

PLANNING DIGITAL HOME SERVICES THROUGH AN ANALYSIS OF CUSTOMERS' ACCEPTANCE

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SUMMARY: *Analysing customers' likely acceptance of new technology before it is marketed is a common practice. Yet, in the case of digital home services, there is scant evidence of this being a routine practice. This paper reports on a study whose two-fold purpose is to analyse customers' acceptance of digital home services and to establish the direction of services to meet the aims of construction companies' strategic marketing planning. The research direction was based on the review of existing research materials and governmental policies on digital home services, and face-to-face interviews using a questionnaire to survey how people understand the concept of digital home services and the attraction of individual service packages. These materials and data were analysed to classify customers according to lifestyle and purchasing power. The results of the analysis were arranged in the form of a customer (or consumer) receptivity index and digital home business strategies. These results are expected to play an important part in planning digital home services and classifying service packages for the marketing of new housing.*

KEYWORDS: *smart home, digital home, home network, digital home services, consumer receptivity, business strategies.*

1. INTRODUCTION

1.1 Research background

Since the ubiquitous¹ computing concept was introduced by Mark Weiser in 1988, effort to adopt it in housing has been under way (Lee and Choi, 2004). It is expected that future housing will be developed not only as a physical means to escape from the elements, but also as a 'housing system' to satisfy people's desire for convenience, safety, pleasantness and happiness. In addition, by realising the ubiquitous environment, which enables the use of computing at anytime, in any place and through any device, the digital home² town will emerge in which media conversions and intelligent, integrated home network/control are possible (MCIE, 2003). The market for this kind of digital home is expected to grow from US\$61.2 billion in 2003 to around US\$379.1 billion in 2012 at an annual rate of 22.4% (MCIE, 2005).

Pilot projects are being executed more by civil organisations than by governments in many countries. Typically, effort has focused on the safety and reliability of remote medical examination, home-auto and entertainment services through policies, the construction of model housing complexes for technical advice and the expansion of foundation facilities. The Japanese government has presented policies related to home networking through e-Japan Strategy II, which developed the 'e-Japan Strategy project' in 2001 and presented the 'e-Life initiative' in 2003, announcing the objective of introducing and using information appliances in every home by 2007. Private corporations are accelerating technology development of health care and home automation by adopting home networking technology in high-class housing in Japan. The US has proposed various technologies for home networking through the Federal Communications Commission and entrusted the major technology development

¹ The word 'ubiquitous' is derived from the Latin 'ubiquitas', which means 'existing or being everywhere at the same time'.

² In this study, digital home is synonymous with smart home, intelligent home, cyber home etc.

of home networking and performance standardisation and related projects to related organisations, the academic community and private corporations such as IHA³ (Internet Home Alliance). Europe has presented the 'Sixth Framework Programme' to establish common R&D strategies and policies, and home networking is included in that programme. Other countries have been making efforts with relevant studies such as the 'Smart Home Foundation' in the Netherlands and 'INTEGER' in the United Kingdom (HMA, 2003).

Korea has made an effort to introduce intelligent systems to the housing environment since the early 1990s and its interest has rapidly increased since the late 1990s as high-speed communication infrastructure was constructed. Studies were conducted into the construction of intelligent housing systems such as the introduction of home automation systems focusing on internet service providers (ISP) and construction companies (Song, 2001). As a result of such efforts, the digital home was included in 'the 10 Tasks for the National Growth of the Country', announced in 2003. Consequently, the Ministry of Information and Communication (MIC, 2003) announced digital home construction plans and executed model businesses; meanwhile, the Ministry of Commerce, Industry and Energy (MCIE, 2003) announced smart-home business plans included in plans subsequent to the next-generation growth strategies. In addition, a digital home consortium was formed focusing on private corporations, with 1,300 model homes under construction and commercial service models under development.

Korea's infrastructure places it in an advantageous position to adopt digital homes, when compared with countries in the early stages of technology development, standardisation and service. In Korea, high-speed internet has been distributed to 80% of households and mobile phones have been taken up by 70% of the population. In addition, the number of wireless hot spots is claimed to be the largest in the world, 90% of homes are located within 4km of the telephone exchange and 60% of households are high-rise apartments as of 2003 (MCIE, 2005). Moreover, differentiated proposals satisfying new lifestyles such as well-being and ubiquity have been rapidly adopted in the marketing of new apartments by private companies since 2003. Construction companies view digital home services as a means for promoting sales, with the result that digital home service packages are being adopted without optimisation in the light of customers' current demands.

1.2 Related research work

Studies of home network businesses related to digital homes (KHNA, 2003) and the application of apartment home network systems (Lee, 2004) have been undertaken to understand the current situation for business and apartments. Also, efforts to estimate the feasibility of services meeting customers' demands have focused on lifestyle and residence type in order to propose home digital service models satisfying customers' demands and to offer home digital service plans (Lee, 2004; KNHC, 2004; KAIT, 2004). The Korea Home Network Industries Association reported the results of its survey on people's recognition of home digital services and the analysis of the home network industry (Lee, 2005).

Fuji Chimera Research Institute conducted a survey of home network users in Japan (FCRI, 2003); a telecoms corporation, IDC, periodically provides materials on worldwide home networking forecasts and analysis (IDC, 2004) and the NPD Group (another major corporation) provides annual home networking reports that survey customers about their attitudes and behaviour with regard to home networking (Techzone, 2005).

Research data on house-building companies, which perform a key role in service offers, are limited to technical plans and model services, such as home network construction plans for digital homes (HDEC, 2004). As such, they cannot suggest strategies for marketing in order to promote digital homes to meet the different types of demands from potential purchasing groups.

1.3 Research objective

The objective of this study is to examine customers' acceptance of digital home services for new apartments in order to use the results to establish strategies for construction companies to activate new apartment marketing, to classify possible purchasing groups and to provide basic data for setting the direction of service promotion. For these purposes, correlation analysis is performed for each purchasing factor using data collected through literature review and interviews with customers: conclusions have been drawn from the results.

³ A cross-industry network of leading companies such as Cisco Systems, GM, HP, IBM, MS, SUN, Samsung and LG electronics are advancing the home technology market.

Using these data, actual customers' recognition of digital homes can be understood, services by customers' specific character can be developed and service offers, which meet customers' demand, can be optimised for market segments. In addition, through the analysis of acceptance according to customer type, differentiated option products can be selected by possible purchasing groups and the effect of service offers can be maximised in future targeted marketing. Through this process, construction companies can establish strategies for promoting digital homes specific to customers' demands, develop future housing systems that can reform the living environment and which are also environment-friendly and raise the quality of life (MCIE, 2003).

2. DIGITAL HOME SERVICES

2.1 Identification of digital home services

Digital home services are the most recent home environment in which people can receive various services including remote education, home automation and multimedia at any time and in any place by accessing all kinds of information and electronic devices through wired and wireless home networks (MIC, 2003). That is, it can be understood as an innovative management service for remote control/remote inspection, home monitoring, video phone/VOD (Video On Demand)/remote medical treatment, information appliance operation and the operation and use of any kind of devices at any time via remote controllers inside the home and mobile phones outside the home (in routine daily life and in emergencies). Recently completed apartment complexes are opening public facilities such as multimedia rooms for playing games, viewing digital movies and doing business. General health centres connected to hospitals, as part of the overall service provision for the residents, are also appearing. These kinds of services can be inclusively understood as digital home services. They can be generalised as in Table 1.

2.2. Classification of digital home services

We can divide these kinds of digital home services according to function into convenience, happiness, safety and comfort services as shown on Table 1.

Table 1: Summary of digital home service (SKT Digital Home Consortium, 2004)

| Service Classification | Detailed Services | |
|---------------------------------|--|--|
| Convenience Service | Remote control | Information appliances, lighting, temperature, curtain |
| | Remote inspection | Electricity, gas and water supplies |
| Happiness Service | Entertainment | HDTV, network game, communication DTV, PC remote control |
| | VOD | Movie, EOD, COD |
| Safety Service | Home safety | Security, remote monitoring, mobilisation |
| | Remote medical treatment | Health care |
| | Protection | Pets, children, elderly people |
| | Prevention of disasters | Prevention of electricity leakage, water leakage, gas leakage |
| Comfort Service | Communication and messaging | High-speed internet, VoIP, display phone, SMS, MMS |
| | Information | Regional information, customising information (news, stocks), remote education |
| | Remote commerce | T-commerce, T-banking, T-stock, two-way advertising, home shopping |
| Telematics | Traffic information, location information, neighbouring information, road guidance | |
| Electronic governmental service | Issue of civil affairs documents, electronic voting, warning of disasters, announcements | |

Digital home services are therefore an axis of well-being and high-tech housing facilities, which have been a trend in the marketing of new apartments, and are understood as the integration of services that satisfy customers' demands for a safe and comfortable life. In order to provide these services, basic infrastructure

should be installed when apartments are constructed and contents should be provided when the services are utilised. However, the digital home is mostly provided as a package integrating individual services, which is included in the sale, so that customers are unable to choose the individual services they want.

Digital home providers could understand customers' likely acceptance better by classifying digital home services and, by doing so, they can execute targeted marketing through the optimal combination of services for different purchasing groups.

3. RESEARCH ON CUSTOMERS' ACCEPTANCE OF DIGITAL HOMES

3.1 Research method

Research was conducted through individual interviews with a total of 650 potential customers of digital home services who were living in residential apartments or residential-commercial apartments in Seoul and Busan. The subjects were limited to adult males and females who had purchasing power and were aged between 20 and 59. They were selected in proportion to their percentages in the population by gender and age. Also, complementary samples were selected through purposive quota sampling and, as a result, 50 subjects who were using digital home services were selected.

Table 2: Research method for customers' acceptance of digital home service

| | |
|----------------------|--|
| Target population | Potential customers using digital home service in the country |
| Sample population | Residents in apartments and in combined residential-commercial buildings in Seoul and Busan |
| | Adult males and females between 20 and 59 years of age |
| Research method | Individual interview using a structured questionnaire |
| Sampling method | Representative sample: sampling in proportion to percentages in the population by gender and age |
| | Complementary sample: purpose quota from those using digital home services |
| The number of sample | Representative sample: 650 (450 in Seoul and 200 in Busan) |
| | Complementary sample: 50 (current digital home users) |
| Sample error | Confidence level: within 95% ⁴ |
| Research period | August 12 to September 3, 2004 |

Data were analysed through correlation analysis within 95% of sample error using SPSS Win v10.0. Since lifestyle and the utilisation (or necessity) of high-tech systems such as digital homes are different according to social and economic status, we divided the subjects according to their socio-economic status (SES)⁵, size of apartment, type of recognition with respect to the necessity of home network services⁶ and possible purchasing group⁷ so that the data could be used for business planning or marketing. The characteristics of the respondents are shown in Table 3 below.

⁴ The research used correlation analysis and factor analysis with a confidence level of 95% of sample error. This implies that approximately 95% of sample data will include the true population value.

⁵ Socio-Economic Status is setting a higher score, where the income level is high and the number of family members is small.

⁶ The total number of affirmative responses in the necessity condition questionnaire (under 9: low, 10-14: middle, more than 15: high)

⁷ Non-purchasing group: income under US\$ 3,684; Potential purchasing group: income US\$ 3,684 – 4,736; Purchasing group: income over US\$ 4,736 (total monthly family income)

Table 3. Characteristics of research respondents (% , n=650, total respondents)

| Section | Classification | Sample Size | Component Ratio |
|---|----------------------------------|-------------|-----------------|
| Sample type | Random | 650 | 92.9 |
| | Complementary | 50 | 7.1 |
| Gender | Male | 196 | 30.2 |
| | Female | 454 | 69.8 |
| Age | 20s | 119 | 18.3 |
| | 30s | 208 | 32.0 |
| | 40s | 196 | 30.2 |
| | Fifties | 127 | 19.5 |
| Region | Seoul | 400 | 61.5 |
| | Busan | 250 | 38.5 |
| SES (Socio-Economic Status) | High (A+B) | 234 | 36.0 |
| | Middle (C1) | 308 | 47.4 |
| | Low (C2+D+E) | 108 | 16.6 |
| Apartment size | Less than 30 pyeong ⁸ | 325 | 50.0 |
| | Between 30 and 40 pyeong | 291 | 44.8 |
| | More than 40 pyong | 34 | 5.2 |
| Recognition of the necessity of digital home services | High | 165 | 25.4 |
| | Middle | 239 | 36.8 |
| | Low | 246 | 37.8 |
| Possible purchasing group | Non-potential purchasing group | 367 | 56.5 |
| | Potential purchasing group | 213 | 32.8 |
| | Realistic purchasing group | 70 | 10.8 |

3.2 Research contents

To measure customers' acceptance of digital home services and to establish directions for promotion, we selected necessary and unnecessary functions based on the respondents' recognition of the necessity of digital home services, preference/non-preference, preference by service function, intention to use and their response to price, and preference, control devices and considerations for providing digital home services in the sale of new apartments. From the factor analysis of purchasing attitude using the results of the questionnaire survey, we derived five purchasing groups, selected possible purchasing groups according to monthly household income and identified the indicators of general acceptance.

3.3 Recognition of digital home services and evaluation of concept acceptance

3.3.1 Recognition of digital home services

In research on the recognition of digital home services, only 4% of the respondents answered 'know very well', 47.5% did 'know a little,' and 48.5% 'heard but did not know details'. The result showed that half of the respondents recognised some digital home services. When we look into details of their recognition, the respondents generally do not recognise various systems but only understand that appliances and devices can be remotely controlled inside and outside the home (Table 4).

⁸ Korean area unit (1 Pyeong = 3.306m²)

Table 4: Recognition of digital home services (% , n=650, satisfied respondents)

| Services | Total (650) | Recognition (335) | Non-recognition (315) |
|---|----------------|----------------------|--------------------------|
| Remote control system | 71.4 | 79.6 | 62.6 |
| - Control home electronic appliances from outside | 15.1 | 17.0 | 13.0 |
| - Operate appliances inside the home using a remote controller | 11.8 | 17.9 | 5.4 |
| - Control all from outside the home | 44.5 | 44.7 | 44.2 |
| Monitoring system | 9.8 | 9 | 10.5 |
| - Check facilities in the home with a mobile phone from outside | 6.2 | 6.3 | 6.0 |
| - See the condition of things in the home from outside | 1.4 | 0.9 | 1.9 |
| - Check outside situations through the TV | 2.2 | 1.8 | 2.6 |
| Security and visitor check service | 4.6 | 5.7 | 3.2 |
| - Automatic lock device | 1.5 | 2.7 | 0.3 |
| - Crime prevention network service | 1.1 | 0.9 | 1.3 |
| - Visitor interception service | 2.0 | 2.1 | 1.6 |
| Others | 16.6 | 18.9 | 13.8 |
| - Operate electronic devices without the limitation of time and space | 5.8 | 7.2 | 4.4 |
| - Improve convenience | 3.1 | 2.4 | 3.8 |
| - Internet apartment with display phone | 7.7 | 9.3 | 5.6 |
| Don't know/No response | 9.3 | 0.3 | 18.7 |

3.3.2 Necessity of digital home service construction

Among the respondents, 66.8% indicated that 'the construction of digital homes is required' (the top 2: very necessary; 4.0%: necessary; 62.8%) and their mean score was 3.65 points⁹. 6.8% answered 'not necessary' (bottom 2: not necessary; 6.3%: absolutely unnecessary; 0.5%). Thus, recognition of the necessity of digital home services is high in general. In the complementary sample group that had experienced digital home services, the top 2 occupied 94.0% and their mean score was 3.96 points out of a possible 5 points. This implies that real users with experience recognise necessity more keenly.

3.3.3 Preference and non-preference

Reasons for preference are 'no limitation of time and place', 'convenience', 'the connection of all electronic information devices to wired and wireless network' and 'managing service of high-tech housing environment' and the reasons for non-preference are mainly matters of price, such as 'installation cost', 'usage cost', 'lack of necessity' and 'complicated in use' (Tables 5 and 6).

⁹ The full score was 5 points in all surveys.

Table 5: Reasons for the preference for digital home services (% , n=510, satisfied respondents)

| Details | Percentage |
|--|------------|
| Improvement in quality of life | 68.9 |
| - Usable to anybody regardless of time and place | 28.8 |
| - Convenient | 23.7 |
| - Limitation of devices, time and places, etc. | 16.2 |
| Home control | 49.2 |
| - All information electronic devices are connected to home network inside the home | 16.7 |
| - Remote control | 8.0 |
| - Use information electronic devices at home from outside | 24.5 |
| Home security | 14.3 |
| - For emergent situation and everyday life | 5.3 |
| - Home security functions | 2.2 |
| - Safe life | 6.8 |
| Infotainment | 12.6 |
| - Various services such as home automation | 8.4 |
| - Enable remote education | 2.0 |
| - Multimedia room for digital movie viewing, etc. | 2.2 |
| Protection control | 8.7 |
| - Construct a complex health control centre connected to hospitals | 5.1 |
| - Receive remote medical examination and consulting | 2.4 |
| - Receiving remote medical examination | 1.2 |
| Community | 2.0 |
| - Use display phone | 1.4 |
| - Fast information exchange | 0.4 |
| - Locate family members, | 0.2 |
| Others | 29.3 |
| - Management service for the most innovated housing environment | 9.4 |
| - Various services available | 6.9 |
| - Feel safe when outing | 13.0 |

Table 6: Reasons for non-preference of digital home services (% , n=65, dissatisfied respondents)

| Detail | Ratio |
|------------------------------|-------|
| High installation cost | 29.2 |
| Not necessary | 23.1 |
| High usage cost | 18.5 |
| Looks complicated to use | 18.5 |
| Lot of unnecessary functions | 24.3 |

3.3.4 Satisfaction and intention to use

Satisfaction was high with service items such as ‘information device control’, ‘electronic device control’, ‘remote inspection’, ‘mode control’, ‘visitor check’ and ‘public health managing system.’ For these items, the

mean points of satisfaction and intention to use were 3.7 and 3.5 points respectively. In particular, ‘information device control’ received high interest in connection with ‘turning off gas valve’ (Table 7).

Table 7: Satisfaction with and intention to use digital home services (point, %)

| Service Item | Satisfaction | | Intention to Use | |
|--|--------------|-------|------------------|-------|
| | Average | Top 2 | Average | Top 2 |
| Information device control | 4.22 | 88.8 | 4.11 | 84.6 |
| Control of information electronic appliances | 3.88 | 75.2 | 3.7 | 67.8 |
| Remote inspection | 3.84 | 72.5 | 3.67 | 63.4 |
| Mode control | 3.77 | 72.6 | 3.6 | 64.9 |
| Visitor check | 3.75 | 65.1 | 3.58 | 60.8 |
| Public health management system | 3.72 | 67.8 | 3.57 | 59.4 |
| Remote medical examination and consulting | 3.6 | 60.6 | 3.49 | 55.7 |
| Locate family members/check location information | 3.47 | 57.8 | 3.31 | 48.5 |
| Display phone | 3.46 | 55.4 | 3.27 | 47.8 |
| Outside monitoring | 3.44 | 53.7 | 3.21 | 44.3 |
| Issue administrative documents | 3.44 | 53.2 | 3.22 | 41.2 |
| Traffic information | 3.42 | 51.8 | 3.19 | 40.3 |
| Insider monitoring | 3.4 | 48.6 | 3.17 | 41.1 |
| VOD (movie), MOD (music) | 3.4 | 52 | 3.22 | 46.3 |
| TV banking | 3.31 | 45.8 | 3.1 | 37.7 |
| High-tech public facilities | 3.29 | 45.7 | 3.09 | 34.9 |
| Remote education | 3.2 | 44.2 | 3.03 | 36.8 |
| Home messaging | 3.16 | 34.9 | 2.94 | 26.9 |
| Pet caring | 2.44 | 16.8 | 2.3 | 13.8 |

3.3.5 Intention to use services

‘Information device control’, ‘mode control’, ‘control of information electronic appliances’ and ‘remote inspection’ ranked high as essential functions. They also ranked high as possible services to use in the event they are paid services. This suggests that these services are recognised as basic and essential functions. On the other hand, ‘pet caring’, ‘remote education’ and ‘home messaging’ were not regarded as necessary functions.

3.3.6 Reasons for intention to use or not to use services

With regard to the intention to use digital home services, half answered ‘use’ (the top 2: 49.5%, average 3.40 points), 36.8 % ‘not sure’, 13.2% ‘don’t want to use’ and 0.5% ‘never use.’ The reason for the relatively lower mean score, when compared with the score of necessity and satisfaction mentioned above, is the burden of installation and usage costs. The intention to install and use for the complementary respondents was high at 3.72 points on average. The reasons for intention not to install or use digital home services were related mainly to cost (Table 8).

Table 8: Reasons for intention not to install and use digital home services (n=328, %, Respondents who intend not to install and use)

| Reasons for intention not to use | Percentage |
|---|------------|
| Installation cost may be high | 43.6 |
| Usage cost may be high | 24.7 |
| Not felt necessary | 17.4 |
| Too early to buy the services – wait until the services are popular | 13.1 |
| Systems look too complicated | 4.3 |
| Not familiar with the details of services | 1.5 |

3.4 Acceptance of digital home system apartments

Respondents who are positive towards the installation of digital home systems in new apartments are 66.8% in the top 2 (very satisfied: 5.4%; satisfied: 61.2%) and their mean for satisfaction is 3.65 points. Satisfaction is particularly high in the complementary subjects.

3.4.1 Digital home control device

The appropriate device for controlling a home network is a ‘TV remote control,’ which was mentioned by the largest number of respondents and is followed by ‘mobile phone’. On the other hand, a majority of respondents gave ‘mobile phone’ as the appropriate device for outside control (Table 9).

Table 9: Digital home control devices (% , n=650)

| Section | Outside control device | | | | Total | |
|-----------------------|------------------------|-----|--------------------|--------------|-------|------|
| | Computer | PDA | Vehicle navigation | Mobile phone | | |
| TV remote control | 3.2 | 0.5 | 1.4 | 58.2 | 63.2 | |
| Computer | 0.8 | 0.2 | - | 2.8 | 3.7 | |
| Inside control device | PDA | 0.2 | 0.2 | 0.5 | 0.9 | |
| | Mobile phone | 0.8 | - | 0.2 | 20 | 20.9 |
| | Web pad | - | - | 0.2 | 6 | 6.2 |
| | Wall pad | - | - | 0.5 | 4.6 | 5.1 |
| Total | 4.9 | 0.8 | 2.3 | 92 | 100 | |

3.4.2 Considerations in applying digital home services

As for considerations in applying digital home service to apartments, respondents answered ‘service usage cost’ as the most important consideration and ‘connection to the mobile phone’ as the second most important. On the other hand, the complementary group which had experience of digital home services mentioned ‘maintenance and A/S’ as the most important consideration (Table 10).

Table 10: Considerations in applying digital home service (% , n=650)

| Considerations in applying digital home service | Most important | Important (including most important) |
|---|----------------|--------------------------------------|
| Service use cost | 44.0 | 74.2 |
| Connection to the mobile phone (necessity of wireless function) | 25.1 | 54.2 |
| Convenience of service use (operation) | 8.6 | 44.5 |
| Maintenance and A/S | 9.1 | 40.2 |
| Security of private life (security function) against hacking | 6.3 | 32.0 |
| Service quality such as communication speed | 4.3 | 26.9 |
| Increase in the value of apartments | 0.9 | 12.2 |
| Variety of service contents | 1.2 | 9.2 |
| Service upgrade | 0.5 | 2.9 |

3.5 Analysis of purchasing attitude

3.5.1 Analysis of purchasing attitude factors

In order to evaluate the acceptance of digital home services and to develop a countermeasure service plan according to customer type and purchase group, factor analysis¹⁰ was carried out on all of the respondents using 17 questions covering purchasing attitude. Consequently, three kinds of purchasing attitude were identified: pursuit of luxury brands, practical and safe purchasing and freshness/uniqueness (Table 11).

Five purchasing types have been identified through analysing the three purchasing attitudes. They are 'pursuit of luxury product + planned purchase', 'pursuit of luxury brands + purchase without a plan', 'serious consideration of image', 'conservative and safe purchase' and 'no fixed form' (Table 12).

The characteristics of each type of purchasing group are as follows. The type, 'pursuit of luxury good + planned purchase' (25.6%), purchases goods in a practical and safe way and pursues luxury goods at the same time is more common among women than men. Also, the percentage of this type is relatively higher among those living in Seoul, in their 20s and high in SES. They are less interested in trends related to well-being, but exhibit a high requirement for the provision of digital homes and express a high intention to install digital home services.

The type, 'pursuit of luxury good + purchase without a plan' (19.1%), prefers luxury goods, obtains information on goods when purchasing items, and purchases goods without comparison of price is a little more common among women than men. The percentage of this type is relatively higher among those living in Seoul, in their 20s, university graduates and high in SES. They show an interest in well-being trends and prefer to find digital home services installed when considering buying new apartments.

The type, 'purchase with consideration of image' (18.6%), shows an interest in new products and new technologies, but not in trends. They tend to purchase products for which they can make the best use and are relatively higher in prevalence among men, those living in Busan, in their 30s or 40s, university graduates and of middle or low SES. They are interested in well-being, are keen on the necessity of digital home construction, and prefer to find digital home services installed when considering buying new apartments.

The type, 'conservative and safe purchase' (16.3%), purchases products used by many people that are practical and highly recommended. The group is mainly those living in Busan, in their 40s or 50s (older age group), high school graduates or below, and of middle or low SES. They do not see the necessity for digital home construction, do not prefer a digital home when buying new apartments and do not intend to install digital home

¹⁰ Factor analysis is used to discover patterns in the relationships amongst variables.

services.

The type, 'no fixed form' (20.3%) is not bound by any factor of purchasing attribute, and the group is mainly from those living in Busan, in their 40s or 50s (older age group) and high school graduates or below. They do not see the necessity for digital homes, do not have the intention to install a home network, and do not prefer to find digital home services installed when buying new apartments.

Table 11: Factor analysis of purchasing attitude

| Factor | Attribute | Factor Scope |
|---------------------------------|---|--------------|
| Pursuit of luxury good/brands | Envy people who possess luxury brands | 0.7566676 |
| | Happy when having luxury brands | 0.7187594 |
| | Buy desired products without economic consideration | 0.6392093 |
| | Go to department store although there is nothing to purchase | 0.6220072 |
| | Brands are for social status/position and not for practical use | 0.5853456 |
| | Consider advertisements seriously | 0.4946822 |
| Practical/safe purchase | Purchase after surveying various channels | 0.5898846 |
| | Purchase products that have sold a lot | 0.5734330 |
| | Compare prices at several stores | 0.5600220 |
| | Purchase products with economic consideration and prior plan | 0.5163144 |
| | Consider others' opinion seriously when purchasing products | 0.4366358 |
| | Hesitate to purchase products that are not used by others | 0.4350491 |
| Pursuit of freshness/uniqueness | Obtain information from others when purchasing product | 0.3999411 |
| | Very interested in new products and new technologies | 0.6702080 |
| | Love products that make me look unique | 0.6293888 |
| | Luxury brands are worthy of their names. | 0.5822195 |
| | Purchase products that customers love without considering the trend | 0.4877360 |

Table 12. Correlation between purchasing type and purchasing attitude factor

| Type | Size | Pursuit of luxury good/brands | Practical/safe purchase | Pursuit of freshness/uniqueness |
|--|---------------|-------------------------------|-------------------------|---------------------------------|
| Pursuit luxury goods + planned purchase | 25.6% (N=166) | 0.512 | 0.8197 | 0.3539 |
| Pursuit luxury goods + purchase without a plan | 19.1% (N=124) | 0.9231 | -0.7165 | 0.2262 |
| Purchase with consideration of image | 18.6% (N=121) | -0.9009 | -0.6384 | 0.9182 |
| Conservative and safe purchase | 16.3% (N=106) | -1.1875 | 0.7422 | -0.5594 |
| No fixed form | 20.3% (N=132) | 0.0981 | -0.4614 | -1.1972 |

3.5.2 Analysis of possible purchasing groups

According to the possibility of purchase, the respondents were classified into purchasing group, potential purchasing group and non-purchasing group.

The purchasing group (10.8%) consists of mainly those with monthly household income over US\$ 4,736 and men, in their 40s or 50s, university graduates and above, high in SES and possessing an apartment larger than 40 pyeong. They also see the necessity for digital home services and prefer to find digital homes services installed.

The potential purchasing group (32.8%) consists of mainly those with monthly household income between US\$ 3,684 and US\$ 4,736, living in Seoul, high in SES, men and possessing an apartment between 30 and 40 pyeong. Around half of them see the necessity for digital home services and the other half do not; they are generally positive to the installation of digital home services.

The non-purchasing group (56.5%) consists of mainly those with monthly household income less than US\$ 3,684, in their 20s or 30s, living in Busan, high school graduates and below, middle or low in SES, and possessing an apartment smaller than 30 pyeong. They do not see the necessity for digital home services and do not prefer digital home services to be installed.

Table 13: Correlation between purchasing type and possible purchasing groups

| Type | Purchase group | Potential purchasing group | Non-purchasing group |
|--|----------------|----------------------------|----------------------|
| Pursuit luxury goods+ planned purchase | 14.5 | 36.1 | 49.4 |
| Pursuit luxury goods + purchase w/o a plan | 11.3 | 29.8 | 58.9 |
| Purchase with consideration of image | 9.9 | 28.9 | 61.2 |
| Conservative and safe purchase | 8.5 | 35.8 | 55.7 |
| No fixed form | 8.3 | 31.8 | 59.8 |

3.5.3 Analysis of acceptance indexes

When we estimated the acceptance indexes for each possible group, the purchasing group gave high points to the preference for digital home services, the necessity of constructing digital homes and the preference for new apartments with digital home services installed.

Table 14: Acceptance indexes for possible purchasing groups

| Acceptance index | Subjects of questionnaire survey | Total | Purchasing group | Potential purchasers | Non-purchasing group |
|---|----------------------------------|-------|------------------|----------------------|----------------------|
| | | 650 | 70 | 213 | 367 |
| Preference for digital home service | Average | 3.76 | 3.9 | 3.76 | 3.73 |
| | Top2 | 78.5 | 82.9 | 77.9 | 77.9 |
| | Top1 | 7.4 | 15.7 | 5.2 | 7.1 |
| Intention to install digital home | Average | 3.4 | 3.61 | 3.5 | 3.31 |
| | Top2 | 49.5 | 61.4 | 55.4 | 43.9 |
| | Top1 | 4.9 | 8.6 | 3.8 | 4.9 |
| Necessity of digital home at luxury apartments | Average | 3.65 | 3.83 | 3.66 | 3.6 |
| | Top2 | 66.8 | 81.4 | 65.7 | 64.6 |
| | Top1 | 4.0 | 5.7 | 2.8 | 4.4 |
| Preference for new apartments with digital home | Average | 3.65 | 3.8 | 3.69 | 3.6 |
| | Top2 | 66.6 | 78.6 | 69.5 | 62.7 |
| | Top1 | 5.4 | 8.6 | 5.2 | 4.9 |

4. DISCUSSION OF RESULTS

Customers' responses to the concept of digital home services were positive and respondents gave high points for digital homes, preference for digital home services, intention to install and use digital home services and preference for new apartments with digital home services. Respondents also mentioned the essential functions of digital homes such as information device control, mode control and the control of information and electronic devices in that order. When multiple answers were allowed, 70.6% mentioned the control of information and electronic devices as a service for which they would pay.

The respondents' intention to install and use digital home services was lower than their recognition of their necessity and preference due to a conservative attitude towards these services, which are in an early stage of development, and the costs of installation and use. When looking into each service item, however, respondents' recognition of necessity and intention to use were relatively high for information device control, mode control, electronic information appliance control, remote inspection, visitor check, public health management system and remote medical examination/consulting service (Table 7).

The study also found a positive result in the respondents' general acceptance indexes such as their preference for digital home services (78.5%), preference for new apartments with digital home services (66.6%) and the necessity of digital home construction (66.8%). The response was even more positive among the complementary respondents who were using digital home systems or who had a preference for digital home services (92.0%). Given these indications and the preference for new apartments with digital home services (88.0%), together with the perceived necessity of digital home construction (94.0%), the market for digital homes is considered likely to offer high potential growth.

If we look into the characteristics of the purchasing group, whose acceptance of digital home services was high, the percentage of respondents was highest among men, those in their 40s or 50s, high in SES and living at an apartment larger than 40 pyeong. This reveals that those with economic and purchasing power have a relatively higher preference for digital home services. Additionally, those living in Seoul, in their 20s or 30s, and with a purchasing attitude that seriously considers brand, image and characteristics were favourably disposed towards general acceptance of digital home services. We thus concluded that it would be appropriate to provide different, state-of-the-art digital services to customers living in large cities enjoying a relatively affluent lifestyle.

5. CONCLUSIONS

The purpose of this study was to examine customers' acceptance of digital home services for new housing, primarily apartments, in order to use the results to establish strategies for construction companies' marketing. This is viewed as being particularly useful for classifying potential purchasing groups and providing basic data for setting the direction of service promotion. For these purposes, correlation analysis and factor analysis was performed for each purchasing factor and group using data collected through face-to-face interviews utilising a questionnaire designed to capture how people understand the concept of digital home services and the attraction of individual service packages. The data were analysed to classify customers according to lifestyle and purchasing power. The results of the analysis were arranged in the form of a consumer receptivity index and digital home business strategies.

Customers' responses to the concept of digital home services were positive and respondents gave high scores to the necessity of digital home services. However, respondents' intention to install and use digital home services was lower than their recognition of its necessity and their preference for it. It seems sensible, therefore, to undertake targeted marketing based on the best combination of services customised for individuals. By providing differentiated digital home services in large cities to the purchasing and potential purchasing groups, it should be possible to meet customers' demand for digital homes.

The research results are most likely limited in their general use, because data were collected for a country with well-developed digital infrastructure. However, the classification of digital home services', customer acceptance survey and factor analysis by purchasing power leading to the development of digital home promotion strategies should have wider application.

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7. REFERENCES

- FCRI. (2003). A user questionnaire on the home network. Fuji Chimera Research Institute. Tokyo.
- Hyundai Engineering & Construction (HDEC). (2003). The strategy of construction of home network apartment, *IBS Korea technology seminar*. Seoul.
- IDC (2004). Worldwide Home Networking 2004-2008 Forecast and Analysis.
- KAIT.(2004). A study on the plan of home digital service provision through the research on home network demands. Korea Association of Information & Telecommunication, Jinhan M&B.
- KHNA. (2003). A Study on the Schemes to Intensify the Home Digital Service. Korea Home Network Industries Association.
- Lee, D. H. (2005). Research of the Home Network Industry Status, Korea Home Network Industries Association, *2005 Seminar on the Home Network Industries Status and Prospect*.
- Lee, I. J. and Choi, J. W. (2004). A study on the design guideline development for smart home based on ubiquitous technology system classification, *Proceedings of Architectural Institute of Korea*, 24(2), p.1223.
- Lee, J. R. (2004). A Study on the Smart Home based on residents. Unpublished Masters Thesis, Yonsei University.
- Lee, S. A. (2004). A Study on the Application Status of the Apartment Home Network System. *Proceedings of the Fifth KICEM Annual Conference*. Korean Institute of Construction Engineering & Management.
- Ministry of Commerce, Industry and Energy of Republic of Korea (MCIE). (2005). The Development Strategy of the Intelligence Type Home Network Industry. *2005 Seminar on the Home Network Industries Status and Prospect*, Korea Home Network Industries Association.
- Ministry of Commerce, Industry and Energy of Republic of Korea. (MCIE). (2003). The planning of next generation growth power development strategy.
- Ministry of Information & Communication Republic of Korea (MIC). (2003). The master plan of digital home construction for digital life, p.2-7.
- SKT Digital Home Consortium (2004). *Republic of Korea Digital Home Pilot Project (the 1st year)*, Ministry of Information & Communication, pp.12-13.
- Song, J. Y. (2001). *The Research of Smart Home System*. Unpublished Masters Thesis Yosei Univ.
- Techzone. (2005). *The NPD Group Uncovers Latest Trends in Home Networking*. Available electronically at: <http://techzone.pcvconsole.com/news.php?tzd=2898>
- Weiser, M. (1996). *Open House*. Available electronically at: <http://www.ubiq.com/hypertext/weiser/wholehouse.doc>
- Weiser, M. (1993). Some computer science issues in ubiquitous computing. *Communications of ACM*, 6(7), pp.75-84.