유비쿼터스 컴퓨팅 기반의 비즈니스 모델에 관한 연구 : 연구 분석 프레임워크 수립 및 실증 분석

황 경 태* · 신 봉 식** · 김 경 재***

Ubiquitous Computing-Driven Business Models : An Analytical Structure & Empirical Validations

Kyung Tae Hwang* · Bongsik Shin** · Kyoung-jae Kim***

Abstract

Ubiquitous computing(UC) is an emerging paradigm. Its arrival as a mainstream is expected to trigger innovative UC-driven business models (UCBMs). Currently, there is no parsimonious methodology to analyze and provide diagnostics for UCBMs. With this research, we propose a analytical architecture that enables the assessment of an UCBM in its structural strengths and weaknesses. With value logic as the cornerstone, the architecture is composed of value actors, value assets, value context, business value propositions, customer value propositions, value creation logics, and value assumptions.

Dimensional variables are initially identified based on the review of business model literature. Then, their significance is empirically examined through 14 UCBM scenarios, and variables that are expected to play an important role in the UCBM assessment are decided. Finally, by analyzing the scenarios in terms of the dimensional variables, we attempted to summarize general characteristics of emerging UCBMs.

Keywords : Ubiquitous Computing, Pervasive Computing, Business Models, Revenue Models, Value Logic, Case Based Reasoning

논문접수일 : 2005년 10월 9일 논문게재확정일 : 2005년 12월 4일

※ This work was supported by the Korea Research Foundation Grant (KRF-2005-B0008) and San Diego State University.

※ We are grateful to Dr. Hogeun Lee at Yonsei University for supporting our search.

* 주저자, 동국대학교 경영대학 정보관리학과 교수

Tel : 02-2260-3708, Fax : 02-0260-3684, e-mail : kthwang@dongguk.edu

** 교신저자, San Diego State University, Department of Information and Decision Systems 부교수

*** 동국대학교 경영대학 정보관리학교 조교수

1. INTRODUCTION

Ubiquitous computing (UC) represents the emerging trend toward numerous, casually accessible, often invisible computing devices, connected to an increasingly ubiquitous network infrastructure. We witnessed how the addition of the network dimension, especially the Internet, resulted in the order of magnitude increase in creative business models. It has evolved into a market platform that can curtail various "frictions" associated with conventional business activities. It can reduce information asymmetry, disrupt traditional value chains, increase transaction speed, remove spatial and temporal boundaries, and improve connectivity of economic agents [Zimmermann, 2000 ; Zott et al., 2000].

UC is a paradigm that elevates the use of networking and computing technologies into a higher level. Accordingly, its emergence is expected to trigger business models that take advantage of UCcapabilities to produce business values. A sustainable business model bears a significant effect on business performance [Afuah and Tucci, 2001 ; Boulton et al, 2000 ; Petrovic et al., 2001 ; and Rayport, 2002]. Despite the inevitable arrival of UC and accompanying opportunities, there is no methodology on which strengths and weaknesses of an UCBM can be analyzed.

With this research, a parsimonious analytical architecture and accompanying dimensions that enable the assessment of an UCBM was initially developed. The main challenge of this work was that the framework should be theoretically sound and also control its definitional boundary to enable penetrating research. Given the dearth of existing studies on UC, we relied much on e-business literature to derive the analytical structure of UCBMs. Justification of the initial reliance on e-business literature is that networking space (e. g., Internet) becomes the habitat of e-business models and UCBMs. Once the architecture was defined, key variables of each dimension were initially identified and their significance was empirically examined through 14 UCBM scenarios. Finally, by analyzing the scenarios in terms of the dimensional variables, we attempted to summarize general characteristics of emerging UCBMs.

2. LITERATURE Review

A consistent definition and usage of the business model concept can offer many benefits. It serves as a structured approach to guide idea generation ; becomes a tool to define and implement a business plan ; allows better communication among partners, customers, and stakeholders ; and helps to clarify managers' expectations from business and technical people [Klueber, 2001]. It can also improve organizational focus ; establish a framework for agile competition ; facilitate the identification of performance measures ; and allow the simulation of new business strategies with risk free experiments [Osterwalder and Pigneur, 2002].

In spite of the value, business model echoes much ambiguity, contradiction, and misconception [Amit and Zott, 2001 ; Hedman and Kalling, 2003] and still remains as the most discussed

but least understood concept [Chesbrough and Rosenbloom, 2000]. The observation of existing studies reveals that such ambiguity and inconsistency partially stem from the fact that the context of arguments cannot be universal and such contextual heterogeneity was not adequately addressed [Chaharbaghi et al., 2003]. Many approached the business model from the perspective of an architecture or a system. A business model is the architectural implementation of business strategy and the foundation for the implementation of business processes and information systems [Osterwalder and Pigneur, 2002]. It is the architectural configuration of components (information, service, product or transactional parties) designed to exploit business opportunities [Amit and Zott, 2001]. It is the architecture to create, market and deliver value and relationship capital(product, service, and information) to customers in order to generate revenue streams [Dubosson-Torbay et al., 2002 ; Timmers, 1998]. More focused on e-business, Afuah and Tucci[2001] defined that an ebusiness model represents "the system of components, linkages, and associated dynamics that utilize the properties of the Internet to produce business value."

Understanding a business model from the architectural viewpoint demands the review and assessment of associated elements. As related, several studies have suggested main dimensions and accompanying variables of a business model although there is much divergence among them. Based on the literature synthesis, we identified and classified recurring elements of a business model in terms of "products and services", "value propositions", "customers", "business processes", "firm infrastructure", "financial aspects", and "market structures" (see <Table 1>).

The items summarized in <Table 1> implies the amorphous status of the "business model" concept. It may also indicate that dimensional constituents essential to a particular model and their importance within a business context may not be homogeneous [Linder and Cantrell, 2000]. It is, therefore, anticipated that

〈Table 1〉 Business model components

RELATED CATEGORIES	COMPONENTS
Products & services	production, pricing, commerce model, product innovation
Value propositions	stakeholder value propositions, value creation logic
Customers	customer relationships, community
Business processes	supply and distribution channels (activities, implementation, capabilities)
Firm infrastructure	organizational form, technology, platforms, assets configuration, knowledge management
Financial aspects	revenue model, capital model, cost structure
Market structures	actors and business networks, their roles and interdependencies, protocols of interactions, governance, legality, market segment, network position

elements essential to assessing UCBMs differ from those of e-commerce and other traditional business models. Based on the conjecture, a parsimonious analytical architecture of an UCBM is derived based on the value theory and literature characterization.

3. ANALYSIS ARCHITECTURE

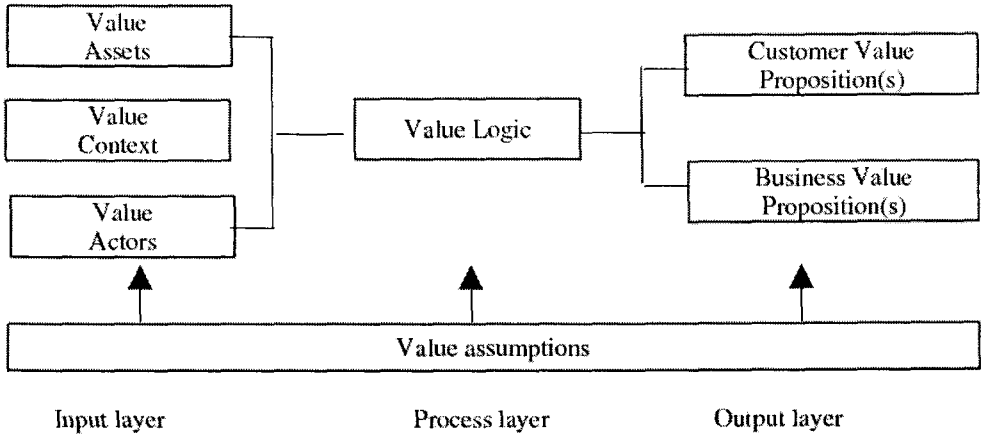
Drawing on the literature review of business model elements (see <Table 1>) and the value theory, an assessment architecture of UCBMs is proposed. It is intended to render a relatively parsimonious analysis structure for an UCBM conceptualized. It is a generalized meta model on which a context specific UCBM can be analyzed (Chaharbaghi et al, 2003). The architecture is composed of seven core dimensions : value assets, value actors, value context, value creation logics, business value propositions, customer value propositions, and value assumptions. The dimensions are delineated into a structure with three analysis levels (inputs, process, and outputs), which merely indicate the precedence relationship, not causality.

Value actors are stakeholders involved in a value creation process. Just as traditional off-line and on-line business models, main stakeholders of UCBM will be suppliers(e.g., service providers), customers (e.g., service users), and mediators (e.g., intermediaries).

Value assets are resources, infrastructure, knowledge and capabilities to be mobilized for intended value creation, and, to a certain degree, reflect the cost of implementing an UCBM. The ***value context*** dimension was included because contextual uniqueness becomes the source of business and customer values for most UCBMs. ***Customer value propositions*** are a tangible or intangible value customers are expected to benefit from a particular UCBM. ***Business value propositions*** represent financial and non-financial benefits an UCBM should offer to its offering company and value network partners. The ***value creation logic,*** as the cornerstone of the framework, describes the condition of interactions, processes, and activities involved to create proposed customer- and business values. Finally, UCBMs will be grounded on a variety of ***value assumptions*** that have to be employed to hypothesize uncertainties exist within the dynamics of value elements.

Here, the value concept becomes the theoretical essence of the architecture. Our tenet is that UC-technologies become the value (including revenue) - triggering source of an UCBM. Value is an economic concept that makes people engage in business relationships. It is the trade - off between benefits and sacrifices [Walter et al., 2001] such as the price/ quality ratio of a product [Kambil et al., 1996] and is the surplus as a result of the difference between perceived use value and exchange value [Bowman and Ambrosini, 2000].

An UCBM should be designed to serve both customer and business values (e.g., profit). With increasing importance of customer orientation, value propositions of a service/product have been focused on meeting



〈Figure 1〉 An analysis architecture of an UCBM

customers' expectations. But, UCBMs' value propositions should ideally target both external (e.g., customers and suppliers) and internal constituencies (e.g., business units and shareholders). UC has a potential to create unique values enabled by higher task dynamism, social computing, shared computing resources, invasiveness, activity timing, transaction efficiency (e.g., costs, speed, and convenience), novelty, and personalization [Amit and Zott, 2001 ; Zott et al., 2000].

In the next section, we empirically attempt to determine dimensional variables that may be significant in assessing the potential of an UCBM. Given that the UCMB is still an emerging concept, we appropriate UCBM scenarios to achieve the research goal. For this, first, prospective UCBM scenarios are identified. Then, the variables of consideration are initially identified from the literature review of business models. Third, significance of the initial variables are assessed in the context of the scenarios and variables that show particular relevance are identified. Fourth, by analyzing the UCBM scenarios in terms of the variables, we attempt to characterize emerging UCBMs. Finally, we discuss implications of the empirical analysis on the integrity of the UCBM architecture.

4. UCBM SCENARIOS

For the empirical study, detailed descriptions of 14 prospective UCBM scenarios are compiled for the research. They are :

1. Customized content provision : This service improves information accessibility by offering various types of customized contents (e.g., entertainment, news) to subscribers through such channels as mobile Internet, fixed displays, or hand-phones.
2. Intelligent environment optimization : This service aims to control temperature, humidity, polluted air, or other environmental pollutions through the mobilization of in-

telligent sensor technologies.

3. Intelligent terminal service : This service enables airport and other terminal clients and travelers to use UC technologies to access real-time information associated with boarding, facilities, baggages, and others.
4. Delivery service : Delivery services can use RFIDs or other technologies to track current locations and delivery status, to expedite sorting and processing, and to prevent unforeseen delivery accidents.
5. Total shopping experience : Shopping can become a lot more friendly experience when products carry RFIDs, when shopping carts and personal devices that recognize RFIDs to provide shopping information and when UC technologies enable automated and expedited transactions such as electronic payments.
6. Supply chain/inventory management : Inventory management and supply chain management becomes more reliable, effective and efficient through the use of UC technologies.
7. Mobile finance : With mobile technologies such as hand phones and PDAs, financial services of all sorts can be offered without temporal and spatial limitations.
8. Vehicle diagnostics & maintenance : This service embeds RFIDs or intelligence sensors within cars, aircrafts, ships, or any other vehicles to enable automated and periodical diagnosis, to issue advanced warnings, and to initiate communications with maintenance service providers.
9. Education and learning support : This service is designed to supplement learning within/without classrooms via UC technologies such as electronic board, electronic notebooks, and monitoring.
10. Environment monitoring : This service enables the monitoring of environment, industry wastes, atmosphere, water sources using a variety of UC technologies including Smart Dust, RFID tags, and portable terminals.
11. Patient support service : Through such UC technologies as smart bracelets, RIFD tags, portable terminals, bio-rhythm monitors and others, this service enables the effective management and care of medical patients.
12. Medial support service : Using a variety of UC technologies, this focuses on supporting medical staff with adequate information and freeing them from daily routines so that they can deliver quality medical services.
13. Facility management and protection : Using UC technologies, this service protects firms, residence, storage facility, artifacts, and other structures from a variety of environmental (e.g., temperature, humidity, fire) and non-environmental (e.g., arson, theft) threats.
14. Home management : Utilizing UC technologies, it is designed to render intelligent maintenance of environment (e.g., temperature), energy and utility, security and safety, and information in a holistic manner.

5. DIMENSIONAL VARIABLES

Initial variables of consideration for each dimension are determined based on the literature review of e-businesses. These variables are, then, applied to the fourteen UCBMs to judge their relevance. The result of this process demonstrated that only a subset of e-business variables could be meaningful for UCBMs. Discussions in this section are based on the variables identified from the scenario analysis, which are deemed relevant for the assessment of UCBMs. It is, however, important to emphasize that our discussion represents only a small set of variables that have to be investigated. Finally, by applying the dimensional variables to the scenarios, we attempted to summarize general characteristics of emerging UCBMs.

5.1 Value Actors

Value actors may be characterized from their roles and relationships. The customer roles may be understood in terms of direct- and indirect functions [Walter et al., 2001]. The former type looks into the shortterm value of customer relationship, especially financial benefits including profitability and volume. Meanwhile, the latter focuses more on customers' long-term contributions in the form of innovations, referrals, feedbacks, and business networking. The analysis indicates that bigger contribution of UCBMs for sellers and intermediaries will be their indirect role in strengthening customer loyalty and lock-in rather than direct financial rewards.

Stakeholders can be characterized by their relationships as well. Such factors as controlling subjects of marketplace (e.g., controlled by sellers, buyers, or neutral third parties) [Berryman et al., 1998] and transactional initiatives and directionality (e.g., active vs. passive, pull vs. push) [Bartelt, 2001] was adequate for explaining UCBMs. Despite, value distribution of scenarios did not reveal any conspicuous patterns.

The nature of value actors in their historical roots was relevant. It was expected that dominant UCBM providers will be off-line based and established businesses because of the significant infrastructure necessary for their provision. Accordingly, the role of on-line and new businesses in delivering UCBMs is expected to be limited. Also, unlike Internet based e-businesses, demand for service mediation (intermediaries) is expected weak and, also, Internet portals are expected to play a reduced role under UCBMs.

5.2 Value Assets

Value assets are soft and hard resources necessary for intended value creation. Here, our discussion focuses on technology assets necessary to realize an UCBM. According to Dubosson-Torbay et al. [2002], they can be divided into tangibles (e.g., IT infrastructure) and intangibles (e.g., specialized knowledge and patents, brands, and human assets). Analysis of the scenarios indicates that tangible assets are expected to play more im-

portant role for the success of UCBMs than intangible assets, simply because many UCBMs are infrastructure-driven (e.g., network, sensors). This observation does not coincide with many schools of thought that placed more weights on intangibles (e.g., knowledge) than tangibles for creating target values.

Grounded on the theory of resource-based view, much research has been conducted to examine the implications of resource characteristics on organizational performance. For instance, derived from the work of Grant [1991], it is hypothesized that durability, transparency, transferability, and replicability are general asset features associated with the success of an UCBM. Also, when an UCBM utilizes assets valuable, rare, imperfectly tradeable and costly to imitate, the odds of its success may improve [Barney, 1986 ; Black and Boal, 1994 ; Markides and Williamson, 1996].

We came up with several projections from the scenario analysis. First, among the asset variables, those of technological innovativeness that makes it difficult to replicate, costly to imitate, and thus offer rare value are expected to be especially relevant. It was also learned that the importance of asset attributes is not consistent across UCBMs. In general, we expect that technology asset features in UCBMs are much weaker success indicators than they are in e-business models. One reason is that many technological elements (e.g., RFID, Wi-Fi, Bluetooth, WiMax, Mobile IP) are already in place and many UCBMs will become functional when the missing links among them are coupled.

In UCBMs, UC technology's interfacing with service users plays the key role in defining both business and customer values. We therefore examined the features of interfacing devices in terms of their activity modes to carry out user services. Analyzed variables included : (1) inter-device coordination vs. intra-device contained ; (2) implicit vs. explicit interactions in which activities are triggered by UC technologies(implicit) or by systems users(explicit) ; and (3) dynamic vs. static in the nature of information being stored within an UC technology. The analysis indicated that UCBM-related activities will take advantage of both inter-device coordination and intra-device contained. It was also shown that UCBM activities are equally triggered by UC technologies (implicit) and by systems users (explicit). Finally, the scenarios revealed that the nature of information being stored or being accessed by UC technologies will be more dynamic than static.

5.3 Value Context

Contextual uniqueness in which UC services trigger becomes the deriving source of business and customer values for most UCBMs. Fano and Gershman [2002] suggested several paradigm changes many UCtechnologies will bring forth to the design of context-driven business models. Among them are : the location of customers becomes the location of business ; the physical location of service ren-

dering becomes a competitive necessity ; mobile devices become the agent of business services ; and service customers are not necessarily human.

Fano and Gershman [2002]'s summary implies that context itself becomes a value source for UCBMs. Context may be physical location and geography, position, identity, time, date, season, special day (e.g., wedding), movement patterns, expressions and moods, physical and psychological conditions, weather and temperature, velocity, altitude, activities, histories, events, or any others [Abowd and Mynatt, 2000 ; Fano and Gershman, 2002]. Context-awareness will be enabled by devices more perceptive, interpretive, and responsive to user needs. Accordingly, UCBM services through the intelligent computing will become more user-centric. Scenarios analysis confirmed that such context variables will drive the uniqueness of each UCBM. Especially, more UCBMs were associated with temporal (e.g., time, date, and season) and spatial (e.g., location, geography, and position) context elements.

With the context driven services, UCBMs are predicted to trigger profound changes in every aspect of our lives. These include higher task dynamism, computing embedded in social activities and interactions, invasiveness, just-in-time services, and spatial and temporal contiguity. Scenario analysis also confirmed that the value context of UCBMs are mostly associated with enhancing awareness, accessibility, and responsiveness. Future research can examine the business implications of UCBMs that emphasize awareness, accessibility, or responsiveness over the others.

5.4 Customer Values

The customer value proposition is a tangible or intangible value customers benefit from a particular UCBM. Improved customer value has direct (profit, volume, and safeguard) and indirect (innovation, market, scout, and access) implications on business performance [Walter et al., 2001]. Price, quality, customization, design functions, innovativeness (or novelty), usefulness, and choices represent important value features of a service [Amit and Zott, 2001 ; Kim and Mauborgne, 2000 ; Parkinson, 2002]. There are also other attributes that may promote the value perception of an UCBM to prospective customers. These include convenience, time savings, privacy and anonymity, accessibility, quality of service, sense of trust, and efficiency [Hauswirth et al., 2001 ; Zott et al., 2000]. Many of them are non-core value elements in a traditional sense ; however, they could emerge as powerful value sources under UCBMs [Lagha et al., 2002]. Additional value factors of an UCBM identified from the scenario analysis are summarized in <Table 2>.

These customer values can be divided into primary and supportive ones. Primary value propositions represent the ones potential customers have certain expectation benchmarks in mind. Supportive value propositions are the ones in which customers do not own the ex-

pectation benchmark but can significantly improve customer recognition and appreciation [Kambil et al., 1996]. The analysis of scenarios indicated that more UCBMs will offer supportive rather than primary value propositions to service users.

〈Table 2〉 Customer values of an UCBM

- Timely & just-in-time info. (e.g., weather, warnings, tracking)
- Prevention (e.g., malfunction, accidents)
- Time and cost savings for routines (e.g., car inspection)
- Improved information accessibility
- Temporal & spatial service contiguity (e.g., content downloading)
- Well-being (e.g., temperature control and air purification)
- Learning & communication support (e.g., electronic lecture support)
- Monitoring & detection (e.g., environment, medical condition)
- Security & protection (e.g., theft, fire, water leakage)
- Management & control (e.g., lights, gas, electricity, temperature)
- Diagnosis (e.g., structure safety and inspection)

5.5 Business Values

Business value propositions represent financial and non-financial benefits an UCBM should offer to a service provider and its value network partners [Bagchi and Tulskie, 2000]. The benefits may be measured by the model's impact on market share, brand and reputation, efficiency (e.g., inventory management) and effectiveness (e.g., process accuracy, loss prevention), and financial results (e.g., savings in labor cost) among others [Applegate, 2001]. Such theoretical structures as the balanced scorecard [Kaplan and Norton, 1992] enable us to comprehend the business values of an UCBM in a systematic manner. The scorecard represents key financial and operational elements of organizational performance in the categories of finance (e.g., revenue growth), internal business (e.g., IT capability), customers (e.g., satisfaction), and innovation and learning (e.g., technology leadership).

The scenario analysis of business values indicates that the financial impact of UCBMs in cost savings and as additional revenue sources will not be as significant as traditional or e-business models. Rather, the true value of UC-driven services is expected to be in non-financial benefits to business stakeholders in the form of better reputation, improved customer loyalty, and lock-in. This implies that the contribution of many UCBMs to a firm's bottom line will be rather indirect.

UC adds elements of network- and technology dimensions to the business model design and therefore may open up more diversified revenue channels industry-wide. Mediation (e.g., information brokerage), utility (e.g., pay-per-use/view), networking (e.g., revenue sharing), sponsorship, licensing, and certification (e.g., trust services), IT provisioning (e.g., hosting), and linking & listing (e.g., UC portals) are some of the prospective ones if the success of e-business models become any

indications.

These revenue channels may be conveniently classified into core and non-core channels for an UCBM. The core revenue results from the main business activity of an UCBM. Meanwhile, other activities less associated with the core business can also produce additional (and therefore non-core) financial opportunities. The core activity of a company becomes a non-core one to others and vice versa. The non-core opportunities also exist in a traditional brick-and-mortar environment. However, an UCBM may make them more conductive to revenue generation because network and technology dimensions in general make it easy in content creation and sharing, data gathering and provisioning, embedding intelligence, and linking and mediating.

The scenario analysis, however, reveals that this conjecture could be rather faulty in their generalization. First, in general, the mediation or brokerage role of UCBMs are expected to be weak and not as critical as in e-business models. There will be UCBMs that take advantage of utility, sponsorships, licensing, and certification as revenue sources but overall their impact as UCBM's revenue options are expected less significant. On the other hand, we expect more revenue channels based on services related with monitoring, risk management, and diagnosis.

5.6 Value Logic

The value creation logic, as a cornerstone of the analysis framework, describes the condition of interactions, processes, and activities involved to create proposed customer- and business values. In short, it describes how customer- and business values are created. The identification of value sources, determination of accompanying solutions, and description of the execution model result in the value logic.

Based on the scenarios, the characteristics of UCBM value logics are assessed and following patterns are recovered.

1. UCBMs' value logic will be mostly service-rather than product-driven.
2. There are three different mechanisms UC technologies trigger a value logic. They are :
   - Localized, automated processing : Automated value activities to improve user value within a localized boundary
   - Network-driven automated processing : Automated/semi-automated activities to improve user values through the appropriation process of external (non-localized) networks
   - Network-driven traditional processing : UC technologies and network processing trigger traditional off-line services
3. Value logic complexity represents the number of stakeholders implicated to the generation of customer and business values of an UCBM. Analysis indicates that, unlike general perceptions, more UCBMs will be defined on the networking of limited business stakeholders. However, there will be

UCBMs with a large number of network partners, especially those in the health industry.

4. The logic of value production among business stakeholders will be both linear and non-linear. Unlike popular projections, however, the value logic of more UCBMs will be based on the traditional linearity(rather than the non-traditional networkdriven) paradigm in the value addition process.
5. The frequency of UCBM services can be both regular (periodic) and irregular (ad hac). The analysis suggests that there will be a balanced demand for both types of services.

The success of an UCBM should be conditioned on various value-logic factors : inherent (e.g., revenue structure), strategic (e.g., marketing, customer relationship, knowledge leverage), circumstantial (e.g., competition, industry value drivers, economy), and organizational (e.g., internal resources). Here we focus on understanding inherent factors that represent the structural characteristics of a value logic that can boost the chance of UCBM success in the marketplace. Two high-level structural features (revenue features and differentiation) of a value logic that are expected to affect UCBM success are derived.

5.7 Revenue Features

Above all, the potential of a value logic should rest much on the characteristics of revenue generation. The failure of many pure ecommerce companies in the past years due to the lack of sustained income flow epitomizes the importance of revenue issues associated with a value logic. Fundamentally, an UCBM should perform better when it is not a give-away type of service and when there are revenue sources beyond transaction or service fees(Lunn, 2002). We can also think of other revenue channel characteristics of a value logic that may affect UCBM performance and they are summarized here.

- Revenue recursiveness (e.g., ad hoc versus recurring)
- Precedence relationship between revenue and service
- Marginal cost of service replication
- Volatility of key revenue channels
- Complexity of revenue generation procedures
- Type of key revenue generation activities
- Key revenue sources (businesses vs. individuals)
- Need for service customization for each user
- Capability of adding new revenue sources

It is hypothesized that UCBMs will fare better when following conditions are met. There are recurring revenue source(s) ; revenue precedes service rendering ; service replication incurs little(or no) marginal cost ; revenue channels are non-volatile ; revenue generation procedures are simple ; businesses rather than individuals constitute stable revenue sources ;

there is little need for service customization for each customer ; and UCBMs are innately expandable and easy to add new revenue channels.

Application of the revenue variables to the chosen scenarios enabled us to make several predictions. As for the revenue recursiveness, some UCBMs simply do not fit into having recursive revenue channels and therefore their business value in improving financial performance is week. Nonetheless, it is expected that more UCBM-driven services will engender recurring rather than ad hoc revenue. With the uniqueness of UCBMs, more fee-based services are expected to result in revenue flow ahead of rendering related services. The marginal cost of additional service provision for UCBMs is expected to be relatively low except when much customization is necessary. Revenue sources of most UCBMs should come from both businesses and individuals, and UCBMs will be highly divergent in the level of service customization.

5.8 Differentiation

The importance of a firm's value logic to differentiate itself from those of others has been consistently emphasized. Especially, when the differentiation is hard to imitate, is grounded on reality such as accurate assumptions, and links to distinctive customer values (Linder and Cantrell, 2001), the value logic should perform better. The differentiation of customer values may have direct (profit, volume, and safeguard) and indirect(innovation, market, scout, and access) implications on business performance [Walter et al., 2001]. Especially, a vale logic that results in an attractive price/value ratio may have a particular impact on business success [Kambil et al., 1996 ; Osterwalder and Pigneur, 2002].

Besides, a value logic may have to offer strengths in specialization [Lunn, 2002] ; customization and stickiness [Osterwalder and Pigneur, 2002 ; Vandermerwe, 1999] ; unexpected product attributes [Kambil et al., 1996] ; novelty [Amit and Zott, 2001] ; service choice and transaction convenience ; vertical (e.g., after-service) and horizontal (e.g., onestop service) complementaries [Amit and Zott, 2001 ; Zott et al., 2000] ; total customer experience [Vandermerwe, 1999] and positive network externalities [Amit and Zott, 2001 ; Vandermerwe, 1999].

The scenario analysis indicated that, compared to existing services, UCBMs could be better in creating customization and stickiness, furnishing prospective users the sense of service novelty, advancing total customer experience, and boosting positive network externalities. On the other hand, UCBMs potential to differentiate (or curtail) pricing from existing on-line or off-line services was expected weak.

6. CONCLUSIONS

Ubiquitous computing is a nascent paradigm that feeds on the principle of technology convergence, especially among network-

ing elements of various scales. Most UC-driven business models are, naturally, untested in their viability and sustainability, and therefore could face many uncertainties in the marketplace. An UCBM should be designed to optimize revenues, to dilute risks, to achieve synergy with existing models (if there are), and to take advantage of emerging opportunities. Naturally, the melt down of many .COM business models renders invaluable lessons, especially because e-business models and UCBMs share much commonality. With this research, analysis dimensions of an UCBM are initially introduced and main attributes of each dimension are identified from the review of current literature. Then, the significance of the selected variables is empirically assessed by applying them to the hypothetical but detailed scenarios. Finally, by mapping dimensional variables to the scenarios, we tried to predict general characteristics of emerging UCBMs.

The analysis indicated that only the subset of e-business variables are adequate for describing and characterizing UCBMs. This discrepancy re-confirmed that the components of a business model can be highly different depending on the context (e.g., industry) it is placed. Further research is necessary to supplement and expand our efforts to further identify relevant dimensional variables and to validate their implications on UCBM success. We believe that the assessment framework we proposed becomes an acceptable starting point for the endeavor.

REFERENCES

[1] Abowd, G.D. and Mynatt, E.D., "Charting Past, Present, and Future Research in Ubiquitous Computing", *ACM Transactions on Human-Computer Interactions*, Vol. 7, No. 1, 2000, pp. 29-58.

[2] Afuah, A. and Tucci, C.L., *Internet Business Models and Strategies*, McGraw- Hill, 2001.

[3] Amit, R. and Zott, C. "Value Creation in e-Business", *Strategic Management Journal*, 22(6/7), 2001, pp. 493-520.

[4] Applegate, L.M. "Emerging E-Business Models : Lessons from the Field", *Harvard Business School Publishing*, (9-801-172), July 2001.

[5] Bagchi, S. and Tulskie, B. "e-Business Models : Integrating Learning from Strategy Development Experiences and Empirical Research", Presented at the 20th Annual International Conference of the Strategic Management Society, Vancouver, 2000.

[6] Barney, J.B. "Organizational culture : Can it be a source of competitive advantage", *Academy of Management Review*, Vol. 11, No. 3, 1986, pp. 656-665.

[7] Bartelt, A. "A Multi-Criteria Taxonomy of Business Models in Electronic Commerce", WELCOM '01 - Second International Workshop on Electronic Commerce, 2001.

[8] Berryman, K., Harrington, L.F., Layton-Rodin, D., and Rerolle, V., "Electronic Com-

merce : Three Emerging Strategies", *The McKinsey Quarterly*, Number 1, 1998.

[9] Black, J.A. and Boal, K.B. "Strategic resources : Traits, configurations and paths to sustainable competitive advantage", *Strategic Management Journal 15*, summer 1994, pp. 131-148.

[10] Boulton, R.E.S., Libert, B.D., and Samek, S. M. "A Business Model for the New Economy", *Journal of Business Strategy*, Vol. 21. No. 4, 2000, pp. 29-35.

[11] Bowman, C. and Ambrosini, V. "Value Creation Versus Value Capture : Towards a Coherent Definition of Value in Strategy", British *Journal of Management*, 11, 2000, pp. 1-15.

[12] Chaharbaghi, K., Fendt, C., and Willis, R. "Meaning, Legitimacy and Impact of Business Models in Fast-Moving Environments", *Management Decision*, Vol. 41, No. 4, 2003, pp. 372-382.

[13] Chesbrough, H. and Rosenbloom, R.S. "The Role of the Business Model in Capturing Value from Innovation : Evidence from Xerox Corporation's Technology Spinoff Companies", http://www.hbs.edu/dor/papers2/0001/01-002.pdf, 2000 (Retrieved on May 1, 2002).

[14] Dubosson-Torbay, M., Osterwalder, A., and Pigneur, Y. "eBusiness Model Design, Classification and Measurements", *Thunderbird International Business Review*, Vol. 44, No. 1, 2002, pp. 5-23.

[15] Fano, A. and Gershman, A., "The Future of Business Services in the Age of Ubiquitous Computing", *Communications of the ACM*, Vol. 45, No. 12, 2002, pp. 83-87.

[16] Grant, Ro. M. "The Resource-Based Theory of Competitive Advantage : Implications for Strategy Formulation", *California Management Review*, Vol. 33, No.3, 1991, pp. 114-135.

[17] Hauswirth, M., Jazayeri, M., and Schneider, M. "A Phase Model for e-Commerce Business Models and its Application to Security Assessment", Proceedings of the 34th Hawaii International Conference on System Sciences, 2001.

[18] Hedman, J. and Kalling T. "The Business Model Concept : Theoretical Underpinnings and Empirical Illustrations", *European Journal of Information Systems*, Vol. 12, No. 1, 2003, pp. 49-59.

[19] Kambil, A., Ginsberg, A., and Bloch, M. "Re-inventing Value Propositions", NYU Stern School, CRIS Working Paper #IS-96-21, November 1996.

[20] Kaplan, R.S. and Norton, D.P. "The Balanced Scorecard - Measures That Drive Performance", *Harvard Business Review*, Vol. 70, No. 1, 1992, pp. 71-79.

[21] Kim, W.C. and Mauborgne, R. "Knowing a Winning Business Idea When You See One", *Harvard Business Review*, Sep-Oct 2000, pp. 129-137.

[22] Klueber, R. "Business Model Design and Implementation for services", Proceedings of Americas Conference on Information Systems, 2001.

[23] Lagha, S.B., Osterwalder, A., and Pigneur, Y. "Modeling e-Business with eBML", http://www.hec.unil.ch/aosterwa/article.php?sid=12, (Retrived on Apr. 24, 2002).

[24] Linder, J.C. and Cantrell, S. "Cast in Concrete or Carved in Water : Five Business Model

Myths that Hold Companies Back", 2001, http://www.accenture.com/xd/xd.asp?it=enweb&xd=_isc/iscresearchreportabstract_119.xml (Retrieved on August 24, 2003).

[25] Linder, J.C. and Cantrell, S. "Changing Business Models : Surveying the Landscape", Accenture, 2000, http://www.accenture.com/xd/xd.asp?it=enweb&xd=_isc/iscresearchrepor tabstract_47.xml(Retrieved on August 24, 2003)

[26] Lunn, M. "Using Business Models and Revenue Streams for Digital Marketplace Success", *Information Management & Computer Security,* Vol. 10, No. 1, 2002, pp. 20-27.

[27] Markides, C.C. and Williamson, P.J. "Corporate diversification and organizational structure : A resource-based view", *Academy of Management Journal,* Vol. 39, No. 2, 1996, pp. 340-367.

[28] Osterwalder, A. and Pigneur, Y. "An e-Business Model Ontology for Modeling e-Business", Proceedings of 15th Bled Electronic Commerce Conference, 2002.

[29] Parkinson, J., "Retail Models in the Connected Economy : Emerging Business Affinities", http://www.cbi.cgey.com/journal/issue3/features/retail/retail.pdf,(Retrieved on April 21, 2002).

[30] Petrovic, O., Kittl, C., and Teksten R.D. "Developing Business Models for e-Business", International Conference on Electronic Commerce, Vienna, 2001.

[31] Rayport, J.F. "The Truth about Internet Business Models", http://tksen.nvgc.vt.edu/Globalebiz/Backup2/WEBSHARE/WWWROOT/NewWebsite/globalread/e-model1.htm (Retrieved on May 6, 2002). 32. Timmers, P. "Business Models for electronic Markets", *Electronic Markets,* Vol, 8, No. 2, 1998, pp. 3-8.

[33] Vandermerwe, S. "The Electronic 'Go-Between Service Provider' : A New 'Middle' Role Taking Centre Stage", *European Management Journal,* Vol. 17, No. 6, 1999, pp. 598-608.

[34] Walter, A., Ritter, T., and Gemunden, H.G. "Value Creation in Buyer-Seller Relationships", *Industrial Marketing Management,* 30, 2001, pp. 365-377.

[35] Zimmermann, H. "Understanding the Digital Economy : Challenges for New Business Models", Proceedings of Americas Conference on Information Systems, 2000.

[36] Zott, C., Amit, R., and Donevy, J. "Strategies for Value Creation in E-Commerce : Best Practice in Europe", *European Management Journal,* Vol. 18, No. 5, 2000, pp. 463-475.

저자소개

황 경 태

KyungTae Hwang is a professor at the Department of MIS in Dongguk University. He earned a Ph.D. from State University of New York at Buffalo, MBA from George Washington University, and Bachelors degree from Yonsei University. His research interests include Information Systems Strategy, IT Governance and Audit, ITSM (IT Service Management, and e-Business.

신 봉 식

Bongsik Shin is an associate professor at the Department of Information and Decision Systems at San Diego State University. He earned a Ph.D. from the University of Arizona and has been teaching telecommunications and electronic commerce. His work has been published or accepted in a number of respected journals including CACM, IEEE Trans. on EM, IEEE Trans. on SMC, JOCEC, JMIS, I&M, JAIS, and DSS. His research interests are in IT business models and IT strategy. He chairs the "San Diego International Systems Conference", an annual conference in IS/IT. Bongsik was profiled in MARQUIS Who's Who in America, MARQUIS Who's Who in Science and Engineering, and International Who's Who of IT.

김 경 재

Kyoung-jae Kim is an assistant professor at the Department of MIS in Dongguk University. He earned ME and Ph.D. from KAIST, and Bachelors degree from Chung-Ang University. His research interests include data mining, customer relationship management, and electronic commerce.

◈ 이 논문은 2005년 10월 9일 접수하여 1차 수정을 거쳐 2005년 12월 4일 게재확정되었습니다.