

Full Length Research Paper

Consumers' automotive purchase decisions: The significance of vehicle-based infotainment systems

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Accepted 14 January 2011

A car infotainment system (CIS) is an information system supporting driving behaviour and providing entertainment activities, it can enrich the basic functions of a car, and is a valuable product. This paper investigates which CIS value factors affect consumers' car purchase intentions. A questionnaire survey collected responses from a sample of 319 consumers, and a structure equation model was used as the analytical method. The results found show that a CIS possesses value when it is useful or provides driving safety, and in that case consumers will exhibit greater tendency to purchase a car. In addition, high price or perceived risk will affect the value of a CIS such that consumers with less tendency to purchase a car. This study also discusses some practical implications for car manufacturers and auto electronics. This paper ultimately seeks to facilitate the future development of the auto market.

Key words: Car infotainment systems (CIS), perceived value, purchase intention, purchase car.

INTRODUCTION

With the development of information technology (IT), many products incorporating IT created brand-new functions, enhanced products' existing value, and made such products more convenient to use. These IT-containing products include information appliances (IA) and digital homes, etc. User-friendly system functions may even lead to user dependence. As far as auto products are concerned, the integration of IT in cars in the form of car infotainment systems (CIS) has boosted the added value of autos.

According to iSuppli's infotainment systems and semiconductor market forecasts, the CIS market was worth US\$30 billion in 2009, although this figure represented a drop of 18.3% from US\$37.4 billion in 2007 (Robinson, 2009). iSuppli also projects that the global automotive

electronics market sales will improve in 2010, and will enjoy moderate growth during the coming five years. In particular, the Chinese auto market has grown steadily, and more than 13 million cars were sold in one year for the first time in 2009, it is therefore, projected that automotive electronics product sales in China will grow by 19% in 2010, and will subsequently enjoy continued major growth (Wang, 2009). The increasing breadth of the automotive electronics market in recent years is chiefly derived from consumers' growing demand for CIS products (Klecha and Drude, 2007, Piazza et al., 2009). Some automotive companies have even designed new car models around information system (Füller et al., 2006). Recent computer science and user interface research has addressed the development and application of automotive information systems (Raab et al., 2008, Zheng et al., 2008, Huang et al., 2009). In addition, some studies have investigated drivers' technology use and driving (Roetting et al., 2003, Rosenbloom, 2006, Zhang et al., 2006). In summary, very significant results have been obtained in CIS engineering research and development (R&D) and user interface operation. In spite of this, very little research has been done on the effective CIS on consumer car purchase behaviour.

Past consumer auto purchase willingness research chiefly focused on product and service quality (Brito et

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Abbreviations: CIS, Car infotainment system; IT, information technology; IA, information appliances; R&D, research and development; DIS, driver information systems; VAM, value-based adoption model; CR, composite reliability; AVE, average variance extracted; ACN, auto collision notification; EDR, event data recorder.

al., 2007), brand and degree of satisfaction (Jamal and Al-Marri, 2007), and sales forecasts (Armstrong et al., 2000). Recently, Zheng et al. (2007) suggested that new products resulting from auto development and information technology can enhance a car's inherent value. Furthermore, Dodds et al. (1991) believed that when consumers perceive products possess value, their willingness to purchase will increase. The research of Dodds et al. (1991) and Zheng et al. (2007) reveals a question worthy of further investigation: Does CIS increase consumers' willingness to purchase a car? Because a CIS provides information, services, and system functions, it can help motorists to improve their driving, and should therefore, enhance the value of the product in consumers' eyes. What factors cause consumers to feel a CIS possesses value? If consumers' product needs are understood, auto dealers should be able to conduct different marketing activities targeted at different customers (Büschken, 2007). Based on these motivations, this study seeks to remedy the lack of investigation of this aspect in past studies. The studies therefore, attempt to gain an understanding of those factors affecting the value of CIS in consumers' minds and consequently their willingness to purchase a car. As far as practical implications are concerned the study hope to provide auto manufacturers with more convincing facts helping manufacturers develop practical CIS that will encourage consumers to purchase cars.

LITERATURE REVIEW

Car infotainment systems

The infotainment concept represents the merger of information and entertainment. Most current academic research on infotainment systems focuses on auto-related systems, which are known as car infotainment systems or automotive infotainment systems. According to Füller et al. (2006) Audi refers to its infotainment systems as "integration state of the art communication and entertainment technologies in the domains of audio, video, navigation, telematics and user interfaces to a infotainment system in the car."

Henfridsson et al., (2009) suggests that an infotainment system should be able to simultaneously provide drivers or passengers with important automotive and driving information, as well as FM/AM, wireless communications, and digital multimedia entertainment function. As a consequence, a CIS is not an independently functioning system, but is instead attached to and dependent on a car, and can be considered a type of auto product. It is installed on a car's standard equipment or a dedicated system specific to a particular type of car.

After reviewing past literature (Klecha and Drude, 2007; Lattanzi et al., 2009; Piazza et al., 2009), the study believe that CIS should include at least the three function

of telematics, driver information systems (DIS), and in-car entertainment. These three types of systems share many similar attributes.

The study concludes that the relationship between the three is one of mutual overlapping yet independent function. A graphic representation of the concept appears in Figure 1.

Telematics is able to support the information needs of DIS and in-car entertainment.

Telematics generally refers to in-car information systems, and can allow other cooperating firms to use different service channels, such as dedicated persons, voice, and digital communications methods, to meet drivers' information needs while driving via global positioning systems (GPS), navigation, and mobile commerce functions.

Innovation in information technology have led to the gradual expansion of telematics applications, which now may include auto collision notification (ACN) and event data recorder (EDR) functions. EDR can record data concerning vehicle accidents, enabling responsibility to be determined and providing evidence concerning cause of accidents.

The development of DIS began as early as the 1970's, when computers first began to emerge. At that time, the Japanese developed the comprehensive automobile traffic control system (CACS), which was the forerunner of DIS. DIS has the following four technical objectives:

- (1) To guide drivers along most appropriate routes in order to avoid congestion or prevent air pollution.
- (2) To provide useful information in order to assist safe driving.
- (3) To give priority of road to public or emergency vehicles.
- (4) To provide information promptly to drivers in case of emergency (Kawashima, 1990).

Based on these four technical objectives, the study believe that DIS provides drivers an information system for use during driving, and this information system can assist drivers to understand their car's current status, including such information as speed and remaining gasoline.

In-car entertainment refers to entertainment functions within a car allowing driver or passengers to enjoy music, audiovisual entertainment, or games etc. A good entertainment system can make driving more enjoyable for vehicle users.

A CIS should include the foregoing systems and functions, and its main users include both drivers and passengers.

Because the intent of this study is to investigate the perceived value of CIS as it affects consumers' intention to purchase a car, the study assume that consumers are motorists, and examine how a CIS supports driving behaviour and provides entertainment and information

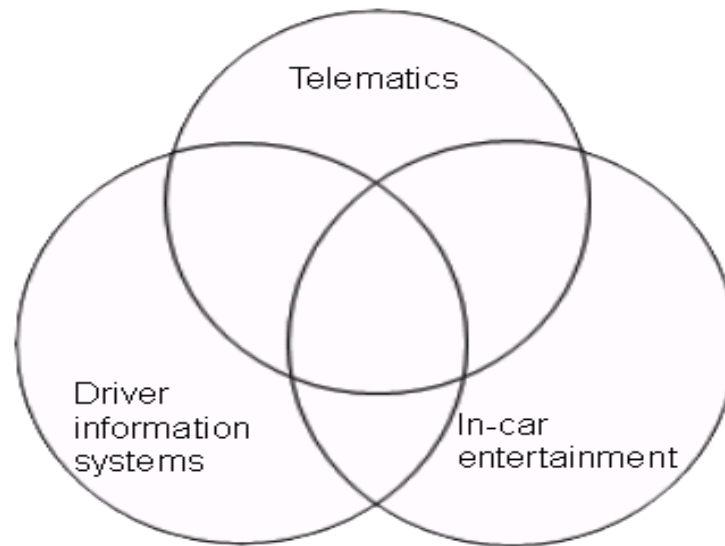


Figure 1. The concept of car infotainment systems.

when a motorist is driving.

Perceived value and purchase intention

Many studies have investigated factors that influence consumers' intention to make a purchase. Studies have focused on such factors as product labels (Beneke, 2010) and experience (Gourville and Soman, 2002). With regard to product value literature, Dodds and Monroe (1985) explored basic concepts relating to product value, and proposed that consumers will wish to purchase products with high value, in contrast, consumers have little wish to purchase products with low value. Value does not indicate the price of a product, but is rather consumers' perception of a product's real value. Product value can directly influence willingness buy (Dodds et al., 1991). Taking a car as an example, when a car has utility value, including transportation or enhancement of personal status, purchase behaviour will occur. Nevertheless, different individuals have differing perceptions of the value of the same products, which is the result of their own subjective cognition. Differing individual perceptions may affect ethics (Kurt and Hacıoglu, 2010) and customer loyalty and satisfaction (Yang and Peterson, 2004). Monroe (2002) expressed the concept of customer-perceived value as the ratio between perceived benefits and perceived sacrifice:

$$\text{Customer-perceived value} = \frac{\text{Perceived benefits}}{\text{Perceived sacrifice}}$$

Based on the suggestions of Monroe (2002), and Dodds et al. (1991), perceived benefits first has a positive influence on consumers' perception of product value, and

afterwards may influence consumers' purchase intention. In contrast, perceived sacrifice first has a negative influence on consumers' perception of product value, and afterwards may influence consumers' purchase intention. Building on these insights, some scholars have established model frameworks for the influence of value on purchase intention. Lu and Hsiao (2010) incorporated overall satisfaction among factors influencing intention to pay. Kim et al. (2007) used this framework to propose the value-based adoption model (VAM), which the study used to investigate intention to use a system. The VAM includes perceived enjoyment among perceived benefits. Nevertheless, in the eyes of consumers, it is difficult to quantify perceive enjoyment in the case of some products, such as stationary items, consumable materials, and durable good. In addition, since retail products such as music CD and book have high homogeneity, low prices, high entertainment value, and are easy to use, consumers do not have to consider very much before making a purchase. Although a CIS provides entertainment functions, it is integrated into a car, and the car itself is inherently a relatively costly product. Since cars have long service lives, and are chiefly used as means of transportation, they are considered durable goods. Customers tend to deliberate thoroughly before buying durable goods (Klein and Lansing, 1955; Bayus, 1991). As a consequence, it is quite likely that most consumers do not purchase a car for the entertainment functions of its CIS.

METHODOLOGY

Research model and hypotheses

This study employs the model shown in Figure 2, which uses the

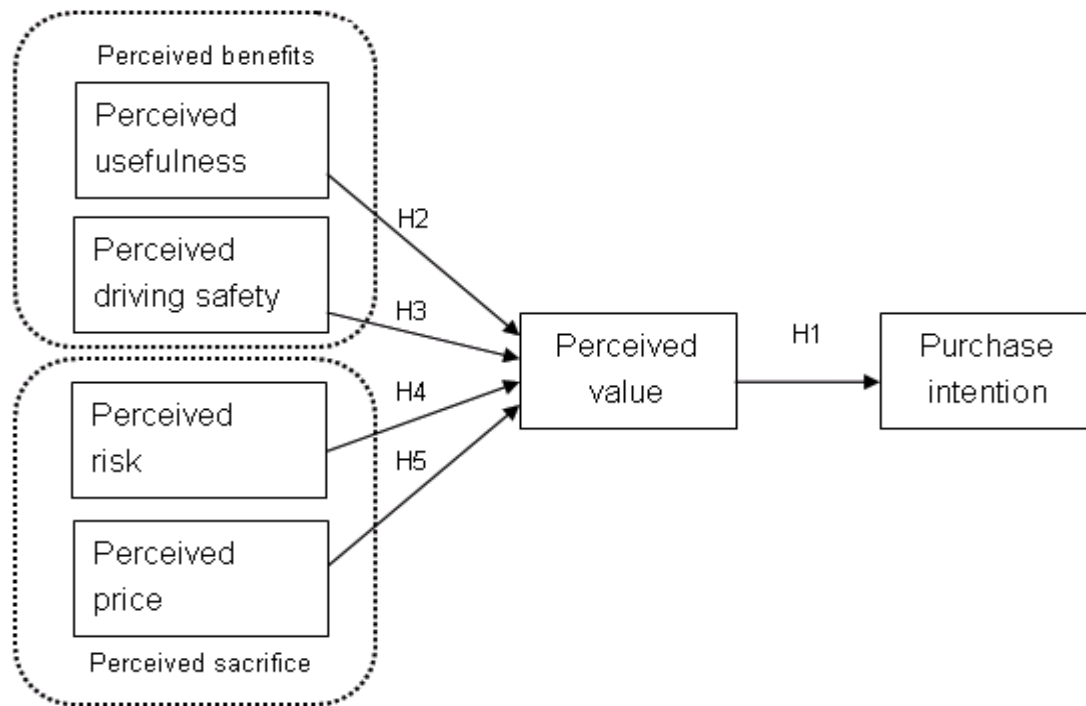


Figure 2. Research model.

customer-perceived value concept of Monroe (2002) as a framework in order to understand consumers' intention to purchase a car. Intention is an important element of attitudinal structuring, and can also be used to predict the outcomes of behaviour (Fishbein and Ajzen, 1975).

Car purchase intention indicates a very high likelihood that a consumer will buy a car. Perceived value is the mediator in this model, perceived value is defined as follows in this study: a consumer's view of a CIS reflecting both perceived benefits and perceived sacrifice. Dodds et al. (1991) suggested that increasing value will have a positive effect on consumers' purchase intention. Because of this, the studies propose the following hypothesis:

H₁: Perceived value is positively related to purchase intention.

Perceived benefits and perceived sacrifice must be able to directly influence consumers' perception of product value. Perceived benefits are positive benefit. As far as individuals are concerned, when the result of a decision provides a benefit, the individual will tend to select the most beneficial choice. Consumers may obtain many benefits from the purchase of products and services, including functional, social, emotional, epistemic, and conditional benefits (Hamilton and Srivastava, 2008). Most people will select the situation most beneficial to themselves when determining the value of a product (Sweeney and Soutar, 2001). When consumers purchase products, the most important benefit is usually whether the products are perceived to be useful. Perceived usefulness is one of the chief beliefs held by individuals with respect to information technology (Davis, 1989). The research of Kim et al. (2007) also suggests that perceived usefulness has a positive effect on perceived value:

H₂: Perceived usefulness is positively related to perceived value.

Apart from the benefit obtained from a product's useful

performance, Roetting et al. (2003) point out that a car's in-cab technology can help motorists drive safely, which constitutes another product benefit. Perceived driving safety refers to a driver's sense of safety when driving (Rosenbloom, 2006).

Generally speaking, motorists who wear their seat belts have a higher perceived driving safety than those who do not wear seat belts. With regard to auto safety equipment, air bags, for example, also give drivers greater perceived driving safety. Although not all technology can improve safety, some important technologies and novel applications can provide unprecedented assistance to drivers. For instance, automotive radar, night time driver vision assistance, side view digital assistance systems, and driver alert systems help motorists to control their cars and achieve even greater perceived driving safety. When consumers feel that these product functions enable better driving safety, and reduce the chance of accidents, they will consider the functions to be valuable. In summary, the study proposes the following hypothesis:

H₃: Perceived driving safety is positively related to perceived value.

Perceived sacrifice means sacrifice of an individual's existing benefits, and will lower the perceived value of a CIS. Naumann (1995) suggests that perceived sacrifice includes both transaction cost and risk. As a consequence, the studies divide perceived sacrifice into the two major factors of perceived risk and perceived price.

Perceived risk chiefly refers to the possibility that consumer behaviour may lead to unforeseeable results, and at least some of these results will be detrimental (Bauer, 1960). Behavioural research has performed extensive analysis of many types of risk, including performance risk, time risk, convenience risk, and information risk, etc. (Kaplan et al., 1974, Peter and Tarpey Sr, 1975, Murray and Schlacter, 1990, Dowling and Stalin, 1994). Srinivasan and Ratchford (1991) proposed that almost all consumers purchasing cars consider risk, which is chiefly because

Table 1. Demographic characteristics of the respondents.

Characteristics		Samples (%)
Gender	Male	191(59.87)
	Female	128(40.13)
Age	18~20	4(1.25)
	21-30	70(21.94)
	31-40	165(51.72)
	Upper 41	80(25.09)
Over the past number of car purchase	0	37(11.60)
	1	149(46.70)
	2	116(36.36)
	Upper 3	17(5.34)
Driving experience	Within 3 months	1(0.31)
	More than 3 months within 1 years	65(20.38)
	Between 1 to 3 years	47(14.73)
	Between 3 to 10 years	104(32.6)
	Upper 10 years	102(31.98)

consumers worry that a product may cause losses of other things, such as performance or convenience. Furthermore, purchase behaviour research has shown that perceived risk has a negative effect on perceived value (Chen and Dubinsky, 2003). The studies therefore, propose the following hypothesis:

H₄: Perceived risk is negatively related to perceived value.

Perceived price is the real monetary price paid by a consumer when purchasing a product, and can be regarded as a financial sacrifice (Monroe and Venkatesan, 1969). When a consumer must sacrifice money, this will affect perceived value (Ingenbleek, 2007). Moreover, Tam (2004) suggests that perceived price has a direct influence on perceived value. The study therefore, proposes the last hypothesis:

H₅: Perceived price is negatively related to perceived value.

Instrument development

This study employs hypotheses testing to verify the research model. A questionnaire was used as the research instrument. The questionnaire scale was modified from scales used in past literature. A pilot questionnaire was first tested on 30 subjects to verify the utility of pilot questionnaire responses. The respondents consisted of EMBA and graduate students. The responses to the pilot questionnaire did not suggest any problems, and values for all constructs exceeded 0.7 and therefore, passed Cronbach's α value. The actual study questionnaire was then developed (see Appendix). The questionnaire contains a total of 24 item questions concerning all constructs. The study employed a seven-point Likert scale as the assessment scale. On this scale, seven points indicated strong agreement, while one point indicated strong disagreement.

Data collection and sample characteristics

In order to meet the needs of the study, and accurately reflect

consumers' car purchase intention, the respondents were required to confirm that the car purchaser was also the primary driver. If this was not the case, the questionnaire was terminated early. The research sample consisted of members of the public in Taiwan. The subjects consisted of an Internet sample and a paper questionnaire sample. The Internet sample comprised 256 respondents, and the valid sample consisted of 222 questionnaires. The paper questionnaires were administered directly in interviews. A relatively large sample was accumulated at 3C (computer, communication and consumer electronics) and auto exhibitions in Taiwan. A total of 97 respondents were obtained.

In order to boost respondents' willingness to fill out the questionnaire, the study randomly distributed online game starter kits as an incentive. The data collection time was from August - December, 2009. A total of 319 valid questionnaires were recovered. Information on the demographic characteristics of the sample is provided in Table 1.

The 191 male respondents comprised a majority of the sample (59.87%). Respondents who had purchased a car numbered 282 (88.40%), and 253 persons had more than one year of driving experience (79.31%).

This indicates that most respondents had a certain amount of driving experience, and that their car purchase intention responses would be more representative.

A Levene's test and the independent sample t-test were used to determine whether a degree of homogeneity existed between the online questionnaire and interview questionnaire groups. When a significance level of $\alpha = 0.05$ was employed, the results indicated that there were no differences between the two sample source groups, which could be considered a simple sample (Table 2).

RESULTS

This study used the structure equation model (SEM) to perform data analysis. The structural equation model can simultaneously test cause and effect relationships and assess potential variables. The study employed Amos

Table 2. Independent samples test for difference samples source.

	Levene's test for equality of variances		t-test for equality menus	
	F-test	Sig.	t-test	Sig. (2-sided)
Gender	2.392	0.123	-0.724	0.470
Age	0.482	0.488	0.571	0.569
Over the past number of car purchase	0.064	0.800	-1.840	0.067
Driving experience	1.043	0.308	-1.118	0.265

Table 3. Convergent validity test.

Constructs	Items	Factor loading	Composite reliability	Average variance extracted
Perceived usefulness (PU)	PU1	0.951	0.981	0.931
	PU2	0.953		
	PU3	0.921		
	PU4	0.914		
Perceived driving safety (PDS)	PDS1	0.894	0.976	0.912
	PDS2	0.934		
	PDS3	0.929		
	PDS4	0.918		
Perceived risk (PR)	PR1	0.841	0.969	0.889
	PR2	0.912		
	PR3	0.931		
	PR4	0.913		
Perceived price (PP)	PP1	0.880	0.977	0.914
	PP2	0.949		
	PP3	0.958		
	PP4	0.895		
Perceived value (PV)	PV1	0.922	0.963	0.899
	PV2	0.886		
	PV3	0.914		
Purchase intention (PI)	PI1	0.941	0.956	0.881
	PI2	0.899		
	PI3	0.836		

7.0 to analyze the measurement model and structural model.

Measurement model

Analysis of the measurement model sought to determine whether the measurement variables used in the research model correctly assessed potential variables. Reliability and convergent validity were evaluated by means of composite reliability (CR) and average variance extracted

(AVE). AVE reveals the degree to which variance in measurement variables can be explained by potential variables, the AVE value should be greater than 0.5 (Bagozzi and Yi, 1988). CR expresses whether the measurement variables can measure potential variables, the CR value should be greater than 0.7. In addition, factor loading was used to assess convergent validity. The factor loading of all questions in this study was greater than 0.8 ($p < 0.001$). The AVE values for all constructs were greater than 0.8, and the CR values were greater than 0.7 (Table 3). As for the assessment of

Table 4. Correlation matrix of the constructs measured through reflective indicators.

Constructs	PU	PDS	PR	PP	PV	PI
PU	0.96					
PDS	0.62	0.96				
PR	-0.14	-0.10	0.94			
PP	-0.42	-0.31	0.22	0.96		
PV	0.49	0.39	-0.29	-0.70	0.95	
PI	0.43	0.35	-0.26	-0.60	0.83	0.94

Note: Diagonals represent the square root of the AVE.

Table 5. Result of goodness-of-fit measures.

Goodness-of-fit measure	Recommendation level	Calculation of measure
χ^2/df	≤ 5	1.49
GFI	≥ 0.8	0.92
RMSEA	≤ 0.08	0.04
NFI	≥ 0.9	0.96
NNFI	≥ 0.9	0.98
CFI	≥ 0.9	0.98
IFI	≥ 0.9	0.98

discriminant validity, the square root of the AVE value was greater than the correlations between individual constructs shown in Table 4. To summarize the results of preliminary data analysis, this study's model demonstrated adequate reliability and validity.

Structural model

The structural model seeks to demonstrate a good fit with the data, and chiefly relies on the GFI, RMSEA, NFI, NNFI, CFI, and IFI values. Hair et al. (2009) recommend that the GFI, NFI, NNFI, CFI values be greater than 0.9, the RMSEA value be less than 0.08, and the χ^2/df be less than 5. This study consequently adopted the recommendations of Hair et al. (2009). The values resulting from data analysis are shown in Table 5.

The structural model chiefly estimated the path coefficient and R^2 value, which express the correlations between each construct and their explanatory ability. Empirical results are summarized in Figure 3.

The results display that CIS value has a significant correlation with consumers' car purchase intention ($\beta = 0.834$, $t\text{-value} = 26.965$, $p < 0.001$), and the model explains 69% of variance (R^2) in car purchase intention, supporting H_1 .

Both perceived usefulness and perceived driving safety had significant correlations with the construct of perceived value ($\beta = 0.486$, $t\text{-value} = 9.901$, $P < 0.001$, $\beta = 0.393$, $t\text{-value} = 7.609$, $P < 0.001$), indicating that H_2 and H_3 were

supported by the data. In addition, perceived risk and perceived price also had significant correlations with perceived value ($\beta = -0.292$, $t\text{-value} = -5.441$, $P < 0.001$, $\beta = -0.697$, $t\text{-value} = -17.324$, $P < 0.001$), thus validating H_4 and H_5 . With regard to explanation of variance, the foregoing four constructs can explain 55% of variance in the value construct.

The foregoing results indicate that the model's hypotheses have empirical support.

DISCUSSION AND IMPLICATIONS

This model used perceived value as a mediator. As a consequence, the study tested whether perceived value was in fact a mediator. It was discovered that perceived usefulness ($\beta = 0.034$, $P = 0.34$), perceived driving safety ($\beta = 0.03$, $P = 0.368$), perceived risk ($\beta = -0.042$, $P = 0.337$), and perceived price ($\beta = -0.02$, $P = 0.541$) were not significant as mediators, which verified that perceived value was indeed a mediator. Because of this, the model uses product value to explain to explain consumers' car purchase intentions: Consumers first confirm the value of a CIS, which then influences their willingness to purchase the car.

From the point of view of benefit, usefulness and driving safety both have a positive influence, and can directly boost the value of a CIS in consumers' eyes. For its part, perceived price has a strong negative correlation with value ($r = -0.697$, $p < 0.001$), and consumers feel that

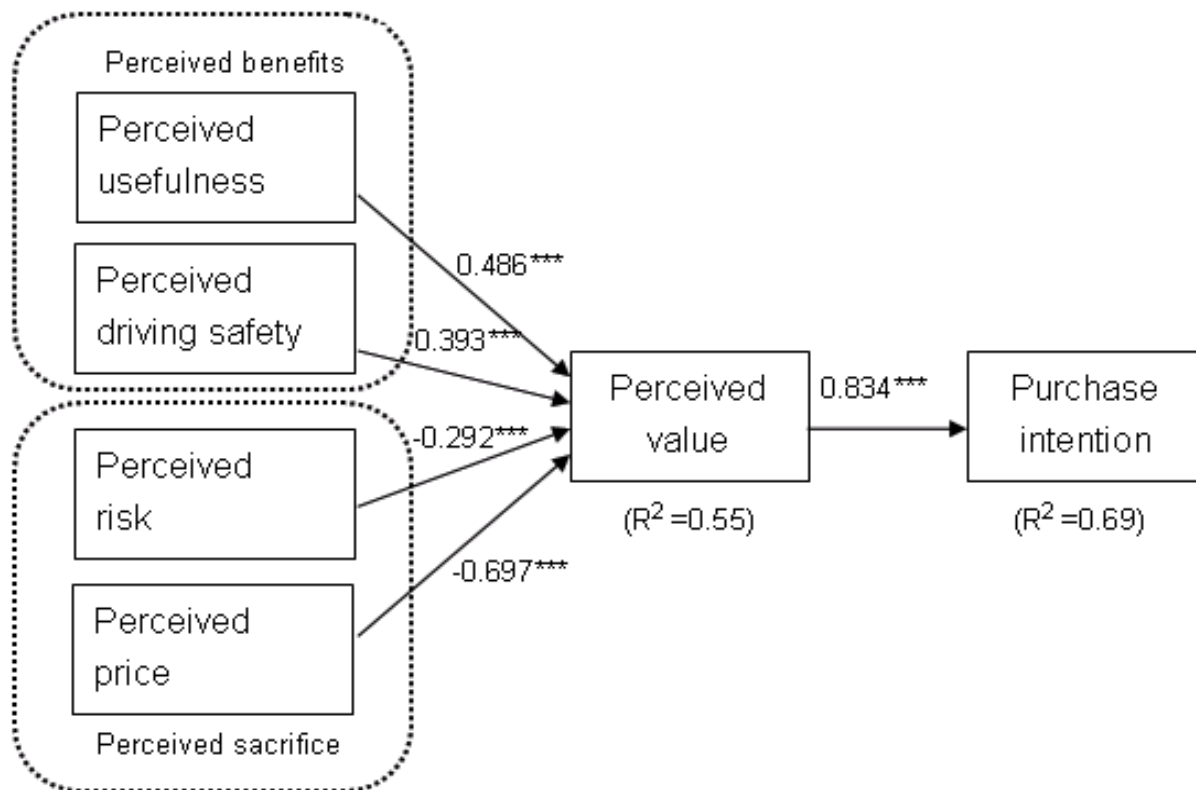


Figure 3. Hypothesis testing results.
*** $p < 0.001$

spending money is a great personal sacrifice. Nevertheless, the final results displayed that consumers are still willing to purchase cars. In order to explain this outcome, the study analyzed the influence of perceived price on purchase intention. The results revealed that there was a significant negative correlation ($\beta = -0.603$, $t\text{-value} = -13.468$, $p < 0.001$), which indicates that benefit factors outweigh sacrifice factors in this model, and consumers therefore, will have a relatively high willingness to purchase a car.

Yet another aspect is that perceived risk has a negative correlation with perceived value. This implies that some consumers feel that, apart from monetary cost, purchasing a car with a CIS will entail other risks.

To summarize the foregoing discussion, this model can explain the influence of product value on purchasing intention, allowing it to be used to investigate several aspects. First, it can be used to determine whether the value of a product influences consumers' purchase behaviour. Secondly, it can be used to determine which factors cause consumers to feel that a certain product possesses value. Thirdly, it can determine which factors will influence perceived value. Kotler and Keller (2008) suggest that disturbance from other persons' attitudes and unexpected circumstances and factors may influence purchasing decisions. It should therefore, be possible to

add other influencing factors to this model, and continue to seek out empirical support in order to make the behavioural theory underlying the model even more practical and complete.

This study also discovered several important implications. Practical and academic implications are discussed in the following two sections.

Implications for practice

First, from the point of view of consumers' perceived benefits, the usefulness of an information technology is valuable to consumers. When auto manufacturers incorporate dedicated applications systems in their products, consumers may feel relatively high willingness to purchase cars if they feel that they contain special, dedicated information systems. Systems software companies can commit some of their resources to the development of this market, and can achieve win-win outcomes by cooperating with auto manufacturers. For instance, Ford and Microsoft have cooperatively developed the "Sync" in-car entertainment and communications system. In addition, information technology R&D efforts can also focus on providing driver or auto safety. In the past, most auto safety features, such as air bags and seat belts,

were intended to provide positive safety in the event of an accident. However, there should be a gradual change to active safety in the future, including such proactive features as automotive radar and driver alert systems. By providing motorists with advance warning, these features can prevent accidents. The development of innovative systems of this type will enhance cars' perceived driving safety in the eyes of motorists.

With regard to consumers' perceived sacrifice, price is still the key factor in consumers' purchase decisions. The prices of CIS on the market are still quite high. Moreover, when consumers accept that a CIS is part of a car's existing equipment, the overall cost of the car will be relatively high. If prices are within consumers' budgets, this will make consumers relatively willing to purchase the cars. As for perceived risk, since system functions still may not effectively improve consumers' driving performance, and consumers may feel that system operation and maintenance will entail inconveniences or other problems, system functions efforts should therefore, seek to improve operating inconveniences while reducing the incidence of accidents.

Implications for theory

This model demonstrated a high degree of correlation between the value and the constructs of perceived usefulness and perceived price. Usefulness can be directly and readily perceived by users when using a system (such as GPS), and is the chief source of perceived benefits. Because the price of a product makes consumers aware that they may have to spend money, consumers perceive price as a sacrifice. As for the finding about the hypothesis concerning perceived risk, the past literature has argued that risk will have a negative influence on perceived value. The study also verified that perceived value is the model's mediator. This result is consistent with that of Kim et al. (2007), and implies that the influence of perceived value on intention can be developed into other stable models. Furthermore, this study also discovered that perceived driving safety has a positive influence on perceived value; the relationship between these two constructs has seldom been discussed in recent research. The study feel that consumers perceive safety on the basis of product characteristics (in the same way that they see whether the nearby area is safe when they buy a house), and look for a sense of safety when the product requires it (but not in the case of such products as music CDs and books). This aspect is provided as a reference for scholars wishing to further study perceived safety.

Conclusion

This study chiefly verifies two arguments: That

consumers' perceptions that a CIS possesses value will influence their car purchase intention, and that a CIS' usefulness and ability to enhance driving safety will tend to increase consumers' perception of the system's value, while price and risk will reduce consumers' perceptions of CIS value.

These two arguments can provide auto manufacturers and software companies with new directions for development. In a practical vein, auto manufacturers must not ignore the existence of CIS. The studies recommend that auto manufacturers consider IT applications to be a function of their new products during the product development period, and recognize that a CIS can give a new car model greater value.

As people discover that resources are limited and energy conservation/carbon emissions reduction consciousness takes hold, power electronic cars will become increasingly common, and these vehicles will need even more microcomputers to perform control functions. The study deeply believe that, after more than a century of evolution, the car will gradually become integrated with information technology over the course of this century. As a result, cars will not only serve as means of transportation, but also rely on its information systems to provide a completely new driving experience and feeling. Cars will become much easier to operate, and also have active safety features in the place of today's passive safety.

LIMITATIONS AND FUTURE RESEARCH RECOMMENDATIONS

In view of the limited available resources, this study was subject to certain restrictions. First, this study took the general public in Taiwan as its research sample. Taiwan is a densely populated area. Its state of economic development is similar to that of Hong Kong and Singapore, and is quite representative of that of much of Asia. In recent years, Taiwan has very tight economic links with China. Taiwan has numerous information technology manufacturers, including Acer, Benq, high tech computer corporation (HTC), and transcend. Although the Taiwanese public have a similar degree of information technology use as their counterparts in North America and Europe, cultural differences exist, and there are also inevitable differences in mental cognition and motivation value (Lguisi, 2009). Secondly, automotive products are quite expensive for Taiwanese consumers, and an average car costs roughly US\$17,000. As a consequence, the cars investigated in this study are considered durable goods by consumers, and may be perceived differently than in other affluent countries. It would therefore, be interesting to investigate how consumers in emerging economies regard this subject. Thirdly, paper and online sampling methods were used to obtain the research sample in order to ensure that the study was representative of all of Taiwan. Because

respondents filling out the questionnaire had to confirm that the car buyer was also the chief driver, the questionnaire method took more time than collecting the sample via the Internet.

Nevertheless, statistical analysis revealed that there was no significant variance in the homogeneity of the two samples, which indicates that the two samples were mutually consistent. Fourthly, with regard to perceived driving safety research questions, the questions were based on the construct proposed by Svenson et al. (1985) and Ferraro and Grange (2007). Nevertheless, there has been little academic investigation of or information on this construct. It is therefore, recommended that scholars researching this area perform further behavioural research on this construct, which will support this study's extension in this direction.

Final, the studies also recommend that future research on value on intentional behaviour can investigate effects for different types of products. Because products include not only tangible items, the direction of investigation should include intangible products, brands, and services in order to understand how perceived value affects consumers' purchase intentions, such research will make a contribution to both future academic development and commercial activities.

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Appendix

Perceived usefulness:

- 1) Compared with an existing, ordinary car, the CIS better inspires me to make the decision to on-board information and entertainment.
- 2) Using the CIS functions, I can obtain on-board information and entertainment more easily.
- 3) The CIS is able to provide all kinds of on-board information and entertainment.
- 4) I feel that, on the whole, the CIS is useful.

Perceived driving safety:

- 1) I feel that a car with CIS has better driving safety than an ordinary car.
- 2) I feel that a car with CIS is more likely to have a driving accident than an ordinary car. (Reversed)
- 3) I feel that CIS promotes driving safety.
- 4) On the whole, driving a car with CIS makes me feel safe.

Perceived risk:

- 1) I feel that purchasing a car with a CIS will cause a loss of driving performance.
- 2) I feel that purchasing a car with a CIS will cause a physical or mental loss.
- 3) I feel that purchasing a car with a CIS will cause a loss of convenience.
- 4) I feel that purchasing a car with a CIS will cause a loss of driving information.

Perceived price:

- 1) The CIS is very expensive.
- 2) The price of the CIS is higher than I had expected.
- 3) I will have to pay a price for the CIS above the expected price.
- 4) I know a car with a CIS will be very expensive for me.

Perceived value:

- 1) Having a car with CIS has a lot of value for me.
- 2) I feel that a car with CIS has good value.
- 3) A car with CIS is worth buying.

Purchase intention:

- 1) I am very likely to spend money to buy a car with a CIS.
- 2) I would be very happy to buy a car with a CIS.
- 3) I would buy a car with a CIS without considering very much.