

Consciousness in Life and Markets for Home Network -A preliminary Study toward Rapid Dissemination of Energy Saving “Embedded” Product

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Abstract This paper reports the results of exploratory research on the relationship between consumers' consciousness in life and their acceptability of home network related functions for the purpose of the reduction in energy consumption in household sector given the energy conserving effect of home network. We initiated questionnaire survey based on the functional -emotional value constructs induced from the preceding focused group interview. Our factor analysis revealed 14 factors explaining everyday consciousness of consumers in housing related market. We segmented and profiled the consumers based on factor scores and then likely functions of home network attracting each segment were examined. Although we largely confirmed the existence of the functional-emotional value constructs, desired functional detail concentrated on security and remote control functions. This result implies it is not appropriate to market such high-tech energy saving product with emphasizing its ecological aspect.

Keywords home network, consciousness in life, factor analysis, cluster analysis

1 Introduction

The first commitment period of Kyoto protocol started at the very beginning of this year and ratified countries have to devote a substantial amount of effort to solve green house gas problem. Although Japan committed to reduce 6% from 1990 base by the end of the period, it seems to be difficult to achieve the goal without more strategic and intensive national approach than ever. Actually Japanese Ministry of Environment (MOE) reports that the gas emission during 2006 amounted to 1,340 million tons which was 6.2% larger than that of 1990. As far as CO₂ emission, explosive growth of emission in civilian sector which had been caused by the rapid dissemination of IT, largely explain the fact*. In fact, the emission of business sector excluding manufacturing showed 39.5% increase from 1990 and that of household sector had grown 30%. To formulate scenario for reducing or at least managing the emission in these sectors immediately thus becomes serious and emerging agenda. Home Energy Management System (HEMS) which is of our concern in this paper is expected to contribute the reduction in household sector†‡.

Although there is not concrete definition of HEMS, it originally has distinct technological feature of which general electrical line carrier and specific power saving radio transmission such as Bluetooth are utilized to network electric and air-conditioning equipment so that it does not require additional wiring§. In terms of commercial aspect, Jukankyo Research Institute[8] observes current HEMS related product and service include (1) energy consumption information service via website, (2) the same information service by energy provider based on outside monitoring, (3) peak cutting switchboard, (4) energy consumption display monitor and (5) home network related services. Previous studies empirically support monitoring and feedback functions ((1), (2) and (4)) can lead to substantial energy saving in household**. Moreover, factors affecting energy saving performance has been explored, albeit

* <http://www.env.go.jp/earth/ondanka/ghg/index.html> (as of July 31, 2008) (in Japanese)

† Japanese Ministry of Economy, Trade and Industry estimates dissemination of HEMS and Building Energy Management System (BEMS) will reduce 1.12 million tons CO₂ emission in 2010 with minimum of 8.04 million tons.

‡ Smartest Home is a Dutch equivalent to HEMS introduced home in essence.

§ See Inoue et al.[7] for detailed discussion. This type of home network infrastructure is called Energy Conservation and Homecare Network (ECONET). It should be noted that there exist many other home network infrastructure and HEMS can be constructed based on other than ECONET. We don't intend to insist any superiority of ECONET to others, but we implicitly assume ECONET based HEMS throughout the research so that we can't deny the possibility of bias due to it.

** See Ueno et al [16] for energy saving effectiveness of specifically HEMS.

contradictory arguments observed in some aspects (e.g. McClelland & Cook[11], Brandon & Lewis[2], McCalley & Midden[10]). However, there still remains unsolved problem concerning how to introduce such products into household. Should this be left to market mechanism, marketing consideration is crucial. This paper investigates the possibility of HEMS prevalence through exploring and stimulating (5) from the standpoint explained in the following paragraph.

Based on the analysis of energy saving effect observed in HEMS field test and preliminary marketing, many practitioners are skeptical of chances to promote HEMS by narrowly emphasizing its energy conservation aspect. For example, Research Institute of Human Engineering for Quality of Life [14] insists energy saving function itself has little merchantability so that combining it with other service is needed. We share the same thinking with the former and extend the scope of HEMS to potential services realized by home network, given the existence of network externality (Katz & Schapiro [6]). Actually, home network will serve as powerful platform for wide variety of derivative services stemming from house appliances network itself in addition to its connection with outside via internet and thus energy saving is merely one of the functions it will be able to provide. Therefore, if marketers unwisely promote home network construction with emphasizing narrowly on energy conservation, such promotion may mask the huge spillover effect the network has. Japanese government recognized this characteristic of home network and proposed to include additional confirmation service of the safety of elderly living alone as a function of HEMS in 2006 Energy White Paper. Research Institute of Human Engineering for Quality of Life[14] conducted focused group interview and found marketability of this service. Based on the above lines of logic, however, we think it is more appropriate to suppose HEMS (more precisely energy saving) as a function of broad domain of home network function rather than thinking the possibility of adding other service for immediate and smooth market penetration, aside from subsidizing solution*. For this reason, we examine attractiveness of potential home network products and services, while our ultimate concern lies in energy conservation in household sector. Thus our research will have implications for public institutions and firms trying to promote home network market in general, regardless of the embedded importance of energy saving purpose.

Looking at Toshiba's home network appliance product named "FEMINITY" promotion URL for instance, you can find 9 home network related functions which facilitate security, remote control and integrated control function as a whole†. However, there is no guarantee customers evenly evaluate the product as a whole due to differences in lifestyles and value. Moreover, home network market seems be in its introduction stage where unexplored market opportunity may still exist. To the extent we know, there is no research suggesting which home network related product and /or service would be promising when network is installed so that we intend to fill this gap. Besides, like internet, as home network essentially constitutes infrastructure for many products and most attractive product may vary across consumers, we investigate the relationship between customer segments and promising product. Our research in essence follows or replicates commercial new product development process for the purposes.

2 Focused Group Interview and Assumptions

Before conducting questionnaire, we undertook focused group interview (FGI) to investigate the relationship between consumers' perceived value and home network functions for designing the items to be included in the questionnaire‡. On doing so, we employed evaluation grid method which is a variant of Kelly repertory method and have popularity as a product development tool in Japan (Sanui & Inui [15])§.

Based on our survey of public information concerning home network, we listed seven additional functions including (1) security, (2) maintenance, (3) housework support, (4) health care, (5) remote control, (6) appliances control and (7) energy reduction/conservation which the basic function of

* See De Haan et al [3] for an approach of rationalizing subsidiary policy or tax incentive on specific energy conservation product.

† <http://www3.toshiba.co.jp/feminoty/dekiru/index.html> (as of July 31, 2008) (in Japanese)

‡ Matsuura & Fukuyo[9] reports the procedure details and results.

§ Van Kleef et al [17] reviews typical tools for new product development. They said that repertory grid is appropriate for the development aiming at marketing oriented incremental new products. As we wrote in the section 2, our proposed functions already exist but we can't predict the way those functions will be provided through home network with certainty. Since we describe the functions in the way being familiar to the participants for activating interview, our analysis is to some extent marketing oriented with existing products provided in different fashion so that evaluation grid method supposed to be appropriate.

integrated appliance control generate. It should be noted that, albeit subjectively, we made strong assumption throughout the research that the basic function *should* realize emotional value described by the terms “convenience” and/or “comfort”, and then investigated the relationship between the functional values and the emotional values subordinated to “comfort” and “convenient” brought by the additional seven functions*. Although we recognize pre-specifying emotional value with which new product satisfies is not common in academic researches, we did so for two reasons.

First, typical repertory grid tool fits to schemes participants being able to distinguishing comparative objects. Given this tradition, our interview participants may feel the functions we listed are dissimilar in a number of respects and consequently can not appreciate the functions as intended without giving specific viewpoint, even when the skilled interviewer leads. The second arises from our concern over marketing of energy saving products. Previous studies found consumers’ values and lifestyles affect their environmental behavior (e.g. recent works including Poortinga et al[13], Barr et al[1] and Fraj and Martinez[4]). However, it is not clear to what extent consumers are willing to buy certain product based on environmental grounds (Polonski & Rosenberger [12]), with the consideration of the fact that brand new product usually performs at a higher level of energy efficiency. Thus we intensely set the goal of home network related products development similar to usual expensive durable products and then examine additional emotional value brought by energy saving function and relative attractiveness among functions. Investigation in this way may contribute to clarify appealing points for dissemination of HEMS beyond ecological consumer segment. Besides, it is common in practice to specify the goal a product aims to achieve at new product development and we believe our assumption was plausible for housing related product in practical marketing research, given the current emphasis on emotional value at the development by Japanese firms.

Figure 1 summarizes the constructs the FGI suggested which forms functional- emotional value relationship to be referred in the next section. Our inference from this constructs bring three suggestions for home network market penetration except pricing policy. First, home network should be marketed as supporting device for ordinary livers. Second, target market in terms of age is 30’s and 40’s. Third, given the emotional values in Figure 1, appealing points at communication should be “fulfillment”, “liberation” “peacefulness”, “relax” and “relief.” Finally, promising functions are security and remote control. We also find participants on average ranked energy saving as third in terms of attractiveness among the proposed functions.

3 The Questionnaire

3.1 The Respondents

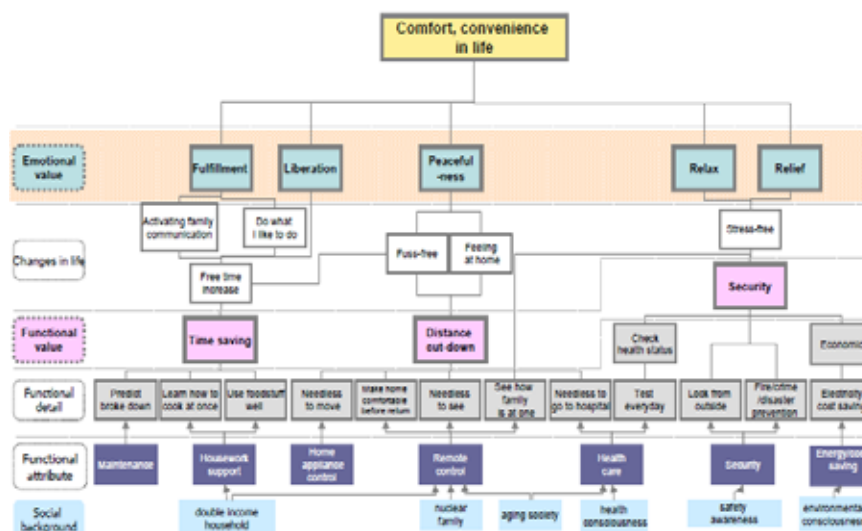


Figure 1 Functional-Emotional Value Development of Additional Home Network Functions

* We basically investigate the functional value in terms of performance or quality dimension because we don't have any price target concerning the service. However, FGI suggested the participants would be willing to pay JPY 50,000 at the installation and 20,000 as monthly charge at maximum.

We then designed internet questionnaire survey for confirming FGI result from August 10-12, 2007. The respondents were selected based on two conditions. First group satisfied all the conditions of (1) the age of 30's and 40's, (2) living in rental housing or apartment but (3) planning or willing to have detached dwelling, second group did (1) the age of 50's and 60's, (2) living in detached dwelling and (3) planning or willing to renovate their house. Each group consists of 200 respondents but to control for gender bias, the number of male and female respondents were set equally (=100)*. However, due to the closing timing problem of the survey URL, we gathered the answer from 201 respondents (M=101, F=100) as to group 1 and 205 (M=103, F=102) and in aggregate we had 406 responds. The survey was conducted on commercial base (i.e. the respondents were paid certain fees in exchange of response) mediated by Macromill Inc., which constructed over 500 thousands respondents pool (as of May, 2007). Our research also suffers from possible shortcomings of which internet surveys have in common (Gosling et al[5]).

3.2 The Questionnaire Design

Table 1 Brief Summary of the Questionnaire

<i>Intent of Questions</i>	<i>No</i>	<i>Headline</i>	<i>Basic Description</i>	<i>Form</i>
S1: Respondents' demographics confirmation	Q1	Marital status	Are you married?	SA
	Q2	Family status	How many family members are you living with?	SA
	Q3	Living arrangement	What type of dwelling are you living in?	SA
S2: Potential variables explaining values in life of the respondents	Q4	Sense of values in life	What kind of lifestyle are you trying to keep now?	MTSA
	Q5	Consciousness on housing	How is your house (or room) now?	MTSA
	Q6	Life attitude	How is your life attitude now?	MTSA
	Q7	Leisure activity	How is your leisure activity now?	MTSA
S3: Potential variables explaining values in future life	Q8	Social life attitude	How is your social life attitude now?	MTSA
	Q9	Sense of values in future life	What kind of lifestyle do you want to take in future?	MTSA
	Q10	Fears for future life(1)	Is there any fear for you and your family when you imagine your life of five years later?	MA
S4: Confirmation of home network perception	Q11	Fears for future life(2)	What is the least comfortable aspect if you have fears in future?	SA
	Q12	Perception of home network	Do you know HEMS (or "intelligent house" or "smart house")?	SA
S5: Marketability and priority of home network functions	Q13	Attractive function of home network	Which functions home network will provide attract you?	MA
	Q14	Attractive function of home network	Which function is most attractive? (in case of checked in Q13)	SA
S4': Supplement to life value	Q15	Other comments	Frankly comment things you feel in dairy life like "it will be more comfortable or convenient if this would be" or "it is inconvenient"	Text
S6: Influence of living with older on the attractiveness of home	Q16	Living together with parents	Do you live with your parent(s)?	SA
S7: Influence of value induced by difference in income level on the attractiveness	Q17	Family income	How much was your before tax family income in the last year?	SA
S8: Confirmation of consuming behavior	Q18	Basic behavioral attribute	To what extent do listed items fit to your ordinary behavior or attitude?	MTSA
S9: Confirmation of energy saving and ecological behavior and attitude	Q19	Ecological behavior	Do you try to save energy or protect ecology in everyday life?	SA
	Q20	Ecological attitude	Mark energy saving or ecological activities you are practicing (in case of checked in Q19)	MA

*SA: Single selection, MA: Multiple selection, MTSA: Single selection based on matrix form

*shaded question is out of examination in this paper.

The questions being examined in this paper can be described as Table 1[†]. Although validated authoritative measures of values and lifestyles exist such as VALS2 employed in Fraj and Martinez [4] for instance, we developed our original questions reflecting FGI result. This is because we did not investigate general constructs of value and lifestyle but these in relation to specifically housing related products and also examine the relationship between the functions and customers' value between the

* We restricted the samples in this way because some of our proposed functions are not the matter of family decision when they live in housing complex. For example, security service is usually contracted with a housing complex as a whole but not single family.

[†] We decide not to report the whole items because of its length. However, the questionnaire items will be available upon request. Please contact to the authors if you're interested in.

functions and current value or needs. 9 segments (S1-S9) constructed the questions. The questions denoted by MTSA had minor questions varying from 7 (Q.8) to 31 (Q.18). While questions 4, 9 and 18 used 5-point-Likert scale, other MTSA questions employed 5-point-semantic differential. In addition to the Table 1, we also obtained social and geographical background of the respondents (e.g. gender, age, occupation, prefecture of domicile and number of children) as back data and thus we could make cluster analysis including those attributes to be discussed in 4.2.

4 Analysis

4.1 Factor Analysis of Consciousness in Life

We first examined everyday consciousness of the respondents. For that purpose, we applied factor analysis to minor questions included in Q4-Q8 (S2) with SPSS Ver.15.0. The analysis revealed 14 factors subject to eigenvalue-one criterion. Although we could otherwise refer to scree graph and reduce the number of factors (perhaps to 3 or 4), from the result of FGI (remembering FGI implied five additional emotional values), we thought the reduction led to over simplification of respondents' consciousness and consequently depressed practical implications. Indeed home network itself constitutes infrastructure for wide variety of products. Marketers can freely add products and appeal with emphasis on specific emotional value. Thus we preserved relatively large number of factors at the cost of generality so that our analysis could provide detailed segmentation of consumers' profile.

Table 2 reports the factors and their factor loadings on subscales (threshold set at 0.3) in descending order of eigenvalue accompanying with Cronbach's alpha. We applied most likelihood method at extraction and then promax oblique rotation with Kaiser normalization. The factor loadings in the table were the values after rotation. Kaiser-Meyer-Ohlin measure was 0.811, while Bartlett test of sphericity told $\chi^2=7,685.88$, $df=1,128$ and $p<0.001$. With these results, we concluded that our sample adequacy was guaranteed. Contrary, the alphas cautioned the internal consistency of F9, 10, 11, 13 and 14 unwarranted with respect to conventional 0.7 criteria. Besides, the table revealed the factor loadings on Q8-20 in F8 and Q6-9 in F12 had extraordinary values (>1)*. While these facts suggested the necessity of reconsideration and intensification, we decided to report the factors here since we concluded, albeit subjectively, this version of analysis describing the consumer consciousness or lifestyles in most plausible manner given the FGI result. Nevertheless, readers are highly asked to keep these risks in mind at interpreting the results.

F1 referred to "commitment to home" which related to the degree people are willing to pay attention or money to make home they want it to be. It might suggest our sample have wide variety of views on home circumstances so that the sample represented broader home related market. Other 13 factors can be mentioned as follows: F2 implied "activeness," F3 "public image conscious," F4 "crime/accident prevention action," F5 "ecology conscious," F6 "communication emphasis," F7 "local community conscious," F8 "crime prevention conscious," F9 "health conscious," F10 "relaxed/carefree life orientation," F11 "internet familiarity," F12 "busyness," F13 "family emphasis," and finally F14 "life-related-fatigue."

* These factor loadings had normal values (0.924 for Q8-20 and 0.961 for Q6-9, respectively) after varimax rotation.

Table 2 Factors Explaining Consumers' Consciousness in Life

Factor	Subscales (minor questions)	Factor Loading	Factor	Subscales (minor questions)	Factor Loading
F1	Q5-2 I'm particular about home (room) interior design	0.970	F8	Q8-20I pay much attention to family not being involved in accident or crime	1.038
	Q5-1 I'm particular about home exterior design	0.888		Q8-19 I pay enough attention not to be involved in accident or crime	0.798
	Q5-3 I do all kinds of things to make my home more comfortable	0.654	F9	Q6-2 I try to eat balanced meals	0.867
	Q5-10 I aspire to make home with my particular tastes at all points	0.496		Q6-1 I try to have meals three times every day	0.701
	Q5-5 I'm particular about the latest household equipments	0.466		Q6-3I exercise at least once a week	0.438
F2	Q7-4 I travel abroad at least once a year	0.774	F10	Q4-8[A]I try to do thing I satisfy with rather than others evaluate ⇔ [B]I try to do things others evaluate	0.678
	Q7-3 I go on over 3days & 2 nights domestic trip at least few times a year	0.709		Q4-7[A]I don't focus on position, property and income ⇔ [B]I focus on rise in position, property and income	0.570
	Q7-5 My friends and acquaintances often visit my home	0.494		Q4-1[A]I cherish life with breadth of mind rather than money and material ⇔ [B]I cherish life with enough money and material rather than mind	0.485
	Q7-6 I often buy appliances when brand new ones are out	0.423		Q4-12 [A]I like to live in the place surrounded by nature but inconvenient ⇔ [B]I like to live in convenient environment but minimal nature	0.429
	Q7-2 I'm away a lot regardless the day	0.414		Q4-11[A]I live the way leading to ecology protection but inconvenient ⇔ [B]I live with putting convenience ahead of ecology prevention	0.413
Q5-13 I spare no expense on furnishing	0.346	F11		Q7-10 I shopped at internet shopping site	0.893
F3	Q5-12 I keep my home clean to invite others at any time			0.891	Q7-9 I use internet more than three days a week
	Q5-8 My home is always well organized		0.803	Q7-13 I use internet bank	0.559
	Q5-9 I clean up my home more than three times a week	0.891	F12	Q6-9I often work on holiday or work in home on holiday	1.021
F4	Q5-19 I always have home emergency goods ready	0.695		Q6-8 I work till late evening	0.627
	Q5-20 I keep fire extinguisher in my home	0.560	F13	Q6-15 I often go out with family	0.896
	Q5-18 I purchase earth quake insurance	0.553		Q6-14 I often take meals with family	0.559
	Q5-7 I contracted with a security company for crime prevention	0.402		Q7-1 I often go for a holiday	0.339
	Q5-6 Anticrime measure in my home is adequate	0.387	F14	Q6-12 I often feel household work is troublesome	0.714
F5	Q8-6 I try to save energy and resources	0.930		Q6-13 I spend much time for household work	0.599
	Q8-7 I try to do something good for greening	0.854		Q6-5 I'm recently susceptible to fall sick	0.410
F6	Q4-5 [A]I prefer to be good together with others than assertive ⇔ [B]I cherish my own personality	0.848			
	Q4-6 [A]I cherish opportunity to meet people ⇔ [B]I cherish my own world	0.740			
	Q4-4 [A]I value interaction with family and friends ⇔ [B]I value my own time	0.493			
F7	Q8-4 I often join community events where I live	0.881			
	Q8-5 I support firms and organizations located nearby	0.672			
	Q8-2 I sometimes invited neighbors and vice versa	0.466			

1 High factor loading on manor questions of Q4 ([A]⇔[B]) means more applicable to A

2 Cronbach's alpha

F1:0.83, F2:0.738, F3:0.787, F4:0.714, F5:0.917, F6:0.749, F7:0.72, F8:0.903, F9:0.683, F10:0.662, F11:0.613, F12:0.792, F13:0.625, F14:0.589

3 The square sum of factor loadings after rotation

F1:5.501, F2:4.727, F3:5.089, F4:3.71, F5:2.94, F6:2.606, F7:3.431, F8:3.702, F9:2.751, F10:2.295, F11:1.894, F12:2.246, F13:2.772, F14:1.556

4.2 Consumers' Profile

We then applied cluster analysis to segment the respondents in terms of S2 based on factor scores obtained from preceding analysis. As a result, the analysis generated 8 clusters and the Figure 2 presents the average factor scores of each segment⁹³. We exclude cluster 8 to which we named "superior manner" from the analysis below because the cluster had relatively small population (n=14) and more importantly the respondents in this cluster seemed not to be motivated by emotional values investigated in this paper. Followings describe heading and brief summery of the notable profile of the average respondents belonging to each cluster.

Cluster 1: Urban life lover

Married males of 50's or 60's living in big city or suburb. They belong to middle family income class (7-10 million JPY). They are sort of self centered and prefer practical benefit than breadth of mind. They also are not conscious about energy saving or ecology. Contrary, they get a lot of energy and like something new.

Cluster2: Affluent liver

Married females of 50's or 60's. They already enjoy affluent life (family income over 10 millions) and thus value breadth of mind than money or material. They also take good care of themselves and their family. They are particular about their home and spare no expense for making home circumstances better. As cluster 1, they get a lot of energy and like something new. Besides, they often visit their nonresident parents for care.

Cluster 3: Family life conscious homemaker

Full-time housewife females of 40's. Their family income ranges widely from lower middle (5 millions) to high (20 millions). As cluster 2, they don't hesitate to spend money for their ideal home. They wisely balance their own time and family time. They concerned about energy and ecology problems and practice actions of energy saving or ecology.

Cluster 4: Community conscious homemaker

Full-time housewife females of 30's. Their family income belongs to lower or lower-middle range (3-5 millions) and consequently they keep their life steady realistic but emphasize breadth of mind. They find value in interaction with others notably families and friends. They also proactively commit to energy saving or ecological activities.

Cluster 5: Work-centered office worker

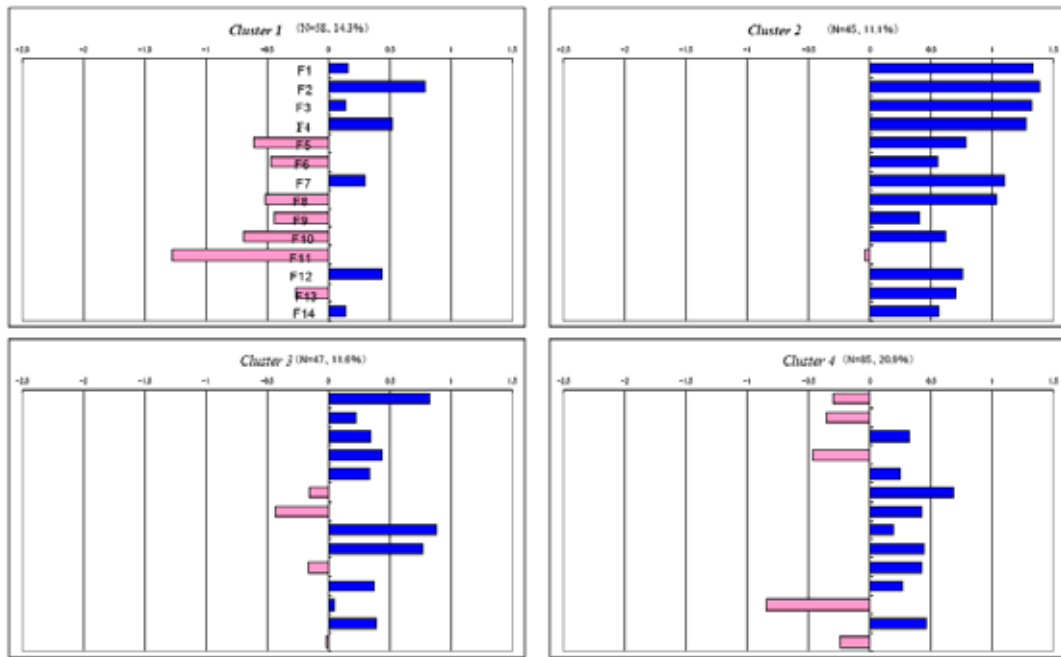
Married males of 50's having intermediate level of income (5-7millions). They live work-centered life and don't pay much attention to family matters, while they live with their parent(s). Consequently, they are not closed to their family. At the same time, they signify ecological problems and practice for it.

Cluster 6: Introverted city dweller

Married males of 40's with upper middle income (7-10millions). They are basically similar to work centered worker in terms of consciousness except ecological attitude.

Cluster 7: Convenience supremacist

⁹³ The numbers of clusters presented here were the product of repeatedly Kmeans partition method in terms of the factor scores with changing the specification. As implied, we signified the interpretative contrasts among generated clusters concerning other items rather than statistical difference or distances at deciding the clusters.



Single 30's male living alone. They are evenly unconscious about their everyday life. They don't care about inner contentment by the interaction with nature and cherish life with much money and material.

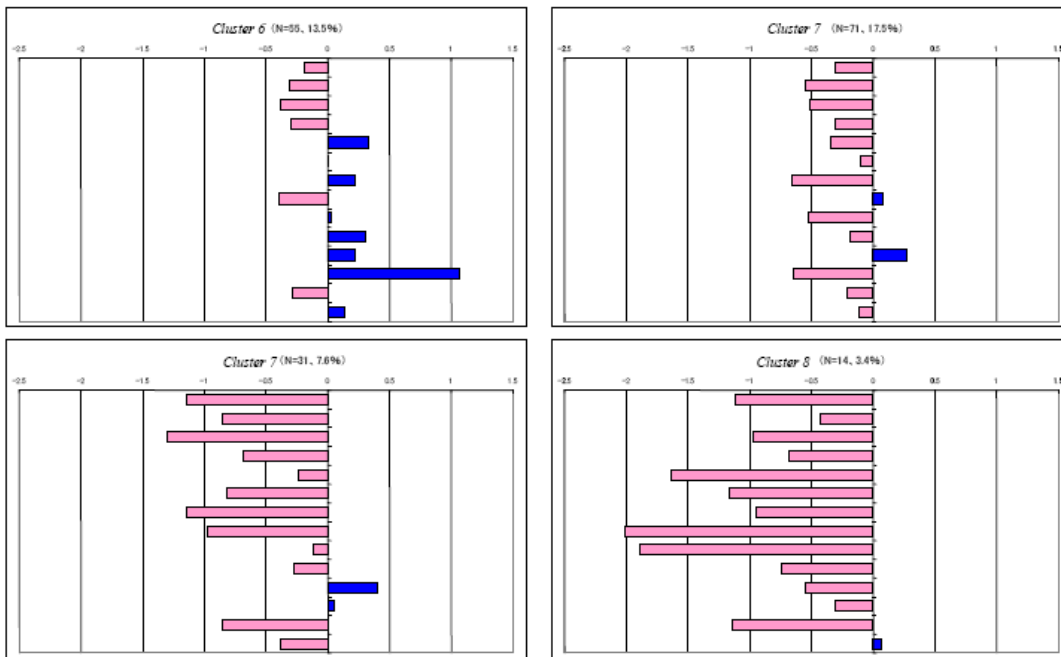


Figure 2 Factor Scores of the Clusters

4.3 Perception of home network

It is worthwhile to briefly notice the respondents' perception of home network before examining functional-emotional value structure since the possibility that the cognitive gap among the clusters would influence the appreciated functions exists. Figure 3 reports the perception of home network and/or its variants by cluster and suggests low perception (38.2% of full sample by aggregating 1-3) about and quite limited prevalence of home network (0.5%). However, we can intuitively infer that (1) female respondents recognize well, (2) elders know well and (3) richer percept well. Moreover, sorted by the proportion of the respondents answering other than 4, "affluent liver" topped, "family life conscious homemaker" took second place and "urban life lover" was ranked third, respectively. This

fact implies customers who concern much about home and maintain active lifestyle know about home network and consequently F1 and F2 relates to the information seeking activities concerning home related product including home network.

4.4 Functional-Emotional Value Structure

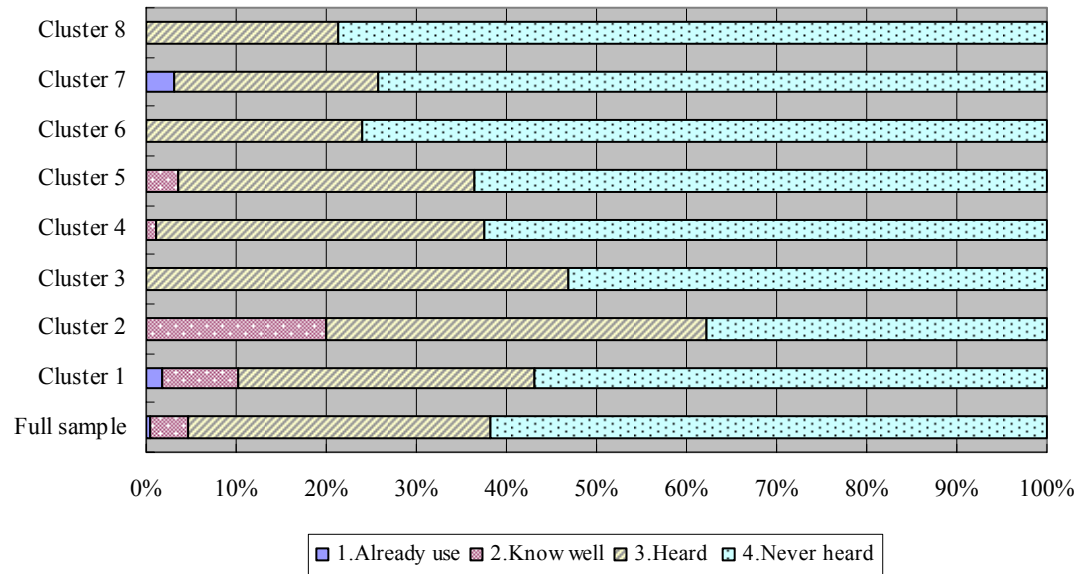


Figure 3 Perception of Home Network

Finally we report the functional-emotional value structure by cluster to confirm whether the figure 1 holds with large sample. On doing so, we refer to S3 questions concerning values in future life as proxies for consequences (change in life in the Figure 1) and emotional value realized as if home network would be installed. Urban life lovers are away a lot and attracted by the functional value of “distance cut-down” induced by remote control function. At the same time, the fact that they value the time for doing what they want suggests the emotional value of “fulfillment” in terms of their own health or time measured by S3 questions. Remote control relates to fulfillment through the path connecting “remote control (functional attribute at the second tier form the bottom in the Figure 1)” - “needless to see (functional detail)”-“distance cut-down (functional value)”-“fuss-free,” “free time increase” and “do what I like to do” (change in life) – “fulfillment (emotional value at the second-top tier)⁹⁴.” Affluent liver also appreciate remote control function, more specifically monitoring nonresident parents’ status because they want to relieve care responsibility. This change contributes to fulfill their emotional value of “peacefulness” through being able to “feeling at home.” As such, although these two groups are attracted by the same function, the emotional value appealed by the function is different between them. Family life conscious homemaker worries about the risk that she or her family will be involved in crime or accident and thus are attracted by security function and collaterally by remote control for the same reason explained in affluent lover cluster. In turn, they want the emotional value of “relax” and/or “relief” because less care contributes to stress-free.

Among the remaining clusters, community conscious homemaker show distinctive features. She is very busy making meets ends in dairy life and to certain extent attracted by housework support and health care functions, while she appreciates security function mostly so that she can realize emotional value of “relax” and/or “relief” as family life conscious homemaker. Seen in this light, her needs involve almost every functional-emotional value relationship. Other three clusters seem to be more or less far from “life” in ordinary sense. Work-centered office workers are too busy to spend considerable time home and to be closed to family. Thus they naturally worry about the health of themselves and their family and are attracted by remote control function. Their functional-emotional value correspondence is equivalent to that of the affluent liver. While introverted city dweller resembles to the work-centered office workers, he is more self-centered. This attribute relates to his concern about accident or crime and thus their selection of security function and it is suggested that they recognize “relax” and/or “relief”. Convenience supremacist is also self-centered but perhaps because he is single, he tends not to care

⁹⁴ Needless to say, the reported path(s) is not one and only path observed in the cluster but most typical one(s).

about future life. Therefore, we can't confirm function and emotional value relationship of home network with this cluster, while the answer insists health care function attracts him.

After scrutinizing the answers in this way, we concluded that despite the differences among the clusters, the Figure 1 at least roughly explained functional-emotional value construct of home network related product. The analysis also confirms FGI result that security and remote control function will be promising. If the rapid dissemination of home network, more precisely the embedded energy management system, would be necessary for achieving CO2 emission, it is wise to develop more attractive details of those functions or promote it with stimulating related emotional value. It is also noted that the questionnaire proposed 50's and 60's market will be potential target despite the participants in FGI of those ages indicating uneasiness to take more high tech into home.

We couldn't find the firm relationship between other five functions including energy saving and emotional value. Concerning energy saving function, this result does not mean the respondents are unconscious about energy or ecology problem. Indeed the clusters 2-6 express strong consciousness about it and moreover cluster 3-6 practice energy saving activities in dairy life. This fact lends support to the previous analysis and gives the plausibility to the speculation that a large part of consumers consider they can (should) reduce energy consumption by themselves and thus do not recognize any value for the function. Ironically, the large parts of consumer segments in which home network expect to realize huge energy saving effect consist of the people being out a lot and not energy eater in household.

5 Conclusions

This paper documents consciousness in life of consumers in home related market and their preference on home network functions. For that purpose, we first apply factor analysis to the data and extract 14 factors explaining consumers' consciousness in life and then segmented consumers in 8 segments and investigate potential home network functions. We focused on values in current life because we thought this setting described the possibility of current market acceptance of home network. However, our analysis easily extends to a global structure model incorporating all variables to examine the relationship between consciousness and home network function.

While our analysis suggested eight clusters having different attribute, needed functions converged in small number. This may in turn implies more focused marketing approach is congruent with home network at this time. For that purpose, the alliance of appliances firms with security firms and/or care firms will be desirable. Put it in other way, additive feature of home network function causes redefinition of home related markets.

Apart from the merchantability of home network, the analysis also raises the questions as to the effectiveness of high tech based energy conservation. It goes without saying that most effective and simple way to reduce energy consumption is not to use appliances. Large portion of our respondents expressed concerns about energy saving and answered that they would accept to some extent inconvenience for that. Energy saving function of home network achieve most effect when it is needed that household sector should reduce energy consumption beyond consumer's unknown acceptable level of inconvenience or the limit of efforts. Given the existence of alternative measures for energy saving such as public education and photovoltaic generation, most effective measure portfolio in terms of money and time should be determined based on relative cost benefit analysis. These analyses are left to further research.

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