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# Values of Silent Commerce: A Study Using Value-Focused Thinking Approach

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## ABSTRACT

Silent commerce is a special type of u-commerce that uses RFID and sensor technologies to make objects intelligent and interactive. The unique features available in silent commerce will provide benefits and added values to users. This study aims to uncover the values of silent commerce from the customers' perspectives and understand what customers desire and expect from silent commerce. The scenario-based method was adopted to provide subjects with the necessary background information and knowledge about the emerging silent commerce phenomenon. The Value-Focused Thinking approach, which provides a systematic way to articulate and organize values, was used to identify the values of silent commerce to users. The result of this study is a means-ends objective network that depicts the fundamental objectives of using silent commerce and how the fundamental objectives can be achieved through means objectives. The findings can serve as a conceptual foundation for future research in the u-commerce area and provide useful guidelines to practitioners in developing and implementing silent commerce applications.

## Keywords

Value, silent commerce, u-commerce, value-focused thinking, scenario-based method.

## INTRODUCTION

After e-commerce and m-commerce, it is believed that now it is the turn for s-commerce (silent commerce) (Xavier, 2003). New technologies such as radio frequency identification (RFID) are used to make ordinary objects intelligent and interactive, and to empower physical objects to communicate with each other and with other enabled elements in the supply chain (Accenture, 2002; Xavier, 2003; Galanxhi-Janaqi and Nah, 2004). This type of commerce is "silent" because commerce and communications among objects take place without human interaction (Xavier, 2003). RFID technology is the main enabling technology in silent commerce. It allows the tagging, tracking, and monitoring of objects along the supply chain, and it creates new business opportunities for organizations (Accenture, 2001; Galanxhi-Janaqi and Nah, 2004). Compared to traditional barcode systems, RFID technology can: 1) read multiple data simultaneously; 2) enable automatic data capture; 3) read beyond lines of sight; 4) be "always on"; 5) store more information and communicate right to the item level (Mahadevan, 2004).

Silent commerce, along with wireless commerce, television commerce, voice commerce, and telematics, are the main types of u-commerce (Galanxhi-Janaqi and Nah, 2004). U-commerce, also referred to as "ubiquitous commerce" or "ultimate-commerce", is believed to be the next wave in commerce (Watson, 2000). U-commerce refers to the use of ubiquitous networks to support personalized and uninterrupted communications and transactions between a firm and its various stakeholders to provide a level of value, above and beyond traditional commerce (Watson et al., 2002).

U-commerce presents a new paradigm that extends the Internet era by providing ubiquity, universality, uniqueness, and unison (Junglas and Watson, 2003). These features are the driving forces of the nomadic information environment – which is a heterogeneous assemblage of interconnected technological, social, and organizational elements that enable the physical and social mobility of computing and communication services within or across organizational borders (Lyytinen and Yoo, 2002). Some important emerging research questions in nomadic computing are to study how nomadic information environment can impact individuals in multiple social and physical contexts and what factors influence users' adoption and use of multiple information channels (Lyytinen and Yoo, 2002). The emerging trend towards u-commerce requires researchers to rethink

some of the fundamentals of IS, introduce new research methods that are suitable for research in nomadic computing environment, and examine the impact of new nomadic computing environment (Lyytinen and Yoo, 2002; Junglas and Watson, 2003).

This research is a step toward this direction with the aim of uncovering the values of silent commerce from the customers' perspectives. This study will provide an understanding of what customers desire and expect from silent commerce, as well as the functions and features they want in silent commerce.

## **U-COMMERCE AND SILENT COMMERCE**

U-commerce represents “anytime”, “anywhere” commerce and it is pervasive – as it will become part of everyday life and will be so prevalent that most people would not even notice its presence (Lyytinen et al., 2004). U-commerce is characterized by four ‘U’ constructs: ubiquity, uniqueness, universality, and unison. Ubiquity means that computers are everywhere, and people are able to access networks and be reachable at anytime and any place. Universality will eliminate the problem of incompatibility caused by the lack of standardization, so people can have universal devices that stay connected all the time regardless of their locations. Uniqueness suggests that users can be uniquely identified not only in identity and preferences, but also in terms of geographical positions. Unison allows data to be integrated across different applications so a consistent view of information can be attained (Watson, 2000; Junglas and Watson, 2003; Galanxhi-Janaqi and Nah, 2004). U-commerce presents a new channel/medium for commerce and shows great promises for future applications and potential markets.

Silent commerce is an emerging type of u-commerce. It refers to the use of powerful, inexpensive, and tiny microprocessors and tags combined with continuous Internet connectivity and sensors, such that objects can communicate directly with customers, suppliers, employees, and even with each other to improve business performance (Accenture, 2004). The main enabling technologies in silent commerce include RFID, sensors, and micro-electromechanical devices (MEMs) which are a class of sensors and actuators that respond to different physical phenomena (Accenture, 2002). Almost any physical item can be embedded with electronic tags and sensors to establish a unique and verifiable identity, store a wealth of information, collect observations from the physical world, and sense changes in the environment.

## **RESEARCH METHODOLOGY**

In this study, we identify the values of silent commerce through a qualitative approach by eliciting values from potential customers. We use both the scenarios-based method and Value-Focused Thinking approach.

### **Scenario-based Method**

This research aims to identify the values of silent commerce which are objectives or principles that one desires in silent commerce. Since most of the applications of silent commerce are not yet available, and therefore, have not been experienced by customers, conventional research methods become impossible. However, it is extremely important that research related to silent commerce be carried out today because insights and results derived from today's research can serve as guidelines or roadmaps for the development, adoption, and diffusion of silent commerce applications (Bria et al., 2001).

Scenarios provide a form or tool to explore a possible and plausible future, and create an awareness of which future applications are possible (Bria et al., 2001). Scenarios are descriptions of possible future states as well as hypothetical sequences of events that will lead the original or current situation to evolve towards the described future states (Camponovo et al., 2004). Scenario-based methodology, therefore, offers a scientific base for describing future states while evaluating them from present-day perspectives (Pitkanen et al., 2003).

Scenarios can be created in a systematic manner: starting with the literature review to identify factors and attributes related to the phenomenon under study, then creating scenarios that systematically cover all the attributes (Pitkanen et al., 2003). In this research, we adopted the constructs introduced by Watson (2000) and Junglas and Watson (2003) as the main attributes of silent commerce. Junglas and Watson (2003) reviewed the literature in e-commerce, m-commerce, and u-commerce, and identified four fundamental characteristics of u-commerce – ubiquity, uniqueness, universality, and unison. As silent commerce is a special type of u-commerce, these characteristics also apply to silent commerce. These four constructs will serve as the theoretical foundation for developing scenarios in this research.

Based on the four fundamentals of u-commerce and the guideline suggested by Weber (1992) to use existing scenarios rather than those created by the researchers, we selected four silent commerce application scenarios from existing resources. These four scenarios were chosen because they illustrate the four constructs of u-commerce well (as explained later):

(1) NTTDoCoMo Felica mobile phone – available at: [http://www.nttdocomo.co.jp/english/p\\_s/products/index.html](http://www.nttdocomo.co.jp/english/p_s/products/index.html),

(2) On-line medicine cabinet – available at:

[http://www.accenture.com/xd/xd.asp?it=enweb&xd=services%5Ctechnology%5Ctech\\_medcab.xml](http://www.accenture.com/xd/xd.asp?it=enweb&xd=services%5Ctechnology%5Ctech_medcab.xml)

(3) On-line wardrobe – available at:

[http://www.accenture.com/xd/xd.asp?it=enweb&xd=services%5Ctechnology%5Ctech\\_wardrobe.xml](http://www.accenture.com/xd/xd.asp?it=enweb&xd=services%5Ctechnology%5Ctech_wardrobe.xml)

(4) Real-world showroom – available at:

[http://www.accenture.com/xd/xd.asp?it=enweb&xd=services%5Ctechnology%5Ctech\\_rwshowroom.xml](http://www.accenture.com/xd/xd.asp?it=enweb&xd=services%5Ctechnology%5Ctech_rwshowroom.xml)

We presented video clips for all four scenarios to subjects during the study rather than using written scenarios for the following reasons: 1) video clips allow us to present vast amount of information in a relatively short time – each video clip lasts 2-3 minutes; 2) video clips utilize rich, multimedia presentation that gives subjects a better understanding of future silent commerce applications; 3) video clips from third-parties may be more objective as compared to written statements developed by researchers.

Table 1 shows a brief narrative for the NTT DoCoMo scenario (#1), and brief descriptions of the scenarios for the on-line medicine cabinet (#2), on-line wardrobe (#3), and real-world showroom (#4).

<p><b>1) NTTDoCoMo Felica mobile phone - a never ending story (adapted from the NTTDoCoMo website)</b></p> <p>“People can do lots of things by waving their phones with Felica technology. They can wave their phones wherever they go. They can wave their phones at the airport, to pay for groceries, and to rent movies. ”</p> <p><b>2) On-line medicine cabinet (adapted from the Accenture website)</b></p> <p>“By using a camera and face-recognition software, the cabinet can identify different persons in a household, and their special needs. For example, if an individual suffers from allergies or asthma, the Online Medicine Cabinet will provide information such as the day's pollen count, and remind that person to take his/her medicine. Sensors on prescription bottle labels allow the cabinet to identify each drug and alert consumers if they have taken the wrong bottle—or if it's the right bottle at the wrong time. The Online Medicine Cabinet also enables the consumers to monitor vital signs, and immediately shares this information with their doctors via the Internet.”</p> <p><b>3) On-line wardrobe (adapted from the Accenture website)</b></p> <p>“The Online Wardrobe uses sensors, tagging and tracking technologies to keep track of the clothing you already own, and helps you buy coordinating items, either online or in physical stores. With the Online Wardrobe, consumers can selectively reveal the contents of their wardrobe to their favorite merchants. In return, they receive personalized offerings and timely reminders about products of interest. The Online Wardrobe recognizes your new purchases through sensors and tags, and provides you with a list of matching items, as well as suggestions for other clothing you might want to purchase online or from a local store. When you're getting ready for the day, your wardrobe can look up what's on your schedule, and suggest appropriate attire to wear.”</p> <p><b>4) Real-world showroom (adapted from the Accenture website)</b></p> <p>“Imagine you're sitting having a coffee and a man passes by in a particularly smart suit. Rather than just admire his taste and wonder where he bought such a well-cut piece of clothing, you pull out your personal digital assistant (PDA) and press a button. Instantly, you have access to information about the suit including brand, similar products, availability, and price. Pressing another button, the very suit is yours and you'll see it at your doorstep next day. ”</p>
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**Table 1: Scenarios used in this research**

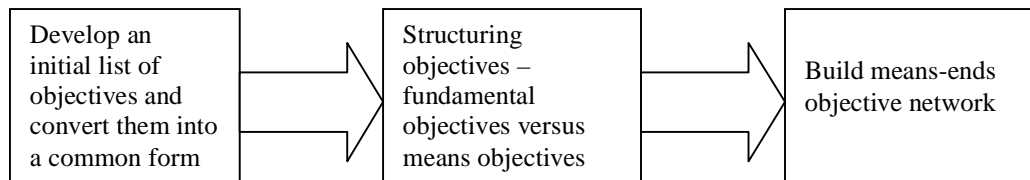
Table 2 shows how these four scenarios cover the four constructs in u-commerce, or more specifically, silent commerce. The combination of these four scenarios covered all the attributes (constructs) of silent commerce; therefore, they are representative of future applications in silent commerce and can be used as the basis to study issues in silent commerce.

Scenario	Attributes			
	Ubiquity	Uniqueness	Universality	Unison
NTTDoCoMo Felica mobile phone	X		X	
On-line medicine cabinet		X		X
On-line wardrobe		X		X
Real-world showroom	X		X	

**Table 2: Attribute coverage of scenarios**

### Value-Focused Thinking Approach

To understand the values of silent commerce, we interview potential customers about their values and opinions regarding the scenarios presented to them. Value Focused Thinking (VFT) provides a systematic way to identify values and organize the values. The VFT approach, which is fundamentally about deciding what is important and how to achieve it, defines essentially what the decision maker cares about (Keeney, 1992). It has been shown to be very helpful for identifying the values and objectives that are usually hidden. Values are principles used for evaluation by customers/users (Keeney, 1992). Values that are of concern are made explicit by the identification of objectives. An objective is a statement of something that one desires to achieve (Keeney, 1992). An objective is characterized by three features: a decision context, an object, and a direction of preference. VFT not only uncovers hidden objectives, but also provides a systematic way of identifying relationships among objectives. The VFT approach is, therefore, well suited for the type of research proposed in this study.



**Figure 1: Steps involved in Value-Focused Thinking**

The steps of VFT are as follows (see figure 1):

(1) Develop an initial list of objectives and convert them into a common form. Several popular techniques that can help stimulate the identification of possible objectives include “wish list”, problems and shortcomings, alternatives, and consequences (Keeney, 1992). Probing questions include:

“What are the benefits of using silent commerce?”

“What problems or concerns can arise in silent commerce?”

“If there is no limitation at all, what are the features or functions of silent commerce you wish to have?”

From the interviews, we collect a list of values that are relevant to silent commerce and convert them into objectives (i.e., expressed them in the format of ‘objectives’) which are common forms for each set of related values.

(2) Structuring objectives – fundamental objectives versus means objectives. After collecting the list of objectives, this step distinguishes between fundamental objectives and means objectives. Fundamental objectives concern “the ends that decision makers value in a specific context” whereas means objectives are “methods to achieve ends” (Keeney, 1992). To separate means objectives from fundamental objectives and to establish their relationships, Keeney (1992) suggested using the “Why Is That Important?” test. For each identified objective, asking “Why Is That Important?” (WITI) yields two types of possible responses. One is that this objective is one of the essential reasons for interest in the situation and is fundamental for decision making. This is called a *fundamental* objective. The other response is that an objective is important because of its implication for some other objective(s). Then this is called a *means* objective.

(3) Building the means-ends objective network. The final step in the VFT approach is to build the means-ends objective network. This network provides a model of the specific interrelationships among the means objectives and their relationships with fundamental objectives. The relationships depicted in the model allow analysts to better understand the complexities of the decision maker's value system, and to select alternatives that are designed to achieve these fundamental objectives via their effects on the means objectives.

### **Data Collection**

A total of 21 subjects were interviewed in this study. Among 21 of them, 7 of them are female and 14 of them are male. The interview sessions began with the presentation of the four video clips which depicted four scenarios of silent commerce. Following that, each subject was interviewed using the Value-Focused Thinking approach. The interviews were open-ended. Techniques such as "wish list" and "benefits and problems" proposed by Keeney (1992) were used to elicit the values of silent commerce from the customers' perspective. The WITI test was employed to distinguish between means objectives and fundamental objectives, as discussed earlier.

Each interview lasted about an hour. The interviews were audio-recorded and notes were taken by researchers during each interview.

As recommended by qualitative researchers (Glaser and Strauss, 1967; Strauss and Corbin, 1998), the sample size was decided by the results gathered from the interviews. As Glaser and Strauss (1967) indicated, the researcher "cannot state at the outset of his research how many [subjects] he will sample during the entire study; he can only count up the [subjects] at the end" (p.61). When subsequent interviews did not yield any new objectives, we concluded that the "point of saturation" was reached. This is a standard "stopping rule" for qualitative research (Glaser and Strauss, 1967; Strauss and Corbin, 1998).

In our study, the comprehensive and intensive nature of each interview allows us to reach the point of saturation after the 14th interview. We continued to interview more subjects (i.e., seven more subjects in total) to ensure that we had indeed reached the "saturation point".

### **RESEARCH RESULTS**

The means and ends objectives were derived from the transcripts of each interview. The initial list of objectives contains 193 means objectives and 21 candidate fundamental objectives. Two researchers carefully reviewed the objectives list: redundant objectives were removed and similar objectives were grouped together. The final set of objectives includes 26 means objectives and 10 fundamental objectives (as shown in Tables 3 and 4). Figure 2 presents the means-ends objective network which was constructed based on the list of 36 unique objectives identified as well as the relationships between the objectives.

## Overall Objective: Maximize Customer Satisfaction in Silent Commerce

### Maximize convenience

*Example:* Maximize time/location flexibility in shopping  
 Minimize effort in shopping  
 Save trips to physical stores

### Maximize reliability of services

*Example:* Maximize reliability of information provided  
 Maximize reliability of functions provided

### Maximize privacy

*Example:* Maximize protection of customer privacy  
 Prevent invasion of customer privacy

### Maximize product quality

*Example:* Maximize quality of product  
 Maximize functionality of product  
 Ensure product is what customer wants

### Minimize cost

*Example:* Minimize product cost  
 Minimize technology/service cost

### Maximize time saving

*Example:* Minimize purchase time  
 Minimize searching time  
 Minimize waiting time at check out

### Maximize security

*Example:* Maximize security of data transmission  
 Maximize security of transactions

### Maximize individualization

*Example:* Maximize ability to meet customer's needs  
 Maximize ability to meet customer's preferences

### Maximize safety/health

*Example:* Provide functions to save life  
 Maximize functions to support health care  
 Maximize instant monitoring of health condition

### Maximize shopping enjoyment

*Example:* Make shopping fun  
 Enable customers to enjoy shopping experience

**Table 3: Fundamental Objectives**

### Maximize functionality of devices

*Example:* Provide more options for customers  
 Ensure multiple functions available in one device  
 Minimize the need to carry multiple devices

### Maximize Ubiquity

*Example:* Enable to shop at anywhere/any time  
 Maximize area of coverage

### Expedite purchases and delivery

*Example:* Simplify shopping  
 Enable automatic delivery

### Provide personalized products/services

*Example:* Enable personalized shopping list  
 Provide personalized suggestions/recommendations  
 Search relevant information for customers based on preference and needs

### Maximize universality of technology standards

*Example:* Ensure vendors are using same standards  
 Ensure technology can be used everywhere  
 Maximize communication across technology standards

### Maximize integration across systems

*Example:* Ensure systems are integrated with partner's systems  
 Ensure systems are linked with vendors' systems

### Automate purchase procedures

*Example:* Automate check out in shopping  
 Automate payment in shopping

### Maximize customer control of personal information

*Example:* Maximize customer control of availability of personal information  
 Maximize customer control of access to personal information  
 Maximize customer control of disclosure of personal information  
 Enable customer to activate/deactivate personal information



**Prevent misuse of customer information***Example:* Minimize identity theft

- Minimize credit theft
- Prevent unauthorized access to customer information

**Maximize richness of product information***Example:* Maximize reality of product presentation

- Maximize ability to touch the product
- Maximize trial-ability of products
- Maximize ability to smell the products

**Enable real-time reminders***Example:* Provide real-time reminder function

- Remind customers to re-order
- Remind customers to replenish

**Maximize comparison shopping***Example:* Provide customer review/rating of products

- Provide a list of products for comparison
- Provide a list of vendors for comparison
- Make it easy to do comparison shopping

**Maximize access to information***Example:* Maximize access to product information

- Enable access to purchase history

**Maximize ease of use***Example:* Maximize user-friendliness

- Maximize ease of navigation
- Minimize effort to learn to use

**Maintain human interaction***Example:* Making shopping a form of socialization

- Maintain interaction with salespersons

**Maximize availability of auxiliary services***Example:* Maximize availability of delivery services

- Maximize availability of pick-up services
- Maximize availability of return services

**Maximize affordability of technology***Example:* Ensure the price of technology is reasonable

- Ensure low cost of upgrading technology

**Maximize availability of product information***Example:* Maximize available product information

- Maximize availability of price information
- Maximize availability of product descriptions

**Maximize legal regulations***Example:* Limit access to information

- Provide acceptable use policy of information
- Specify boundaries of information
- Specify how information can and cannot be used

**Maximize reliability of technology***Example:* Maximize stability of technology

- Ensure system captures right information
- Ensure system functions properly

**Ensure secure infrastructure***Example:* Ensure secure data transmission

- Prevent hacking/intercepting
- Maximize encryption mechanism
- Prevent unauthorized tracking of signals

**Enable pay-per-use***Example:* Enable customers to choose among pricing options/functions

- Enable customers to pay based on consumption

**Maximize accuracy of information***Example:* Minimize errors in information provided by system

- Ensure information is updated
- Ensure information is consistent

**Ensure intuitive information presentation***Example:* Ensure user-friendliness of information format

- Ensure information presentation style is intuitive

**Maximize protection of customer information***Example:* Provide privacy statement

- Ensure proper use of customer information by organizations
- Ensure organizations are not sharing/selling customer information without customer's consent

**Maximize location-based services***Example:* Provide information about product locations

- Provide location-based advertisements
- Help to locate products

**Table 4: Means Objectives**

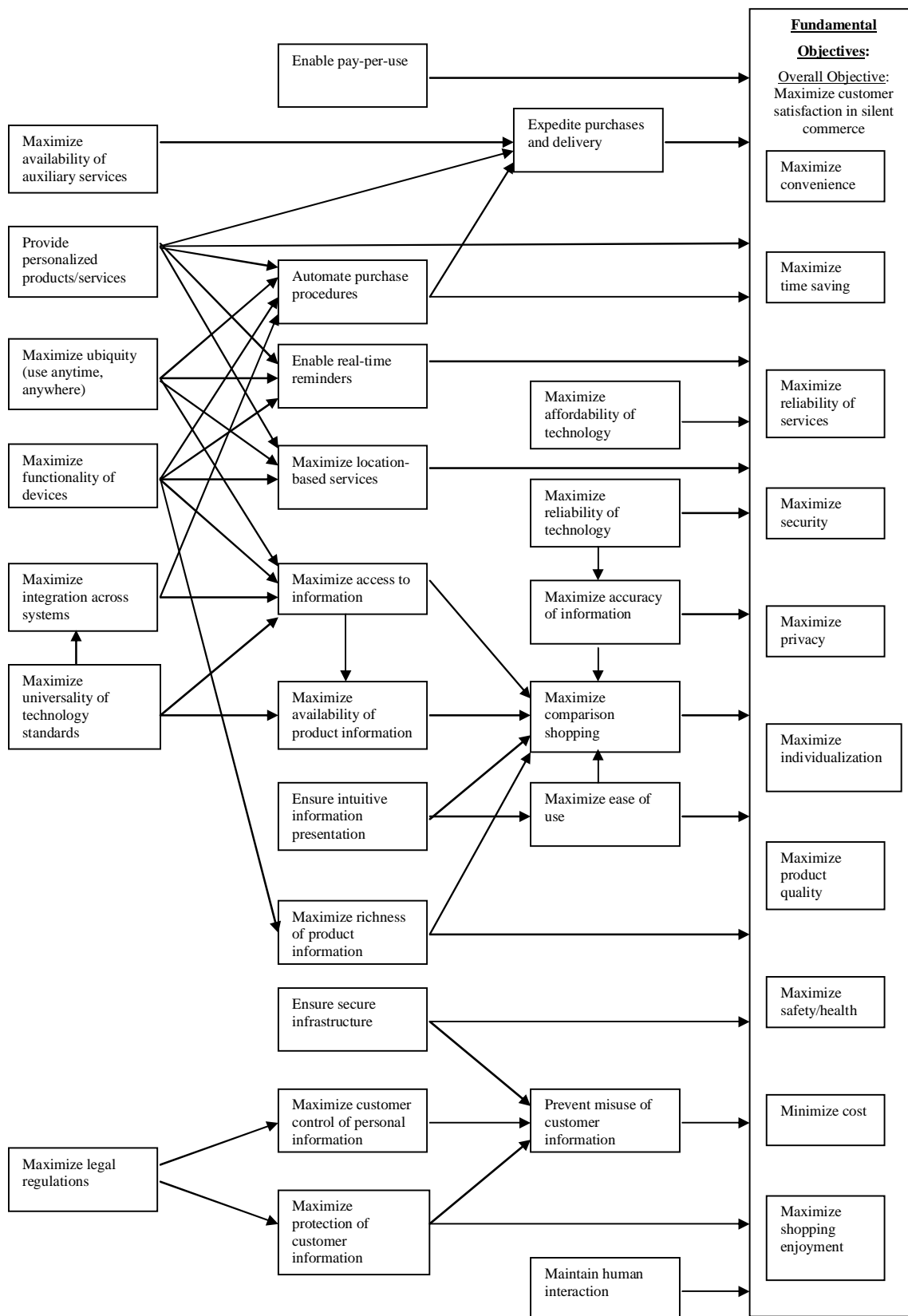


Figure 2: Means-Ends Objective Network

## DISCUSSIONS AND IMPLICATIONS

Figure 2 presents the fundamental objectives and means objectives, as well as the relationships between the objectives. We will discuss the fundamental and means objectives in Section 5.1, and provide implications for practice and research in Section 5.2.

### Fundamental Objectives and Means Objectives

The overall objective of silent commerce for customers is to maximize customer satisfaction in silent commerce. There are ten fundamental objectives that can help to achieve this overall objective, and they are: maximize convenience, maximize time saving, maximize reliability of services, maximize security, maximize privacy, maximize individualization, maximize product quality, maximize safety/health, minimize cost, and maximize shopping enjoyment. These ten objectives highlighted the fundamental values of silent commerce from the customers' perspectives, determine the "principles" (Keeney, 1992) that customers use to assess silent commerce, and discover what customers desire to achieve in silent commerce. These fundamental objectives are the fundamental reasons and drives for customers to adopt and use silent commerce applications.

"Maximize convenience" and "Maximize time saving" have been highlighted by subjects as the main benefits of silent commerce. Enabled by RFID and sensor technologies, silent commerce allows objects to be intelligent and interactive; therefore, it can automate check-out or payment in shopping, remind customers to refill orders, or even automatically place orders for customers. Hence, it can help customers to save trips to physical stores, maximize time or location flexibility in shopping, and be more efficient in making purchases. The "anytime, anywhere" ability of silent commerce maximizes access to product information and purchase history, which makes comparison shopping easier. This in turn brings "convenience" and "time saving" to customers. For example, one subject stated, "when I am thinking of silent commerce, I am thinking about convenience and time saving it can bring to me. If convenience is not there, why do I need to switch to this new type of commerce? If doing silent commerce won't allow me to save time in shopping, I won't decide to use it."

"Security" and "Privacy" are the main concerns customers have in using silent commerce. As one subject highlighted, "RFID technologies can be a threat to customer privacy, because literally companies can track everything of me – the clothes I have in my wardrobe, the medicine I am taking, and even the price of the clothes I am wearing. I think it is scary". Another subject stated, "Since all the information is transmitted through radio frequency, I am not sure how secure it is..." These examples are in line with the existing literature where privacy and security have been identified as major challenges for customers in using silent commerce (Galanxhi-Janaqi and Nah, 2004; Lyytinen et al., 2004). The privacy concerns in using RFID and sensor technologies are also evident in recent news from CNN titled "Parents protested radio ID tags for students" where parents do not agree with the use of RFID technology to track their children's movement in the school (refer to <http://www.cnn.com/2005/EDUCATION/02/10/tracking.students.ap/index.html>).

To ease customers' privacy concerns, legal regulations must be developed to protect customers and to regulate practice in silent commerce. There should be regulations relating to the use policy of customer information, specifications of how customer information can and cannot be used, and limiting access to customer personal information. Organizations must present privacy statements to customers and clearly state how the information will and will not be used. Organizations should also provide options (e.g., opt-in, opt-out, preference setting) to customers on such usage. Regulations should enforce proper use of customer information by organizations and ensure that organizations cannot share or sell customer information without the customers' consent. Such regulations can help to prevent or minimize identity theft, credit theft, and unauthorized access to customer information, and therefore, protect customers' privacy.

"Cost" is another concern for customers in silent commerce. The cost of the RFID tags and readers, and the cost incurred to receive personalized services are also concerns. As one subject noted, "if the cost of using silent commerce applications is reasonable and affordable, I will use it; otherwise, there is no incentive for me to use this kind of service because I have cheaper alternatives such as e-commerce". On the other hand, silent commerce supports comparison shopping, which can help customers get better deals for the products they want. In this way, silent commerce can help customers to save money.

"Reliability of services" must be ensured in order for customers to use silent commerce. If silent commerce provides personalized products and services to customers, offers real-time reminder functions, and gives personalized recommendations and suggestions to support customers' purchasing, customers may "become more and more dependent on the services provided by silent commerce"; therefore, they want to be assured that the technology is stable and functioning properly and the information provided by silent commerce applications is accurate and up-to-date. In short, they want assurance that they can safely "rely on the functions and information provided by silent commerce applications".

"Maximize individualization" suggests that silent commerce applications meet customers' needs and preferences. This fundamental objective can be achieved by the "uniqueness" feature of silent commerce. "Uniqueness" is the ultimate form of

“localization”, “identification”, and “portability” (Junglas and Watson, 2003). Personalized products and services, location based services, real-time reminder functions, and comparison shopping capability provided in silent commerce have the potential to better meet customers’ needs and preferences. Personalization will become the key criteria in guiding customers’ decisions concerning whether to use silent commerce or not in a specific context.

“Product quality” is always an important consideration for any type of commerce (Siau et al., 2004). Customers want to make sure that “the product is of high quality, has the functions that are needed, and is indeed the product I want”. The accuracy of product information, as well as the richness of product information, such as the ability to “feel the product”, “touch the product”, and “smell the product” can help customers assess product quality. As the technology continues to advance, new technologies that have the capability to let customers feel, touch and smell products remotely might become possible.

“Maximize safety/health” is a fundamental objective in silent commerce applications. Health care service is also one of the top three fastest growing sectors for RFID applications (ITAA, 2004). The “on-line medicine cabinet” is an example of silent commerce applications that are related to health care. As one subject indicated, “the real-time reminder function available in the on-line medicine cabinet is going to be really useful. To remind people to take the right medicine on time is critical to ensuring safety and health.”

“Maximize shopping enjoyment” refers to make shopping fun by enabling customers to enjoy the shopping experience. For some customers, automating purchasing procedures and expediting purchasing can free some customers from repetitive and time-consuming shopping experiences; for some customers, comparison shopping through silent commerce makes shopping more interesting and fun; for other customers, shopping in the physical stores is a socializing activity that they value, therefore, silent commerce can be used to expedite and support the traditional type of commerce. For example, the “on-line wardrobe” can be used to aid and support one’s shopping in physical stores.

### **Implications for Practice and Research**

The network derived in this study highlights the issues and values that are of concern to customers in silent commerce. The means-ends objective network developed in this study can serve as guidelines and roadmaps for organizations that are interested in developing and introducing silent commerce applications. Some of the means objectives identified in this study suggest features and functions customers would like to have in silent commerce. These objectives, therefore, have major implications for organizations that are embarking on silent commerce applications.

Personalization is the key in silent commerce. It provides “uniqueness”, which is one of the four main characteristics of u-commerce. It is evident in our study that personalization is the means to achieve convenience, time saving, and individualization – three of the fundamental objectives customers value. Silent commerce utilizes RFID and sensor technologies to make ordinary objects intelligent and interactive, which makes personalization technologically feasible. Organizations that are interested in developing silent commerce applications should make full use of such kinds of technology to deliver products and services based on customers’ needs and preferences.

Location-based services is another type of services that can be valuable to customers. When “mobile devices and appliances become the eyes and ears of remote service providers” (Fano and Gershman, 2002), organizations will have the ability to track the location of customers and provide products or services to them based on where they are; therefore, “the location of your customer becomes the location of your business” (Fano and Gershman, 2002).

Real-time reminder is a function that proves to be useful for customers. The intelligent objects in silent commerce can serve as “personal assistants” for customers. The examples of “on-line medicine cabinet” and “on-line wardrobe” elaborated such kinds of services: silent commerce applications can remind customers to take their medication at the right time, report weather conditions to them before they set out from their homes, and make personalized suggestions such as on clothing and restaurants.

Pay-per-use can be the future trend of subscription and payment model. As embedded microscopic sensors or devices have the computing power to keep track of the usage of objects, customers can pay based on their consumption of an object rather than the actual manufacturing cost of the object. For example, a chair might have microprocessors and sensor chips embedded so that it can monitor the amount of time customers sit on it and charge based on the duration that the chair is used.

The intelligent objects can make purchase decisions by themselves without human intervention. Intelligent objects are capable of making decisions and are empowered to act on them. For example, a smart refrigerator can monitor the groceries

and automatically order and replenish the products. This can free customers from the chores of grocery shopping and bring convenience and quality to their lives.

The results of this study indicate that scenario-based methods are suitable for studying future states (Pitkanen et al., 2003). As IS researchers are interested in emerging information technology and its potential impact on organizations and individuals, the use of scenario-based methods can provide researchers the freedom to study some “uncertain, complex, and fast developing situations” (Camponovo et al., 2004). This will not only benefit IS research by making it possible to study emerging IT phenomena without being constrained by time and the state-of-the-art of technology, but it will also benefit practitioners as the results derived from such academic studies can provide useful guidelines and insight in real life. This is also in line with the call to directly link MIS research to practice and produce results of relevance to practice (Benbasat and Zmud, 1999).

This research is also a step towards developing a theory in the context of silent commerce. It answers the call for theory in IS research where it is recommended that researchers focus on “generating ideas, theories, and hypothesis, rather than simply testing them” (Fitzgerald et al., 1985; Klein and Lyytinen, 1985). Value-Focused Thinking, which provides a systematic approach to elicit and organize values, has proven to be an effective method of developing constructs in a relatively understudied area.

The means-ends objective network derived from this study can also serve as a conceptual foundation for future research. This research can also be replicated in the near future when the idea of silent commerce has become more widely accepted. The results of this research can also be operationalized to develop a set of instruments to measure the values of silent commerce.

## CONCLUSIONS

Silent commerce is the next wave in commerce. It has tremendous potential and possibilities. Practitioners have started to devise u-commerce applications in the market although its applications are still rare. For researchers, it is vital to start conducting empirical research to gain a better understanding of the upcoming silent commerce phenomenon and its implications and impact on individuals, organizations, and society.

As one of the first research to empirically study the values of silent commerce, this study contributes to a new area of research on disruptive technology (Bower and Christensen, 1995). This study adopted the scenario-based method and Value-Focused Thinking approach to explore the values of silent commerce and identify relationships between those values. The results of this study can serve as a conceptual foundation for future research in the area; the results can also provide useful guidelines to practitioners in developing and implementing silent commerce applications.

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