SATISFACTION FACTORS RELATED TO SATELLITE TVRO USAGE IN KOTA KINABALU, SABAH, MALAYSIA

Noraini Abdullah[1*], Suhaimi Salleh[2] & Ramzah Dambul[3]

[1]Dr., Universiti Malaysia Sabah, MALAYSIA, noraini abdullah.ums@gmail.com

[2] Mr, Universiti Malaysia Sabah, MALAYSIA, suhaimi.binsalleh@gmail.com

[3] Dr., Universiti Malaysia Sabah, MALAYSIA, rdambul@gmail.com

*Corresponding Author

Abstract

Global information are carried with phenomenal speed from within and across via Information and Communication Technology (ICT) networks. Globalization, socialization as well as the impact viewership of these telecommunication technology have encompasses the transnational and transcultural integration of human and non-human activities. Such is the satellite television viewership. Television Received Only (TVRO) system is an unlicensed satellite television reception system sprouting in Malaysia besides other licensed channels, ASTRO and free-to-air (FTA). This study thus attempts to investigates the effects of the viewership perspectives and preferences on the satellite television adoption, specifically in Sabah. This paper also aims in exhibiting the relationship on the aspects of satellite television usage and the viewers satisfaction factors using the multiple regression (MR) technique. A total of 148 respondents participated in this study where the concentration of TVRO parabolas were found indicating of its usage, namely, in the capital city of Kota Kinabalu in Sabah. Questionnaires were administered, followed by the processes in mathematical modelling viz., factor analysis, four-phases in model-building, multicollinearity remedials, removals of insignificant variables and model comparisons were made. Identification of the best model was based on the eight selection criteria (8SC). The best model obtained from corresponding channels through TVRO was justified through the randomness and normality tests of the standardized residuals..The common significant factors from the best model M7.0.14 (TVRO) were composed of television usage, satisfaction factors such as entertainment and tranquillity, increase of knowledge on Malaysian issues, as a support to good services, cheap subscription fee, motivation factor due to negligible film censorship and external factors such as the influence of mobile telephones.

Keywords: mathematical modelling, satellite television, multiple regression (MR), satisfaction factors, best model.

1 INTRODUCTION

Massive amounts of information being transferred in a blink of an eye will enable the humankind to advance in a multitude of ways. United Nations Educational, Sciences and Cultural Organization (UNESCO, 2008) had stated that ICT is "the combination of informatics technology with other, related technologies, specifically communication technology". While globalization had been proposed by Al-Rodhan *et al.* (2006) and socialization by Haralambos & Holborn (2004), appreciation on global processes towards human and non-human development and stability, progress as well as transnational and transcultural integration besides influences in socialization would certainly gave impacts ICT concepts.

In Malaysia, television is the most popular among all components of mass media. Television had become an indispensable household item and watching television program had become a favourite past time activity. With the support of this notion, Media Guide (2004) had identified that television is the most popular as it is able to reach 96% of adult population that aged 15 years old and above among the media available in Malaysia.

Although the rapid proliferation of broadcaster and television channels in the past ten years bodes well for both viewers as well as for local production houses, broadcasting industry has always been in control by the government. For years, ASTRO had held a monopoly on the Malaysian satellite television scene. In order to watch a variety genre of international programmes, viewers are enquired to subscribe to ASTRO. However, with the emergence of the TVRO satellite system, viewers are able to watch programmes without subscribing.

Hence, the purpose of this study is to investigate the satisfaction factors of satellite television usage using the TVRO system through identifying the significant variables that contribute in to the viewers' perspective on satellite television system, TVRO in the state of Sabah.

2 LITERATURE REVIEW

Jagdish & Kosta (2009) had designed an antenna feed (parabolic dish antenna) with prime concern for the growing conjunction in the mobile networks. Where high directivity and high power density were needed, the parabolic antaenna using the horn feed had evolved as a useful device for point-to-point communications. Different frequency band performance ranging between 4.8 GHz to 5.9 GHz having horn feed, had worked well for the parabolic reflector antenna. Parabolic dish anrtenna is the most commonly and widely used in satellite and radar communication.

The emergence of satellite television with unlicensed satellite reception using TVRO dishes had sprouted in Malaysia especially in the East. With the illegal decoder which cost about RM 450 to RM 900, it comes with a standard viewing package, consumers are able to watch a variety of programmes in different fields like entertainment, news, sports and so forth illegally. With the purchase of the illegal decoder just once, viewers are able to watch programs received by satellite for free. According to Oliver and Ramzah (2011), observations on the ground showed that Sabah can be safely assumed to be one of the states with the highest number of unlicensed TVRO users and this phenomenon has been persistent in Sabah since 1970s (Syed Agil & Azizah, 2007).

3 METHODOLOGY

3.1 Data Collection

This study was carried out in two regions viz., 25 residential areas around the city of Kota Kinabalu and in the district of Keningau, in Sabah, Malaysia, as shown n Figure 1, where TV satellite programmes using TVRO could be received. Using questionnaires, 206 respondents in Kota Kinabalu were collected. The questionnaires comprised of two sections of 192 items where Section 1 represented the items on the receivability rate and IT awareness, while Section 2 items were on respondents' profiles and approaches.

3.2 Multiple Regression (MR) Technique

According to Devore (2012), multiple regression (MR) is an extension of the simple linear regression consisting of two or more independent variables $(W_1, W_2, W_3, ..., W_k)$ relating to the dependent variable (Y). The general MR equation is as shown in equation (1.0) and is given as: $\mathrm{Y} = \Omega_0 + \Omega_1 \mathrm{W}_1 + \Omega_2 \mathrm{W}_2 + ... + \Omega_k \mathrm{W}_k + \mathrm{u}$ ....(1.0) where *Y* is the dependent variable, W_j is the j-th independent variable, Ω_0 is the constant regression coefficient, Ω_k is the k-th regression coefficient of independent variable W_j, u is the random residuals and *k* is the number of independent variables where *j =1, 2, …, k.* All these variables were categorical or qualitative; hence, each independent variable would be accompanied by a corresponding dummy variable denoting the satisfaction factors related to the satellite TV usage (Noraini *et al*., 2014).

3.3 Data Cleaning and Filtering

Data cleaning has to be done on corrupted data, information with missing values, data with inappropriate information and etc. with the intention to improve the database (Dasu & Johnson, 2003). Several criteria for doing so have been suggested by Ballou & Tayi (1999) which were namely for: accuracy, integrity, completeness, reliability, consistent, uniformity, confidence and unique.

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Modelling processes developed would include data sampling, data filtering and rescaling, variable selection using factor analysis, variable transformation into dummies and finally model-building procedures to obtain the best model. Data cleaning and filtering would involve two stages, i.e. filtering through column by column and row by row methods. Information which had no numerical values, data with similar categories and unexplained data, such as data with negative values would have to be removed. Errors during model building can hence be reduced and consequently, the misinterpretation of the model's outcome can be avoided.

3.4 Factor Analysis and Statistical Tests

According to Huck (2012), factor analysis is a statistical procedure performed to reduce the number of variables in a data set besides relating their relationships. While according to Hair *et al.* (1995), factor analysis is a statistical method which is part of the multivariate analysis. Its main objective is to identify the basic structure in a data matrics; thus the corelations between the variables known as factors. However, Zainodin *et al*. (2011) has considered factors as variables. There were 17 variables that could be used as independent variables in this study.

The number of possible models without interactions can be calculated using the following formula: $N = \sum_{j=1}^{q} C_j^q$ … (2.0) where '*q*' is the number of independent variables and *j=1,2,…q*. In this paper, q=3, hence, the total models without interactions are: $N = C_1^3 + C_2^3 + C_3^3 = 7$ models … (3.0). Gujarati & Porter (2009) had implicated that the number of observations (n) has to be greater than the number of parameters (np) so as to satisfy the regression assumptions. Zainodin *et al.* (2014) had shown the formula used to calculate the number of parameters which thus imply the appropriateness of a regression model.

3.5 Model-Building

Zainodin *et al.* (2011) had shown the four phases in model-building while the multicollinearity remedial techniques and coefficient test on variables with absolute correlation coefficients more than 0.95 (i.e.$|r|\geq 0.95$) had been carried out as in Noraini & Zainodin (2013). The coefficient test of the multiple regression models was carried out to remove any insignificant factors which will have p-values greater than 0.05 (Zainodin *et al*., 2014). The removals of insignificant factors were carried out until the factors that remain would have all the p-values were less than 0.05. The best model was then chosen from the selected models that remained based on the Eight Selection Criteria (8SC) (Ramanathan, 2002).The model which had most of the minimum of the selection criteria would be chosen as the best model.

4 RESULTS AND DISCUSSIONS

Initially, there were 206 respondents who had participated in this research in Kota Kinabalu; however, only 148 respondents who had fully answered the questionnaires would qualify for further factor analysis to be carried out. There were 192 items or variables that can be chosen for analysis, and after data cleaning and filtering using the column-by-column, followed by row-by-row methods, only 17 variables had thus remained in the data sets that can be used for further analysis.

Factor analysis was carried out based on the principal components. A 62.7% of the total variance explained for TVRO had resulted in five components with eigen values greater than one being obtained. The KMO-Bartlett tesst were 0.691, while the Bartlett's test of sphericity was also found to be significant for TVRO in Kota Kinabalu.

In this paper, for TVRO the first component containing four factors was chosen for analysis, and was represented by the symbols Y, Q, R and S as shown in Table 1. The factor on satellite TV usage was chosen as the dependent variable (Y), while the other three factors were the independent qualitative variables, namely, satisfaction, motivation and external factors. Each qualitative factor had its own respective transformed dummy variable.

Table 1: Summary and Symbols of Factors on TV Usage in Kota Kinabalu

Factor	Description	Category	Variable
Y: Usage	Satellite TV Usage	Y	Quantitative
W_1=Q :	Q_1 : Satisfaction- Status & Self-pride Q_2: Satisfaction-Entertainment & Tranquility	1=Not Important 2=Less Important	

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Satisfaction $[Y_I=f(Q)]$	Q_3: Satisfaction –Strengthen family ties Q_4: Satisfaction –Increase knowledge on Malaysian issues Q_5: Satisfaction – Increase knowledge on global issues Q_6: Satisfaction – As support to good services Q_7: Satisfaction – Cheap subscripton fee	3=Slightly Important 4=Important 5=Very Important	Qualitative
W_2=R :Motivation $[Y_2=f(R)]$	R_1: Motivation- Family R_2: Motivation- Friends R_3 :Motivation- Promotion of price discounts R_4: Motivation- Normal price of cheap service R_5: Motivation- Negligible film censorship R_6 : Motivation- Transparent and free information R_7 : Motivation-Access to sexual materials R_8 : Motivation- Offer entertainment materials (like sports, arts, games, etc.)	1=Not Important 2=Less Important 3=Slightly Important 4=Important 5=Very Important	Qualitative
W_3=S:External Factors $[Y_3=f(S)]$	S_1:Access- Using internet S_2:Access- Using local newspaper S_3:Access- Using national newspaper S_4:Access- Using house telephone lines S_5: Access- Using moble telephones	1=Not Suitable 2=Less Suitable 3=Slightly Suitable 4= Suitable 5=VerySuitable	Qualitative

Refering to equation (3.0), since there were three independent qualitative or categorical variables (Q,R,S) , hence the total number of models without interactions were 7 models. Table 2 showed all the seven possible models for TVR usage in Kota Kinabalu.

Table 2: All Possible Models on the TVRO Usage in Kota Kinabalu

M1	$M1:Y_1=\Omega_0+\delta_1Q_1+\delta_2Q_2+\delta_3Q_3+\delta_4Q_4+\delta_5Q_5+\delta_6Q_6+\delta_7Q_7+u_1$
M2	$M2:Y_2=\Omega_0+\lambda_1R_1+\lambda_2R_2+\lambda_3R_3+\lambda_4R_4+\lambda_5R_5+\lambda_6R_6+\lambda_7R_7+\lambda_8R_8+u_2$
M3	$M3:Y_3=\Omega_0+\pi_1S_1+\pi_2S_2+\pi_3S_3+\pi_4S_4+\pi_5S_5+u_3$
M4	$M4:Y_4=\Omega_0+\delta_1Q_1+\delta_2Q_2+\delta_3Q_3+\delta_4Q_4+\delta_5Q_5+\delta_6Q_6+\delta_7Q_7+$ $\lambda_1R_1+\lambda_2R_2+\lambda_3R_3+\lambda_4R_4+\lambda_5R_5+\lambda_6R_6+\lambda_7R_7+\lambda_8R_8+u_4$
M5	$M5:Y_5=\Omega_0+\delta_1Q_1+\delta_2Q_2+\delta_3Q_3+\delta_4Q_4+\delta_5Q_5+\delta_6Q_6+\delta_7Q_7+$ $\lambda_1S_1+\lambda_2S_2+\lambda_3S_3+\lambda_4S_4+\lambda_5S_5+u_5$
M6	$M6:Y_6=\Omega_0+\lambda_1R_1+\lambda_2R_2+\lambda_3R_3+\lambda_4R_4+\lambda_5R_5+\lambda_6R_6+\lambda_7R_7+\lambda_8R_8+$ $\lambda_1S_1+\lambda_2S_2+\lambda_3S_3+\lambda_4S_4+\lambda_5S_5+u_6$
M7	$M7:Y_7=\Omega_0+\delta_1Q_1+\delta_2Q_2+\delta_3Q_3+\delta_4Q_4+\delta_5Q_5+\delta_6Q_6+\delta_7Q_7+$ $\lambda_1R_1+\lambda_2R_2+\lambda_3R_3+\lambda_4R_4+\lambda_5R_5+\lambda_6R_6+\lambda_7R_7+\lambda_8R_8+$ $\lambda_1S_1+\lambda_2S_2+\lambda_3S_3+\lambda_4S_4+\lambda_5S_5+u_7$

Taking model M4:[f (Q,R)] for illustrative purposes:

$$\begin{aligned}M4:Y_4=\Omega_0&+\delta_1Q_1+\delta_2Q_2+\delta_3Q_3+\delta_4Q_4+\delta_5Q_5+\delta_6Q_6+\delta_7Q_7+\\&\lambda_1R_1+\lambda_2R_2+\lambda_3R_3+\lambda_4R_4+\lambda_5R_5+\lambda_6R_6+\lambda_7R_7+\lambda_8R_8+u_4\end{aligned} \quad \text{……..........(4.0)}$$

where *Y* as the dependent variable on satellite TV usage, Q_j are the j^{th} independent variables of factors on ‘Satisfaction’ with *j=1,2,…,7*, and R_j are the j^{th} independent variables of factors on ‘Motivation’ with *j=1,2,…,8.* The j^{th} regression coefficients were given by δ_j and λ_j for the independent variables, Q_j and R_j respectively.

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The random error was given by ‘u_j’, and ‘k_j’ is the total number of independent categorical variables with respect to each factor for $j = 1, 2, \ldots, k$.

The presence of multicollinearity in the models could be identified when there exists absolute correlation coefficients greater than 0.95. The highest absolute correlation value between the independent variables will be subsequently removed as shown by Noraini and Zainodin, 2013. Next, the coefficient test was performed on all the models that had undergone the multicollinearity remedial test. Using model M5.0.0 for illustration purposes on the coefficient test, Table 3 showed that factor S_4 has the highest p-value of 0.979. Hence, factor S_4 was removed from model M5.0.0 and the model was then rerun to become model M5.0.1.

Table 3: Coefficient Test of Model M5.0.0

Model M5.0.0	Unstandardized Coefficients		Standardized Coefficients	t	P- value
	B	Standardized Error	Beta		
(Constant)	12.894	1.050		12.285	0.000
Q1	0.523	0.456	0.069	1.147	0.254
Q2	-0.916	0.501	-0.116	-1.828	0.070
Q3	0.576	0.533	0.069	1.080	0.282
Q4	6.763	1.501	0.601	4.507	0.000
Q5	-2.875	1.790	-0.231	-1.606	0.111
Q6	0.354	1.213	0.027	0.292	0.771
Q7	4.007	1.191	0.296	3.364	0.001
S1	0.447	0.546	0.059	0.819	0.414
S2	0.277	0.731	0.031	0.379	0.705
S3	1.215	0.550	0.166	2.210	0.029
S4	-0.012	0.463	-0.002	-0.026	0.979
S5	1.310	0.986	0.092	1.329	0.186

Table 4 showed that factor Q_6 in model M5.0.1 has the highest p-value of 0.771. Hence, factor Q_6 was removed and model M5.0.1 was then rerun to then become model M5.0.2.

Table 4: Coefficient Test of Model M5.0.1

Model M5.0.1	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	B	Standardized Error	Beta		
(Constant)	12.895	1.045		12.343	0.000
Q1	0.521	0.449	0.069	1.161	0.248
Q2	-0.916	0.499	-0.116	-1.837	0.068
Q3	0.577	0.529	0.069	1.091	0.277
Q4	6.763	1.495	0.601	4.523	0.000
Q5	-2.874	1.783	-0.231	-1.612	0.109
Q6	0.352	1.206	0.027	0.292	0.771
Q7	4.008	1.187	0.296	3.377	0.001
S1	0.447	0.544	0.059	0.822	0.413
S2	0.275	0.723	0.031	0.380	0.705
S3	1.212	0.537	0.166	2.257	0.026
S5	1.305	0.967	0.092	1.349	0.180

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Table 5 showed that factor S_2 in model M5.0.2 has the highest p-value of 0.718. Hence, factor S_2 was removed and model M5.0.2 was then rerun to become model M5.0.3.

Table 5: Coefficient Test of Model M5.0.2

Model M5.0.2	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	B	Standard Error	Beta		
(Constant)	12.939	1.031		12.556	0.000
Q1	0.530	0.446	0.070	1.188	0.237
Q2	-0.907	0.496	-0.115	-1.828	0.070
Q3	0.558	0.523	0.067	1.067	0.288
Q4	6.756	1.490	0.600	4.535	0.000
Q5	-2.742	1.719	-0.220	-1.595	0.113
Q7	4.200	0.985	0.310	4.265	0.000
S1	0.438	0.541	0.058	0.809	0.420
S2	0.260	0.719	0.030	0.362	0.718
S3	1.231	0.531	0.169	2.319	0.022
S5	1.303	0.964	0.092	1.352	0.179

Table 6 showed that factor S_1 in model M5.0.3 has the highest p-value of 0.299. Hence, factor S_1 was removed and model M5.0.3 was then rerun to become model M5.0.4.

Table 6: Coefficient Test of Model M5.0.3

Model M5.0.3	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	B	Standardized Error	Beta		
(Constant)	12.959	1.026		12.632	0.000
Q1	0.534	0.444	0.071	1.203	0.231
Q2	-0.922	0.493	-0.116	-1.871	0.064
Q3	0.585	0.516	0.070	1.132	0.260
Q4	6.761	1.485	0.601	4.553	0.000
Q5	-2.742	1.714	-0.220	-1.600	0.112
Q7	4.174	0.979	0.309	4.263	0.000
S1	0.516	0.495	0.068	1.042	0.299
S3	1.320	0.470	0.181	2.810	0.006
S5	1.393	0.929	0.098	1.501	0.136

Table 7: Coefficient Test of Model M5.0.4

Model M5.0.4	Unstandardized Coefficients		Standardized Coefficients	T	P-value
	B	Standardized Error	Beta		
(Constant)	12.960	1.026		12.629	0.000
Q1	0.602	0.440	0.080	1.370	0.173
Q2	-0.939	0.493	-0.119	-1.907	0.059
Q3	0.507	0.511	0.061	0.992	0.323
Q4	6.512	1.466	0.579	4.442	0.000
Q5	-2.363	1.675	-0.190	-1.410	0.161
Q7	4.184	0.979	0.309	4.273	0.000
S3	1.505	0.435	0.206	3.463	0.001
S5	1.570	0.913	0.110	1.719	0.088

Table 7 showed that factor Q_3 in model M5.0.4 has the highest p-value of 0.323. Hence, factor Q_3 was removed and model M5.0.4 was then rerun to become model M5.0.5.

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Table 8 showed that factor Q_5 in model M5.0.5 has the highest p-value of 0.184. Hence, factor Q_5 was removed and model M5.0.5 was then rerun to become model M5.0.6.

Table 8: Coefficient Test of Model M5.0.5

Model M5.0.5	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	B	Standard Error	Beta		
(Constant)	13.035	1.023		12.739	0.000
Q1	0.611	0.440	0.081	1.390	0.167
Q2	-0.792	0.470	-0.100	-1.686	0.094
Q4	6.499	1.466	0.578	4.433	0.000
Q5	-2.228	1.670	-0.179	-1.334	0.184
Q7	4.254	0.977	0.314	4.356	0.000
S3	1.497	0.435	0.205	3.445	0.001
S5	1.612	0.912	0.113	1.767	0.079

Table 9 showed that factor Q_2 in model M5.0.6 has the highest p-value of 0.100. Hence, factor Q_2 was removed and model M5.0.6 was then rerun to become model M5.0.7.

Table 9: Coefficient Test of Model M5.0.6

Model M5.0.6		Unstandardized Coefficients		Standardized Coefficients	t	P-value
		B	Standard Error	Beta		
	(Constant)	12.605	0.974		12.943	0.000
	Q1	0.727	0.432	0.097	1.682	0.095
	Q2	-0.779	0.471	-0.098	-1.655	0.100
	Q4	4.859	0.801	0.432	6.068	0.000
	Q7	3.782	0.913	0.280	4.143	0.000
	S3	1.426	0.432	0.195	3.296	0.001
	S5	1.935	0.882	0.136	2.195	0.030

Table 10 showed that factor Q_1 in model M5.0.7 has the highest p-value of 0.166. Hence, factor Q_1 was removed and model M5.0.7 was then rerun to become model M5.0.8.

Table 10: Coefficient Test of Model M5.0.7

Model M5.0.7	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	B	Standard Error	Beta		
(Constant)	12.505	0.978		12.787	0.000
Q1	0.594	0.427	0.079	1.391	0.166
Q4	4.712	0.801	0.419	5.885	0.000
Q7	3.596	0.911	0.266	3.945	0.000
S3	1.529	0.431	0.210	3.553	0.001
S5	1.704	0.876	0.120	1.946	0.054

Table 11 showed that factor S_5 in model M5.08 has the highest p-value of 0.066. Hence, factor S_5 was removed and model M5.0.8 was then rerun to become model M5.0.9.

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Table 11: Coefficient Test of Model M5.0.8

Model M5.0.8		Unstandardized Coefficients		Standardized Coefficients	t	P-value
		B	Standard Error	Beta		
	(Constant)	12.661	0.975		12.991	0.000
	Q4	4.628	0.801	0.411	5.778	0.000
	Q7	3.791	0.904	0.280	4.196	0.000
	S3	1.499	0.431	0.206	3.475	0.001
	S5	1.626	0.877	0.114	1.854	0.066

Table 12 showed that all the factors in model M5.09 have the p-values of less than 0.05. Hence, model M5.0.9 was then said to be a model without multicollinearity and insignificant variables.

Table 12: Coefficient Test of Model M5.0.9

Model M5.0.9		Unstandardized Coefficients		Standardized Coefficients	t	P-value
		B	Standard Error	Beta		
	(Constant)	13.769	0.776		17.736	<0.000
	Q4	5.125	0.761	0.456	6.734	<0.000
	Q7	3.655	0.908	0.270	4.025	<0.000
	S3	1.644	0.428	0.225	3.843	<0.000

Subsequent nine removals of insignificant variables (S_4, Q_6, S_2, S_1, Q_3 , Q_5 , Q_2, Q_1 and S_5) had been carried out on model M5.0.9. Referring to model labelling (Zainodin *et al.,* 2011; Noraini & Zainodin, 2013), model M5.0.9 thus indicated there was null multicollinearity source variable and nine insignificant variables had been removed. The elimination process can be given as:

M5.0.1=> M5.0.2=> M5.0.3=> M5.0.4=> M5.0.5=> M5.0.6=> M5.0.7=> M5.0.8=> M5.0.9.

It can be seen in Table 12 that the significant factors that remained in the model had all their p-values being less than 0.05. These modelling procedures were illustrated in detail in Zainodin *et al.* (2011) and Noraini & Zainodin (2013). Remedials and model-building phases were performed so that the models that remained were free from multicollinearity and insignificant factors. All the possible 7 models had undergone the statistical tests in the methodology section. Table 13 showed the selected models on the TVRO usage in Kota Kinabalu.

Table 13: Selected Models on TVRO Usage	
M1.0.5	$\widehat{Y}_1 = \Omega_0 + \delta_4 Q_4 + \delta_7 Q_7$
M2.0.5	$\widehat{Y}_2 = \Omega_0 + \lambda_1 R_1 + \lambda_3 R_3 + \lambda_5 R_5$
M3.0.3	$\widehat{Y}_3 = \Omega_0 + \lambda_3 S_3 + \lambda_5 S_5$
M4.0.10	$\widehat{Y}_4 = \Omega_0 + \delta_4 Q_4 + \delta_6 Q_6 + \delta_7 Q_7 + \lambda_3 R_3 + \lambda_5 R_5$
M5.0.9	$\widehat{Y}_5 = \Omega_0 + \delta_4 Q_4 + \delta_7 Q_7 + \lambda_3 S_3$
M6.0.9	$\widehat{Y}_6 = \Omega_0 + \lambda_3 R_3 + \lambda_5 R_5 + \lambda_3 S_3 + \lambda_5 S_5$
M7.0.14	$\widehat{Y}_7 = \Omega_0 + \delta_2 Q_2 + \delta_4 Q_4 + \delta_6 Q_6 + \delta_7 Q_7 + \lambda_5 R_5 + \lambda_5 S_5$

Finally the best model was chosen based on the model having the majority of the least values of the eight selection criteria (8SC)(Ramanathan, 2002) as shown in Table 14. It can be seen from the table that the best model was model 7.0.14.

Table 14: Best Model Based on Eight Selection Criteria (8SC)

Model	R^2	(k+1)	SSE	n	AIC	FPE	GCV	HQ	RICE	SCHWARZ	SGMASQ	SHIBATA
M1.0.5	0.494	3	863.037	148	6.072	6.073	6.075	6.224	6.077	6.452	5.951	6.067
M2.0.5	0.462	4	917.696	148	6.545	6.545	6.549	6.764	6.554	7.097	6.372	6.535
M3.0.3	0.236	3	1303.922	148	9.175	9.175	9.178	9.404	9.182	9.749	8.992	9.167
M4.0.10	0.624	6	641.752	148	4.702	4.703	4.710	4.940	4.718	5.309	4.519	4.687
M5.0.9	0.541	4	782.740	148	5.583	5.583	5.586	5.769	5.591	6.053	5.435	5.574
M6.0.9	0.524	5	813.158	148	5.878	5.879	5.885	6.125	5.892	6.504	5.686	5.865
M7.0.14	0.647	7	602.193	148	4.472	4.473	4.482	4.737	4.493	5.153	4.270	4.453

Model M7.0.14 can be given by the equation in (6.0):

$$M7.0.14:\widehat{Y}_7 = \Omega_0 + \delta_2 Q_2 + \delta_4 Q_4 + \delta_6 Q_6 + \delta_7 Q_7 + \lambda_5 R_5 + \lambda_5 S_5 \quad \text{...(5.0)}$$

Substituting the values of the regression coefficients, equation (5.0) then becomes:

$$M7.0.14:\widehat{Y}_7 = 10.951 - 0.986Q_2 + 3.960Q_4 - 2.582Q_6 + 4.826Q_7 + 5.120R_5 + 2.515S_5 \quad \text{................(6.0)}$$

Substituting the original representation of the research factors into equation (6.0), the best model M7.0.14 is implicated by: Y = Satellite TVRO usage

Q_2 = Satisfaction Factor: Entertainment and tranquility
Q_4 = Satisfaction Factor: Increase knowledge on Malaysian issues
Q_6 = Satisfaction Factor: As support to good services
Q_7 = Satisfaction Factor: Cheap subscripton fee
R_5 = Motivation Factor: Negligible film censorship
S_5 = External Factor: Using mobile phones

The goodness-of-fit tests were then carried out on the best model M7.0.14 using the run test and the normality test. With the 2-tailed asymptote value of 0.339, this implied that the model was random. The normality test based on the Kolmogorov-Smirnov statsitics gave a value of 0.241 with a p-value of less than 0.05 hence indicating that the model was normal.

Equation (6.0) implied that the satellite TVRO usage was significantly affected by four satisfaction factors, a motivation factor and an external factor in the best model of M7.0.14. These relevant factors were those that were negatively related with entertainment and tranquility and as support to good services. On the other hand, the satellite TVRO usage was also positively related with the increase in knowledge on the Malaysian issues, the current cheap subscription fee, the negligible film censorship on the films shown and the influence of mobile phones used during media communication regarding the programmes available on the satellite TVRO channels.

5 CONCLUSION

This paper had thus introduced the concept and procedures in mathematical modelling using the multiple regression technique so as to identify significant factors that affect the satellite TV usage in Kota Kinabalu. Significant factors can be represented as in the best model of M7.0.14:

$$M7.0.14:\widehat{Y}_7 = 10.951 - 0.986Q_2 + 3.960Q_4 - 2.582Q_6 + 4.826Q_7 + 5.120R_5 + 2.515S_5$$

where, Y is Satellite TVRO usage; Q_2 is the satisfaction factor on entertainment and tranquility; Q_4 is the satisfaction factor on the Increase in knowledge on Malaysian issues; Q_6 is the satisfaction factor on the support to good services; Q_7 is the satisfaction factor on cheap subscripton fee; R_5 is the motivation factor on the negligible film censorship and lastly, S_5 is the external factor on the influence of using mobile phones for media communication. These factors give positive and negative impacts on the satellite TV usage in Kota Kinabalu. Increased usage using TVRO channels can thus be forecasted and its implications on the social and economic impacts as well as on the future political scenarios in the state of Sabah can be further explored and discussed.

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