Psychological models for development of motorcycle helmet use among students in Vietnam

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Abstract. A helmet can reduce head accident severity. The aim of this research study was to study the intention for helmet use of students who ride motorcycles in Vietnam, by Structural Equation Modeling (SEM). Questionnaires developed by several traffic psychology modules, including the Theory of Planned Behaviour (TPB), Traffic Locus of Control (T-LOC), and Health Belief Model (HBM), were distributed to students at Ton Thang University and University of Architecture, Ho Chi Minh City. SEM was used to explain helmet use behaviour. The results indicate that TPB, T-LOC and HBM could explain the variance in helmet use behaviour. However, TPB can explain behaviour (helmet use intention) better than T-LOC and HBM. The outcome of this study is useful for the agencies responsible to improve motorcycle safety.

Keyword: Helmet use, Motorcyclist, Traffic psychology, Structural Equation Modeling.

1. Introduction

Most prevention research has identified that helmets can reduce head injuries and reduce the chance of death [1], so wearing a helmet is a behaviour that should be observed when driving a motorcycle on the road. Most of the world has law enforcement about helmets for drivers. Vietnam is one country that has been successful in helmet law enforcement with a high helmet wearing rate. In addition to law enforcement, a campaign is an alternative that supports helmet use behaviour. According to the last studies on helmets in Ho Chi Minh City, Vietnam, traffic psychology factors (Subjective Norm and Perceived Behavioural Control etc.) have been associated with helmet use [2]. However, there is still a few of relating studies. Studies of traffic safety factors (TPB, HBM and T-LOC) tend to the creation of more effective campaign measures, and when done simultaneously with stronger traffic law enforcement, this will lead to a sustainable behaviour of helmet use. The aim of this research is to study the relationship between helmet use intention factor and other psychological factors by using the Traffic Locus of Control (T-LOC), Theory of Planned Behaviour model (TPB), Health Belief Model (HBM), on riders' behaviour toward helmet use.

2. Psychological Models and Hypotheses

Locus of Control (LC) was used to test our first model [3-4]. In this study, the LC model is composed of two elements which are internal and external LC belief modulation (see Fig.1) [4]. Internal LC indicates that events, such as accidents, are the result of someone's actions which can be controlled. On the other hand, external Traffic Locus of Control (T-LOC) orientation indicates that the events cannot

be controlled by anyone. [5] Technically, it is easier to motivate people to use helmets associated with internal beliefs rather than external beliefs, because the belief of one's control has a direct correlation to the conscious decision to use a helmet to reduce risks of injuries from a crash.

As described in Fig.2, TPB states the reason for a person's intention to have certain behaviors. A person's attitude and subjective norms determine the behavioral intention. Attitudes are a person's behavioral evaluations such as thoughts about the benefit of using helmets [6-7]. On the other hand, subjective norms, composed of beliefs, also concern other people's beliefs [4, 8].

Threat perception and behavioral evaluation (see Fig. 3) are the two angles of health behavior that the HBM [4, 9] focuses on. There are two elements of threat perception which are delicateness of a cycling crash and anticipated severity of a crash's consequence, such as the possibility of getting a head injury. Based on the aforementioned literature review, the following are our study of the T-LOC model, TPB model and HBM model and our hypotheses are shown in Figures 1, 2 and 3. Therefore, we employ the T-LOC to explain the intention of helmet use. Accordingly, we propose the following hypotheses:

H_1: Internal variables are positively related to the intention of helmet use.

H_2: External variables are positively related to the intention of helmet use.

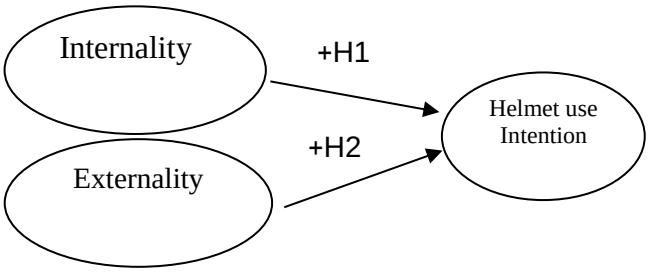

Figure 1. Traffic Locus of Control (T-LOC) framework.

We employ TPB to explain the intention of helmet use and helmet use behaviour. Accordingly, we propose the following hypotheses:

H_3: An Intention variable is positively related to the helmet use behavioural variable

H_4: An Attitude variable is positively related to the intention of helmet use.

H_5: A Subjective norm variable is positively related to the intention of helmet use.

H_6: A Perceived behavioural control variable is positively related to the intention of helmet use.

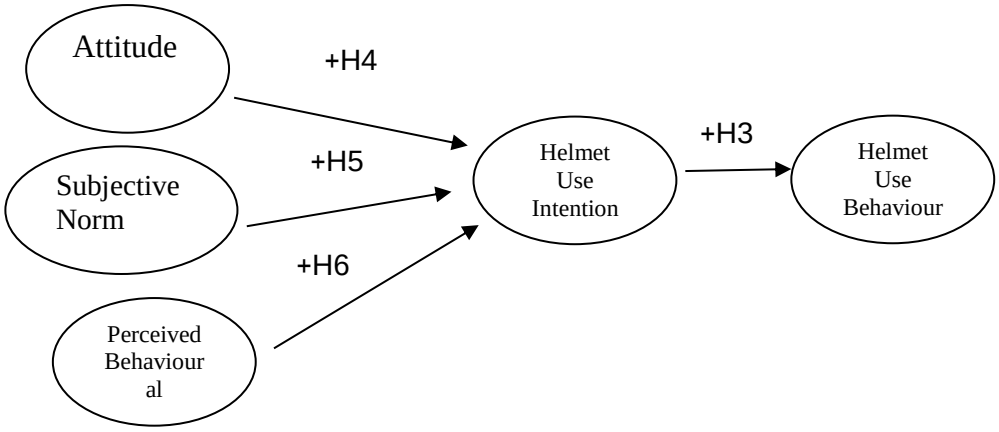

Figure 2. Theory of Planned Behavior model (TPB) framework.

Also, we employ the HBM to explain the intention of helmet use. Accordingly, we propose the following hypotheses:

H_7: A Perceived susceptibility variable is positively related to the intention of helmet use.

H_8: A Perceived severity variable is positively related to the intention of helmet use.

H_9: A Perceived benefits variable is positively related to the intention of helmet use.

H_{10}: A Perceived barriers variable is negatively related to the intention of helmet use.

H_{11}: A Motivation variable is positively related to the intention of helmet use.

H_{12}: A Cues to action variable is positively related to the intention of helmet use.

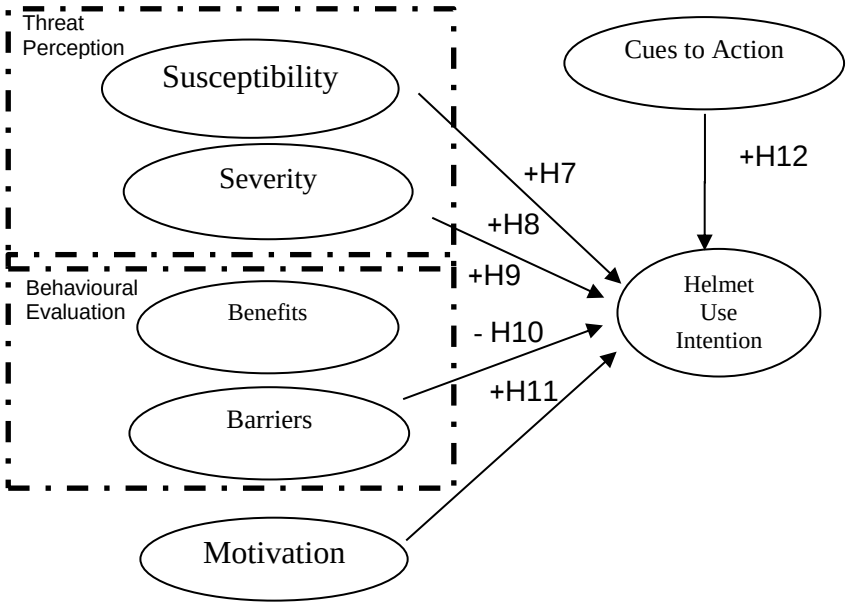

Figure 3. Health Belief Model (HBM) framework.

3. Methodology

3.1. Data collection and measures

Face-to-face interview where given to students for data collection. All of the total of 250 respondents were involved in this study survey. The time for an interview was about 10 min. The object of this study was to explore helmet use behaviour among students. The final sample size in this study was 210 (male = 104, female = 106). From the descriptive study, students were aged 17 to 28 years old (Average = 20 years old). Student riders had average experience of 3.8 (2.3) years. However, more than 70% of them had a motorcycle license and more than 90% of them had a motorcycle helmet. Table 1 shows the measurement items and scales. This study developed the psychological questionnaires examining behaviour using T-LOC, TPB and HBM as a frame of reference.

Table 1. Variables, Concepts of the Items and Scales

Variables	Items	Alpha	Example of item	Scoring
Traffic Locus of Control (T-LOC)				
Internality	2	0.26	I can reduce my accident risk.	1=Strongly Disagree /5 =Strongly Agree
Externality	2	0.31	Accidents depend mostly on shortcomings in other drivers' driving skills.	1=Strongly Disagree /5 =Strongly Agree
Theory of Planned Behavior model (TPB)				

Intention	2	0.61	For the next 3 months, I will wear a helmet when driving...	1=Strongly Disagree/ 5 =Strongly Agree
Behavioural	1	-	How often do you wear a helmet in the city?	1=Never/5= Always
Subjective Norm	2	0.79	People who are important to me think that I should wear a helmet.	1=Strongly Disagree/ 5 =Strongly Agree
Perceived Behavioral Control	2	0.53	I believe I have the ability to wear a helmet.	1=Strongly Disagree/ 5 =Strongly Agree
Attitude	3	0.73	Wearing a helmet is:	1=Bad/5= Good
Health Belief Model (HBM)				
Perceived benefits	2	0.50	Wearing a helmet protects me from getting a head injury in an accident**.**	1=Strongly Disagree/ 5 =Strongly Agree
Perceived severity	2	0.49	Being injured in an accident due to not wearing a helmet could lead to long term health problems, costs and income losses.	1=Strongly Disagree/ 5 =Strongly Agree
Perceived barriers	1	-	Wearing a helmet is uncomfortable when it is hot.	1=Strongly Disagree/ 5 =Strongly Agree
Health motivation	1	-	Nothing is as important as good health.	1=Strongly Disagree/ 5 =Strongly Agree
Perceived susceptibility	1	-	My probability of having an accident in the next 3 months is very small.	1=Strongly Disagree/ 5 =Strongly Agree
Cues to action	1	-	If more people would wear a helmet, then I would also wear a helmet more often.	1=Strongly Disagree/ 5 =Strongly Agree

3.2 Data analysis

The analysis of the results was divided into two parts (Adapted from the step study from Tankasem et al. (2016)) [10-11]. Overall, the model fit was evaluated against the number of recommended fit statistics and fit indices based on Hair et al. (2010) [12]. The first analysis was a factor analysis on latent variables given by questionnaire. Reliability of the latent variables was analyzed by three indices including Cronbach's α (Alpha). All variables were analyzed based on a hypothetical model, based on T-LOC, TPB and HBM, by confirmatory factor analysis (CFA). The final part used Structural Equation Modeling (SEM) to analyze all variables.

4. Results and Discussions

We present the indexes in the Structural Equation Model and factors influencing the indexes with standardized path coefficients. The most often indicated number of recommended statistics and indices in Table 2 are fitted for the SEM based on Hair et al. (2010) [12]. Therefore, the model fits between the theoretical constructs and observation constructs.

Figures 4, 5 and 6 show the results of structural models with standardized path coefficients for T-LOC model, TPB model and HBM model, respectively. Only the TPB model's fit passes a number of recommended fit indices.

Table 2. Explanatory power and fit index of models.

Model fit	**Recommended value**	**Model T-LOC**	**Model TPB**	**Model HBM**
$\chi 2$		13.063	46.927	39.368
df		7	22	29
Chi-square/df	< 3.0	1.866	2.133	1.357
GFI	> 0.90	0.981	0.956	0.963
CFI	> 0.90	0.913	0.953	0.950
RMSEA	< 0.08	0.064	0.074	0.041

Note: The *p*-value is sensitive to sample size > 200

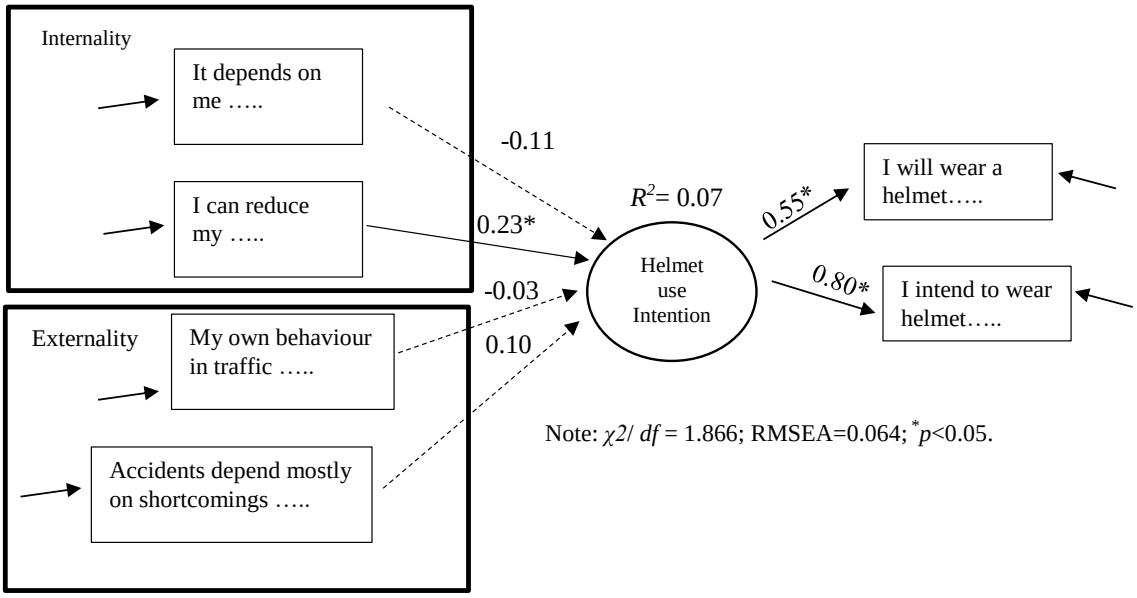

Figure 4. T-LOC model structure

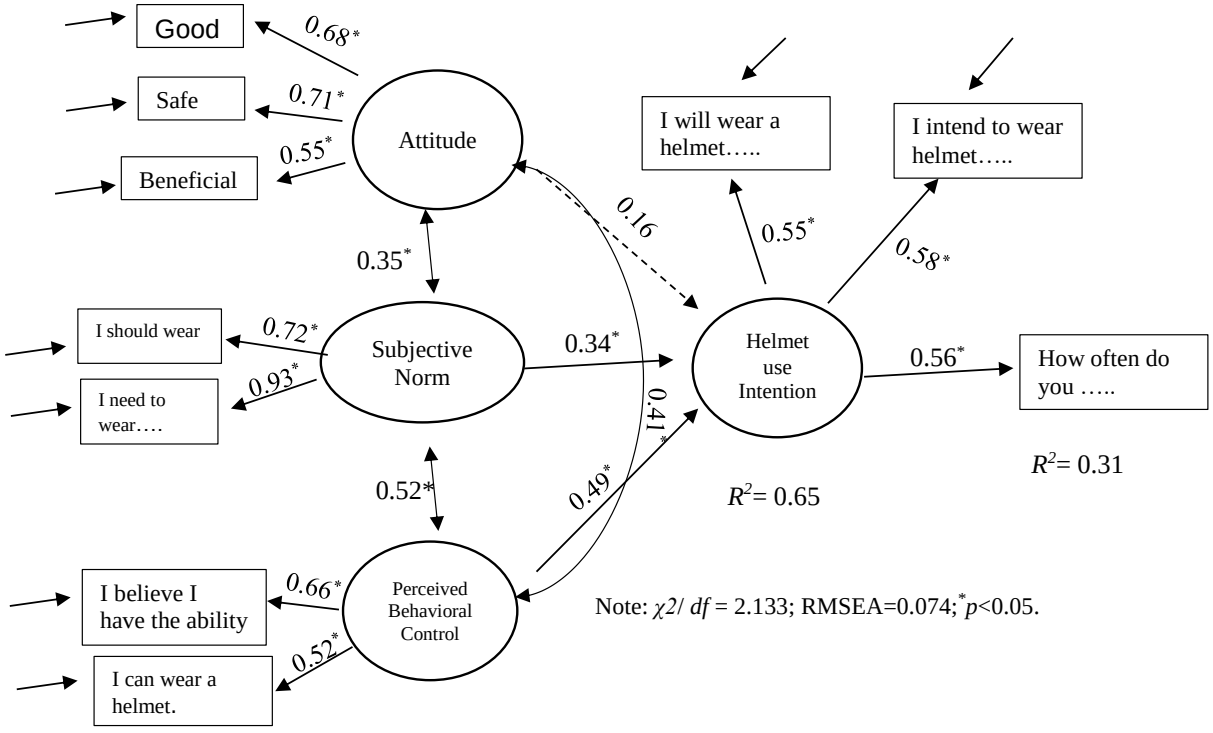

Figure 5. TPB model structure

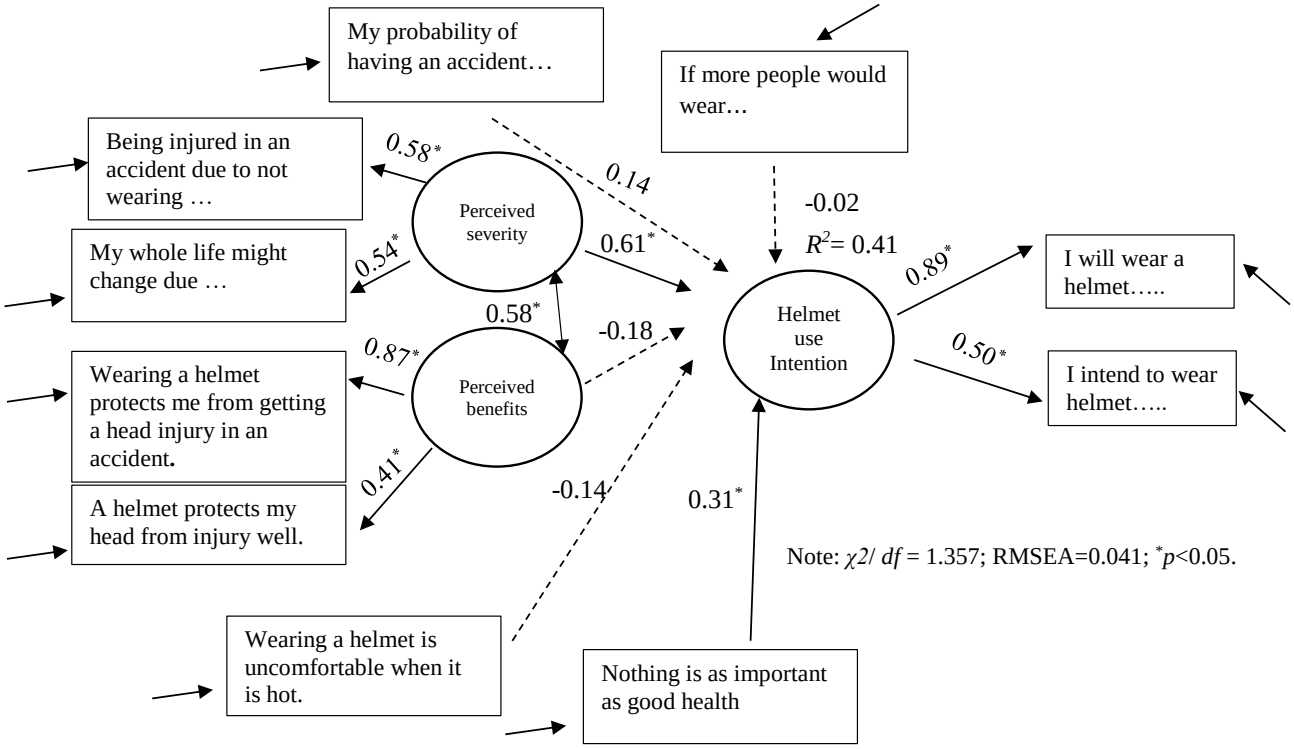

Figure 6. HBM model structure

These results confirm the hypothesis H_1 that for the psychological factors of T-LOC, the Internality factor is positively and significantly correlated with the helmet use Intention factor at the 95% confidence level. The measurement strategies for LC are general orientations in life or a particular domain limitation. Because general LC explains low variance in the amount of health behaviour, scales of particular domains have been improved [8, 4]. Multidimensional Health Focus of Control scale or MHLC, developed by Wallston et al. (1978), has been used the most as an instrument to measure the control of the health locus. [4] We discovered that MHCL is too broad, so we used the T-LOC measure for the motorcyclist's situation (Fig.4).

In this TPB study, these results confirm the hypotheses (H_4 and H_5) that the psychological factors of TPB, Subjective Norm factor and Perceived Behavioural Control factor are positively and significantly correlated with the helmet use Intention factor at the 95% confidence level (Fig. 5). According to TPB, the third Intention predictor is created by perceived behavioural control; this refers to one's insight about whether a behaviour is easy or difficult. [4, 6-8] A similar conclusion was reported by Brijs et al. (2014); Kumphong et al. (2017).

In the results of the Health Belief Model (HBM**)**, these results confirm the hypotheses (H_8 and H_{11}) that the psychological factors of HBM (Fig.6), Perceived severity factor and Health motivation factor are positively and significantly correlated with the helmet use Intention factor at the 95% confidence level. Threat Perception is composed of two different belief sets related to perceived severity, such as "Being injured in an accident due to not wearing a helmet could lead to long term health problems, costs and income losses" to the use of helmet, as well as advantages like safety. Moreover, the HBM also includes cues to action and health motivation. "Health motivation" cites the stimulus of one to wear a helmet, while health motivation means someone is ready to worry about health [4, 16]. Health motivation is not only for cycling but determines the value that someone gives to safety and health. In this study the TPB could better explain behaviour than T-LOC and HBM.

5. Conclusions

Based on, the objectives of this study are to compare psychological factors influencing the helmet use intentions of motorcycle riders in university under the framework of T-LOC, TPB and HBM. These results confirm the hypothesis that the psychological factors (Internality, Subjective norms, Perceived severity and Perceived behavioral control) of all models have significant relations with the helmet use Intention factor. The TPB model can better explain behaviour than other models. These findings suggest that changing Social attitude, Subjective norms, Perceived severity and Perceived behavioral control for motorcycle riders about helmet use in another country can reduce the rate of fatalities among student motorcyclists.

6. References

[1] World Health Organization 2006 *Helmets :A road safety manual for decision-makers and practitioners* (Geneva: Switzerland)
[2] Trinh T A and Le T P L 2016 Motorcycle Helmet Usage among Children Passengers: Role of Parents as Promoter *Sustainable Development of Civil, Urban and Transportation Engineering Conference* (Procedia Engineering vol 142) pp10-17.
[3] Rotter J B 1966 *Generalized expectancies for internal versus external control of reinforcement* (Psychological Monographs)
[4] Lajunen T and Räsänen M 2004 Can social psychological models be used to promote bicycle helmet use among teenagers? A comparison of the Health Belief Model, Theory of Planned Behavior and the Locus of Control (*Journal of Safety Research* Vol 35) pp 115-123
[5] Warner H W Ozkan T and Lajunen T 2010 Can the traffic locus of control (T-LOC) scale be successfully used to predict Swedish drivers' speeding behaviour? (*Accident Analysis and Prevention* Vol 42) pp 1113–1117
[6] Ajzen I and Fishbein M 1980 *Understanding Attitudes and Predicting Social Behavior* (Prentice-Hall: Inc.: Englewood Cliffs: New Jersey)
[7] Ajzen I 2005 *Attitudes, Personality and behavior* (New York: USA)
[8] Conner M and Sparks P 1996 The Theory of Planned Behaviour and health behaviours *Predicting health behaviour* (Buckingham: Open University Press) pp. 121– 162
[9] Rosenstock I M 1966 *Why people use health services?* (Milbank Memorial Fund Quarterly Vol 44) pp 94– 124
[10] Tankasem P Satiennam T and Satiennam W 2016 Cross-cultural differences in speeding intention of drivers on urban road environments in Asian developing countries (*International Journal of Technology* Vol 7) pp 1187-1195.
[11] Tankasem P Satiennam T and Satiennam W 2016 Psychological factors influencing speeding intentions of car driver and motorcycle riders in urban road environments (*International Journal of Technology* Vol 7) pp 1179-1186.
[12] Hair J F Black W C Babin B J and Anderson R E 2010 *Multivariate Data Analysis a global perspective 7th ed*. (New Jersey: USA)
[13] Wallston, K. A., Wallston, B. S., & DeVellis, R. (1978). Development of Multidimensional Health Locus of Control (MHLC) scales (*Health Education Monographs* Vol 11) pp 160– 170.
[14] Brijs K Brijs T Sann S Trinh T A Wets G and Ruiter R A C 2014 Psychological determinants of motorcycle helmet use among young adults in Cambodia (*Transportation Research Part F Traffic Psychology and Behaviour* Vol 26) pp 273-290
[15] Kumphong J Satiennam T and Satiennam W 2017. A Study of Social Norms and Motorcycle Helmet Use Intentions among Student Riders in University: A comparison of the Theory of Reasoned Action and the Theory of Planned Behavior. *The 12th International Conference of Eastern Asia Society for Transportation Studies* (Sheraton Saigon Hotel & Towers: Ho Chi Minh City: Vietnam)
[16] Becker, M. H., Haefner, D. P., & Maiman, L. A. (1977). The Health Belief Model in the prediction of dietary compliance: a field experiment (*Journal of Health and Social Behaviour* Vol 18) pp 348–366.

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