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# **An Empirical Study on the Consumer Acceptance of Digital and Physical Products in E-Commerce**

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## **Abstract**

Although E-Commerce has marketability as well as usefulness, there are few empirical research on consumer acceptance, explained by economic theory. This paper suggests that the consumer product acceptance is determined by the difference of transaction cost and some other factors, such as uncertainty and asset specificity. In addition, it suggests that the characteristics of digital products may also play an important role in electronic markets.

We find that (1)consumers prefer electronic purchase in buying digital products and (2)transaction costs, uncertainty, and asset specificity have a significant effect on consumer product acceptance. Especially, there is a positive correlation between asset specificity and consumer acceptance in digital products that would be strategic items, paid attention in E-Commerce. Finally, we provide guidelines for a company that wants to deal with their products in E-Commerce.

**Key words: E-Commerce, Digital Product, Transaction cost, Consumer Acceptance**

## **1. Introduction**

According to the growth of information technology, there are consumer needs for customized, speedier products and services. Globally competitive knowledge and information products will be designated as strategic items and receive intensive attention in E-Commerce. As electronic markets can reduce time and costs and create new value, they are paid more attention to new marketing channel. Low transaction costs allow buyers to look for more product offers. And other factors, such as product uncertainty and asset specificity will affect on consumer product acceptance as well.

Furthermore, the characteristics of product might also play an important role in electronic markets. Consumer transaction process of digital products, such as airplane, travel and reservation service, may differ from economic characteristics, contrary to that of physical products. In an early stage, only physical products were transacted in a market, but these days demand on digital products is drastically increasing. This paper defines that there are two kinds of products, physical and digital products that are transacted in traditional and electronic

market.

The reason focusing on digital products is that the purchasing process of digital products has different economic features from that of physical products. Whereas digital products reduce the price because of few reproduction costs and distribution costs, they can make the high price by personalizing and customizing products[28]. It implies the characteristics of products can affect product price and product acceptance.

The objective of this paper is to examine how transaction costs, relevant to consumer product acceptance between traditional and electronic markets is applied. Second, based on transaction cost economics(TCE)[30], we assume that transaction cost, product uncertainty, and asset specificity affect consumer product acceptance. Through this study, we present for directing enterprises to plan strategies within an organization, to select proper products, and price their products in e-commerce. In the future, we can create business and extend it for developing a new profitable product.

This paper is organized as follows. The next section offers theoretical framework by analyzing TCE, digital products and consumer purchase process. In Section 3, we describe research variables and hypotheses. Section 4 presents a research method and results obtained from statistical analysis. Section 5 concludes this study and suggests future direction.

## **2. Theoretical foundations**

### ***2.1 E-Commerce and Transaction cost economics***

TCE was developed by Coase [10], Klein et al. [17] and Williamson [31][32]. Transaction costs are largely influenced by three transaction parameters: asset specificity, uncertainty, and the frequency of transaction. Product uncertainty refers to the cost associated with explaining and understanding products. Asset specificity refers to a degree to which durable investments that are undertaken in support of particular transactions, the transaction-specific skills and assets that are utilized in the production processes and provision of services for particular customers, such as human, physical, and site asset specificity [33].

Malone *et al.*[21] analyzes how factors such as the ease of product description and the degree to which products are specific to particular customers affect whether these interconnections will take the form of electronic hierarchies or electronic markets. Clemons[9] analyzes enterprises make decisions on minimizing the risks and costs of producing products. Bakos[3] proposes reduced price hypothesis in electronic markets. This reduction in search cost plays a major role in determining the implications of electronic marketplaces for market efficiency

and competitive behavior.

Strader and Shaw [25],[26] identify that digitalizable products are particularly suited for electronic markets because they not only take advantage of the digitization of the market mechanism, but also the distribution mechanism, resulting in very low transaction costs. Liang *et al.* [19] studied the characteristics of product purchase process in electronic markets and applied transaction costs theories to electronic market. They suggest that consumers move to electronic markets which reduce transaction costs and the consumer product acceptance is influenced by transaction costs including uncertainties and specificities. But there is no generalization on products, such as digitalizable products(i.e. travel information, stock information, e-book, game, MP3, and so on.). Lee [18] shows the aucnet, the auto auction market in Japan, makes higher price than in tradition markets. First, the aucnet arranges the auction catalogue via the satellite and suggests easy access to product and price information for buyers. Secondly, using institutional surveillance, it improves the quality of products and gives customers the confidence on products. Whereas the aucnet reduces the search costs, it suggests relatively high quality products and high price. In other words, they decrease product uncertainty and increase asset specificity.

As transaction cost, uncertainty and specificity are lowered by reducing the risk of transaction process under the development of IT, lowering uncertainty by explaining a product sufficiently, and overcoming the difference of time and place, consumer product acceptance becomes high in electronic markets[22], [33]. But the specificity of all products does not become low. Whereas the specificity of standardized products becomes low, that of products which gives knowledge and information becomes very high. In spite of high specificity and transaction cost of digital products, consumer product acceptance was high. Digital products such as differential software, customized and personalized travel info., education info., and stock info. have high specificity. The characteristics of digital products which are customized and personalized make consumer acceptance high in electronic markets.

## ***2.2 Physical and digital Products***

Whereas physical products are tangible, such as music CD, foods, and clothes in real world, digital products are intangible, which can be digitalized and create information and knowledge[5],[8],[16],[27]. Recent development in technology provoked new interest in digital products. We assume that different consumers may have very different values for particular digital goods.

Choi *et al.*[7] identify digital products into information products, concepts, and processes and services. He emphasized that digital products in EC would be important. Varian [29] takes

digital products to be anything that can be digitized. Many digital products are experienced goods which buyers must consume to learn their quality. Bakos and Brynjolfsson[5] point out that this creates new opportunities for repackaging content through strategies such as bundling, site licensing, subscriptions, rentals, differential pricing and per-use fees. Digital products have attracted people for promising businesses in EC. Fishburn and Odlyzko [12] study pricing of goods that is likely to be consumed in large quantities by individuals, such as movies or software. The value of Information often derives from a bundle of Information components, rather than from its individual pieces [2].

Digital products are stronger for them than for physical goods as follows: First, digital products allow perfect copies to be created and distributed almost without cost via the Internet. Second, digital products are characterized by negligible marginal costs [27]. Varian focuses on a particular aspect of differential price on digital products, such as quality discrimination and versioning. He suggests that a consumer is making a choice to maximize expected utility or minimize expected utility or minimize expected costs[30].

### 2.3 Research Variables

The operationalization of the constructs follows as table 1

<Table 1> Operationalization of constructs

<b>Construct</b>	<b>Items</b>	<b>Operationalization</b>
Consumer Acceptance	Decision on purchasing products	The degree of product acceptance (tradition vs. electronic markets)
Transaction Cost	Search Cost	Conscious Costs of finding products
	Comparison Cost	Conscious Costs of comparing alternatives
	Examination Cost	Conscious costs of examining and trying products
	Negotiation Cost	Conscious costs of negotiating terms and condition with sellers
	Order/Pay Cost	Conscious costs of order and payment
	Transportation Cost	Conscious costs of receiving purchased products
	Post-Service Cost	Conscious costs of maintaining and support products
Uncertainty	Product Uncertainty	Not meet the customer's expectation in the transaction process
	Process Uncertainty	Not have a complete confidence in the transaction process
Asset Specificity	Site Asset Specificity	Trade in a particular location
	Physical Asset Specificity	Need special physical equipment
	Human Asset Specificity	Need special expertise
	Brand Asset Specificity	Have brand reputation
	Time Asset Specificity	Timing of transaction

#### 2.3.1 Consumer product acceptance and transaction costs

The factors of affecting consumer acceptance are shop-design, discount, transaction costs and etc[14],[24]. But under the same conditions, consumers move into the electronic channel, which is low transaction costs.

### *2.3.2 Purchase process and transaction costs*

Transaction costs are generated by transaction process. Prior research suggests an Customer Purchase Life Cycle approach which includes seven major stages; search, comparison, examination, negotiation, order/purchase, and delivery[14],[15],[19],[20]. Two factors, influencing on transaction costs are asset specificity and uncertainty of product description. The largest difference of traditional and electronic markets is the reduction of transaction costs by the new information technologies[4],[18],[21].

### *2.3.3 Asset Specificity*

Asset specificity refers to the degree to which durable investments, that are undertaken in support of particular transactions, the transaction-specific skills and assets that are utilized in the production processes and provision of services for particular customers, such as human, physical, and site asset specificity[23]. Digital products can have the high-asset specificity by proposing customized and personalized products.

### *2.3.4 Uncertainty*

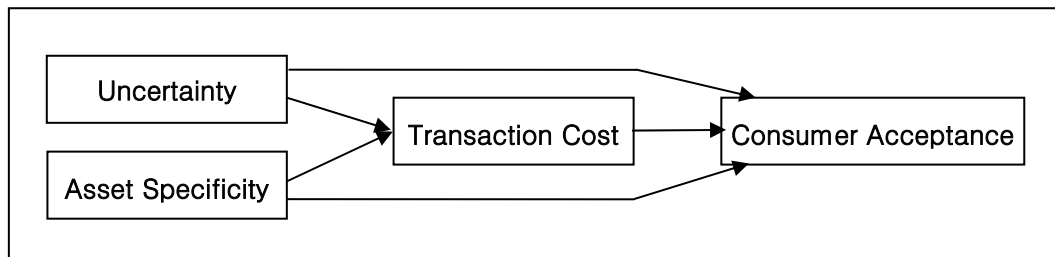
Uncertainty of product description refers to the amount of the attributes of a product in detail enough to allow potential buyers to make selection. Information technology makes transaction process simple and more explanation possible to allow the potential consumers to select products. The amount of information to be processed decreases in electronic markets. Therefore, uncertainty and transaction costs become lower.

## **3. Research Model and Hypotheses**

### ***3.1 Research model and variables***

Liang *et al.*[19] studied that customers would go with a channel that has lower transaction costs and the transaction cost of product on the web would be determined by the uncertainty and asset specificity, using five products with different characteristics. Due to the nature of electronic channels, not all products and services are suitable for marketing electronically. We bring research framework of Liang *et al.* (see Fig.1). We select carefully to represent different types of products. For example, physical products are books, music CD, electronic appliances,

life products(toothpaste, soap..), and presents(cosmetics, perfume..). Digital products consist of information contents, i.e., such as cyber education service, stock information service, and travel/reservation service, i.e., software.



<Figure 1> Research Framework

### 3.2 Hypotheses

#### 3.2.1 the relationship of consumer acceptance and transaction costs.

We hypothesized that consumer acceptance in electronic market will be higher than that in traditional market. We focus that the factors of consumer product acceptance are the difference of transaction costs. Also, Products have different characteristics. Whereas digital products have very low reproduction costs and distribution costs, they give customers satisfaction by customizing and personalizing products. Therefore, we assume that consumer acceptance on digital products is higher than that on physical products.

**Hypothesis 1-1 The possibility of purchasing products in electronic markets is higher than that in traditional markets.**

**Hypothesis 1-2 The possibility of consumer acceptance on digital products is higher than that on physical products.**

#### 3.3.2 Consumer acceptance

We analyze the relationship of four constructs which consumer acceptance, transaction costs, asset specificity and uncertainty. We assume that the factors, affected consumer acceptance are transaction costs, asset specificity and uncertainty. Prior research suggests that transaction costs including asset specificity and uncertainty are low in electronic markets. We hypothesize that consumer acceptance become high through reducing transaction costs, such as search costs and comparison costs in electronic market.

Also consumer acceptance is high by lowering product and process uncertainty through electronic markets. However consumer acceptance is high by increasing asset specificity

which is usefulness and private value in electronic markets. In other words, consumer acceptance is higher through reducing transaction costs and uncertainty, but through increasing asset specificity.

**H 2-1 Lower transaction costs in electronic markets increases consumer acceptance**

**H 2-2 Lower uncertainty costs in electronic markets increases consumer acceptance**

**H 2-3 Higher asset specificity in electronic markets increases consumer acceptance.**

#### 4. Research Method

To test TCE presented above, an empirical study is conducted. Ten products were chosen to assess the customer acceptance. A questionnaire was designed by 15 items representing customer acceptance(1 item), transaction cost(7 items), uncertainty(2 items), asset specificity(5 items). We use a 5-point Likert scale from absolutely no to absolutely yes to see subject's intention of purchasing products.

387 subjects who were familiar with Internet (i.e., potential customers for electronic markets) were participated in the experiment. 72 of them are graduate students, while the other 77 subjects had work experience. 287 undergraduate students were taking courses of Internet Business from the department of management of Ewha University, Seoul, Korea. They had already finished several business courses. For this reason, the subjects were considered to have enough knowledge and skill to understand research experiment.

Relying on the survey method, the methodologies of this research are T-test, ANOVA to verify hypothesis and structural equation modeling to evaluate research model. Structural equation model is an approach to assessing a model that involves multiple constructs with multiple constructs with multiple observation items [6],[13]. SPSS 9.0 and AMOS 3.61[1] were used to analyze. The Cronbach alpha for each item is also high, as listed in Table 2. This indicates that the instrument is reliable

<Table 2> Statistics and Reliability Analysis

Items	Means	Std. Div	Cronbach $\alpha$
Consumer Acceptance	3.5491	.4165	.6130
Search	2.5409	.5479	.8083
Comparison	2.6396	.4885	.7741
Examination	2.9206	.4444	.6756
Negotiation	2.7965	.5919	.8423
Payment	2.6298	.8381	.9563
Transportation	2.4205	.6665	.8745
Post-service	3.1772	.6285	.8684
Product Uncertainty	2.8152	.5314	.7487
Process Uncertainty	2.7383	.5516	.8166
Site Asset Specificity	3.0035	.6016	.8088



Physical Asset Specificity	3.2089	.7074	.8865
Human Asset Specificity	2.6366	.6628	.8700
Brand Asset Specificity	3.5708	.5260	.8125
Time Asset Specificity	3.2486	.6206	.8425

## 5. Analysis

### 5.1 the measurement model

We performed the exploratory factor analysis to assess their discriminant and convergent validity of our measures(See Table 3).

Variables	Factor 1	Factor 2	
Brand Asset Specificity	.644	-3.851E-02	.416
Time Asset Specificity	.563	-.177	.349
Physical Asset Specificity	.392	9.555E-02	.163
Human Asset Specificity	.374	.152	.163
Site Asset Specificity	.323	8.714E-02	.112
Product Uncertainty	-2.608E-03	.543	.294
Process Uncertainty	7.306E-02	.406	.170
Eigen Value	1.860	1.280	3.140
Cumulative %	26.568	18.282	44.849
% of Variance	16.200	7.613	23.813

<Table 3> Exploratory factor analysis

\*Extraction Method: Maximum Likelihood. Rotation Method: Varimax with Kaiser Normalization.

### 5.2 Analysis of Research Results

The collected data were analyzed to see whether the difference of transaction costs is between traditional and electronic markets and whether transaction cost, uncertainty, and asset specificity are the factors of consumer acceptance.

#### 5.2.1 transaction costs and consumer acceptance (Hypothesis 1)

Unlike Liang *et al.*'s results, customers prefer electronic market over traditional markets. The average consumer acceptance is 3.5491 which is higher than the indifference level of 3.0( $t=6.68$ ,  $p<0.05$ ). The level of consumer acceptance on digital products is higher than that on physical products. The average consumer acceptance on digital product is 3.6229, compared to physical products(average 3.001). The results of digital and physical products were respectively listed in Table 4. Digital products, such as, software, stock info, edu info and physical products, such as book, musicCD were preferred in electronic market( $p<0.05$ ). But life products such as clothes were preferred in traditional markets( $p<0.05$ ). Therefore, Hypothesis 1 is accepted.

<Table 4> T-test Statistics by products

	Products	Means	Std. Div	T-value	Sig.
Digital	Software*	3.6036	.9235	12.842	.000
	Travel info*	3.9328	.5809	31.590	.000
	Education info*	3.3333	.8933	7.341	.000
	Stock info*	3.5896	.9426	12.274	.000
Physical Product	Book*	3.8915	.8103	21.643	.000
	CD*	3.7558	.8942	16.585	.000
	Appliance	3.0259	.9853	.517	.606
	Life*	2.4468	1.0718	-10.128	.000
	Clothes*	1.9896	.8249	-24.065	.000
	Present	2.8964	1.0616	-1.918	.056

\* Correlation is significant at the 0.05 level.

### 5.2.2 Customer acceptance model (Hypothesis 2)

We ran AMOS three times. The first model tested customer acceptance including digital and physical products. We assume that different types of product have different influence on consumer acceptance model. Therefore, we decompose the data into two sub models; digital products and physical products. The second one is customer acceptance model for digital products. The third one is for physical products.

#### (1) Testing the model

To examine the structural equation model, we evaluate the size, sign, and significance of the standardized path coefficients. Fig.2.1 and Table 5 show our structural model and path coefficients. The fit between the data and the theoretical model is also acceptable ( $\chi^2 = 0.792$ ,  $p=0.373$ ). Therefore, we conclude that the measurement model discriminated adequately between the constructs. Overall, various goodness-of-fit statistics indicate that the model shows a good fit (NFI=0.996, GFI=0.999, AGFI=0.990, RMR=0.003, RMSEA=0.000). All factors except asset specificity and acceptance are significant statistically. 17% of Squared multiple correlation (SMC) in customer acceptance and 30% of SMC in transaction costs are accounted for by the model. The percentages explained by the model are greater than 10%, which implies a satisfactory and significant model [11].

<Table 5> Coefficient matrix of consumer acceptance model

	Transaction Cost	Uncertainty	Specificity	SMC
Consumer Acceptance	-.362 *(0.000)	-.263*(0.000)	.166*(0.001)	17%
Transaction Cost		.543*(0.000)	-.030(0.552)	30%

\* Correlation is significant at the 0.05 level.

(2) Consumer acceptance model for digital products

We ran model for digital product, such as software, travel info., education info., and stock info. Fig.2.2 and Table 6 show our structural model on digital products and path coefficients. The fit between the data and the theoretical model is also acceptable ( $\chi^2 = 2.006$ ,  $p=0.157$ ). Overall, various goodness-of-fit statistics indicate that the model shows a good fit (NFI=0.991, GFI=0.997, AGFI=0.974, RMR=0.006, RMSEA=0.051). All factors are significant statistically. 19% of Squared multiple correlations in customer acceptance and 32% of SMC in transaction costs are accounted for by the model.

<Table 6> Coefficient matrix of consumer acceptance model for digital products

	<b>Transaction Cost</b>	<b>Uncertainty</b>	<b>Specificity</b>	<b>SMC</b>
<b>Consumer Acceptance</b>	<b>-.395*(0.000)</b>	<b>-.333*(0.000)</b>	<b>.195*(0.000)</b>	19%
<b>Transaction Cost</b>		<b>.560*(0.000)</b>	<b>-.107*(0.035)</b>	32%

\* Correlation is significant at the 0.05 level.

(3) Consumer acceptance model for physical products

We ran model for physical product, such as, book, music CD, appliances, life products, clothes, presents. Fig.2.3 and Table 7 show our structural model on physical products and path coefficients. The fit between the data and the theoretical model is also acceptable ( $\chi^2 = 3.088$ ,  $p=0.097$ ). Overall, various goodness-of-fit statistics indicate that the model shows a good fit(NFI=.985, GFI=.996, AGFI=.96, RMR=.007, RMSEA=.074). All factors except asset specificity and acceptance are significant statistically. 18% of Squared multiple correlations in customer acceptance and 29% of SMC in transaction costs are accounted for by the model.

<Table 7> Coefficient matrix of consumer acceptance model for physical products

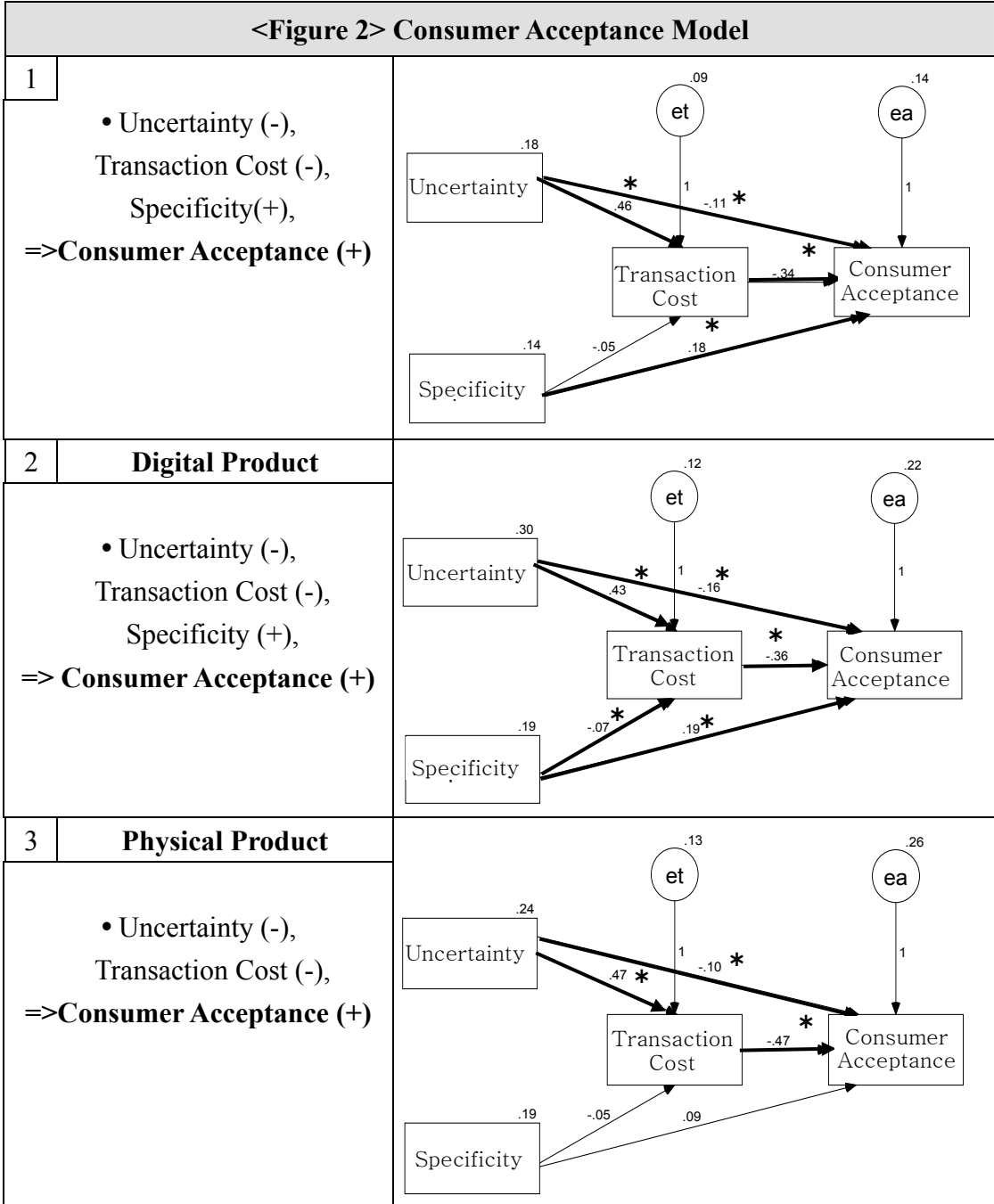
	<b>Transaction Cost</b>	<b>Uncertainty</b>	<b>Specificity</b>	<b>SMC</b>
<b>Consumer Acceptance</b>	<b>-.407*(0.000)</b>	<b>-.272*(0.000)</b>	.057(0.267)	18%
<b>Transaction Cost</b>		<b>.529*(0.000)</b>	.005(0.923)	29%

\*Correlation is significant at the 0.05 level.

5.2.3 Analysis of Results

We can find some interesting things. As the effect of consumer acceptance on different products was mixed in the model, we ran two models; for digital and physical products. First, we found that the factors of consumer acceptance are transaction costs, uncertainty and

uncertainty. Secondly, What we find is the effect of asset specificity on digital product acceptance. In other words, whereas asset specificity over consumer acceptance is significant statistically for digital products, it is not significant statistically for physical products. The result output from AMOS under the significance level of  $p=0.05$  is shown in Fig.2.



\* Correlation is significant at the 0.05 level.

**6. Discussion and conclusions**

This research has an empirical test on the factors of consumer acceptance based on transaction

cost theories, by classifying products into digital products and physical products.

First, we found that consumers prefer electronic markets over the web. The reason is that customers perceive low transaction costs in web. Therefore, the lower transaction costs are, the higher consumer acceptance is. Emerging new electronic market, search and comparison cost are drastically lowering and other examining, negotiating and after-service costs are as well. This implies that electronic markets are alternatives of consumer purchasing over traditional markets in the near future.

Consumer acceptance on digital products is higher than that on physical products in electronic markets. Search, comparison, transportation and after-service costs of digital products are very low. They are more likely to be purchased than physical products in electronic markets. Also, we found what products are more suitable for electronic markets, based on the TCE.

Second, we found the factors of consumer acceptance are transaction cost, uncertainty and specificity. The lower uncertainty and transaction cost are and the higher asset specificity is, the higher consumer acceptance is. In case of digital products, we find the effect of asset specificity over consumer acceptance. The reason is that asset specificity of digital products, customized and personalized, becomes high, compared to that of physical products that are simple and standardized.

In order to market a product successfully on the web, we should manage product uncertainty, and the asset specificity involved in the electronic transaction as well. This implies that if we implement the strategies of improving asset specificity and lowering uncertainty, we can raise consumer product acceptance. As noted earlier, consumer acceptance framework may be valuable to help establish the strategies of digital and physical products in electronic market. For instance, enterprises can understand customers' willingness to pay, make digital products profitable and charge high prices by customizing products. Therefore, the results of empirical analysis are expected to help the enterprises apply product development and marketing strategies.

Future works are as follows: First, even if we discovered the factors of consumer acceptance with TCE, TCE could not explain consumer acceptance completely. For this, we need to study on other factors, such as shop-design, discount, and so on. Second, we did not actually measure the cost. Rather, we focus on the perceived costs of the customer. This assessment could lead to biases. Thirdly, as experimental subjects are comprised of students and employee who are interested in EC, it could not explain total users' attitude. We need to generalize subject sets.

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