An investigation of illegal direction change behavior of road users using behavioral models

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Abstract: Illegal direction change is accounted the highest ratio for road accident causes in Hochiminh City, Vietnam. Illegal direction change is examined through separate behavioral models such theory of planned behavior, health belief model and integrated behavior model. Integrated behavior model including health belief model, theory of planned behavior variables and extended socio-cognitive variables is identified to be one of the best model (with the highest percentage of total variance) that is for applying predictive illegal direction behavior not only for HCMC but also for other cities and provinces of Vietnam. The high significant variables of the integrated behavior model as behavioral intention, perceived benefits, subjective norm and perceived severity are selected to propose the appropriate community campaigns of road safety.

Key words: Road User Behavioral Models, Road Accident, Integrated Behavioral Model.

1. INTRODUCTION

Road accidents have caused a huge loss to the society in Vietnam. 880 million USD of economic loss due to road accident in Vietnam (accounting for 2.45% of GDP) was estimated by ADB (2003). This was higher than the average economic loss of Asian countries (2.1% of GDP). In 2007, it estimated about 2.89% of GDP in the Master Plan of Road Safety in Vietnam (MOT, 2007).

Hochiminh city (HCMC) was considered as the place where have had the highest number of accidents, fatalities and injuries (accounting for 9.14% of the country in period of 1999-2009 in Vietnam. However, unfortunately the number of accidents, injuries, and fatalities has fluctuated uncertainly for the last many years.

According to MOT (2007), almost road accidents and deaths have occurred on the highways and urban roads where the traffic is high in volume and highly mixed or the roads quality is better than others. Road users behavior has been identified as the main road safety risk (84%); the error of vehicle was very low taking 1% (HCMC_Statistic-Department, 2009) and the risk due to infrastructure accounted for 15%.

Averagely, the main causes of serious road accident were going on illegal direction change (28%), wrong way (21%), speeding (18%). This has reflected that the illegal changing direction (IDC) behavior has been one of the critical root-cause that has driven the increase of road accident in HCMC.

The differences of topography, weather, ethnic distribution, population and colony create different cultural regions of the North, The Central and The South of Vietnam with specific Regional characteristics. Being considered as a major hub for economic, commerce, finance, tourist, culture and science of Vietnam, Ho Chi Minh City (HCMC) has attracted many immigrants from the whole country (accounting for 1/3) to come to work and live. Therefore, the different people characteristics of HCM people have created the diversified road user' perception.

Studying and researchs of IDC behaviors will surely be helpful for us better to understand the socio-cognitive variables of road users. From this understanding, we can better predict behavioral intention and behavior of road user and to propose the road safety campaigns for increasing the road user perceptions of road safety.

With all above important attributes, IDC behavior in HCMC is chosen by the author to predict behavior intention as well as behavior through the methods of individual theory of planned behavior (TPB), health belief model (HBM) and integrated behavior models (IBM).

2. OBJECTIVES

Essentially, main objective of this research is to investigate what factors among separated behavior models (TPB, HBM) and IBM and any predictive variables would help predict the IDC intention and behavior of road users in Vietnam. In addition, all social - environment variables such as age, gender, occupation, household type, leisure activities of the drivers are included in the model to examine. The predictive variables of IDC behavioral intention and behavior models are used to find common and different social cognitive impacts for risky behavior prediction in HCMC. The Vietnamese habit, characters are examined by the behavioral models to propose suit road safety campaigns, education programs or awareness programs for increasing road safety perception of people in HCMC.

3. THEORETICAL APPROACH

Road traffic safety is caused mainly by driver' behaviors rather than technical failures or environment conditions (Lajunen, Parker et al., 2002; NTSC 2005). Risky driving behavior or traffic violent behavior basically includes self-assertive driving, speeding, rule violations (M. Anthony Machin, 2007), dangerous overtaking (Miguel Angel Recarte, 2002), not checking mirror, overtaking a right turner, going for the wrong switch, racing away from traffic lights. (Lajunen, Parker et al., 2002), dangerous violent, skill errors (Winter and Dodou, 2010), drunk driving (Beullens and Bulck, 2008).

It has been regulated by the Government regulation of No:34/2010/NĐ-CP signed by the Prime Minister (Nguyen_Tan_Dung, 2010) that the IDC behavior includes turning left, turning right, turning around which are explained specifically as following are not permitted:

- ✓ Do not respect priority rights for pedestrian, handicapped, handicapped wheelchair, un-motorized vehicle on their lanes and vehicles on opposite lane;
- ✓ Without turning on signal, light of vehicle;
- ✓ In the pedestrian lane, bridge, under bypass, narrow road, limited seeing of curve, prohibited turn sign;
- ✓ At the intersection between road and railway

In reality, the IDC behaviors has not been found in any researches or studies yet however some topic which have covered dangerous overtaking (Miguel Angel Recarte, 2002),

wrong lane at roundabout/ junction, taking wrong exit from roundabout, failing to notice a cyclist were found as the relation with IDC behaviors (Lajunen, Parker et al., 2002).

With the purpose of understanding what and how drivers have dealed with risky driving behaviors, many studies, researches have concentrated on drivers behaviors through different behavioral models been executed. The researchs also aimed to increase drivers' perception to reduce road accident loss (Rothengatter, 2002; Josep Castellà a, 2004; Eric R. Dahlen, 2005; Victoir, Eertmans et al., 2005; De Pelsmacker and Janssens, 2007; Mette Moller and Gregersen, 2008; Mark A. Elliott, 2010). Some of popular behavioral models which were discussed, applied to examine road user behavior are HBM (Rosenstock, 1974), TPB model (Ajzen, 1991), social-cognitive model (Melinder, 2007), psychosocial function (Mette Moller and Gregersen, 2008).

The extended socio-cognitive variables in the original models were applying widely to predict violation driving intension and behavior (Warner; Letirand and Delhomme, 2005; Mark A. Elliott, 2005; Forward, 2006; Warner and Aberg, 2006; De Pelsmacker and Janssens, 2007; L. Åberg, 2007; Paris and Broucke, 2008; Mark A. Elliott, 2010). IBM were proved its powerful in predictive road user behavior toward helmet wearing behavior and speeding behavior (Trinh , 2013).

3.1 Health Belief Model (HBM)

HBM was proved the helpful road safety model of motivation for taking a positive action to prevent the negative action (speeding, wearing helmet) (CAST, 2009). Three main variables were concerned in the model as perceived evaluation, perceived threat and cues to action (CAST, 2009).

Perceived evaluation consists of perceived benefits and perceived barriers. Perceived benefits is described the advantage when road user do IDC behavior, as "saving time", "giving a feeling of control over vehicles", "making a good impression on others". Perceived barriers is presented the disadvantage (increasing the risk of getting fined) when road user do IDC.

Perceived threat includes perceived susceptibility and perceived severity. Perceived susceptibility is mentioned the chance of getting bad consequences (getting a ticket, damaging vehicle, getting hurt, hurting others) while doing IDC. Perceived severity is clarified the dangerous level of doing IDC.

The last variable of the model is cues to action. This variable mentions the internal information such as supporting higher fine, automatic ticket and external information (supporting the campaign, education programs) to motivate readiness for behavior change (legal direction change).

HBM was applied widely in road safety area to predict different risky driving behaviors (Fernandes, Hatfield et al., 2006; Fernandes and Neves, 2010). HBM variables had not found significant much in predictive the risky behaviors (Sissons-Joshi, Beckett et al., 1994; Quine, Rutter et al., 1998; Lajunen and Räsänen, 2004; Quine, 2006; Ambak, 2010). Perceived benefits was found significant impact to predict intention and behavior of wearing helmet (Quine, 2006; Trinh, 2013), speeding (Trinh, 2013). Perceived susceptibility was identified significant predictor in the wearing helmet behavioral model (Trinh, 2013).

3.2 Theory of Planned Behavior

TPB was extended from the theory of reasoned action and that included five variables in the model such as attitude, subjective norm, perceived behavior control, intention and behavior (CAST, 2009; Armitage and Conner, 2001).

Attitude indicates the cognitive attitude and affective attitude (Eagly and Chaiken, 1993; De Pelsmacker and Janssens, 2007). Road users understand IDC is bad/ dislikable/inacceptable but doing this behavior made them feel exciting/ fun.

Subjective norm is described road user perception from the social pressure (their mother, farther, sister, boy/girl friend…) in the doing IDC.

Perceived behavior control is measured their control level (easy or hard) toward the IDC behavior.

IDC behavioral intention is their personal decision of doing legal direction changing in the next 3 months.

Affective attitude and cognitive attitude, subjective norm and perceived behavioral control were found significantly in lots of the predictive risk traffic models (Parker, Reason et al., 1995; Forward, 2006).

Original HBM are found greater predictive power than original HBM in term of predictive behavioral intention. In the predictive road user behavior model researches, original HBM is showed efficient predictive power than original TPB in wearing helmet behavior on the contrary speeding behavior. IBM was applied in the two other models are proved their predictive power for eliminating disadvantage points and increasing advantage points of original HBM and TPB models (Trinh, 2013).

3.3 Integrated Behavioral Model (IBM)

IBM is a combination among original HBM variables, original TPB variables and extended socio-cognitive variables. IBM is to examine and to predict IDC intention and behavior of Vietnamese. A simplified schematic of IBM is presented in the figure 1.

Similar approach method of the proposed IBM in the Phd thesis (Trinh, 2013), original TPB (cognitive attitude, perceived behavioral control in general, subjective norm, behavioral intention), original HBM variables (perceived evaluation, perceived threat, cues to action) and four more socio-cognitive variables (affective attitude, perceived behavioral control in specific, descriptive norm, personal norm) are inputted in turn to the model.

Perceived behavioral control in specific situations describes the level control (easy/ hard) of road user to do legal direction change in specific situations (in a hurry, all other do IDC).

Descriptive norm was proved as a strong predictor of the behavioral intention models and the behavior models (Rivis and Sheeran, 2003). Descriptive norm shows the frequency of road user in HCMC do the typical behavior (IDC).

Personal norm is a combination of moral value (IDC is irresponsible) and anticipated regret (IDC is intolerable). Personal norm is significant impact to traffic behavior model (De Pelsmacker and Janssens, 2007; Elliot, 2001).

4. METHODS AND DATA COLLECTION

A questionnaire is designed to measure IDC behavior of road users (target respondents: people driving a motor vehicle) by the face to face method at the public transport terminals,

households, companies, industry zones, gas stations, markets, colleges, universities in 24 districts and subdistricts of HCMC in spring 2011. The interviewers are provided a careful training of the questionnaire content, interviewing skill, locations, samples to know how collect valid attitude of participant's determinant in term of the IDC behavior. To get the good and value result form the main survey, 10% of samples is conducted for the pretest survey to adjust a completed and perfect questionnaire form and survey skills before. Participation is voluntary and respondents can withdraw at any time and their data would be withdrawn. 415 valid questionnaires show a respond rate of 92%. The sample includes 55% (n=226) of male and 45% of female with a mean age of 30 years (range from 13 - 70 years). 20.5% of participants is student and 48% of them has university level degree. The majority of respondents has at least one motorbike with the rate is 85.6%. The driver accounts for 9.2% of respondents.

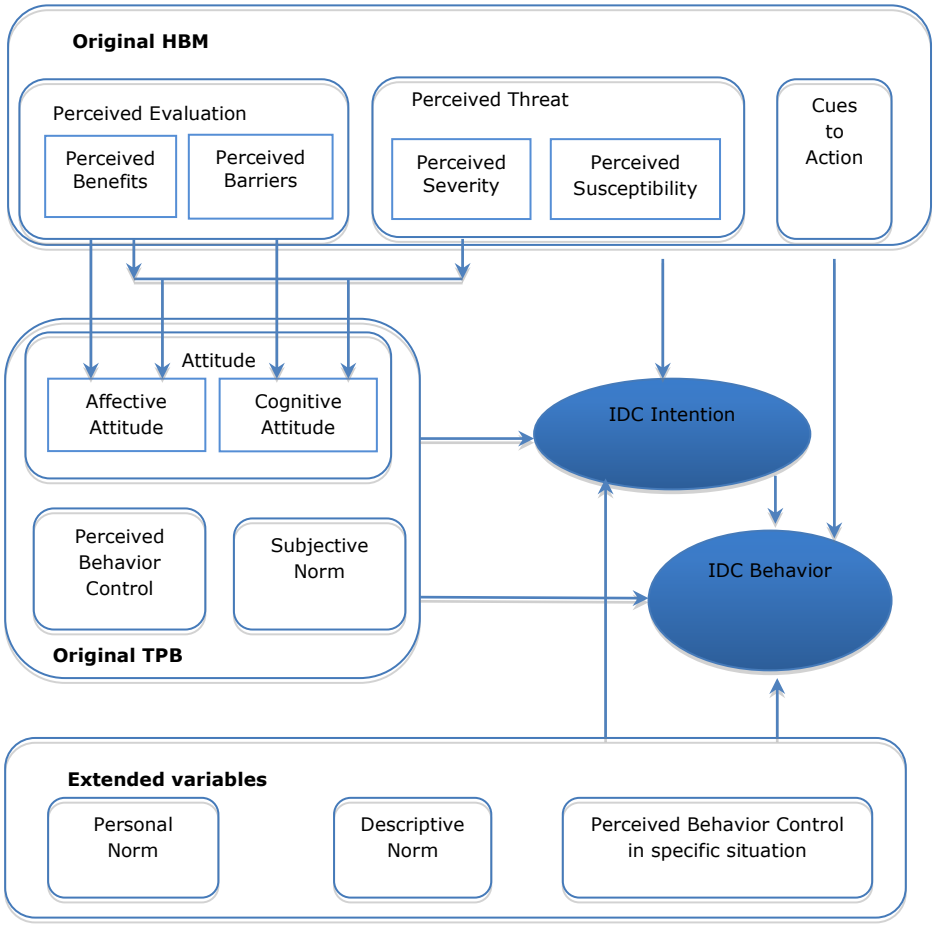

Figure 1. Proposed integrated behavior model for IDC

14 standard items (variables) are used to measure the socio-cognitive constructs of the integrated illegal direction changing behaviour. All items are measured using 5-point scales (1: disagreement/ never to 5: agreement/ very often).

The participants' responses on the provisional questionnaire are entered into an SPSS data file and aggregated all questions to be a variable. The Pearson correlation, mean, standard deviation and Cronbach's alpha are tested to identify potential predictors of behavioral intention and behavior as well as to check the reliability of all items (questions) in each proposed (Table 1, Table 2).

Separate original HBM and TPB variables are entered to examine the contribution of the predictors and to identify better predictive models of IDC intension behavior and behavior by the regression model (Table 3, Table 4). Cognitive attitude and affective attitude are explored on the threat perceived (perceived benefits and barriers) and both the threat perceived and the perceived evaluation (perceived severity and susceptibility) by regression models (Table 5).

IBM variables are input in turn in four steps by the stepwise linear regression model. The original variables of the better predictive model (HBM or TPB) are added in the first step. The remaining steps are done by adding the variables of the weaker model and extended variables (Table 6, Table 7).

Table 1. Descriptive of 14 socio-cognitive variables

Concepts	Items	Scoring	M	S.D.	N
PBe	IDC makes you save time	(1)	2.33	0.89	415
(α= .80)	IDC gives you a feeling of control over the car	(1)	2.41	0.90	415
	IDC makes a good impression on others	(1)	1.99	0.87	415
PBa	IDC increases the risk of getting fined	(1)	3.85	0.7	415
C_ATT	IDC is bad	(1)	3.85	0.88	415
(α= .75)	IDC is dislikeable	(1)	3.83	0.90	415
	IDC is acceptable (reverse coded)	(1)	3.58	0.96	415
A_ATT	IDC is exciting	(1)	2.07	0.90	415
(α= .87: r= .77)	IDC is fun	(1)	2.07	0.92	415
PN	IDC is irresponsible	(1)	3.81	0.85	415
(α= .83: r= .71)	IDC is intolerable	(1)	3.78	0.89	415
DN	How often do other drivers in HCMC IDC?	(2)	3.47	0.91	415
SN	Important social referent 1 would accept I IDC	(1)	2.02	0.95	415
(α= .89)	Important social referent 2 would accept I IDC	(1)	2.07	0.98	415
	Most people who are important to me think I should never IDC (reverse coded)	(1)	2.23	0.83	415
PBC	I am able to prevent myself from IDC	(1)	3.72	0.93	415
(α= .74: r= .58)	It is easy for me to legal direction change	(1)	3.61	0.91	415
PBC_SS	Preventing myself from IDC when I am in a hurry	(3)	3.45	0.75	415
(α= .64: r= .47)	Preventing myself from I IDC when most others do	(3)	3,42	0,86	415
CA	I fully support cameras to automatically ticket IDC on highways	(1)	4.03	0.85	413
(α= .79)	I fully support more public road safety awareness campaigns	(1)	4.14	0.83	413
	I fully support higher fines	(1)	3.78	1.02	411
	I fully support more traffic safety education in primary & secondary schools	(1)	3.99	0.87	412
PSe	IDC is dangerous	(1)	3.90	0.90	415
PSu	The chance of getting a ticket when IDC is high	(1)	4.04	0.86	413
(α= .79)	The chance of damaging my vehicle when IDC is high	(1)	3.88	0.86	400
	The chance of getting hurt in an accident when IDC is high	(1)	3.88	0.82	400
	The chance of hurting others in an accident when is high	(1)	3.93	0.86	400
BI	I have the intention to legal direction change in the next	(1)	3.83	0.88	415
(α= .90: r= .82)	3 months				
	I am willing to legal direction change in the next 3 months	(1)	3.94	0.92	415
B	How often do you IDC?	(2)	2.41	1.00	415

(1): 1=disagree: 5=agree; (2): 1=never: 5=very often; (3): 1=very hard: 5=very easy

Table 2. Statistic of 14 socio-cognitive variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. PBe														
2. PBa	-.69[b]													
3. C_ATT	-.62[b]	.56[b]												
4. A_ATT	.53[b]	-.48[b]	-.55[b]											
5. PN	-.61[b]	.57[b]	.66[b]	-.61[b]										
6. DN	-.44[b]	.38[b]	.38[b]	-.41[b]	.40[b]									
7. SN	.67[b]	-.60[b]	-.62[b]	.60[b]	-.64[b]	-.47[b]								
8. PBC	-.50[b]	.47[b]	.57[b]	-.44[b]	.54[b]	.40[b]	-.52[b]							
9. PBC_SS	-.45[b]	.44[b]	.44[b]	-.45[b]	.43[b]	.31[b]	-.45[b]	.40[b]						
10. CA	-.18[b]	.19[b]	.19[b]	-.15[b]	.25[b]	.17[b]	-.23[b]	.19[b]	.18[b]					
11. PSe	-.69[b]	.69[b]	.53[b]	-.49[b]	.52[b]	.41[b]	-.58[b]	.47[b]	.39[b]	.14[b]				
12. PSu	-.21[b]	.27[b]	.26[b]	-.25[b]	.32[b]	.23[b]	-.29[b]	.23[b]	.15[b]	.30[b]	.21[b]			
13. BI	-.60[b]	.57[b]	.57[b]	-.47[b]	.60[b]	.46[b]	-.64[b]	.47[b]	.43[b]	.19[b]	.56[b]	.26[b]		
14. B	.60[b]	-.54[b]	-.58[b]	.51[b]	-.54[b]	-.41[b]	.62[b]	-.45[b]	-.41[b]	-.14[b]	-.56[b]	-.19[b]	-.61[b]	
Mean[†]	2.25	3.85	3.75	2.07	3.80	3.47	2.11	3.67	3.43	3.98	3.90	3.92	3.88	2.41
SD	0.75	0.97	0.75	0.86	0.80	0.91	0.83	0.82	0.69	0.70	0.99	0.66	0.86	1.00

[*] p values are as follows: [a]$p < 0.05$; [b]$p < 0.01$; [c]$p < 0.001$

[†] Scores range between 1 and 5

5. RESULTS

There are 30.1% and 38.8% of respondents answered that they "occasionally" and "rarely" do IDC. They "occasionally" do this violation behavior on the urban roads (23.1%). The result shows farmer is occupied the highest ratio (1%) of "very often" doing IDC while private employer gets the highest ratio of often doing its (3.1%) among other occupations. Young people (20-30 years) do IDC "occasionally" (30.7%) and "often" (5.7%) than other age levels.

Table 1 shows all questions of road users trend positive of risky behavior (mean range from 3-4 point).

Table 2 presents the means, the standard deviations, the reliability (cronbach alpha test) of each variable and the correlations for each measure. These correlation values are acceptable and significant. The cronbach' alpha checks for reliability of all concepts are higher than 0.71 with the exception of perceived behavior control in general (0.58) and perceived behavior control in specific situation (0.47).

5.1 Health Belief Model

All original variables of HBM including perceived benefits, perceived barriers, perceived severity, perceived susceptibility and cues to action are predicted the IDC intention and behavior. Perceived benefits, perceived barriers, perceived severity and perceived susceptibility account for 41% of the variance in IDC intentions ($p<0.001$). The perceived benefit is considered as the most important factor (ß= -0.238, $p<0.000$), followed by perceived barriers (ß= 0.223, $p<0.000$), perceived severity (ß = 0.214, $p<0.000$) and perceived susceptibility (ß= 0.084, $p<0.05$) (Table 3).

Table 3. HBM model in speeding

Regression of behavioural intentions on HBM-variables*						
Variables entered	B	SE B	B	t	p	$sr^{2\dagger}$
PERCEIVED BENEFITS	-.270	.067	-.238	-4.010	.000	.025
PERCEIVED BARRIERS	.195	.053	.223	3.674	.000	.021
PERCEIVED SEVERITY	.184	.051	.214	3.613	.000	.020
PERCEIVED SUSCEPTIBILITY	.109	.055	.084	1.991	.047	.006
CUES TO ACTION	**.044**	**.051**	**.036**	**.870**	**.385**	**.001**
*N= 395, R^2= 0.41						
Regression of behaviour on HBM-variables*						
Variables entered	B	SE B	B	t	p	sr^2
PERCEIVED BENEFITS	.480	.076	.369	6.278	.000	.059
PERCEIVED BARRIERS	-.135	.060	-.135	-2.250	.025	.008
PERCEIVED SEVERITY	-.198	.058	-.202	-3.449	.001	.018
PERCEIVED SUSCEPTIBILITY	-.060	.062	-.041	-.970	.333	.001
CUES TO ACTION	.024	.057	.017	.417	.677	.000
*N= 395, R^2= 0.42						

$^{\dagger}sr^2$= the squared semi-partial correlation coefficient. This coefficient equals the R-square change value from the regression when a variable is added or removed.

Regarding the predictive IDC behavior model, perceived benefits, perceived barriers and perceived severity variables are significant with 42% of the total variance. The strongest predictor is contributed from perceived benefits (ß = 0.369, p<000), followed by perceived barriers (ß = -0.135, $p<0.03$) and perceived severity (ß=-0.202, $p<0.002$) (Table 3).

5.2 Theory Of Planned Behavior

In the case of adding separately the original TPB variables in to the predictive model, it is presented statistically significant predictors with accounting for 60% of the total variance in IDC intention (Table 4). The subjective norm variable is considered as the strongest predictor (ß = -0.431, p<0.000), followed by cognitive attitude (ß = 0.243, p<0.000), perceived behavioral control in general (ß = 0.048, p<0.03).

Behavior intentions and perceived behavioral control in general are predicted statistically significant toward the IDC behavior and explaining 41% of the total variance. Behavior intention is identified as the most important predictor (ß = -0.516, p<0.000), followed by perceived behavior in general (ß =-0.206, p<0.000).

Table 4. TPB model for Speeding Intention and Speeding behavior

Regression of behavioural intentions on TPB-variables*						
Variables entered	B	SE B	β	t	p	sr^2
COGNITIVE ATTITUDE	.280	.057	.243	4.931	.000	.032
SUBJECTIVE NORM	-.446	.049	-.431	-9.037	.000	.107
PERCEIVED BEHAVIOURAL CONTROL IN GENERAL	.111	.048	.106	2.318	.021	.007
*N= 415, R^2= 0.46						
Regression of behaviour on TPB-variables*						
Variables entered	B	SE B	β	t	p	sr^2
BEHAVIOURAL INTENTIONS	-.600	.050	-.516	-12.006	.000	.207
PERCEIVED BEHAVIOURAL CONTROL IN GENERAL	-.251	.053	-.206	-4.786	.000	.033
*N= 415, R^2= 0.41						

Cognitive attitude is predicted on all of questions that are representative for perceived benefits and barriers with 42% of the total variance. Affective attitude is contributed from one question of perceived benefits and perceived barriers accounting 31% of the variance. “IDC increases the risk of getting fined” is presented the strongest predictor of the cognitive attitude regression model (ß = 0.257, p<0.000) and being the weaker predictor of the affective attitude regression model (ß = -0.222, p<0.000). “IDC is making a good impression” is considered as the most important predictor (ß = 0.246, p<0.000).

Considering more perceived severity and perceived susceptibility in the predictive cognitive and affective attitude models, the total variance is a bit higher (42% and 31% respectively). The predictors of the cognitive attitude model are less than the previous models (Table 5). “IDC is making a good impression” is contributed as the strongest predictor in both cognitive and affective attitude models (ß = -0.224, p<0.000; ß = 0.212, p<0.000).

Table 5. Regression predictive model for attitude and cognitive attitude

Regression of cognitive attitude on perceived benefits and barriers*						
Variables entered	B	SE B	β	t	p	sr^2
IDC makes you save time	-.137	.049	-.163	-2.820	.005	.011
IDC gives you a feeling of control over the vehicle	-.105	.044	-.127	-2.388	.017	.008
IDC is making a good impression	-.202	.041	-.235	-.4880	.000	.033
IDC increases the risk of getting fined	.197	.041	.257	4.834	.000	.033
*N= 415, R^2= 0.42						
Regression of affective attitude on perceived benefits and barriers*						
Variables entered	B	SE B	β	t	p	sr^2
IDC makes you save time	.119	.061	.123	1.951	.052	.006
IDC gives you a feeling of control over the vehicle	.075	.056	.078	1.353	.177	.003
IDC is making a good impression	.245	.052	.246	4.704	.000	.037
IDC increases the risk of getting fined	-.196	.051	-.222	-3.826	.000	.025
*N= 415, R^2= 0.31						
Regression of cognitive attitude on perceived benefits and barriers + perceived severity and susceptibility*						
Variables entered	B	SE B	β	t	p	sr^2
IDC makes you save time	-.121	.050	-.146	-2.397	.017	.008
IDC gives you a feeling of control over the vehicle	-.077	.045	-.094	-1.701	.090	.004
IDC is making a good impression	-.191	.043	-.224	-4.416	.000	.029
IDC increases the risk of getting fined	.149	.046	.196	3.222	.001	.015
IDC is dangerous	.067	.044	.090	1.529	.127	.003
The chance of getting a ticket when IDC is high	.041	.034	.048	1.214	.225	.002
The chance of damaging my vehicle when IDC is high	.020	.061	.023	.320	.749	.000
The chance of getting hurt in an accident when IDC is high	.132	.080	.146	1.644	.101	.004
The chance of hurting others in an accident when IDC is high	-.066	.074	-.076	-.890	.374	.001
*N= 398, R^2= 0.44						
Regression of affective attitude on perceived benefits and barriers + perceived severity and susceptibility*						
Variables entered	B	SE B	β	t	p	sr^2
IDC makes you save time	.102	.064	.105	1.598	.111	.004
IDC gives you a feeling of control over the vehicle	.034	.057	.036	.600	.549	.001
IDC is making a good impression	.211	.054	.212	3.869	.000	.026
IDC increases the risk of getting fined	-.101	.058	-.114	-1.736	.083	.005
IDC is dangerous	-.154	.055	-.178	-2.805	.005	.013
The chance of getting a ticket when IDC is high	-.065	.043	-.065	-1.532	.126	.004
The chance of damaging my vehicle when IDC is high	-.137	.077	-.136	-1.780	.076	.005
The chance of getting hurt in an accident when IDC is high	.063	.101	.060	.624	.533	.001
The chance of hurting others in an accident when IDC is high	-.022	.093	-.022	-.237	.813	.000
*N= 398, R^2= 0.34						

5.3 Integrated Behavioral Model

IDC behavioral intention models are predicted from proposed socio-cognitive variables in four steps that present in Table 6 and Figure 2.

Table 6. IBM for predictive IDC intention

STEP 1	B	SE B	β	t	p	sr^2
COGNITIVE ATTITUDE	.264	.059	**.228**	4.477	**.000**	**.028**
SUBJECTIVE NORM	-.449	.051	**-.435**	-8.802	**.000**	**.109**
PERCEIVED BEHAVIOURAL CONTROL IN GENERAL	.113	.049	**.109**	2.309	**.021**	**.007**
R^2= .45 R^2 change= .45 F change= 107.447 (p< .000)						
STEP 2	B	SE B	β	t	p	sr^2
COGNITIVE ATTITUDE	.228	.060	**.197**	3.777	**.000**	**.020**
SUBJECTIVE NORM	-.407	.055	**-.394**	-7.408	**.000**	**.076**
PERCEIVED BEHAVIOURAL CONTROL IN GENERAL	.089	.049	.085	1.804	.072	.004
AFFECTIVE ATTITUDE	-.032	.049	-.032	-.651	.515	.001
PERCEIVED BEHAVIOURAL CONTROL IN SPECIFIC SITUATIONS	.145	.055	**.117**	2.635	**.009**	**.010**
R^2= .46 R^2 change= .01 F change= 4.154 (p= 0.16)						
STEP 3	B	SE B	β	t	p	sr^2
COGNITIVE ATTITUDE	.135	.062	**.116**	2.189	**.029**	**.006**
SUBJECTIVE NORM	-.324	.056	**-.314**	-5.838	**.000**	**.044**
PERCEIVED BEHAVIOURAL CONTROL IN GENERAL	.038	.049	.037	.782	.435	.001
AFFECTIVE ATTITUDE	.036	.049	.036	.728	.467	.001
PERCEIVED BEHAVIOURAL CONTROL IN SPECIFIC SITUATIONS	.131	.053	**.105**	2.453	**.015**	**.008**
DESCRIPTIVE NORM	.131	.040	**.138**	3.282	**.001**	**.014**
PERSONAL NORM	.231	.058	**.217**	4.001	**.000**	**.021**
R^2= .50 R^2 change= .04 F change= 13.482 (p< .000)						
STEP 4	B	SE B	β	t	p	sr^2
COGNITIVE ATTITUDE	.096	.062	.083	1.552	.122	.003
SUBJECTIVE NORM	-.263	.058	**-.254**	-4.524	**.000**	**.026**
PERCEIVED BEHAVIOURAL CONTROL IN GENERAL	.017	.048	.016	.347	.729	.000
AFFECTIVE ATTITUDE	.053	.049	.053	1.080	.281	.001
PERCEIVED BEHAVIOURAL CONTROL IN SPECIFIC SITUATIONS	.106	.053	**.085**	1.985	**.048**	**.005**
DESCRIPTIVE NORM	.112	.040	**.119**	2.821	**.005**	**.010**
PERSONAL NORM	.200	.058	**.188**	3.431	**.001**	**.015**
PERCEIVED BENEFITS	.007	.068	.006	.100	.920	.000
PERCEIVED BARRIERS	.092	.050	.106	1.859	.064	.004
PERCEIVED SEVERITY	.112	.047	**.130**	2.380	**.018**	**.007**
PERCEIVED SUSCEPTIBILITY	.022	.051	.017	.439	.661	.000
CUES TO ACTION	-.016	.047	-.013	-.352	.725	.000
R^2= .52 R^2 change= .02 F change= 3.634 (p= .003)						
*N= 395						

TPB variables are more powerful predictions than the HBM variables in term of the predictive IDC behavioral intention (same findings as Phd thesis (Anh 2013). So original TPB variables and other socio-cognitive variables are entered before HBM variables in four steps by stepwise regression model.

In the first step, all three original TPB variables are identified contributing to the model with 45% of total variance. Subjective norm is the most important predictor (ß = -0.435,

p<0.000) followed by cognitive attitude (ß = 0.228, p<0.000) and perceived behavior control in general (ß = 0.109, p<0.05).

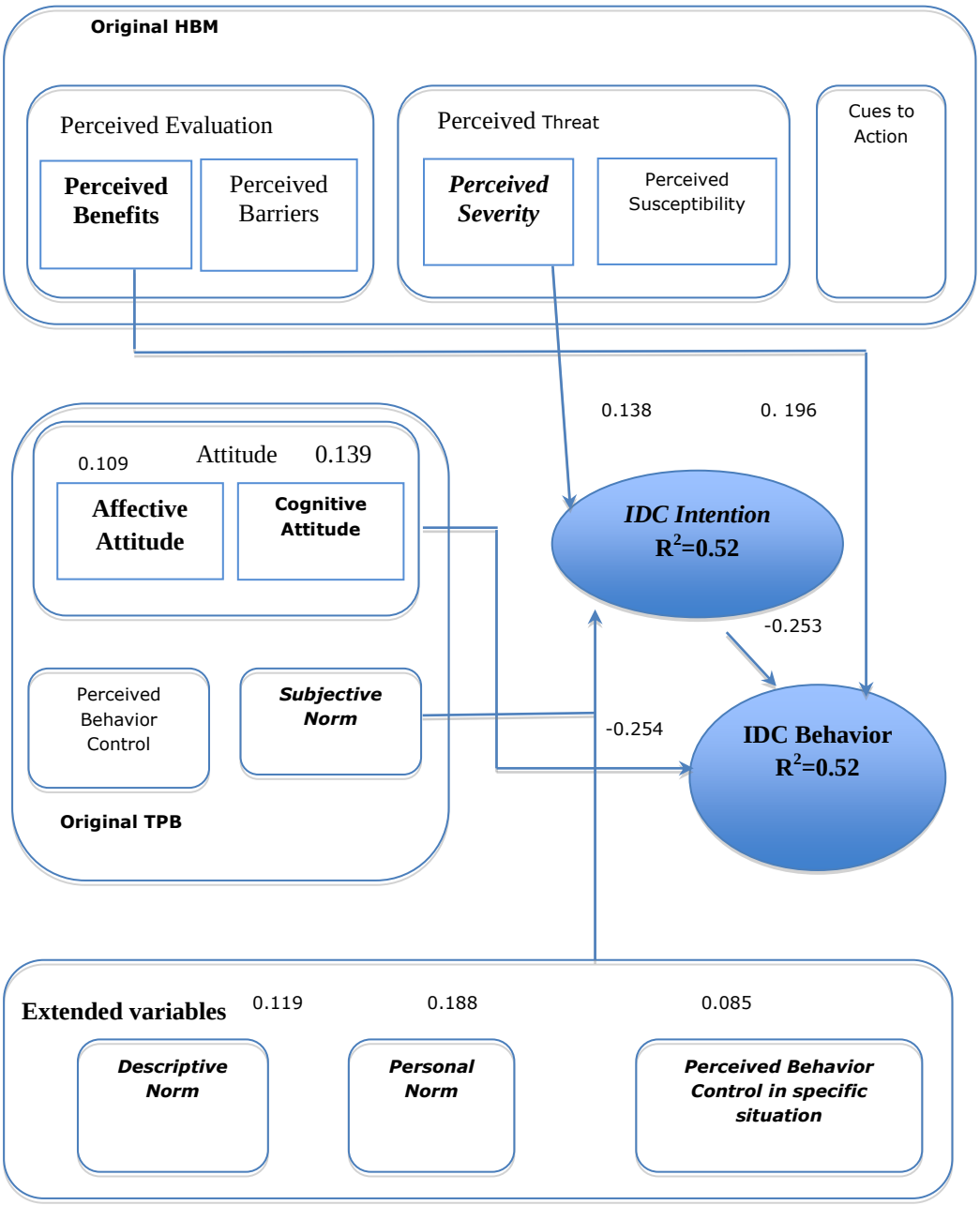

Figure 2. IBM for IDC intention and behavior.

The second step including more affective attitude and perceived behavioral control in specific situations are added to explain 46% of the total variance. The strongest predictor is contributed from subjective norm (ß = -0.394, p<0.000), followed by cognitive attitude (ß = 0.197, p<0.000) and perceived behavior control in specific situation (ß = 0.117, p<0.01).

Descriptive norm and personal norm are added in the third step accounting 50% of total variance. Subjective norm is contributed as the most important variable in the predictive model (ß = -0.314, p<0.000). The other significant predictors are personal norm, descriptive

norm, cognitive attitude and perceived behavioral control in specific situation (ß = 0.217, ß = 0.138, ß = 0.116, ß = 0.105, p<0.01).

All original HBM variables are entered in the predictive model explaining 52% of total variance. Subjective norm is identified as the strongest predictor with ß = -0.254, p<0.000. Perceived severity of the HBM model is considered at the second important predictor, followed by personal norm, descriptive norm and perceived behavioral control in specific (ß = 0.130, 0.188, 0.119, 0.085, p<0.05, respectively).

Regarding the predictive IDC behavior, HBM variables are added first because of their power predictions that are examined in the separate HBM and TPB.

At the first step, HBM variables explain 42% of the variance in IDC, with perceived benefits (ß = -0.369, p<0.03) is considered as the strongest contribution, followed by perceived severity (ß = -0.202, p<0.02) and perceived barriers (ß = -0.135, p<0.03).

Behavioral intention, perceived behavioral control in general are added accounting 49% of total variance. Behavioral intention becomes the most important predictor of the IBM model in the second step with ß = -0.316, p<0.000. Perceived benefits and perceived severity are significant predictors with ß = 0.273, -0.121, p<0.04, respectively.

In the step 3, no significant prediction is found from adding more descriptive norm and personal norm but perceived behavioral control in specific situation is significant predictor for the IDC model (ß = -0.091 p<0.000). All variables explain 50% of the variance with the strongest predictor as behavior intention (ß = -0.266 p<0.000) followed by perceived benefits (ß = 0.230, p<0.000), perceived severity (ß = -0.115, p<0.05).

Regarding the last step, 13 socio-cognitive variables (adding more cognitive and affective attitude) explain an additional 2% of the variance comparing to the third step (R^2 = 50%). Behavioral intention is considered as the most important variable of the predictive model (ß = -0.115, p<0.000), followed by perceived benefits (ß = 0.196, p<0.002), cognitive attitude (ß = -0.139, p<0.05) and affective attitude (ß = -0.109, p<0.05).

6. DISCUSSION

In general, the respondents are found “occasionally” and “rarely” doing IDC and mainly doing in urban roads. Most of road users doing IDC “often” are identified as famer, private employer and young respondents.

6.1 Theoretical findings

Nine variables of three different models (HBM, TPB, extended socio-cognitive variables) are found and estimated significantly the IDC model. In term of the original HBM, (1) perceived severity, (2) perceived benefit are contributed the significant impact to predict IDC. Original TPB variables are predicted toward IDC model such as (3) subjective norm, (4) cognitive attitude, (5) and behavioral intention. The remaining four extended socio-cognitive variables are identified significant contribution toward the predictive IDC model included (6) affective attitude, (7) perceived behavior control in specific situation, (8) descriptive norm, and (9) personal norm.

Perceived severity: Perceived severity and perceived susceptibility are two main aspects to evaluate the perceived threat concept.

Perceived severity is proved a weak power in the predictive model (Anh 2013). In this research, perceived severity is identified the second important predictors of the predictive

IDC intention model by IBM and the third position impact to the predictive model by HBM. In term of predictive behavior by HBM, perceived severity is kept the second important. For IBM, perceived severity could not contribute as the strongest predictor toward IDC behavior but still has impact until cognitive and affective attitude variables are entered in the model.

Table 7. IBM for predictive IDC behavior

STEP 1	B	SE B	β	t	p	sr^2
PERCEIVED BENEFITS	.480	.076	**.369**	6.278	**.000**	**.059**
PERCEIVED BARRIERS	-.135	.060	**-.135**	-2.250	**.025**	**.008**
PERCEIVED SEVERITY	-.198	.058	**-.202**	-3.449	**.001**	**.018**
PERCEIVED SUSCEPTIBILITY	-.060	.062	-.041	-.970	.333	.001
CUES TO ACTION	.024	.057	.017	.417	.677	.000
R^2= .42 R^2 change= .42	F change= 55.364 (p< .000)					
STEP 2	B	SE B	β	t	p	sr^2
PERCEIVED BENEFITS	.355	.074	**.273**	4.781	**.000**	**.030**
PERCEIVED BARRIERS	-.052	.058	-.052	-.906	.365	.001
PERCEIVED SEVERITY	-.119	.055	**-.121**	-2.155	**.032**	**.006**
PERCEIVED SUSCEPTIBILITY	-.012	.059	-.008	-.198	.843	.000
CUES TO ACTION	.047	.054	.034	.874	.382	.001
BEHAVIOURAL INTENTIONS	-.361	.055	**-.316**	-6.579	**.000**	**.058**
PERCEIVED BEHAVIOURAL CONTROL IN GENERAL	-.098	.053	-.082	-1.852	.065	.004
R^2= .49 R^2 change= .07	F change= 26.383 (p< .000)					
STEP 3	B	SE B	β	t	p	sr^2
PERCEIVED BENEFITS	.299	.076	**.230**	3.918	**.000**	**.020**
PERCEIVED BARRIERS	-.028	.058	-.028	-.491	.624	.000
PERCEIVED SEVERITY	-.113	.055	**-.115**	-2.060	**.040**	**.006**
PERCEIVED SUSCEPTIBILITY	.002	.059	.002	.042	.966	.000
CUES TO ACTION	.069	.054	.049	1.267	.206	.002
BEHAVIOURAL INTENTIONS	-.304	.058	**-.266**	-5.263	**.000**	**.036**
PERCEIVED BEHAVIOURAL CONTROL IN GENERAL	-.047	.055	-.040	-.864	.388	.001
PERCEIVED BEHAVIOURAL CONTROL IN SPECIFIC SITUATIONS	-.130	.061	**-.091**	-2.117	**.035**	**.006**
DESCRIPTIVE NORM	-.070	.046	-.065	-1.524	.128	.003
PERSONAL NORM	-.097	.064	-.080	-1.525	.128	.003
R^2= .50 R^2 change= .01	F change= 3.323 (p= .020)					
STEP 4	B	SE B	β	t	p	sr^2
PERCEIVED BENEFITS	.255	.076	**.196**	3.343	**.001**	**.014**
PERCEIVED BARRIERS	-.019	.057	-.019	-.336	.737	.000
PERCEIVED SEVERITY	-.098	.054	-.100	-1.805	.072	.004
PERCEIVED SUSCEPTIBILITY	.016	.058	.011	.276	.783	.000
CUES TO ACTION	.055	.054	.039	1.020	.308	.001
BEHAVIOURAL INTENTIONS	-.289	.057	**-.253**	-5.037	**.000**	**.032**
PERCEIVED BEHAVIOURAL CONTROL IN GENERAL	-.012	.055	-.010	-.212	.832	.000
PERCEIVED BEHAVIOURAL CONTROL IN SPECIFIC SITUATIONS	-.088	.062	-.062	-1.432	.153	.003
DESCRIPTIVE NORM	-.048	.046	-.044	-1.037	.300	.001
PERSONAL NORM	-.003	.068	-.003	-.047	.962	.000
COGNITIVE ATTITUDE	-.185	.071	**-.139**	-2.597	**.010**	**.008**
AFFECTIVE ATTITUDE	.123	.055	**.109**	2.238	**.026**	**.006**
R^2= .52 R^2 change= .02	F change= 6.543 (p= .002)					
*N= 395						

Perceived severity has not been found with any significant contribution to both predictive affective and cognitive attitude in this research.

Perceived benefits: Perceived evaluation are measured from perceived benefits and perceived barriers.

Perceived benefits is identified the significant important variable to predict IDC intention and behavior. In term of HBM, perceived benefit is contributed the most important toward IDC intention and behavior. For IBM, perceived benefits is found the significant impact toward the predictive IDC behavior only. It is became the most important predictor when applying only HBM variables, and it is turned to the second important predictor when applying TPB and extended socio-cognitive variables.

Attitude: Affective and cognitive attitudes are combined to evaluate the attitude of road users regarding IDC. These variables were identified significantly to predictive intention and behavior in the previous studies (Rothengatter 1993; Levelt and Swov 1998).

Cognitive attitude is found with the significant impact toward IDC intention by TPB model and IBM model before adding HBM variables. Cognitive and affective attitude are presented the significant contribution in the predictive IDC behavior by the IBM when these variables are added into the model.

Subjective Norm And Perceived Behavior Control in specific situation: Subjective norm was proved as the weak relationship with intention (Godin and Kok 1996; Forward 2006) (Armitage and Conner 2001). The found interesting thing in this research is the most important role of subjective norm toward predictive IDC intention by both TPB and IBM. Regarding to IDC behavior estimation, subjective norm is found insignificant to all TPB and IBM model.

Perceived behavior control in specific situation is proved its predictive power of IDC intention model. Although perceived behavior control in specific situation can not contributed a high impact to predict IDC intention but it is contribute the impact to all of models of IBM. In term of IDC behavior, perceived behavior control in specific situation is become insignificant when cognitive and affective attitude are entered to the model.

Personal Norm and Descriptive Norm: Personal norm was identified significantly to predict intention and behavior (Elliot 2001; Mark A. Elliott 2010). And descriptive norm was found a stronger contribution to predict the intention than subjective norm (Rivis and Sheeran 2003) and to predict behavior (Mark A. Elliott 2010).

In this research, personal norm and descriptive norm are found significant predictors toward IDC intention after they are added in the models. Personal norm is ranked at the top three predictors of intention and have a bigger impact to IDC behavior than descriptive norm.

Behavioral Intention: Behavior intention is found as the most powerful predictor of IDC behavior by both TPB or IBM, that same conclusion with other researches (Conner, Lawto et al.)

6.2 Comparison findings

Separate original HBM, TPB and IBM are applied to estimate IDC intention and behavior of road user in HCMC, Vietnam. The results find that (1) within original behavior models (TPB and HBM): in term of IDC intention, original TPB variables are predicted more powerful than

original HBM variables but HBM variables are predicted well than original TPB variables. (2) within integrated model (IBM): the original TPB variables (step 1) are explained the lowest of variance (R^2 = 45%). Adding 2 more socio-cognitive variables (step 2), 3 socio-cognitive variables (step 3) and 5 original HBM variables (step 4) are made a small increasing of the total variance in each step (R^2 = 0.46, 0.50 and 0.52, respectively) to predict the IDC behavioral intention. In term of the predictive IDC behavior, 5 original HBM variables are contributed the lowest of variance (R^2=42%). Adding original TPB variables (step 2) is made 7% increasing of total variance than the first step. 3 socio-cognitive variables (step 3) and 2 socio-cognitive variables (step 4) are contributed more 1% and 2% of variance than the previous step. Original TPB variables and extended socio-cognitive variables are predicted IDC intention and behavior better than original HBM variables.

In theoretical aspect, best model is considered as the highest R^2 value but in the practical aspect, best model should be considered "clean and clear" (Lippke and Ziegelmann, 2008). The results show adding more variables (total of 12 variables in step 4) to be made higher R^2 for predictive IDC intention and behavior so the final step is selected as the best model of IDC for both IDC intention and behavior

7. IMPLEMENTATION

To reduce efficiently IDC behavior of road users, the proposed implementation is considered (1) "Why people do IDC", (2) "What kind of implementation should be considered?" (3) "What thing should involve in the proposed implementation", (4) "How to implement efficiently".

Following the proposed model mention in section 6.2.7, the key determinants should be considered for policy makers in order as behavior intention, perceived severity, subjective norm and perceived benefits. Perceived benefits of IDC is caused a big from "making a good impression on the others" idea of road user than "saving time" or "giving them a feeling of control vehicles".

Answering the (1) question, road users in this research are found that they do IDC mainly because of their intention and their willing to do IDC in the next three months (behavioral intention), the dangerous level to do this behavior (perceived severity), and their idea to do IDC would make a good impression on the others (perceived benefits). The road user intentions of doing IDC in the next 3 months are indicated mainly from the important social person accept their IDC behavior and think them should never do IDC behavior (subjective norm), and the dangerous level of doing IDC behavior (perceived severity).

All causes of doing IDC intention and behavior are proved that an appropriate community campaign to increasing the road user perception and awareness is necessary (2).

The proposed campaign should designed following social marketing theory (CAST 2009). (3) So, the key success of the potential campaign is identifying the target audiences and designing the appropriate education, awareness programs through creation of messages and selection of media channels to motivate readiness for behavior change. The messages in the awareness and education programs should concentrated to the "dangerous level of IDC behavior" and "the other people boycott the IDC behavior". The public media should be considered as television, radio, panel, poster, education in the school. A strict enforcement from the government combination with the proposed campaign can raise audience awareness about campaign theme.

(4) The detail plan of work, approach, people, time, cost for evaluating, monitoring, measuring the intervention program should be established to satisfy the final question.

8. CONCLUSIONS

Behavioral models including TPB, HBM and IBM are applied separately to examine the road users toward IDC behavior and to select the best model to apply further in Vietnam; the case study is in HCMC.

Behavioral intention variable is the strongest predictor of behavior models while subjective norm variable is the most important predictor of behavioral intention models. Perceived severity is quite important predictor because of contributing to all type of models (HBM, IBM of both predictive IDC intention and behavior). For the application of IDC intention model, the original TPB model has proved to be more efficient than the original HBM model. While predicting the IDC behavior model, original HBM is identified more efficient than original TPB model. IBM including original HBM and TPB variables is selected as the best model of theory as well as practice for Vietnamese road user behavior.

The most important effective result of this research is to identify an efficient and scientific model of road user behavior in Viet Nam. This model could be consider as research successfully for the first time in Vietnam and it can obviously be able to explain the current situation and suitable in term of IDC behavior. By applied only nine simple variables and without complexity, this model will potentially help the governor authority understand IDC behavior; so that they can build, design and implement it as well as evaluate road safety communication campaigns effectively.

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