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사용자 관점 UCA 기술 경제성 분석 : QFD 응용*

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Commercial Aspects of Ubiquitous Contents Access Technologies : User Perspective Analysis using QFD*

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■ Abstract ■

In this paper, we investigated economic viability of UCA (Ubiquitous Contents Access) technologies from user adoption perspective. UCA technologies are expected to get embedded into media and telecom merging services. Embracing new technologies such as UCA technologies, forged through an industry convergence, means opting for a technological innovation that will have technological as well as economic and strategic implications. As such, we adopted user perspective innovation adoption theories to explore key antecedents affecting consumer acceptance of these emerging technologies. Subsequently, using QFD (Quality Function Deployment) method, the impacts of UCA technical functions on user's perceived value enhancements are estimated. The QFD analysis result indicates that the new UCA service technologies could achieve about 42% enhancement on user perceived adoption intention compared to existing digital contents service technologies. The proposed analysis framework and findings suggests significant insights for further research.

Keyword : UCA Technology, Innovation Adoption, QFD, Digital Contents, Media and Telecom Merging Service

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1. Introduction

Of the many digital convergence services, merging media and telecom has been drawing particular attention from both IT and media industries. Since the move involves not only traditional telecom sectors and IT industries, but also media and e-commerce, digital convergence between media and telecommunications means nothing less than the emergence of a new type of value chain between industries, formed through the resulting realignment among industries. Including recently introduced satellite DMB service, WIBRO, HSDPA technologies are being prepared for commercial launching.

Embracing a new business model forged through an industry convergence, means opting for a technological innovation that will have technological as well as economic and strategic implications [28]. Wirtz [39] suggested that three major drivers are required to successfully embark on services involving industry convergence : technological innovation, market deregulation, and change of user perception of the new services. As such, network providers and contents providers continuously investigate innovative technical functions to enhance the user perceived value on media and telecom merging services. One of the distinctive features of this trend is the upgrading the digital contents service quality since it is the one of the focal points of user adoption.

In this paper, we investigated the UCA (Ubiquitous Contents Access) technologies impact on user adoption of media and telecom merging services, into which the UCA technologies are embedded. The development of UCA technologies specifications and functionalities has been under progress by the Broadcasting Media Research Group in ETRI, Korea, since 2005. The new technologies could enhance Quality of Service (QoS) on digital contents fabrication and delivery via mobile telecom channels. The UCA technologies is now emerging, and draw attention from the network providers in the sense of radically upgrading the contents service level to cope with increasing data-centric customers.

To design the new services necessarily involves estimating factors to affect user's acceptance intention. It plays a critical role in determining economic feasibility of the new technology design. The importance of reflecting user perspective in early stage of new product design has been emphasized in many places. Assessing the economic feasibility of new technology is a daunting task, and it requires rigorous analysis to accurately forecast the user acceptance behavior when the new product or service is launched. Extracting user quality factors, importance weights of factors, and assessment of user perceived incremental values attributable to technical functions of new design or technology is crucial. Quality function deployment (QFD) is one of the widely used methods to assess the design quality in light of user quality [14, 15, 17, 19, 27]. QFD has an advantage of identifying technical factor's contribution to user quality, as well as reflecting them to design specifications. This approach is effective especially during the technical design stage of the new services since the user quality factors are dependent upon the technical functionality. The evaluation of user perceived values and technical functions could be reciprocally controlled.

However, in the field of emerging service areas such as merging media and telecom, most of the literatures used survey method to investigate the user quality factors, and the attempt to link to design quality has been seldom tried. The purpose of this paper is to fill this gap by extending user perception based behavioral research further to technological design of user service functions. We addressed the following research inquiries for this. First, what factors determine user adoption intention of digital contents based media and telecom merging services? Second, what are the antecedents of these factors, i.e. what attributes consist of user perceived quality of service that influence on user adoption level? Third, how to measure the contribution effect of UCA technologies on user adoption factors and intentions?

The rest of the paper is organized as follows. In next section 2, we introduced brief research background, and research method is organized in section 3. In section 4, theoretical behavioral model explaining the user adoption mechanism for digital contents centered merging media and telecom products. On the base of this, QFD procedures and analysis results are reported in section 5, followed by the research findings in section 6. Wrap-up of the study and implications are offered in section 5.

2. Background

2.1 UCA Technologies

UCA technologies are devised aiming at interoperable digital contents creation and transmission across the multiple platforms and networks so that end users can access to various contents independent to service delivery networks and reception devices with enhanced service quality. The existing services in this category are in the early stage of market penetration. Limited innovative early adopters are subscribing satellite DMB and mobile VOD services provided by Korean mobile network operators. UCA technologies are expected to contribute to rapid propagation of merging media and telecom services.

The strategic importance of UCA technologies could be attributable to upgrading fundamental digital contents service quality. Including satellite DMB, WIBRO and HSDPA services are expected to be forthcoming soon. Technical functions of UCA technologies are organized as the following five; scalable contents creation and packaging, inter-operable contents transmission and distribution, integrated QoS (Quality of Service) control and management, automatic contents adaptation, and automatic contents reconfiguration. The details are omitted due to the space limitation.

2.2 Innovation Adoption Theories

Rather than a limited notion referring to the initial application of a new technology or service, innovation is increasingly considered as a process ; which is to say, a process of diffusion (of innovation) that helps understand the process of adoption of a new product or service among consumers [28]. It is a process through which the outcome of a technological innovation such as a new technology is adopted, used and modified/improved by members of a society, triggering ripple effects across the economy. The technology acceptance model [10] focuses on the attitudinal explanations of intention to use a specific technology or service. TAM model has been widely used by several researchers to explain the attitudes and behaviors of information system users. Although the model is mainly applied to explaining the adoption of technology within organizations, the constructs of the model are meant to be fairly general [13]. Further details are reduced and available in [3-6, 8, 16, 18, 20, 21, 30, 32, 41].

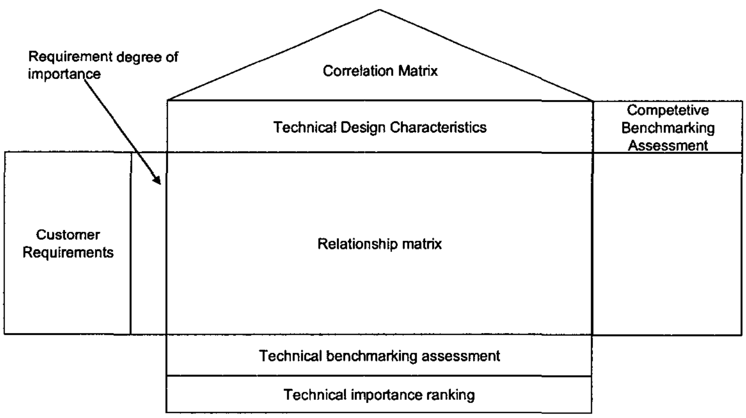
2.3 QFD Framework

QFD has been successfully applied in product and service design by many organizations. It is today established as an important quality tool in the design process [7, 15, 22, 29]. QFD is a planning tool which focuses particularly on customer requirements and expectations. It is often said to act as the "Voice of the customer" (VOC). It has been described as, "a system for designing a product or a service based on customer demands and involving all members of the organization" [27]. Lynch and Cross [26] also defined QFD as, "a system for designing a product or a service based on customer wants, involving all members of the supplying organization."

QFD offers a structured approach to integrating customer requirements with products and service design specifications, through the use of charts and matrices [14, 23]. The resultant "House of Quality (HOQ)" [17, 19] is made up of two principal portions - the horizontal portion comprising information related to the customer and the vertical portion, comprising information related to the supplier inputs. The HOQ model is illustrated in <Figure 1>, and the fundamental details are explained in Hauer and Clausing [19].

3. Method

The study had been conducted with the ETRI UCA technologies development project team in Korea from July 2005 to February 2006. Engineers from the outsourcing vendors, specialized in each technical function of UCA technologies, participated in technical effect analysis for QFD analysis. About fifty respondents were chosen from undergraduate students to estimate user perspective parameters related to UCA technologies in the merging media and telecom scenario.



<Figure 1> House of Quality [17]

<Table 1> Research procedure [14, 17, 19, 22, 34, 35]

Step	Activity	Method	Remark
1	User Adoption Model Development	Literature Survey	Innovation Adoption Theory, Service Quality Theory, TAM, Flow theory, e-Channel preference models, etc
2	UCA Technologies Enabled User Functions Extraction	Focused Group Brainstorming	ETRI UCA Technology Group, Engineersn from Technical Vendors
3	Incremental Value Assessment	QFD, AHP	Undergraduate students 52 sample data collection - survey Collect final 12 samples applying AHP consistency index criteria $(CI < 0.1)$
4	Analysis of Relationship between User function and Technology Function	QFD	ETRI UCA Technology Group, Engineers from Technical Vendors
5	Effect Estimation	QFD(Modified)	Statical Analysis

The method was designed to estimate the contribution effect of UCA technologies on user adoption when the technologies are embedded into various media and telecom merging services such as satellite DMB and forthcoming services of WIBRO, HSDPA, and so on. As summarized in <Table 1>, the procedures are organized as the following five steps. Procedure details are abbreviated

4. UCA enabled Service Adoption Model

Mobile telecom services and media broadcasting have their own distinctive values to capturing the market segment each respectively. The value of mobile services mainly stems from its ubiquitous functionalities, while the value focus of media is on entertainment and news broadcasting. The converging services of media and mobile telecom take on functional characteristics of the both services, and the unique value could be offered from synergy. In this perspective, we investigated the extant literatures to develop the conceptual model that could explain the user adoption intention for this innovative merging service of media and telecom.

Though exploring user behavior on this has received scant attention in academic research thus far, past research does provide a solid foundation for theory development in the area of mobile service adoption. Integrating an existing research, we adopted innovation adoption model of Agarwal and Prasad [2] and Rogers [33] as the theoretical foundation of our proposed model. We developed the conceptual model recognizing two central categories that influence adoption, awareness and personal value of the innovation.

4.1 Personal Value of the Innovation

In terms of merging traits of media and telecom, we defined relative advantage and playfulness as the key mediating constructs influencing adoption intention, which correspond to personal value of the adoption in Agarwal and Prasad [2] and Rogers [33].

The relative advantage implies perceived distinctive value relative to existing convergent or stand-alone services. The users will appreciate the merging services in general and in particular in this instance of UCA technologies embedded services, if the new service is valued distinctively compared to existing convergent or stand alone services. The playfulness refers to perceived entertainment value of the new services mostly from digital contents, which has been delivered mostly via TV and other online channels.

Relative advantage captures the extent to which a potential adopter views the innovation as offering an advantage over previous ways of performing the same task. Recent empirical studies in the information technology domain [1, 11, 24, 31] support the importance of relative advantage in predicting adoption behavior. Although Davis et al. [11] labeled the construct "perceived usefulness", Moore and Benbasat [31] claim that relative advantage is very similar to the notion of usefulness in the technology acceptance model [11] where usefulness is defined as the user's subjective assessment of the extent to which using an innovation will increase his or her job performance within a given organizational context.

Recent work has noted the conceptual similarity between the state of absorption and flow experience [38]. Citing examples of absorbed attention during activities where individuals appear to enjoy themselves intensely, Csikszentmihaiyi [9] developed a theory of flow : "the state in which people are so involved in an activity that nothing else seems to matter". Building upon the work of Csikszentmihaiyi [9], Trevino and Webster [36] presented arguments suggesting that the notion of flow is an important element of understanding human-technology interactions, and indeed, an important antecedent of attitudes toward technologies.

4.2 Awareness

The awareness is important because of the likelihood that information about many innovations may simultaneously be flowing through the social system. It is an adopter's acknowledgement that one or more of these innovations hold promise because of their ability to address a felt need that causes information seeking behavior. Such awareness of the innovation, although not a direct predictor of adoption behavior, compels potential adopters to seek further information. This view is consistent with prior research where awareness precedes other processes in innovation adoption [31]. We extracted five variables of reliability, customizability, interactivity, variety, (device) multi-functionality. The variables were organized from the extant literature on mobile contents applications, innovation adoption, and technology acceptance. These five variables were derived for, and used inter-changeably with user QoS attributes.

Reliability is extracted from DeLone and McLean [12]. The reliability of the system is most fundamental prerequisite to mobile services quality. In the digital contents transmission environment, not alone voice communication, superior reliability of mobile transmission quality should offer distinctive value. Seamless connection with proper quality digital contents delivery should be a necessary antecedents impacting on potential adopter's perceived value of relative advantage and contents enjoyment. As such, we extracted the reliability as the first attribute of perceived awareness.

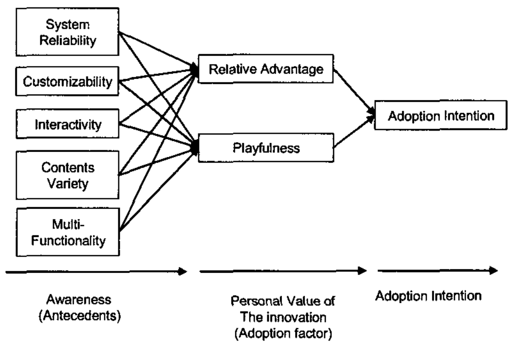
The interactivity implies dynamic relationship between the service providers and end users. Promoting interactive communication shall enhance adopter's perceived value on the service, thereby leading to more adoption intention. Interactive is one of the crucial antecedents affecting e-commerce system success. The UCA technology could enable diverse interactive services such as real-time exam or Q&A in e-learning context as well.

The contents variety refers to the extent of offering service diversity. UCA technologies embedded new services could allow vast amounts of digital contents created from different contexts to be available regardless of device platform. It should impact on perceived value of playfulness and relative advantage.

The customization means to provide the personally organized information or contents to users [25, 40]. For instance, extraction of particular parts of the contents at user's discretion will impact on enhancing relative advantage and playfulness, which in turn improves commercial value of the service significantly [37]. While existing mobile services provide only limited search function, enhanced customization capability enabled by UCA technologies will greatly influence the personal value of the new services.

Recent advances of providing integrated services of voice communication and MP3 play on single mobile phone offers distinctive value at least to some segment customer group. Likewise, providing multiple services on one single reception device regardless of user's mobile service subscription category, enabled by UCA technologies, shall contribute to the personal value of adoption. One plausible example would be not only receiving DMB contents but also accessing Internet, with satellite DMB reception device.

<Figure 2> summarizes the adoption behavior mechanism for media and telecom merging services aiming to measure the contribution effect of UCA technologies.



⟨Figure 2⟩ Conceptual model

5. QFD Analysis

As illustrated in <Figure 1>, HOQ table requires customer requirements and technical design characteristics. The technical design characteristics are organized as the five technical functions comprising UCA technologies. Two constructs of relative advantage and playfulness are extracted to represent personal value of the innovation, which directly affect the user's adoption intention. The five variables impacting on personal value of the innovation represent the customer requirements. Since the purpose of this study is to assess the contribution effect of UCA technologies, we extracted new and enhanced user functions available from UCA technologies for measurement purpose. As the variables we extracted are conceptual, we need more specific operational customer requirements to quantitatively measure the differences between the user perceived AS-IS levels and TO-BE levels. <Table 2> summarizes the ten user functions and their descriptions, which are included in the evaluation questionnaire.

The ten user functions are matched with the five variables (user QoS attributes). <Table 3> illustrates the matching between the variables affecting the personal values and user functions, and distinctive service levels that are possible by the existing technologies and UCA technologies. For instance, the user perceived value enhancement on customization is assessed by measuring the difference between the AS-IS perceived value and TO-BE perceived value of four user functions of searching, contents customization, summarization, and multi-quality option selection.

Further, since the perceived personal values are twofold ; relative advantage and playfulness, the values of AS-IS and TO-BE are measured two times in accordance with each value perspective. Thus, the first QFD matrix is developed to measure the UCA technologies contribution effect on personal value of relative advantage. <Table 4> illustrates the first QFD

〈Table 2〉 Enhanced user functions by UCA technologies

No	User Function	Description
1	Seamless stable reception	Enhanced digital contents reception quality
2	User QoS monitoring	User can monitor network status to control quality.
3	Ubiquitous reception	Enhanced reception quality
4	Advanced search	Menu driven advanced search for contents browsing
5	Contents customization	Storing and editing the authorized contents
6	Summarization	Partial extraction and re-editing the contents
7	Multiple quality options	High, medium, or plain quality service level selection
8	Interactive service	Real time two-way communication
9	Inter-operable contents	Contents subscription provided by other service medium
10	Device Multi-functionality	Multiple service usage with single reception device

〈Table 3〉 As-IS versus TO-BE expectation

User Quality Attributes	UCA technologies Embedded (TO-BE)	Existing technology Status (AS-IS)
System Reliability	∘ Seamless connection ∘ QoS monitoring ∘ Faster speed	∘ Occasional disconnection ∘ The absence of quality monitoring
Customization	∘ Advanced search function ∘ Contents customization ∘ Summarization funtction ∘ Multi-quality services	∘ Limited search function
Interactivity	∘ Full interactive services	∘ Limited interactivity
Contents Variety	∘ Inter-operable contents service	∘ service-specific contents
Multi-Functionality	∘ Multiple-services on single device	∘ One device - One service

〈Table 4〉 The QFD matrix for relative advantage

User functions & Awareness values		W.F(%); (1)		RA		Weighted RA			UCA Technology Factor (7)				
Fun-ctions	Awareness Value (QoS Attribute)			AS-IS Cus. value (2)	TO-BE Cus. value (3)	Weighted AS-IS; (1)×(2) (4)	Weighted TO-BE; (1)×(3) (5)	GAP ; (5)-(4) (6)	Contents Scaling Packaging	Inter-Operable Contents Transmission	Integrated QoS Control	Automatic Contents Adaptation	Automatic Contents Reconfiguration
1	System Reliability	0.1300	13	2.79	4.09	0.3627	0.5317	0.1690	3	1	5	5	3
2		0.0414	4	2.34	3.47	0.0969	0.1437	0.0468	0	0	5	0	3
3		0.0795	8	2.68	4.11	0.2131	0.3267	0.1137	1	3	1	3	3
4	Customization	0.0505	5	2.32	3.60	0.1172	0.1818	0.0646	3	0	0	0	5
5		0.0695	7	2.26	3.45	0.1571	0.2398	0.0827	5	0	0	3	5
6		0.0531	5	2.72	3.49	0.1444	0.1853	0.0409	5	0	0	0	5
7		0.0540	5	2.77	3.74	0.1496	0.2020	0.0524	3	3	3	3	3
8	Interactivity	0.1440	14	2.42	3.96	0.3485	0.5702	0.2218	3	5	0	0	3
9	Contents Variety	0.2272	23	2.60	3.98	0.5907	0.9043	0.3135	5	0	0	5	3
10	Multi-functionality	0.1508	15	2.68	4.00	0.4041	0.6032	0.1991	3	5	1	5	3
SUM		1	100	N/A	N/A	2.5842	3.8887	1.3044					
UCA Technology Contribution (7)		(8) AS-IS; SUM{(4)*(7)}							8.82	4.64	3.36	8.35	8.59
		(9) TO-BE; SUM{(5)*(7)}							13.24	7.99	4.91	12.50	12.88
		GAP (9)-(8)							4.42	3.35	1.55	4.15	4.29

〈Table 5〉 The QFD matrix for playfulness

User functions & Awareness values		W.F(%); (1)		P		Weighted P			UCA Technology Factor (7)				
Fun-ctions	Awareness Value (QoS Attribute)			AS-IS Cus. value (2)	TO-BE Cus. value (3)	Weighted AS-IS; (1)×(2) (4)	Weighted TO-BE; (1)×(3) (5)	GAP ; (5)-(4) (6)	Contents Scaling Packaging	Inter-Operable Contents Transmission	Integrated QoS Control	Automatic Contents Adaptation	Automatic Contents Reconfiguration
1	System Reliability	0.1300	13	2.74	2.91	0.3562	0.3783	0.0221	3	1	5	5	3
2		0.0414	4	2.49	4.11	0.1031	0.1702	0.0671	0	0	5	0	3
3		0.0795	8	2.92	3.47	0.2321	0.2759	0.0437	1	3	1	3	3
4	Customization	0.0505	5	2.51	4.30	0.1268	0.2172	0.0904	3	0	0	0	5
5		0.0695	7	2.64	3.60	0.1835	0.2502	0.0667	5	0	0	3	5
6		0.0531	5	2.58	3.62	0.1370	0.1922	0.0552	5	0	0	0	5
7		0.0540	5	3.00	3.60	0.1620	0.1944	0.0324	3	3	3	3	3
8	Interactivity	0.1440	14	2.89	3.89	0.4162	0.5602	0.1440	3	5	0	0	3
9	Contents Variety	0.2272	23	2.91	4.02	0.6612	0.9133	0.2522	5	0	0	5	3
10	Multi-functionality	0.1508	15	2.68	3.91	0.4041	0.5896	0.1855	3	5	1	5	3
SUM		1	100	N/A	N/A	2.7821	3.7414	0.9593					
UCA Technology Contribution (7)		(8) AS-IS; SUM{(4)*(7)}							9.54	5.02	3.42	8.84	9.24
		(9) TO-BE; SUM{(5)*(7)}							12.87	7.54	4.19	11.57	12.54
		GAP (9)-(8)							3.34	2.52	0.77	2.73	3.30

analysis. In <Table 4>, the differences between AS-IS values and TO-BE values represent the user perceived relative advantages enabled by the UCA technologies. For each user function, a respondent scores their perceived relative advantage assessment of AS-IS level and TO-BE level using traditional five scale (1 : very low, 2 : low, 3 : average, 4 : high, 5 : very high) measurement instrument.

In the same manner, the second QFD matrix is developed on playfulness. The QFD analysis results on this are illustrated in <Table 5>. Note that the figures on the relation part of the two QFD matrices are identical because the user functions and technical factors are same in both analyses. We also adopted 5 scale measure for the cells showing the relationship as ; 0 (no relationship), 1 (minimal relationship), 3 (moderate relationship), 5 (strong relationship) as in [19]. To estimate the various weights on the five variables and associated user functions, we applied AHP procedure as in [22]. The columns and rows in <Table 4> represent the followings.

(1) Weight : Relative importance weight of QoS attributes and user functions on relative advantage.
(2) AS-IS level : Perceived relative advantage score for existing service level.
(3) TO-BE level : Perceived relative advantage score for UCA enabled service level.
(4) AS-IS composite level : (1)×(2), Weighted value of relative advantage for existing service level.
(5) TO-BE composite level : (1)×(3), Weighted value of relative advantage for UCA enabled service level.
(6) GAP : The difference between weighted TO-BE level and weighted AS-IS level : The contribution on relative advantage by UCA enabled services
(7) UCA technology relationship with user functions
(8) Weighted UCA technology contribution impact on AS-IS level of relative advantage : Summation of {relationship figure of each function multiplied by AS-IS composite level}
(9) Weighted UCA technology contribution impact on TO-BE level of relative advantage : Summation of {relationship figure of each function multiplied by TO-BE composite level}
(10) Gap : Difference between (8) and (7)

6. Findings

We organized the analysis results for the assessment of contribution effect of UCA technologies on user adoption of media and telecom merging services. We first present the AS-IS versus TO-BE value increment results as per the user QoS attributes. Next, the contribution effect of each technical function comprising UCA technologies is presented.

6.1 Assessment on user value enhancement

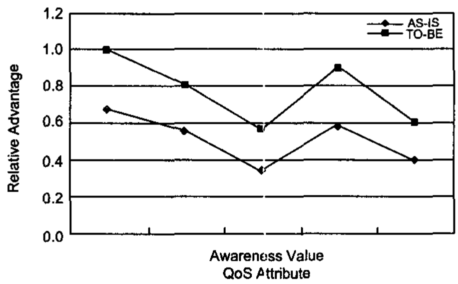
The perceived composite value scores of AS-IS versus TO-BE, with respect to relative advantage and playfulness, are illustrated in <Figure 3> and <Figure 4> each respectively. The value scores are plotted as per the five variables representing user QoS attributes (reliability, customization, interactivity, variety, multi-functionality). The values on <Figure 3> and <Figure 4> are extracted and summed from the

QDF matrix column (4) and (5) of <Table 4> and <Table 5> each respectively.

In <Figure 3>, the results indicate that UCA technologies significantly contribute to enhancing relative advantage by 50.48%. System reliability and contents variety show relatively high scores for both AS-IS and TO-BE values among the five QoS attributes. It explains that users regard system reliability and contents variety as the more significant factors affecting relative advantage in media and telecom merging service environment. As for the incremental value of relative advantage, the results indicate that UCA technologies contribution on relative advantage are achieved by enhancing system reliability and contents variety more compared to other user QoS attributes. Overall analysis results reveal the fact that UCA technologies effect to improve the personal value of relative advantage by improving all user QoS attributes.

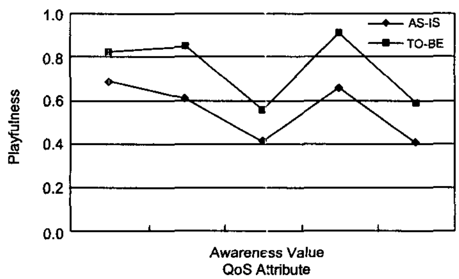
<Figure 4> illustrates the QFD analysis results of UCA technology contribution effect on playfulness. It indicates that UCA technologies significantly contribute to enhancing playfulness by 34.48%. As for the playfulness, customization and contents variety show relatively higher scores for both AS-IS and TO-BE values. System reliability also shows strong playfulness value effect. Users regard customization and contents variety as the more significant factors affecting playfulness. As for the incremental value of playfulness, the results indicate that UCA technologies contribution on playfulness is achieved by enhancing customization and contents variety compared to other user QoS attributes.

The aggregated results of the two QFD analyses on relative advantage and playfulness are



	AS-IS	TO-BE	Increment	Increment/AS-IS (%)
System Reliability	0.67	1.00	0.33	48.98
Customization	0.57	0.81	0.24	42.34
Interactivity	0.35	0.57	0.22	63.64
Contents Variety	0.59	0.90	0.31	53.08
Multi-functionality	0.40	0.60	0.20	49.25
SUM	2.58	3.89	1.30	50.48

〈Figure 3〉 Impact on relative advantage

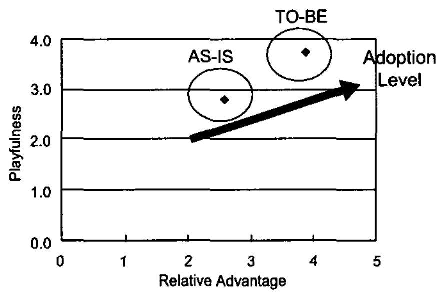


	AS-IS	TO-BE	Increment	Increment/AS-IS (%)
System Reliability	0.69	0.82	0.13	19.22
Customization	0.61	0.85	0.24	40.17
Interactivity	0.42	0.56	0.14	34.60
Contents Variety	0.66	0.91	0.25	38.14
Multi-functionality	0.40	0.59	0.19	45.90
SUM	2.78	3.74	0.96	34.48

〈Figure 4〉 Impact on playfulness

illustrated in <Figure 5>. Using the AHP [34, 35] results of the same relative importance of the playfulness and relative advantage on adoption intention, the incremental adoption level is calculated to be 42.35%. UCA technology contributes to enhancing relative advantage by 50.78%, and playfulness by 34%, which in sum leads to 42.35% of adoption intention increase.

	AS-IS	TO-BE	Increment	Increment/AS-IS (%)
Relative Advantage	2.58	3.89	1.31	50.78
Playfulness	2.78	3.74	0.96	34.53
Total	5.36	7.63	2.27	42.35

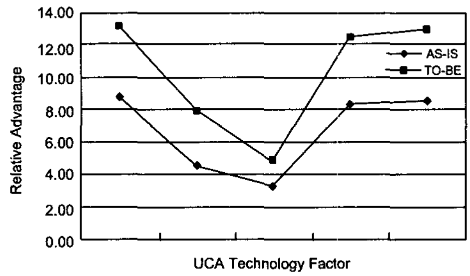


〈Figure 5〉 Impact on adoption intention

6.2 Assessment on UCA technologies contribution

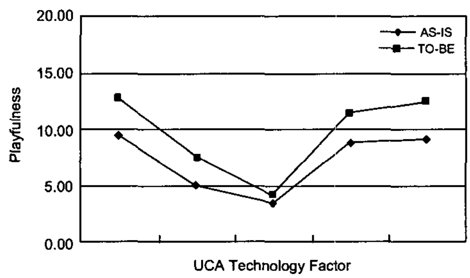
The contribution effects of UCA technology factors on enhancing relative advantage and playfulness are illustrated in <Figure 6> and <Figule 7> each respectively. Technology factors are organized as the technical functions of contents scaling, inter-operable contents transmission, integrated QoS control, automatic contents adaptation, automatic contents reconfiguration.

<Figure 6> indicates that all technical functions contribute to enhancing relative advantage. Among them, contents scale packaging, automatic contents adaptation, and automatic contents reconfiguration functions contributions are relatively high. Inter-operable contents transmission function shows most significant incremental contribution effect of 72% compared to AS-IS level. Similar results are revealed for the playfulness. In sum, by aggregating contribution effect on relative advantage and playfulness, each UCA technology function impact on adoption intentions is illustrated in <Table 6>.



UCA Technology Factor	Contents Scaling Packaging	Inter-Operable Contents Transmission	Integrated QoS Control	Automatic Contents Adaptation	Automatic Contents reconfiguration
AS-IS; SUM{(4)*(7)}	8.82	4.64	3.36	8.35	8.59
TO-BE; SUM{(5)*(7)}	13.24	7.99	4.91	12.50	12.88
Increment	4.42	3.35	1.55	4.15	4.29
Increment/AS-IS (%)	50.11	72.22	46.04	49.77	49.94

〈Figure 6〉 Technology impact on relative advantage



UCA Technology Factor	Contents Scaling Packaging	Inter-Operable Contents Transmission	Integrated QoS Control	Automatic Contents Adaptation	Automatic Contents reconfiguration
AS-IS; SUM{(4)*(7)}	9.54	5.02	3.42	8.84	9.24
TO-BE; SUM{(5)*(7)}	12.87	7.54	4.19	11.57	12.54
Increment	3.34	2.52	0.77	2.73	3.30
Increment/AS-IS (%)	35.00	50.29	22.59	30.85	35.74

〈Figure 7〉 Technology impact on playfulness

〈Table 6〉 Summary on technology contribution

	AS-IS	TO-BE	Increment	Increment/AS-IS(%)
Contents Scaling Packaging	18.36	26.11	7.76	42.27
Inter-Operable Contents Transmission	10.85	15.52	4.67	43.04
Integrated QoS Control	6.78	9.10	2.32	34.22
Automatic Contents Adaptation	17.19	24.07	6.88	40.02
Automatic Contents Reconfiguration	17.83	25.42	7.59	42.57

7. Conclusion

In this paper, we applied the modified QFD procedure to assess the contribution effect of UCA technologies on user adoption of media and telecom merging services when the technologies are embedded. The constructs and variables of the user adoption model were extracted from the extant literatures, and measured using AHP procedures.

The result indicates that user perceived QoS level shall be improved by UCA technologies, which in turn leads to user adoption intention increase by 42%. The analysis also showed that each UCA technology function contributes to relative advantage and playfulness though the effects are not uniform.

The contribution of this study is to extend the behavioral user adoption model to reflecting technology design aspects. Modified QFD procedure illustrated in this study also suggests to managing multiple criteria. The limitation of this study could be attributable to measurement scenario. We assumed that the technical functions we defined would be developed at mature level. Actually, we are not sure how far the technologies we develop will progress. The respondents to evaluate the user perceived QoS attributes are not fully aware of the maturity level of proposed user functions. We only assumed that user functions would be provided. The other limitation is that various marketing scenarios are not considered. We have left it as a next study. However, this limitation will not affect the research findings since estimating future technologies will necessarily involves uncertainty. The study provides significant insights for further research. The procedures and findings in this study could be extended to similar researches on technology impact analysis from user perspective.

Reference

[1] Adams, D.A., R.R. Nelson, and P.A. Todd, "Perceived usefulness ease of use, and usage of information technology : a replication," *MIS Quarterly*, (1992), pp.227-247.

[2] Agarwal, R. and J. Prasad, "The antecedents and consequents of user perceptions in information technology adoption," *Decision Support Systems*, Vol.22, No.1 (1998), pp.15-29.

[3] Ajzen, I., "From Intentions to Actions : A Theory of Planned Behavior," In Action Control : *From Cognition to Behavior*, Springer Verlag, New York, 1985.

[4] Ajzen, I., *Attitudes, Personality, and Behavior*, The Dorsey Press, Chicago, 1988.

[5] Ajzen, I. and M. Fishbein, *Understanding*

Attitudes and predicting Social Behavior, Englewood Cliffs, NJ, Prentice-Hall, 1980.

[6] Ajzen, I. and T.J. Madden, "Prediction of Goal-Directed Behavior : Attitudes, Intentions and Perceived Behavioral Control," *Journal of Experimental Social Psychology*, Vol.22(1986), pp.453-474.

[7] Akao, Y., "History of quality function deployment in Japan, the best on quality," *International Academy for Book Series*, Vol.3(1990), NY : New York, pp.183-196.

[8] Brancheau, J.C. and J.C. Wetherbe, "The Adoption of Spreadsheet Software : Testing Innovation Diffusion Theory in the Context of End-user Computing," *Information Systems Research*, Vol.1(1990), pp. 115-143.

[9] Csikszentmihaiyi, M., *Flow : The Psychology of Optimal Experience, Harper and Row*, New York, 1990.

[10] Davis, F.D., "Perceived usefulness, Perceived ease of use, and user acceptance of information technology," *MIS Quarterly*, Vol.13, No.3(1989), pp.318-339.

[11] Davis, F.D., R.P. Bagozzi, and P.R. Warshaw, "User acceptance of computer technology : a comparison of two theoretical models," *Management Science*, Vol.35, No.8(1989), pp.982-1003.

[12] DeLone, W.H. and E.R. McLean, "The DeLone and McLean Model of Information Systems Success : A Ten Year Update," *Journal of Management Information Systems*, Vol.19, No.4(2000), pp.9-30.

[13] Doll, W.J., A. Hendrickson, and X. Deng, "Using Davis's perceived usefulness and ease-of use instruments for decision making : A confirmatory and multigroup invariance analysis," *Decision Sciences*, Vol.29, No.4(1998), pp.839-869.

[14] Ermer, D.S. and M.K. Kniper, "Delighting the Customer : Quality Function Deployment for Quality Service Design," *Total Quality Management*, Vol.9, No.4&5(1998), pp.86-91.

[15] Ekdahl, F. and A. Gustafson, "QFD, the Swedish experience," *Proceedings of the 9th Symposium on QFD*, 1997.

[16] Fishbein, M. and I. Ajzen, *Belief, Attitude, Intention and Behavior : An Introduction to Theory and Research*, Addison-Wesley 1975.

[17] Franceschini, F. and S. Rossetto, "Quality function deployment : How to improve its use," *Total Quality Management*, Vol.9, No.6(1998), pp.491-500.

[18] Grover, V., "An Empirically Derived Model for the Adoption of Customer-based Interorganizational Systems," *Decision Science*, Vol.24(1993), pp.603-640.

[19] Hauser, J.R. and D.R. Clausing, "The House of Quality," *Harvard Business Review*, May-June(1988), pp.63-73.

[20] Huff, S. and M. Munro, "Information Technology Assessment and Adoption : A Field Study," *MIS Quarterly*, Vol.9(1985), pp. 327-339.

[21] Jung, T.H. and R. Butler, "The Measurement of the Marketing Effectiveness of the Internet in the Tourism and Hospitality Industry," In Fesenmaier, D. R., Klein, S. og Buhalis, D. (eds.), *Information and Communication Technologies in Tourism 2000*. Springer-Verlag, Wien-New York, 2000.

[22] Lai, Y-J., E.S.S.A. Ho, and S.I. Chang, "Identifying Customer Preferences in Qual-

ity Function Deployment using Group Decision Making Techniques," In *Integrated Product and Process Development*, Edt. by Usher, J.M. and H.R. Parsaei, Wiley (1998), pp.1-28.

[23] Natarajan, R., R.E. Martz, and K. Kurosaka, "Applying QFD to Internal Service System Design," *Quality Progress*, Vol.32, No.2 (1999), pp.65-70.

[24] Keil, M., P.M. Beranek, and B.R. Konsynski, "Usefulness and ease of use : field study evidence regarding task considerations," *Decision Support Systems*, Vol.13, No.1 (1995), pp.75-91.

[25] Liu, C. and K.P. Arnett, "Exploring the Factors Associated with Web Site Success in the Context of E-Commerce," *Information and Management*, Vol.38(2000), pp. 23-33.

[26] Lynch, R.L. and K.F. Cross, *Measure Up : Yardsticks for Continuous Improvement*, Basil Blackwell, Cambridge, MA., 1991.

[27] Maddux, G.A., R.W. Amos, and A.R. Wyskid, "Organizations can apply QFD as strategic planning tool," *Industrial Engineering*, 1991.

[28] Mahler, V. and E.M. Rogers, "The Diffusion of Interactive Communication Innovations and the Critical Mass : the Adoption of Telecommunications Services by German Banks," *Telecommunication Policy*, Vol.23 (1999), pp.719-740.

[29] Mazur, G.H., "QFD outside North America - Current Practice in Europe, The Pacific Rim, South Africa and points beyond," *Proceeding of the 6th Symposium on QFD*, 1994.

[30] McFarlan, F.W. and J.L. McKenney, "The Information Archipelago-Gaps and Bridges," *Harvard Business Review*, Vol.60(1982), pp.109-119.

[31] Moore, G.C. and I. Benbasat, "Development of an instrument to measure the perceptions of adopting an information technology innovation," *Information Systems Research*, Vol.2, No.3(1991), pp.191-222.

[32] Ramamurthy, K. and G. Premkumar, "Determinants and Outcomes of Electronic Data Interchange diffusion," *IEEE Transactions on Engineering Management*, Vol. 42(1995), pp.332-351.

[33] Rogers, E.M., *Diffusion of Innovations*, 5th ed. Free Press, New York, 2003.

[34] Saaty, T.L., "The Analytic Hierarchy Process : Planning, Priority Setting," *Resource Allocation, RWS Publications, Pittsburg*, 1991.

[35] Saaty, T.L., "How to Make a Decision : The Analytic Hierarchy Process," *Interfaces*, Vol.24, No.6(1994), pp.19-46.

[36] Trevino, L. and J. Webster, "Flow in computer-mediated communication," *Communication Research*, Vol.19, No.5(1992), pp. 539-573.

[37] Watson, R., A. Sigmund, and F. Leyland, "Attractors : building mountains in the flat landscape of the world wide web," *California Management Review*, Vol.40, Winter (1998), pp.36-43.

[38] Wild, T.C., D. Kuiken, D. Schopflocher, "The Role of Absorption in Experiential Involvement," *Journal of Personality and Social Psychology*, Vol.69, No.3(1995), pp. 559-579.

[39] Wirtz, B.W., "Reconfiguration of Value Chains in Converging media and Commu-

nication Market," *Long Range Planning*, Vol.34(2001), pp.489-506.

[40] Wu, D.I., M. Tremaine, K. Instone, M. Turoff, *A Framework for Classifying Personalization Scheme Used on e-Commerce Websites*, HICSS'03, 2000.

[41] Zmud, R.W., "An Examination of "Push-Pull" Theory Applied to Process Innovation in Knowledge Work," *Management Science*, Vol.30(1984), pp.727-738.