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A behavioural model of the adoption and use of new telecommunications media: the effects of communication scenarios and media product/service attributes

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Abstract

Recent years have seen the dramatic growth of new modes of communication. Above and beyond using land line and mobile phone for voice real-time communication, people spend increasing amounts of time receiving and sending messages through social networks (e.g. Myspace or Facebook) and also through real-time communication software (e.g. Skype or MSN). As indicated by the significant decline on the amount of call volumes of land line and mobile phone during the period from 2000 to 2006 in UK and in Taiwan, we conjecture that consumers are transferring to these new forms of communication in order to satisfy their communication needs, diminishing the demand for established channels.

The purpose of this research is to develop a behavioural model to analyse the perceived value and weight of the specific media attributes that drive people to adopt or use these new communication channels. Seven telecommunications media available in 2010 have been categorised in this research included land-line, mobile phone, short message service (SMS), E-mail, Internet telephony, instant messaging and social networking. Various media product/service attributes such as synchronicity, multi-tasking, price, quality, mobility, privacy and video which might affect the media choice of consumers were first identified. Importantly, this research has designed six types of communication scenarios in the online survey with 894 valid responses to clarify the effects of different communication aims, distinguish consumers' intended

behaviours toward these telecommunications media.

Various existing methods for modelling choice of media were considered including choice models based on intentions data, conjoint analysis and simple multi-attribute rating techniques exploiting ranks (SMARTER). The weight of each attribute in each communication has been estimated leading to forecasts of individual media choice of adoption and use. By calculating the forecasting error between the probability of the estimated media choice and the actual using behaviour, we found that using conjoint analysis to forecast the consumer's media choice is better than using SMARTER. In the issue of segmenting customers, using employment status is better than using self-explicated utility, which was introduced and applied quite often by past related researches. In addition, through aggregating the probability of the individual's media choice and the data on the proportion of communication spending in each scenario obtained by our survey, the market share of each media has been estimated. Media substitution effects between scenarios will also be addressed leading to forecasts of end usage patterns, a critical element in the investment decisions made by telecommunications and internet providers.

JEL codes: C42, C53, C81.

Key words: Multi-attribute choice model, Telecommunications media, Communication scenario, New product adoption, Substitution effect, ICT forecasting.

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1. Introduction

Previous research has examined consumer behaviour as it relates to only one or two ICT products' adoption, describing the consumer's perception of one specific product and the factors which affect the consumer's purchase decision or the usage pattern of the given product (Wang et al., 2006; Funk, 2005; Rennecker and Godwin, 2005; Leung, 2007). However, other products introduced in the market at the same time might also affect the consumer's purchase decision between the innovation and the existing products (Jun et al., 2002; Rice and Katz, 2003). Nevertheless, at the current stage of the improvement of internet speed and the increasingly mature technology for communication channels, telecommunication channels will converge to create a new telecom market structure. This research will discuss most of the communication channels that have been established for a long time, have the mature technology support, and have the considerable number of users in order to gain an overall understand of the whole telecom market and the interactions between channels.

Before the invention of the telegraph, telephone, and the Internet, people conversed face to face when nearby or through the postal service to communicate with people at a distance when they might experience an uncertain period of time before getting a response from the receiver. Nowadays people can use the telephone to communicate with each other without leaving their home or use the mobile phone to connect when on the move or outdoors. It is also possible now to see the receiver's face when making a phone call. In addition, if people want to exchange information through text, e-mail has also provided a popular option for them to send and receive mail through the Internet almost anytime and anywhere.

By the fast developing of Internet technologies and high competition between Internet providers, people have more opportunities on adopting new Internet applications. Internet telephony, one real-time communication software, is one of the most popular Internet applications. In the beginning Internet telephony was only applied in the professional compute lab but now it is well-known by most of the computer users. Social networking applications have also become popular in some specific groups such as students in the school or university. People use social networking applications such as Facebook or Myspace to send and read messages from their friends and share experiences online.

With new channels becoming available, consumers will consider transferring part of their voice communication needs into these new channels in order to satisfy their

communication needs. For example, people could use mobile to substitute for their landline-based communications. However, the increasing volume on mobile has not been enough to recover the drop in local calls which suggests there are other new communication channels provided in this telecommunication market such as SMS or internet application software that allows consumers to converse not only by voice but also by text message. As a result, there may be increasing competition between the existing established channels and new communication channels.

With such a range of communication channels now available in 2010, how do people make their decisions to adopt and use these media in order to successful fulfill their communication needs? Because of the nature of the design of these communication channels, each channel will have its specific attributes which will affect a user's adoption and usage depending on the particular communication purpose and the benefits and disadvantages of the alternative channels. Consumers will compare the benefits between these communication channels through assessing the importance of each attribute, thus choosing the most suitable channel for them each time they need to communicate with someone. Therefore, establishing which attributes will be considered by users in the various communications contexts they face and finding out how these attributes influence the users' channel adoptions will be the focus of this research. The research aims to help establish a framework for modeling consumers' communication channel choice and show how these will affect the forecasts of the adoption and usage pattern of these alternative communication channels.

After the first section of telecommunications market introduction, Section two outlines the background of telecommunications media discussed in this research and the media attributes which would influence the consumer's media choice. In Section three, the choice models including conjoint analysis and simple multi-attributes ranking technique exploiting ranks are addressed, while section four describes the communication scenario design, the questionnaire design and the data collection. Section five demonstrates the estimation results of media attributes' weighting and the media choice probability. The estimated medium market share and new entrant medium forecasting are described as well. We conclude in section six with a brief discussion of the media choice and the communication scenario design effect.

2. Background

2.1. Telecommunications media

Due to the evolution and improvements in telecommunication technology, there are now a variety of alternative channels which provide a much wider range of environments from which people choose. Landline and mobile are the two established communication channels that most people have used for the last ten years. For example in Taiwan, the penetration rate of landline is reached to 57.9% in 2007, and the penetration rate of mobile is reached to 105.8% in 2007 (Taiwan National Communication Commission, 2008). Consumers are therefore familiar with these two communication media due to the wide spread availability of these for a long time. However, there are not only these two communication media provided in the telecommunications markets in the 2000s.

Some fast developing alternative channels are more widely available to consumers. For example, the short message service (SMS) and the multi-media message service (MMS), which are the add-in functions of mobile, are now well-known and according to the statistics from the UK Office of Communications in 2008, the usage of SMS and MMS have doubled during the period from 2004 to 2007(UK Office of Communication, 2008). The improvement in the speed of the internet in recent years has also led some internet real-time applications to be adopted successful, such as the instant message, internet telephony, and social networks, such as Facebook. As a result, people now can not only transmit messages immediately, have a conversation with friends abroad anytime and anywhere, but also can see each other through Internet real-time application software which lets people converse as if face to face.

In this research, we first categorize the communication media now available in 2010 into two types: voice media and text media. Landline, mobile and internet telephony belong to the voice media type where people can have voice conversations using these media; email, short message service, multi-media message service, instant message and social network all belong to the text media type which people can communicate by using a range of data transportation forms such as text message or video transportation within these communication media.

2.2. The product/service attributes of telecommunications media

The attributes of telecommunications media have been identified through the literature review, interviews and focus groups we have done in order gaining the confirmatory evidence, several relevant attributes which may affect the consumer's communication channel decision have been identified and established. In this research, the consumer's decision making will be examined through the evaluation of the

importance of these attributes. Here are the definitions of these attributes:

(1) **Synchronicity**: sending and receiving messages simultaneously;
(2) **Multi-tasking**: conversing with more than one person with different topics at the same time;
(3) **Quality**: no delay, loss or noise when sending or receiving messages;
(4) **Price**: cost per conversation;
(5) **Easy to use**: friendly operational interface;
(6) **Mobility**: able to receive and send messages everywhere and move around during the conversation;
(7) **Privacy**: protecting the conversation without it being monitored or recorded by the third party;
(8) **Video**: able to see each other whilst conversing/ chatting.

Table 1: The experimental design for communication scenarios

Time length Nature of the conversation	Long	Short
Formal	Scenario One (Discuss work with your superior/ manager)	Scenario Three (Confirm critical information)
Informal	Scenario Two (Spend a long time chatting with your friends)	Scenario Four (Short, every-day conversation)
Transaction	Scenario Five (To make a complaint or require the information to service provider such as gas, water, internet or electricity)	Scenario Six (To make a reservation at a theatre or a restaurant)

2.3. Communication scenario

After carrying out a number of preliminary interviews and focus groups with students and staffs in the university, we have found that the duration and the content of conversations are the two main concerns of respondents when choosing the communication channel. Therefore, in order to analyze the effect of these two factors,

we have designed four communication scenarios which could regularly occur in people's daily life by using the length of the conversation and the degree of formality of the conversation as the two defining characteristics. Moreover, to include most of the possible communication types, two transaction communications which would not happen daily but are a necessary aspect of the communication for everyone were added. Table 1 is the experimental design of communication scenarios used in this research. Each experienced scenario of the conversation is given a short explanation or a short story to allow the respondent to get involved in our communication situation and therefore give the answer more precisely.

3. Models

Various consumer behaviour models and product adoption models, such as the technology acceptance model and innovation diffusion theory, are considered in this research. The technology acceptance model (TAM) and innovation diffusion theory (IDT) are widely used by many researchers to explain the adoption of the new ICT product based on the respondents' subjective cognition (Davis et al., 1989; Rogers, 1995; Pavlou, 2003; Keat and Mohan, 2004). The key factors in the TAM model are the perceived usefulness and the perceived ease of use, which will have direct positive effect on the attitude to the new product or service, and the behavioural intention to adopt it. Five characteristics discussed in the IDT model are: relative advantage, compatibility, complexity, trial ability, and observability. These characteristics, which are measured by the consumer's perception of the product, are used to explain the user's adoption and decision making process a new product or service.

However, for a manufacturer to design a new product, those perception factors might not be enough to be used directly for product research and development. As a result, some multi-attribute utility models such as conjoint analysis and simple multi-attribute rating technique exploiting ranks will also be considered in this research in order to capture the factors more objectively. These multi-attribute utility models are used to model the process of the consumer's decision making by decomposing the product into several attributes. The aggregate of the consumer's evaluation of these attributes will be the basis to analyze their product preferences and furthermore to forecast the future use intentions.

In this research simple multi-attribute rating technique exploiting ranks (SMARTER) and hybrid conjoint analysis have been applied to analysis the respondent's media decision making between six different communication scenarios. The probability of

the medium adoption prediction is estimated by the logistic model where the independent variable is zero for non-adoption and one for adoption. Multiple regression is used to predict the probability of the medium using intention.

There are three reasons for this research to apply these two models to compare the forecasting results. First, the hybrid conjoint analysis requires the consumers to evaluate their perception of each attributes of each channel and use their self-explicated utility to cluster consumers into several groups. For this research, in particular we will use these data in each group to forecast the channel adoption in the future. On the other hand, SMARTER requires the respondents to give the priority of the importance of each attribute and then calculates the possible channel which could be adopted by consumers. It used mainly to help managers to make complex decisions when several options are faced at a same time.

Second, by using of cluster analysis in conjoint analysis, the respondents will be segmented into several groups, depending on their self-explicated values, and the utility function of each group will then be produced. Therefore, the individual's utility function model and the group's utility function model can be obtained using the conjoint analysis. It also can predict the potential of a new product design by using the parameters estimated throughout the utility function model to evaluate the groups' preference and adoption of a new product design. In contrast, SMARTER is mainly focused on the individual's decision making rather than the group opinion. SMARTER cumulates the evaluations of each attribute and gives the decision maker a qualitative suggestion between all alternatives

Third, the weight of each attribute in conjoint analysis is calculated by the utility function model and it can represent the group opinion. In SMARTER, the weight of each attribute is decided by the decision maker

3.1. Simple multi-attributes ranking technique

The Simple Multi-attribute Rating Technique Exploiting Ranks (SMARTER), which was improved by Edwards and Barron (1994) from the simple multi-attribute rating technique, SMART, (Edward, 1971) is one kind of MAUT which used to help the decision maker to evaluate their decision making process and obtain the best utility from all available alternatives. SMARTER is especially used in individual decision making, for managers in one company to evaluate the alternative options. For

example, an investment decision could involve in thousands dollars and might be made by the high level manager only. Therefore, SMARTER can help a manager to progress their decision step by step and then for individuals also to progress their daily decision.

SMARTER assumes that the decision making process should include more than one attribute, and these attributes could be quantify via consumer's evaluation. After computing each attribute's utility function and their weight, the multi-attribute utility function will be built, and the utility of each alternative can be computed and compared afterward.

SMARTER is based on estimating the utility of alternatives choices. In this research we add the variable of conversation types in SMARTER as it would affect the consumer's decision making when getting involving into different communication scenario. Therefore the medium utility estimated via SMARTER is shown as follows:

$$U_{ijk} = \sum_{\ell=1}^{L} \omega_{ik\ell} E_{ij\ell}$$

where

U_{ijk} : The utility of j^{th} medium of i^{th} respondent in k^{th} conversation type

$\omega_{ik\ell}$: The weighting of ℓ^{th} attribute in k^{th} conversation type which was given by i^{th} respondent

$E_{ij\ell}$: The evaluation of j^{th} medium on ℓ^{th} attribute which was given by i^{th} respondent

3.2. Conjoint analysis model

Conjoint analysis is one of the most popular methods used in marketing research to analyze consumer's product adoption (Wittink, Vriens and Burhenne, 1994). This conjoint analysis method requires the respondents to give an evaluation of the selected products on the specific attributes which have been decomposed by our research and are believed to be the main attributes affecting the consumer's perceptions of the product.

In conjoint analysis, the respondents are requested to provide a large number of evaluations of alternatives preferences in order to estimate the individual utility function. To avoid over stretching the respondents and still tolerate the individual

differences in the utility function estimation, Green, Goldberg, and Montemayor (1981) suggested a hybrid data collection and analysis procedure for conjoint analysis to estimate the utility model. This hybrid model for conjoint analysis requires the respondents to explicate their individual's preference for each attribute and alternatives and then uses respondents' individual information to segment into several groups in order to understand the different between respondents and to increase the validity of the research result.

As shown in 3.1, we also add the variable of conversation types in the hybrid conjoint model to estimate the difference between communication scenarios. The hybrid conjoint method has considered both the self-explicated utility and full profile stimulus data as follows:

$$P_{ijk} = a + \beta_0 U_{ijk} + \sum \beta_\ell x_{\ell j}$$

where

P_{ijk} : The i^{th} respondent's use intention of j^{th} medium in k^{th} conversation given by our survey

$x_{\ell j}$: ℓ^{th} attribute of j^{th} medium

β_ℓ : The estimated part_worth utility of ℓ^{th} attribute

Let $U_{attribute_\ell} = \beta_\ell$, we can estimate the medium's utility function:

$$U_{medium_j C_k} = \sum U_{attribute_\ell C_k}$$

Where

$U_{medium_j C_k}$: The estimated j^{th} medium's part_worth utility in k^{th} conversation

$U_{attribute_\ell C_k}$: The part_worth utility of ℓ^{th} attribute in k^{th} conversation

To predict the probability of medium adoption and using intention, Multinomial Logit model has been used as below:

$$P_{medium_j C_k} = \frac{e^{U_{medium_j C_k}}}{\sum e^{U_{medium_j C_k}}}$$

where

$P_{medium_j C_k}$: The estimated probability of the using intention of j^{th} medium in k^{th} conversation

In order to compare the forecast accuracy of different models, Mean Absolute Error (MAE) and Mean Squared Error (MSE) are used in this research.

Mean Absolute Error (MAE) $MAE = \frac{1}{N}\sum_{i=1}^{n}\left|P_{ijk} - P_{medium_j C_k}\right|$

Mean Squared Error (MSE) $MSE = \frac{1}{N}\sum_{i=1}^{n}\left(P_{ijk} - P_{medium_j C_k}\right)^2$

3.3. Market share construction and New product forecasting

After obtaining the estimated probability of the using intention of each medium in each communication scenario, we multiply it by the individual's proportion of weekly conversation spending on each communication scenario to estimate the individual's usage of each medium.

Estimated individual media usage

$$I_i M_{medium_j} = \sum (P_{medium_j Ci} * I_i C_k)$$

where

$I_i M_{medium_j}$: The proportion of weekly conversation that i^{th} respondent would communicate via j^{th} medium

$I_i C_k$: normalized proportion of weekly conversation spending on k^{th} conversation by i^{th} respondent

By aggregating the individual's media usage, the estimated market share of each medium can be obtained.

Estimated medium market share from n respondents

$$GM_{medium_j} = \frac{\sum IM_{medium_j}}{n}$$

where

GM_{medium_j} : The market share of j^{th} medium

To forecast the change of the market share when one new product has entered the market or one attribute has been add or delete from an existing medium, the equation shown below is used.

$$GM_{medium_{new}} = \sum \beta_\ell x_{\ell new}$$

Where

$GM_{medium_{new}}$: The market share of a new medium

$x_{\ell new}$: ℓ^{th} attribute of a new medium

β_ℓ : $\beta_\ell = U_{attribute_\ell}$ The estimated part_worth utility of ℓ^{th} attribute

4. Data

4.1. Questionnaire design

Five parts of questionnaire have been designed including the communication scenario, the self-explicated function, the proportion of weekly conversation spending, the media usage history and the demographic information.

In the first part, the respondent was given six different communication scenarios separately and be asked to answer the evaluation and priority of these communication media. The items in the first part of this questionnaire all come from the literature review and the interviews we have carried out before. The respondent first was asked to pick the media they would like to use in the future and the media they have used depended on their previous experiences of communication channel choice. Then the respondent prioritized the importance of the attributes listed on the questionnaire in the different conversational scenarios. In the second part, respondents were asked to evaluate the perceived level of attribute of each medium. In the third part, the proportion of weekly conversation spending on each communication scenario was

given by respondents. The part four and part five of questionnaire were the media usage history, the available ICT devices used to access these media and the demographic information.

4.2. Sample source

The questionnaire was designed as a web survey by the software of SNAP 8.0. Emails of the web survey invitation have been sent to all students and staffs in Lancaster University, UK, from23 March 2009 to 3rd May 2009. 938 responses were received. A prize draw was used to increase participation. Various criterions are used to clean the data such as the amount of missing data, unreasonable answers and multiple submissions. After data cleaning, 894 valid responses have used in data analysis. Table 2 shows the demographic information of 894 respondents. Due to the aim of this research is to improving and developing a methodology on forecasting consumer's telecommunications media choice, the data used in this research is for demonstrating and adjusting the methodology.

Table 2 Demographic information

		All (894)	Student (740)	Staff (154)			All (894)	Student (740)	Staff (154)
Gender	Male	358	305	53	Marital status	Single	750	670	80
	Female	536	435	101		Married	122	64	58
Age	18-24	612	579	33		Divorced	15	4	11
	25-34	180	129	51		Separated	7	2	5
	35-44	47	16	31	Children	0	783	663	120
	45-54	36	15	21		1	61	45	16
	55-64	18	1	17		2	43	28	15
	65 +	1	0	1		3	2	1	1
Nationality	British	594	476	118		4 +	5	3	2
	European	119	105	14	Faculty	Management	365	300	65
	Others	181	159	22		Science and Technology	169	152	17
						Arts and Social Science	312	261	51
						Health and Medicine	48	27	21

K-means clustering method has been used to segment respondents into two and three groups. This segmentation step is one of the procedures of the hybrid conjoint analysis. It used the respondents' self evaluation of each communication channel and the results of the segmentation were used to estimate the utility function separately for each cluster.

In addition, due to the insignificant difference of the analysis between groups clustered above, the respondent's employment status has also been considered as one segment component.

5. Results

We use the data collected from the survey and estimated from the models to forecast the consumer's future usage and using behaviour after analyzing the consumer's individual preference utility function and the choice model.

The potential and optimal construction of the telecommunications medium is predicted via the utility function and the attributes we have found in this research. In addition, by aggregating the choice preference, the market share of existing and new media would be forecasted.

5.1. Weighting of media attributes

Table 3 shows the implicit weights analyzed by students and staffs to the attributes. According to the attributes selected in scenario one, a long and formal conversation, we can see that quality and price are the most two important attributes for respondents while discussing work. However, the result of parameter estimates of video gives us a different point of view. Respondents would not consider the available of video while conversing in scenario one and even become a related negative effect on the attribute perception. The explanation of this result is that while conversing with business or working issue, if people have choose to do this kind of conversation without face to face, then they would not prefer to be seen while making conversation.

Table 3 Summary of the conjoint analysis result of attribute weighting

	Synchronicity(a)	Multitasking(b)	Quality(c)	Price(d)	Mobility(e)	Video(f)
Scenario one (Student)	0.051	0.051	0.378	0.319	0.058	-0.063
	6%	6%	41%	35%	6%	7%
Scenario two Student	0.064	0.198	0.118	0.049	0.049	--
	13%	41%	25%	10%	10%	--
Scenario three Student	0.436	-0.063	0.315	0.311	0.023	-0.050
	36%	5%	26%	26%	2%	4%
Scenario four Student	-0.126	0.263	0.177	-0.198	0.095	--
	15%	31%	21%	23%	11%	--
Scenario five Student	0.579	-0.138	0.311	0.434	--	-0.096
	37%	9%	20%	28%	--	6%
Scenario six Student	0.58	-0.08	0.17	0.20	0.03	-0.02
	54%	7%	16%	19%	3%	2%
	Synchronicity	Multitasking	Quality	Price	Mobility	Video
Scenario one staff	--	--	0.385	0.310	--	-0.095
	--	--	49%	39%	--	12%
Scenario two staff	0.106	0.053	0.232	--	--	-0.052
	24%	12%	52%	--	--	12%
Scenario three staff	0.500	-0.116	0.296	0.369	--	-0.112
	36%	8%	21%	26%	--	8%
Scenario four staff	-0.096	0.115	0.321	-0.077	--	--
	16%	19%	53%	13%	--	--
Scenario five staff	0.551	-0.134	0.213	0.375	-0.040	-0.143
	38%	9%	15%	26%	3%	10%
Scenario six staff	0.55	-0.08	0.22	0.25	--	-0.07
	47%	7%	19%	21%	--	6%

Note: Scenario one: long and formal conversation; Scenario two: long and informal conversation; Scenario three: short and formal conversation; Scenario four: short and informal conversation; Scenario five: long transaction conversation; Scenario six: short transaction conversation.

(a) 0 = asynchronous, 1 = synchronous; (b) 0 = does not have this function, 1 = has this function;

(c) 0 = low quality of speech, 1 = high quality of speech; (d) 0 = high or expensive cost per conversation, 1 = low or free cost per conversation; (e) 0 = does not have this function, 1 = has this function; (f) 0 = does not have this function, 1 = has this function.

In scenario two, a long and informal conversation, quality is the most important attribute with 52% weighting for the staff group while spending a long time on chatting. However, for the student group, multitasking becomes the most important attribute with 41% weighting which affect student's media choice in scenario two and quality is the second important attribute for students. Moreover, price in scenario two becomes less important then it in scenario one, which means that price is not an important attribute when communicating in an informal conversation. This can be explained that while chatting with friends and family, student group would like to have multiple topics with different friends and it is the trend for people nowadays to do so. Consequently, price might not be the main point for students to consider due to the necessary of high quality requirement. From the point of view of staff group, synchronicity is the second important attribute with 24% weighting when chatting with friends and family. Therefore we can see that the attribute weightings between two groups are quite different. In addition, the video function also has a related negative effect on media choice for the staff group while making a long and informal conversation.

In scenario three, a short and formal conversation, synchronicity is the most important attribute for both student group and staff group. It is obviously to see that while confirming critical data, sending and receiving data are both very important and must be completed carefully. Therefore, while focusing on confirming data, people would not prefer to move around or doing other topic simultaneously. That is why the parameter of multitasking and mobile are both being negative.

In scenario four, while making a short and informal conversation, the staff group would prefer to use a high quality medium with 53% weighting of quality attribute. Due to the short conversation, the price is not important and even has become related negative for the effect of media choice. On the other hand, for the student group, multitasking is the most important attribute with 31% weighting. Price also has a related negative effect for the student group with 23% weighting. Due to only take a few minutes to complete this kind of conversation, the price per conversation has become not as important as quality or others. If they can do it quickly under a good quality environment, then price would not be the first consideration. In addition, synchronicity is also not very important while making short and daily conversation. The reason for it might due to the characteristic of this kind of conversation. The content of this communication might be quite similar everyday, therefore it would not be so necessary to have the synchronicity attribute, compared to other attributes.

In both transaction conversations of scenario five and six, synchronicity is the most important attributes for the long and short transaction conversation. Due to the characteristic of transaction communications, sending and receiving information are both very important while booking or requiring information from others. It is also obviously to see that due to complete the transaction conversation, people need to focus on their communication content. Therefore, the attribute of multitasking is not so important for people to consider and even become negative effect while making transaction conversations because it would not make people concentrated on the conversation and might also loss some important information.

5.2. Media using intention

The media choice is constructed by the attributes which was obtained from respondents' perception of attribute importance in each communication scenario. After analyzing the importance of the attributes which drive respondents' communication media using behaviour, the potential media using intention for each group have been estimated.

According to the result shown in the table 4, we can see that while communicating in a long and formal conversation, the majority of media choice of adoption and use is email. However, in a long and informal conversation, the media choice is quite different. The majority choice of media adoption is landline for both groups. One of the second media adoption choices for student group is SMS, which is a text medium, but for staff group, the second choice is mobile, which is a voice medium. In addition, Table 5 shows the results of media using intention between two groups are more interesting. The first choice of media use for the stuff group is Landline and the second choice is SMS or Mobile. In contrast, for student group, instant message and social networking are both the first choice of media use and Mobile is the third choice.

The majority of media choice in a short and formal conversation is voice medium, Landline and mobile. However, in a short and informal conversation, the first choice of media adoption of student group is SMS, which is a text medium. Although landline is the first choice of media adoption for staff group, SMS is still the majority choice of media use for both student group and staff group. The majority media choices in transaction conversations are landline and Mobile, which are both voice media.

Table 4: Summary of the conjoint analysis result of media adoption probability

	SMS	Landline	Email	Mobile	Internet telephony	Instant message	Social network	Explanation rate
Scenario one Student	0.361	0.554	0.796	0.399	0.228	0.228	0.356	72.50%
Scenario two Student	0.788	0.788	0.630	0.788	0.291	0.611	0.611	88.50%
Scenario three Student	0.354	0.892	0.724	0.807	0.204	0.147	0.223	77.10%
Scenario four Student	0.916	0.701	0.733	0.754	0.254	0.617	0.617	88.80%
Scenario five Student	0.111	0.888	0.793	0.755	0.157	0.049	0.091	87.00%
Scenario six Student	0.160	0.878	0.440	0.805	0.132	0.047	0.079	82.80%
	SMS	Landline	Email	Mobile	Internet telephony	Instant message	Social network	Explanation rate
Scenario one staff	0.336	0.721	0.882	0.491	0.227	0.227	0.309	79%
Scenario two staff	0.692	0.940	0.824	0.828	0.314	0.405	0.518	84.50%
Scenario three staff	0.181	0.892	0.689	0.789	0.094	0.041	0.086	85.80%
Scenario four staff	0.847	0.896	0.896	0.773	0.245	0.382	0.501	85.60%
Scenario five staff	0.048	0.886	0.701	0.666	0.048	0.011	0.041	90.70%
Scenario six staff	0.198	0.882	0.580	0.882	0.052	0.052	0.052	87.40%

Note: The media adoption probability shown in table 4 is the related probability.

Table 5: Summary of the conjoint analysis result of media use intention probability

		SMS	Landline	Email	Mobile	Internet telephony	Instant message	Social network
Scenario one Student	Utility	0.41	0.39	1.00	0.38	0.00	0.11	0.26
	Probability	0.14	0.14	0.26	0.14	0.09	0.11	0.12
Scenario two Student	Utility	0.60	0.67	0.60	0.92	0.00	1.00	1.00
	Probability	0.13	0.13	0.13	0.17	0.07	0.19	0.19
Scenario three Student	Utility	0.24	0.96	0.74	1.00	0.11	0.00	0.09
	Probability	0.11	0.22	0.18	0.23	0.09	0.08	0.09
Scenario four Student	Utility	1.00	0.53	0.38	0.73	0.00	0.56	0.56
	Probability	0.22	0.14	0.12	0.17	0.08	0.14	0.14
Scenario five Student	Utility	0.16	1.00	0.79	0.86	0.20	0.00	0.14
	Probability	0.10	0.23	0.19	0.20	0.10	0.08	0.10
Scenario six Student	Utility	0.14	0.99	0.41	1.00	0.12	0.00	0.03
	Probability	0.10	0.24	0.13	0.24	0.10	0.09	0.09
		SMS	Landline	Email	Mobile	Internet telephony	Instant message	Social network
Scenario one staff	Utility	0.35	0.35	1.00	0.16	0.00	0.00	0.20
	Probability	0.14	0.14	0.27	0.12	0.10	0.10	0.12
Scenario two staff	Utility	0.73	1.00	0.73	0.87	0.00	0.14	0.27
	Probability	0.16	0.21	0.16	0.19	0.08	0.09	0.10
Scenario three staff	Utility	0.24	1.00	0.80	0.83	0.18	0.00	0.17
	Probability	0.11	0.23	0.19	0.19	0.10	0.08	0.10
Scenario four staff	Utility	1.00	0.76	0.81	0.76	0.00	0.29	0.29
	Probability	0.21	0.17	0.17	0.17	0.08	0.10	0.10
Scenario five staff	Utility	0.11	1.00	0.74	0.73	0.20	0.00	0.21
	Probability	0.10	0.24	0.18	0.18	0.11	0.09	0.11
Scenario six staff	Utility	0.18	1.00	0.55	0.89	0.12	0.00	0.11
	Probability	0.11	0.24	0.15	0.22	0.10	0.09	0.10

Note: The media use intention probability shown in table 5 is the normalized probability.

5.3. Forecasting accuracy

In order to compare the forecasting accuracy, we first use the mean absolute error (MAE) and the mean squared error (MSE) to estimate the errors between the estimated media choice probability and the actual media usage probability given by our survey. Table 6 shows the MAE and MSE for each choice model and each clustering group. Preliminary we can say that using conjoint analysis to forecast the consumer's media choice is better than using SMARTER. In the issue of segmenting customers, using employment status to segment respondents is better than using self-explicated utility, which was introduced and applied quite often by past related researches, either clustering into 3 groups or 2 groups.

Table 6: Forecast Accuracy of the choice models

Model		MAE	MSE		MAE	MSE		MAE	MSE
Conjoint analysis	Scenario one staff	0.228	0.08	Scenario two staff	0.211	0.068	Scenario three staff	0.173	0.052
	Scenario one student	0.28	0.109	Scenario two student	0.237	0.08	Scenario three student	0.211	0.072
	Scenario one group1	0.298	0.12	Scenario two group1	0.226	0.074	Scenario three group1	0.219	0.075
	Scenario one group2	0.245	0.09	Scenario two group2	0.242	0.084	Scenario three group2	0.193	0.062
SMARTER	Scenario one	0.343	0.202	Scenario two	0.281	0.135	Scenario three	0.344	0.202
Conjoint analysis	Scenario four staff	0.218	0.073	Scenario five staff	0.165	0.048	Scenario six staff	0.156	0.048
	Scenario four student	0.236	0.082	Scenario five student	0.182	0.06	Scenario six student	0.176	0.059
	Scenario four group1	0.232	0.08	Scenario five	0.18	0.059	Scenario six	0.173	0.058
	Scenario four group2	0.236	0.083						
SMARTER	Scenario four	0.279	0.137	Scenario five	0.38	0.243	Scenario six	0.393	0.255

5.4. Market share of each medium and new product forecasting

After obtaining the probability of medium using intention, the market share of individual level and group level can be estimated. Table 7 is the result of the group level market share prediction.

Table 7: The estimated market share of each medium of each group

	Market share All	Market share student	Market share staff
SMS	15%	15%	15%
Landline	17%	16%	19%
Email	16%	15%	19%
Mobile	18%	18%	17%
Internet telephony	9%	8%	9%
Instant message	13%	13%	9%
Social network	13%	14%	11%

Table 8 is the parameter estimates of attributes which used to construct the medium market share. Here we can see that the market share of the best set in this table is 30~32%, which is much higher than the market share estimated for each existing telecommunications medium in table 7. Therefore, according to the condition given here, there might be a new and unknown telecommunications medium which could capture a lot of market share that not be launched yet.

Table 8: The parameter estimation of attributes for constructing the medium market share

	Synchronicity	Multitasking	Quality	Price	Mobility	Video	Market share of the best set
All	0.039	0.04	0.13	0.091	0.017	-0.006	32%
Student	0.041	0.048	0.123	0.089	0.022	-0.005	32%
Staff	0.032	0.004	0.162	0.103	-0.012	-0.013	30%

6. Conclusion

6.1. Conclusion

The purpose of this research is to develop a methodology for explaining and predicting the media choice. The results show that the communication scenarios play a very important role on affecting consumer's telecommunications media choice for different market segments. Clustering via the employment status is more significant effectively than via the self-explicated medium utility. However, the difference between student group and staff group is only significant in the scenario two, four and six, either in the adoption choice or usage choice.

The weighting of attributes of media adoption and media using intention are different between communication scenarios. The choice of media adoption and media using intention are also different between communication scenarios. However, the media choice between adoption and using intention are quite similar.

For text media and voice media choice, we found that for scenario one and four and scenario two of student group, text media would be the most preferable media to do this kind of conversation. On the other hand, voice media would be the most preferred choice in scenario two, three and the transaction conversations. It gives an idea that the communication scenarios would not only affect the attribute weighting, but also would affect the choice between voice media and text media.

For the type of conversation, both the nature and length, we also found that the media choice would be different between the time lengths and also between the natures of conversation. For long conversation, people would prefer the text media for the formal content, and voice media for the informal content. Furthermore, for short conversation, people would prefer the voice media on the formal content and text media on the informal content. However for transaction conversations, people would prefer the voice media to complete the conversation.

6.2. Limitation and further research

The estimation of attribute weighting and media choice are only given an example of the methodology we provide in this research. The results we obtained only apply to the data sample we collected and also for academic environment. However, the methodology we provide also can apply to examine other database for further data collection.

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