has become a constraint to the students, lecturers, supervisors, college, school and university. The main purpose of this study is to investigate the factors that influence the Ph.D students in UUM to achieve GOT according to the importance level of factors. From the opinion of the respondents, skill factor, supervisor factor and financial factor have been ranked as the top three factors that influence the Ph.D students in achieving GOT. In addition, interestingly, the respondents justified that infrastructure factor as the least important factor that affecting timely completion. Thus, with the important level of each factor that we gained, it can be certainly implemented by the university to boost the number of Ph.D students to complete their studies within four years. The results of this study will be beneficial to the Ph.D students in UUM. Moreover, by understanding the needs and expectations of Ph.D students, supervisors can support the Ph.D students with a better and appropriate supervision. This could certainly improve the university's Key Performance Indicators (KPI) whilst ameliorate the university's position in World University Rankings.

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