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Determining Significant Factors for Selection of Private Higher Education Institutions in Malaysia using Binary Logistic Regression

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ABSTRACT

This study aims to statistically identify significant factors that influence IPTS selection in Malaysia using binary logistic regression. There are three phases in this study namely *Identification of Variables*, *Distribution of Questionnaire* and *Analysis of Results*. The variables used in the questionnaire were adapted from the past study of the authors. Nine factors in the selection of HEIs were identified and adapted in this study. Questionnaire was selected as the research tool and electronically distributed to the students of seven IPTS throughout Terengganu with a total response of 305. Results were loaded into SPSS for statistical analysis using descriptive, exploratory, normality, correlation, reliability, and binary logistic regression. The results reveal three significant factors in the selection of IPTS namely *Cost*, *Social Factors* and *Job Prospects*. Although accuracy is high, the model is not suitable for prediction since the variation is less than 70%. Findings for this study could support IPTS marketing strategies and better understanding of IPTS selection criteria in Malaysia.

1. Introduction and Background

Higher education in Malaysia is under the purview of the *Ministry of Higher Education* (MOHE). There are two types of Higher Education Institutions (HEIs) in Malaysia: Public HEIs (IPTA) and Private HEIs (IPTS). Entry to HEIs is based on the *Sijil Pelajaran Malaysia (SPM)* and *Sijil Tinggi Pelajaran Malaysia (STPM)* examination results. As of January 2020, 20 IPTAs and 466 IPTSs were registered with MOHE [1,2]. Collectively, IPTA offers more than 1000 academic programs, whilst IPTS offers more than 8000 programs [3]. Although more than 50% of secondary school students are eligible to pursue higher education yearly, only some are offered a place to study at local HEIs.

For the last three years, the number of secondary school students taking the *SPM* and *STPM* examinations was reported to be around 400,000 and 40,000, respectively. However, the number of

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students accepting IPTS offers was very low and has affected student enrolment tremendously [4,5], with 33 IPTS reported to be closed in 2017.

The problem of students falling through the cracks is serious, and several government agencies have organised special initiatives to ensure eligible students can pursue higher education, for example, programs organised by the Terengganu State government and *Perbadanan Tabung Pendidikan Tinggi Negara*.

Post Covid-19, IPTS must identify new ways and devise new strategies to remain competitive in the industry. As such, this study aims to statistically identify significant factors that influence IPTS selection in Malaysia using binary logistic regression.

2. Literature Review

The literature has identified nine factors for IPT selection. The first factor is *cost, which* refers to education costs, study aids and cost of living [6-22]. The second is *program-specific factors* such as programmes offered, accreditation body, study duration, program content and structure [11,21-23,34]. *Reputation* is another factor considered, which includes image, reputation, and links with foreign universities [6,11,17-22,24,26]. Next is *social factors* such as input from family members, peers and social media [6-9,16-17,19,21,25-26]. Other factors include educational facilities (lecture hall, laboratory, library, etc.) and campus facilities (dormitories, sports complex, Wi-Fi, etc.) [6,18,20,24,27-29]. *Employment prospects* and alumni success stories are also considered as one of the factors for IPTS selection [15,17-18,22,30,34]. In addition, the *location* of IPT and distance from home also play a vital role, especially post-Covid-19 [10,13,22,28-29,31-32,34]. Finally, *marketing* includes advertising and promotion (TV, Internet, education carnival, etc) [6,29].

3. Methodology

The questionnaire was selected as the research tool and divided into three sections. Table 1 illustrate the sections in the questionnaire. Section 1 gathers the demographic profile of the respondents, such as *Gender, Age, Race, Education Level, Program of Study, Name of HEI* and *Alumni Status*. Section 2 identifies HEI-specific factors, for example, *Reputation, Location, Programs, Staff* and *Facilities* whilst Section 3 identifies non-HEI-specific factors, for example *Cost, Social, Marketing, Prospects,* and *Loyalty* in the selection of HEIs. A 5-point Likert scale ranging from 1 "*Strongly Disagree*" to 5 "*Strongly Agree*" as proposed by Khamis [33] is used in Sections 2 and 3.

Table 1
Questionnaire section

Section	Component	Item
1	Demographics	• Gender • Age • Race • Education level • Program of study • Name of HEI • Alumni Status
2	HEI-Specific Factors	• Reputation • Location • Programs • Staff • Facilities
3	Non-HEI-Specific Factors	• Cost • Social • Marketing • Prospects • Recommendation

3.1 Identification of Variables

The variables used in the questionnaire were adaptations of the study by Wan Roslina *et al*., [34]. Through a systematic literature review, the authors have identified nine factors for HEI selection: *Image*, *Programs*, *Social Factors*, *Cost*, *Facilities*, *Marketing*, *Location*, *Prospects*, and *Academics*. The questionnaire included the factors as variables with minor revisions to the terms used. A pilot survey was administered to 30 participants to evaluate feasibility before distribution to target respondents. Revisions to the questionnaire were made based on the pilot survey results.

3.2 Questionnaire Distribution

The questionnaire was electronically distributed to the respondents through *Google Form*. Respondents were students of seven IPTS throughout the state of Terengganu in Malaysia. The total number of responses was 305 from the 2000 questionnaires distributed, with a response rate of 15.35%, which is acceptable according to Krejcie [35]. The link to the questionnaire was disabled one month after the first distribution.

3.3 Analysis of Results

The survey results were loaded into SPSS (version 25) for statistical analysis. An assessment was conducted to test the reliability and validity of the measurements used. Basic and advanced statistical analyses such as *descriptive*, *exploratory*, *normality*, *correlation*, *reliability* and *binary logistic regression* were then carried out.

4. Results and Discussion

4.1 Reliability Analysis

This analysis was performed after the pilot study to confirm the reliability of the research instrument. A value of 0.8 in *Cronbach's Alpha Coefficient Reliability Test* is considered highly reliable according to Carmines [36]. Since the value of all variables in Table 2 is higher than 0.8, it can be concluded that the questionnaire is a reliable measurement instrument.

Table 2
Cronbach's Alpha Coefficient Reliability Test

Variables	Items	Alpha
Reputation	3	0.929
Location	2	0.933
Programs	3	0.926
Staff	2	0.924
Facilities	2	0.929
Cost	2	0.932
Social	3	0.926
Marketing	3	0.928
Prospects	2	0.925

4.2 Demographics

The respondents comprised 162 (53.1%) female and 143 (46.9%) male respondents. Figure 1 illustrates that 77.7% were between 18-20, 17.4% were between 21-23, and 4.9% were older than 23 years old.

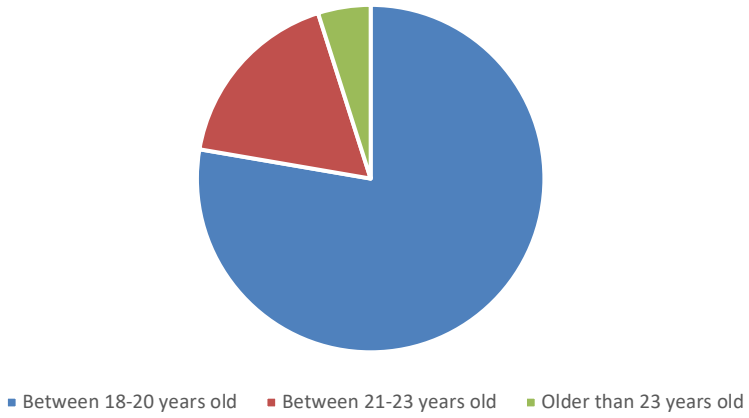

Fig. 1. Age of the Respondents

83.3% of the respondents are pursuing diploma whilst 16.7% are currently in foundation programs. Based on Figure 2, 31.8% of the respondents are from *University College TATI*, 13.8% from *Ranaco Training Institute,* 12.8% from *Kolej Yayasan Islam Terengganu,* 10.8% from *Kolej Al-Quran Terengganu, 10.8%* from *Kolej Cosmopoint,* 10.5% from *Kolej TESDEC* and 9.5% from *Kolej Universiti Bestari*.

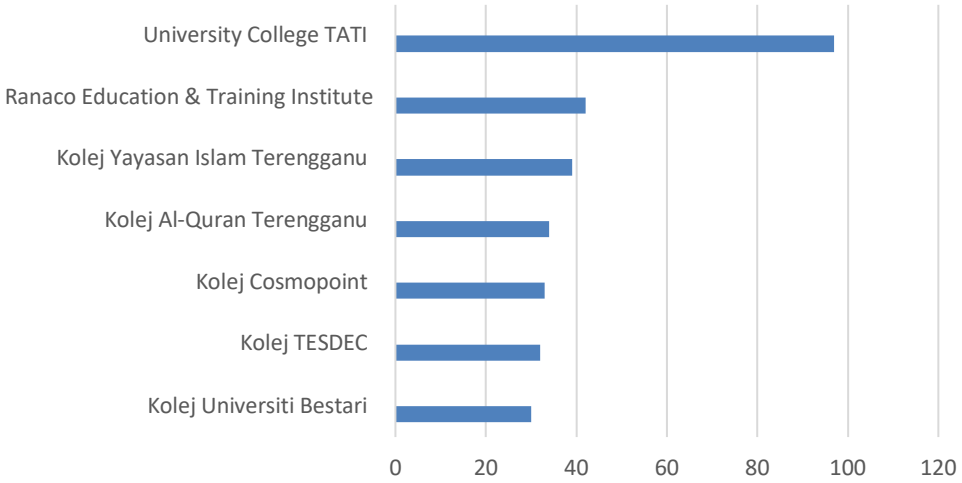

Fig. 2. Education Institution of the Respondents

4.3 Report Dependent Variable-Y Recommendation

The original dependent variable "*Recommendation of HEI to family and friends*" was transformed into two binary classes for logistic regression application (Disagree (0) and Agree (1)). Answers 1,2,3 (*Strongly Disagree, Disagree, Neutral*) were classified as Disagree and answers 4, 5 (*Agree, Strongly Agree*) were classified as Agree. As seen in Figure 3, 76.7% of the respondents recommended their current HEI to family and friends.

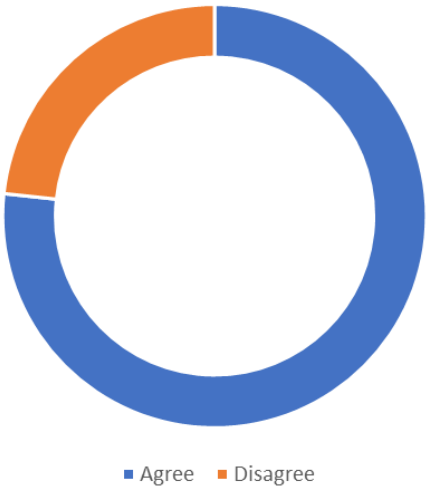

Fig. 3. Dependent Variable (Recommendation of HEI to family and friends)

4.4 Assumptions for Logistic Regression

All nine independent variables are continuous while the dependent variable is classified as "0" (*Disagree*) and "1" (*Agree*). The independence of observations and the dependent variable are mutually exclusive and have exhaustive categories**.** The deviance residual plot indicates that it satisfied the independence assumption.

4.5 Multicollinearity Checking

Results shown in Table 3 assumed that there are no multicollinearity problems among the explanatory variables. The *Variance Inflation Factor* (VIF) did not exceed 10 for it to be considered for multicollinearity problems. All variables have a VIF value of less than 10**,** implying no multicollinearity problem existed, and *Binary Logistic Regression* can be performed.

Table 3
Multicollinearity Checking

Variables	VIF
Reputation	2.249
Location	1.889
Programs	3.175
Staff	3.622
Facilities	2.258
Cost	1.715
Social	2.970
Marketing	2.701
Prospects	2.714

4.6 Binary Logistic Regression

The *Binary Logistic Regression* results are illustrated in Table 4. It clearly shows three significant variables: *Cost*, *Social* and *Prospects* since the p-value is less than 0.05. In other words, these factors are significantly affecting the dependent variable.

Table 4
Binary Logistic Regression Results

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Step 1[a] Reputation	-.398	.513	.602	1	.438	.672	.246	1.835
Location	-.0 10	.322	.001	1	.975	.990	.526	1.862
Programs	.507	.526	.930	1	.335	1.660	.592	4.651
Staff	.605	.506	1.429	1	.232	1.832	.679	4.941
Facilities	-.215	.376	.327	1	.567	.807	.386	1.685
Cost	1.522	.374	16.560	1	.000	4.582	2.201	9.536
Social	1.730	.544	10.126	1	.001	5.640	1.943	16.368
Marketing	.065	.487	0.18	1	.894	1.067	.411	2.773
Prospects	1.285	.431	8.882	1	.003	3.614	1.552	8.413
Constant	-17.082	2.431	49.396	1	.000	.000		

a. Variable(s) entered on step 1: Reputation, Location, Programs, Staff, Facilities, Cost, Social, Marketing, Prospects.

To check whether the final model was fit for prediction, the *Final Estimated Logistic Regression* was carried out, and the result is presented in Table 5.

Table 5
Binary Logistic Regression with significant variables

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Step 1[a] Cost	1.575	.344	20.959	1	.000	4.829	2.461	9.476
Social	1.816	.432	17.641	1	.000	6.145	2.634	14.337
Prospects	1.471	.395	13.854	1	.000	4.353	2.006	9.443
Constant	-16.101	2.203	53.439	1	.000	.000		

a. Variable(s) entered on step 1: Cost, Social, Prospects

The Final Estimated Logistic Regression equation with significant variables:

$$log\left[\frac{P(Recommend)=Agree)}{1-P(Not\ Recommend=Disagree)}\right] = -16.101 + 1.575_{Cost\_mean} + 1.816_{Social\_mean} + 1.471_{Prospects\_mean} \quad (1)$$

According to the model summary presented in Table 6, variation in the dependent variable using *Cox & Snell* R^2 and *Nagelkerke* R^2 is 43.7% and 66% respectively. Since the variation is smaller than 70%, the model is not advisable for prediction.

Table 6
Logical Regression Model Summary

Step	-2 Log likelihood	Cox & Snell R^2	Nagelkerke R^2
1	155.813[a]	.437	.660

a. Estimation terminated at iteration number 7 because parameter estimates changed by less than .001

4.7 Hosmer & Lemeshow Test

The Hosmer and Lemeshow Test results determine how well-adjusted the logistic regression model is presented in Table 7.

Table 7
Hosmer and Lemeshow Test

Step	Chi-square	df	Sig
1	10.631	8	.223

i. H_0 : The Regression Model is fit
ii. H_1 : The Regression Model is not fit

Since the p-value is larger than 0.05, it fails to reject the null hypothesis (H_0). This indicates that the model fits well with the entire set of observations, based on the test's output, at a confidence level of 95%.

4.8 Confusion Matrix

The interpretation of the overall percentage shown by the model is highly accurate in predicting the recommendation of HEI to family and friends, 90.2% accuracy.

Table 8
Confusion Matrix

Observed			Predicted		
			Recommendation		Percentage Correct
			Disagree	Agree	
Step 1	Recommendation	Disagree	49	22	69.0
		Agree	8	226	96.6
	Overall Percentage				90.2

a. The cut value is .500

4.9 Interpretation on Odds Ratio

Table 9 shows that the odds ratio for "*Cost*" is exp (1.575) = 4.8, meaning that the odds of recommending HEI are estimated to increase by five times with the increase in value. The more affordable the education cost and the availability of more scholarships, the more likely the current students recommend the HEI. Meanwhile the odds ratio for "*Social*" is exp (1.816) = 6.145, meaning that the odds of recommending HEI are estimated to increase by six times with the increase in value. The odds ratio for "Prospects" is exp (1.471) = 4.353 meaning that the odds of recommending HEI are estimated to increase by four times with the increase in value.

Table 9
Interpretation on Odds Ratio

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a] Cost	1.575	.344	20.959	1	.000	4.829
Social	1.816	.432	17.641	1	.000	6.145
Prospects	1.471	.395	13.854	1	.000	4.353
Constant	-16.101	2.203	53.439	1	.000	.000

a. Variable(s) entered on step 1: Cost, Social, Prospects

5. Conclusion

This study has successfully determined three significant factors of IPTS selection in Malaysia using binary logistic regression. Reliability analysis concluded that the questionnaire was a reliable measurement instrument. The questionnaire was electronically distributed to the 305 respondents at seven IPTS throughout the state of Terengganu in Malaysia. Multicollinearity checking concludes no multicollinearity problems among the variables in the questionnaire. Binary logistic regression concludes the significance of *Cost*, *Social Factors* and *Job Prospects* factors based on the p-value in selecting IPTS. Works in the near future include the development of a new IPTS selection model using *Interpretive Structural Modelling*, a methodology for identifying IPTS selection criteria and the relationships among them.

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