What is the impact of user preferences on the design of the hospital online registration system: An integrated approach

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Research

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Abstract

Background

An efficient registration system for all these types of Taiwan medical institutions will enable outpatients to register online and inform them of the best time to go to the hospital and when their turn for medical treatment is. Hence, understanding the outpatients'/users' actual needs is important for hospital managers to design a user-friendly registration system.

Purpose

This study, based on means-end chain (MEC) theory and the Kano model, aims to: 1) understand user preferences toward using a hospital online registration system by constructing the Kano–MEC hierarchical value map, and 2) deduce and formulate effective system planning and promotion strategies. Methodology/approach Mixed methods research was employed to collect data. A total of 16 hospital registration websites were examined and 34 in-depth interviews were conducted. All the interview transcripts were analyzed, and 16 attribute, 13 consequence, and 4 value variables were obtained for a final questionnaire design. A total of 376 valid samples were collected from a questionnaire survey to construct a Kano–MEC hierarchical value map.

Results

The Kano–MEC hierarchical value map depicts hospital online registration users' innermost thoughts and cognitive structure with regard to their attribute/consequence/value preferences and their attribute performance, as categorized by Kano's quality classifications.

Conclusions

The Kano–MEC map showed that "right-clicking the registration by department tab," "modifying or canceling one's appointment," "downloading doctor's schedule," "doctor introduction," "right-clicking the registration by doctor's name," and "instant messaging" are classified as Kano's one-dimensional attributes that can improve users' satisfaction and reduce their dissatisfaction by increasing quality fulfillment. Practice Implications Evidently, managers should focus on "right-clicking the registration by department tab," "modifying or canceling one's appointment," "downloading doctor's schedule," "doctor introduction," "right-clicking the registration by doctor's name," and "instant messaging" to formulate their system planning for enhancing the functions of their online registration system and increasing user satisfaction.

Background

Birth, aging, sickness, and death are unavoidable stages of life and connected with medical and health care. People aim to live healthy, wealthy, and prosperous lives. Therefore, establishing good social security and healthcare systems is important for governments. In 1995, Taiwan established the National Health Insurance (NHI) system to ensure that its citizens have access to affordable medical treatment. The NHI system currently covers 99.6% of the population and has contracts with 93% of the country's hospitals and clinics

[1]. The NHI system is well known around the world for its quality medical services and equal treatment guarantees. People can simply use their NHI card to make an appointment with their doctor via walk-in, telephone, or Internet registration. Through walk-in registration, people give their outpatient NHI card to the registration counter, pay the registration fee, and wait in line for their registered number to be called. Through telephone registration, people provide the outpatient's name, ID number, the doctor's name, and outpatient departments. Before medical treatment, outpatients should go to the hospital, show their NHI card, and pay the registration fee. However, outpatients are unable to make sure that the registration operator keys in the right information and appointment details; thus, some errors during registration may result in outpatients spending more time before they see a doctor. Internet (online) registration is the most convenient way to make an appointment with a doctor. People simply access the hospital registration system website, key in the outpatient information, and receive their registration number. At the time of their appointment, outpatients can go directly to the doctor and pay the registration and treatment fees after medical treatment.

Although people under NHI have access to good medical care, people still spend too much time waiting at the doctor's office [2]. Liu and Wu [3] indicated that the average waiting time for treatment is about 100, 72, 36, and 30 minutes in medical centers, regional hospitals, district hospitals, and clinics, respectively. An efficient registration system for all these types of Taiwan medical institutions will enable outpatients to register online and inform them of the best time to go to the hospital and when their turn for medical treatment is. Shortening the waiting time for treatment is possible. Hence, understanding the outpatients'/users' actual needs is important for hospital managers to design a user-friendly registration system.

In the literature, means-end chain (MEC) theory originally proposed by Gutman [4] has been widely used to understand users' actual needs and wants [5, 6, 7]. This theory argues that when users determine to use a product or system, they would consider what they would acquire after using it. As a result, their preference for the product's/system's attributes becomes the focal point during their decision-making process. The underlying idea of MECs is that invisible chains exist in the innermost minds of users, linking a product's/system's attributes (As) preferred by users with consequences (Cs) and values (Vs) perceived by these users upon using these attributes [4]. Referring to Gutman [4], this study adopted MEC theory to understand outpatients'/users' innermost thoughts toward the online registration system provided by hospitals via A–C–V chain aggregation (namely, MECs). Although MEC theory can inform researchers and practitioners which attributes, consequences, and values are important to users, it is unable to explain which attributes are "attractive features," "indifferent features," and "must-have features." Therefore, this study further adopted the Kano model to reveal which attributes of an online registration system are highly prioritized by users by using Kano's quality classification (i.e., attractive, indifferent, must-be, one-dimensional, and reverse quality). By integrating MEC theory and the Kano model, this study aims to 1) understand user preferences toward using a hospital online registration system by constructing the Kano–MEC hierarchical value map (HVM) and 2) deduce and formulate effective system planning and promotion strategies.

Literature Review

Means-end Chain (MEC) Theory

Gutman [4] proposed the MEC model to depict the relationship between consumption behavior and personal value. Reynolds and Gutman [8] adopted the laddering technique originally developed by Hinkle [9] to uncover the implicit meanings in each MEC. The basic idea of MEC is that a product's attributes are the means through which consumers obtain consequences/feelings after consuming such attributes to achieve consumers' desired end state of being [10, 11, 12, 13]. Therefore, each MEC contains three major components: attribute (A), consequence (C), and values (V). Each MEC includes three levels of abstractness. At the lowest level are attributes, which can be abstract, such as atmosphere and style, or concrete such as price and weight. At the next level are functional and psychosocial consequences. At the highest level are values, which could be instrumental or terminal. Aggregating individual MECs from customers enables researchers to form a tree diagram, namely, an HVM, which visualizes customers' innermost thinking toward a particular product or service. Today, MECs have become a representative theory to reveal consumers' innermost cognitive structure of a particular product/service [14]. In practice, MEC theory has been widely used to deal with issues in the retail, communication, tourism, and healthcare industries [13, 15, 16, 17].

Kano Model

Rooted in motivation-hygiene theory [18], the two-dimensional model, which maps customer satisfaction and product development, was proposed by Kano et al. [19]. The Kano model classifies customer preference into five categories: must-be quality, one-dimensional quality, attractive quality, indifferent quality, and reverse quality. In a quality evaluation, attributes in the must-be category can be viewed as the essential requirements that a product or service must possess to meet customer demands. If such attributes are well done, then customers take this for granted and their satisfaction level will not rise at all. However, if such attributes are missing or not well done, customers would view this product or service as incomplete and will be dissatisfied. In the one-dimensional category, customers will be satisfied if these attributes are fulfilled, but they will be dissatisfied if these attributes are not fulfilled. Attributes classified as indifferent quality will neither result in customer satisfaction or dissatisfaction nor influence customers' quality evaluation of the product or the service. In the attractive category, attributes are not normally expected by customers. Put another way, these attributes provide satisfaction if they are fulfilled, but do not cause dissatisfaction if they are not fulfilled. Moreover, a product or service that has particular attributes in the reverse category may lead to customer dissatisfaction. In practice, the Kano model is applied not only in quality control but also in the fields of product development, services, information, and healthcare [20, 21, 22, 23, 24, 25].

Methods

Research Framework and Procedure

This study adopted MEC theory to examine the preferences and cognitive appraisals of users toward the hospital online registration system and then utilized the Kano model to classify the attributes or features of

the online registration system into Kano's five categories (i.e., one-dimensional, must-be, indifferent, attractive, and reverse quality). Through the use of the HVM derived from MEC theory and Kano's quality appraisal, the findings of this study can provide hospital managers with insightful information to formulate effective strategies with regard to system planning, webpage copywriting and design, and function design. Figure 1 illustrates the research framework of this study.

Samples, Variables, Questionnaire Design, and Data Collection

This study adopted one-on-one in-depth interviews to collect data for an MEC analysis. Thirty-four participants with experience using the hospital online registration system were recruited. Male and female participants were evenly split. Most of the participants were aged between 25 and 34 years old and are heavy Internet users in Taiwan [26]; this is also the main group that is familiar with the hospital online registration system. Each interview took roughly 45 minutes. The following are the main questions asked in each interview:

1. Please recall the hospital online registration system that you have used before. What are the names of the hospitals? Please provide detailed information for the one that impressed you the most and why.
2. Which attributes/features of the online registration system do you prefer the most? Why are they important to you? Please provide more information.
3. What consequences or feelings do you have when the online registration system offers such attributes? What would you feel if such attributes are not provided and why?
4. Which values can you achieve after using this system?

All interviews were audio recorded, transcribed, and conducted with permission from the participants. To ensure accuracy, the interview transcripts were content analyzed by using the terms identified in Table 1 and confirmed by each respondent. The extracted phrases from the transcripts were then coded into the appropriate categories of MEC as A, C, and V variables, as shown in Table 2. Thirty-three variables were gathered, including 16 attribute, 13 consequence, and 4 value variables. The percentage agreement and the reliability coefficient agreement among the three coders are 94.7% and 98.2%, respectively, thereby indicating that the content analysis results are reliable [27].

Table 1

Variable definition

Item	Conceptual definition	Operational definition
Attribute (A)	A product's features or characteristics are preferred by customers.	The factors that people consider when using the online registration system to make doctor's appointments
Consequence (C)	Direct/indirect results of positive/negative feelings after consuming the product's attributes	The direct or indirect results/feelings upon using the online registration system
Value (V)	Reflecting customers' needs and desires and what they care about most in life	The psychological pursuit of the desired states of being in life

Table 2

Variable, codes, and definition

Code	Attribute	Definition
A1	Functional menu layout	Menu of the hospital online registration system
A2	Q & A	Frequently asked questions about using the hospital online registration system
A3	Site map	Visible page list on a site
A4	English interface	Registration system offering an English interface
A5	Right-clicking the registration by department tab	Making an appointment by clicking through the department tab
A6	Modifying or canceling one's appointment	Modifying or canceling one's doctor's appointments
A7	Downloading doctor's schedule	Doctor's schedule available online for downloading
A8	Doctor introduction	Doctor introduction, including specialization, license, and experience
A9	Schedule change notices	Schedule change notices such as doctor changed and clinic cancelled
A10	Department and clinic code	Code for registration with department and clinic
A11	Hospital floor layout	Description of hospital floor layout
A12	Privacy notice of patients	Patients required knowing before/after seeing a doctor
A13	Right-clicking the registration by symptom of a disease	Making an appointment by clicking through the tab about one's symptom of a disease
A14	Right-clicking the registration by Doctor's name	Making an appointment by clicking through the tab of doctor's name
A15	Instant messaging	Instant messaging about the progress of clinic appointment number
A16	App	App for hospital registration system
Code	Consequence	Definition
C1	Efficient	Operating in a way that users desire to obtain results
C2	Time-saving	Reducing the amount of time needed to make an appointment
C3	Convenience	Ease of making a doctor's appointment
C4	Vision design	Visual enjoyment due to the good layout of the registration webpage
C5	Causing offense	Causing users to feel upset or angry when using the registration system

Code	Attribute	Definition
C6	Rich content	The elements provided by the system are complete and sufficient
C7	Availability	Features are available
C8	Not embarrassed	System design does not make users embarrassed to use it
C9	Useless	Not working
C10	Informative	Facilitates the acquisition of information
C11	Habitual	Can be used constantly
C12	Useful	Helps users register online
C13	Easy to use	User-friendly
Code	Consequence	Definition
V1	A sense of security	A desired state where users can feel confident and safe.
V2	A sense of belonging	Acceptance felt by users as a member of the hospital
V3	A sense of enjoyment	Pleasure from enjoyable experiences
V4	A sense of satisfaction	Happiness from the achievement of fulfilling a need

With the use of the 33 variables from the 34 in-depth interviews, an MEC dot connection questionnaire was designed by arranging all the attribute, consequence, and value variables into three columns from the left to the right. All respondents were asked to choose which attributes in the first column were important to them and then draw a line to connect the dots from the attributes to the dots in the consequence and value columns to form their A–C–V chains for HVM construction. For Kano analysis, the functional/dysfunctional questions were designed by asking “How do you feel if this attribute (i.e., functional menu layout [A1], Q&A [A2], …, and App [A16]) is provided/not provided by the hospital online registration system?” All respondents were required to choose one of the following five levels: delighted, must-be, neutral, live with, and dislike. Therefore, the final questionnaire was designed to include one conditional question and four parts. The conditional question was used to validate that the respondent had used the online registration system before. The first part of the designed dot connection questionnaire was for the MEC analysis, and the second and third parts were the five-level Kano questionnaire, including functional and dysfunctional questions. The last part was designed to collect the respondents’ demographic information, such as gender, age, and monthly income.

In this study, data were gathered via a paper-based questionnaire survey over three months in the summer of 2018. With ineffective or missing data eliminated from 500 collected questionnaires, a total of 376 valid samples with an effective recovery rate of 75.2% were used for further analysis.

MEC and Kano Analyses

For MEC analysis, data collected from the dot connection-type questions that represent the A–C and C–V linkages and frequencies from 376 valid samples were tabulated into the summary implication matrix. In this work, 16 attribute, 13 consequence, and 4 value variables formed 260 (16 × 13 + 13 × 4) active cells in the summary implication matrix, and the total number of linkages was 4,092. Displaying 4,092 A–C and C–V linkages in a single HVM is impossible because doing so would make the HVM too complex to read. Consequently, setting a cut-off value is essential before constructing the HVM. The basic idea for the cut-off value determination is the use of a relatively small number of cells in the summary implication matrix to represent a large portion of the total number of linkages [5, 11, 14, 28, 29]. A detailed discussion of cut-off point determination and related criteria was provided in Pieters et al. [28]. High linkage frequencies correspond to high importance of these linkages [14]. Therefore, for HVM construction, this study set the cut-off values at 22, 50, and 71 to represent weak, middle, and strong linkages, respectively. As shown in Table 3, the first cut-off value of 22 was set to construct the HVM because this level contained 74.8% of the 4,092 A–C–V linkages made by 376 respondents by using only 24.29% of all possible cells in the summary implication matrix. In other words, this HVM uncovered 74.8% of the overall information provided by the respondents but used only 24.29% of all possible cells in the matrix. A similar idea was applied to the second and third cut-off value determinations.

Table 3
Cut-off value determination

Cut-off	No. of active cells	No. of active cells as a proportion of all cells	No. of active cells as a proportion of all cells mentioned at least once	No. of active linkages	No. of active linkages as a proportion of all linkages
0	260	100%		4092	
1	210	81%	100.00%	4092	100.00%
2	183	70%	87.14%	4065	99.34%
3	161	62%	76.67%	4021	98.26%
...	...	...	...	...	...
21	52	20%	24.76%	3082	75.32%
22	51	20%	24.29%	3061	74.80%
23	50	19%	23.81%	3039	74.27%
24	49	19%	23.33%	3016	73.70%
...	...	...	...	...	...
49	26	10%	12.38%	2208	53.96%
50	25	10%	11.90%	2159	52.76%
51	25	10%	11.90%	2159	52.76%
...	...	...	...	...	...
71	20	8%	9.52%	1861	45.48%
72	17	7%	8.10%	1648	40.27%

For the Kano analysis, this study adopted the five-level Kano questionnaire (i.e., delighted, must-be, neutral, live-with, and dislike) and used the Kano evaluation table (Table 4) proposed by Matzler and Hinterhuber [30] to classify 16 attributes of the online registration system into one-dimensional, must-be, attractive, indifferent, and reverse quality. Furthermore, this study used customer satisfaction coefficient (see formulas 1 and 2) to evaluate which attributes can influence the satisfaction of online registration system users.

Table 4

Kano evaluation table

Customer requirements		Attributes were not offered				
		Delight 5	Must-be 4	Neutral 3	Live-with 2	Dislike 1
Attributes were offered	Delight 5	Questionable	Attractive	Attractive	Attractive	One-dimensional
	Must-be that way 4	Reverse	Indifferent	Indifferent	Indifferent	Must-be
	Neutral 3	Reverse	Indifferent	Indifferent	Indifferent	Must-be
	Live-with it 2	Reverse	Indifferent	Indifferent	Indifferent	Must-be
	Dislike 1	Reverse	Reverse	Reverse	Reverse	Questionable
Source: Adapted from Matzler & Hinterhuber (1998)						

$$\text{Extent of satisfaction: } \frac{AQ+OQ}{AQ+OQ+MQ+IQ} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(Formula1)}$$

$$\text{Extent of dissatifaction: } \frac{OQ+MQ}{(AQ+OQ+MQ+IQ)\times(-1)} \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(Formula 2)}$$

Acronyms: must-be quality (MQ), one-dimensional quality (OQ), attractive quality (AQ), indifferent quality (IQ), and attractive quality (AQ)

Results

Sample Description

Among 376 valid samples (see Table 5), male and females occupied 39.36% and 60.64% of respondents, respectively. Approximately 36% of respondents were aged between 21 and 30 years old. A total of 67.29% respondents had a college or university degree. About 29% of them had a monthly income between NT$30,001 and NT$60,000 (US$: NT$ = 1:30) (Taiwan's GDP per capita is US$24,402), while the next income group (less than $30,000) accounted for 28.46%.

Table 5
Sample profile

Item	Type	No.	%	Item	Type	No.	%
Gender	male	148	39.36%	Children	none	225	59.84%
	female	228	60.64%		yes	151	40.16%
Age	20 and younger	35	9.31%	No. of children	0	225	59.84%
	21–30	136	36.17%		1	38	10.11%
	31–40	56	14.89%		2	88	23.40%
	41–50	78	20.74%		3	16	4.26%
	51and older	71	18.88%		4 and more	9	2.39%
Monthly income (US$:NTD$=1:30)	Less than $30000	107	28.46%	Education	Junior high school or less	6	1.60%
	$30001~$60000	109	28.99%		High school & vocational school	64	17.02%
	$60001~$90000	60	15.96%		College & University	253	67.29%
	$90001~$120000	58	15.43%		Master and Ph.D.	53	14.10%
	More than $120000	42	11.17%				

HVM of the Hospital Online Registration System

In Fig. 2, the dotted line (weak linkage) indicates that a cut-off value of 22 was set for an HVM construction by using A–C and C–V linkage frequencies of 22 or higher in the summary implication matrix. For example, “app (A16)” provides users with “useful (C12)” feelings after using the online registration system, yielding “a sense of satisfaction (V3),” that is, hospital online registration system managers should promote that their app is useful and meets the satisfaction of users. Given that a high linkage frequency represents the high importance of the linkage, this study mainly focused on the discussion of those important (strong) linkages. The bold lines (see Fig. 2) with a cut-off value of 71 represent that these A–C–V linkages are perceived as important by 376 respondents. “Functional menu layout (A1),” for instance, causes users to perceive that the system is “efficient (C1)” and leads to their “sense of security (V1).” In addition, users prefer “right-clicking the registration by department tab (A5)” and “modifying or canceling one’s appointment (A6)” provided by the hospital’s online system, because these attributes can produce a “convenience (C3)” benefit, achieving their psychological state of “security (V1),” “enjoyment (V2),” and “satisfaction (V3).” If a hospital’s registration system has the “downloading doctor’s schedule (A7)” attribute, then this attribute can make users perceive the “convenience (C3)” and “availability (C7)” of the system and thereby achieve “security

(V1)," "enjoyment (V2)," and "satisfaction (V3)." Moreover, "doctor's introduction (A8)" causes users to perceive that the system is "informative (C10)" and further leads to their "sense of satisfaction (V3)." "Right-clicking the registration by symptom of a disease (A13)" makes patients feel "not embarrassed (C8)" to register online and thus arouses the users' "sense of satisfaction (V3)." Furthermore, the "instant messaging (A15)" attribute provided by the hospital online registration system not only provides users with "time-saving (C2)" and "easy-to-use (C13)" benefits but also gives users "a sense of security (V1)" and "a sense of enjoyment (V4)." Hospital managers should focus on "functional menu layout (A1)," "right-clicking the registration by department tab (A5)," "modifying or canceling one's appointment (A6)," "downloading doctor's schedule (A7)," "doctor's introduction (A8)," "right-clicking the registration by symptom of a disease (A13)," and "instant messaging (A15)" in creating an online registration system, because these attributes are the most important features that encourage patients to make an appointment with doctors online.

Kano Classification of User's Perceptions toward Hospital Online Registration System

Kano analysis

Witell and Löfgren [31] empirically confirmed that the five-level Kano questionnaire is the most effective measurement for the classification of quality attributes. In this study, attribute data gathered from five-level Kano questionnaire were statistically analyzed and summarized in Table 6. The percentages of each row represent the results of the quality appraisals from 376 respondents. The highest percentage indicates the particular attribute belonging to that particular Kano classification, termed the first-priority attributes of Kano's quality classification. The second highest percentage attribute is named the second-priority attributes of Kano's quality classification.

Table 6

Kano classification

Code	Attribute	AQ	IQ	RQ	MQ	QQ	OQ	Quality classification	
								1st priority	2nd priority
A1	Functional menu layout	9.90%	33.10%	0.50%	27.70%	0.80%	28.00%	IQ	OQ
A2	Q & a	20.50%	49.40%	0.80%	10.40%	0.80%	18.10%	IQ	AQ
A3	Site map	12.50%	48.60%	0.50%	17.60%	0.50%	20.30%	IQ	OQ
A4	English interface	12.30%	67.50%	1.30%	8.80%	0.50%	9.60%	IQ	AQ
A5	Right-clicking the registration by department tab	7.20%	9.90%	0.50%	30.70%	0.50%	51.20%	OQ	MQ
A6	Modifying or canceling one's appointment	6.70%	13.30%	0.30%	32.50%	1.60%	45.60%	OQ	MQ
A7	Downloading doctor's schedule	4.50%	10.90%	0.30%	35.20%	0.50%	48.60%	OQ	MQ
A8	Doctor introduction	12.50%	25.10%	0.80%	27.50%	0.50%	33.60%	OQ	MQ
A9	Schedule change notices	12.30%	49.50%	0.50%	19.50%	1.10%	17.10%	IQ	MQ
A10	Department & clinic code	8.80%	43.00%	0.50%	21.90%	0.90%	24.90%	IQ	OQ
A11	Hospital floor layout	10.20%	36.50%	0.30%	27.30%	1.10%	24.60%	IQ	MQ
A12	Privacy notice of patients	14.70%	50.50%	1.30%	17.20%	0.50%	15.80%	IQ	MQ

Note: 1) AQ: attractive quality; IQ: indifferent quality; MQ: must-be quality; OQ: one-dimensional quality; 2) Figures in the shade of dark grey represent that the relative accumulated frequency is the highest in the row.

Code	Attribute	AQ	IQ	RQ	MQ	QQ	OQ	Quality classification	
								1st priority	2nd priority
A13	Right-clicking the registration by symptom of a disease	12.00%	13.10%	0.50%	27.50%	0.80%	46.10%	OQ	MQ
A14	Right-clicking the registration by doctor's name	10.10%	36.50%	1.10%	25.10%	1.30%	25.90%	IQ	OQ
A15	Instant messaging	12.50%	9.60%	0.30%	22.20%	1.30%	54.10%	OQ	MQ
A16	App	22.10%	37.10%	0.50%	9.60%	0.80%	29.90%	IQ	OQ

Note: 1) AQ: attractive quality; IQ: indifferent quality; MQ: must-be quality; OQ: one-dimensional quality; 2) Figures in the shade of dark grey represent that the relative accumulated frequency is the highest in the row.

First-priority attributes of Kano's quality classification

1. One-dimensional quality (OQ)

For users, the attributes of an online registration system are classified as one-dimensional quality, which represents that user satisfaction will increase if the quality performance is good. By contrast, bad performance decreases satisfaction. As shown in the first-priority column with the symbol OQ, "right-clicking the registration by department tab (A5) (51.2%)," "modifying or canceling one's appointment (A6) (45.6%)," "downloading doctor's schedule (A7) (48.5%)," "doctor introduction (A8) (33.6%)," "right-clicking the registration by doctor's name (A13) (46.0%)," and "instant messaging (A15) (54.1%)" are classified as one-dimensional quality. Thus, the managers of hospital registration systems should pay more attention to the improvement of these attributes.

2. Must-be quality (MQ)

None of the 16 attributes was classified as must-be quality in the first-priority Kano classification, which indicates that users believe the hospital online registration system must have these attributes. User satisfaction will not increase because the system provides these must-be attributes. However, user satisfaction will decrease dramatically if these attributes are not provided.

3. Attractive quality (AQ)

None of the 16 attributes fell under attractive quality. If the system does not have such attributes, users will not feel dissatisfied or disappointed [32].

4. Indifferent quality (IQ)

Whether the online registration system provides the attributes with indifferent quality will not result in user satisfaction or dissatisfaction. In this study, the following 10 attributes are classified as indifferent quality: “functional menu layout (A1) (33.1%),” “Q&A (A2) (49.3%),” “right-clicking the registration by symptom of a disease (A3) (48.5%),” “English interface (A4) (67.5%),” “schedule change notices (A9) (49.5%),” “department and clinic code (A10) (43.0%),” “hospital floor layout (A11) (36.6%),” “privacy notice of patients (A12) (50.5%),” “right-clicking the registration by doctor’s name (A14) (36.5%),” and “app (A16) (37.1%).”

5. Reverse quality (RQ)

Attributes in the reverse category may lead to user dissatisfaction if the system provides such attributes. In this study, none of the 16 attributes was classified under reverse quality.

Second-priority attributes of Kano’s quality classification

In the first-priority Kano’s quality classification, 10 out of 16 attributes were in the indifferent category, showing that user satisfaction would not be influenced by these 10 attributes. Therefore, this study further examined the second highest percentage in each row to find the second-priority attribute quality classification of each attribute. As shown in the last column (second-priority quality classification) of Table 6, a total of 9, 2, and 5 items of attributes were grouped in the must-be, attractive, and one-dimensional categories, respectively.

1. Must-be quality (MQ)

In the second-priority quality classification, “right-clicking the registration by department tab (A5) (30.7%),” “modifying or canceling one’s appointment (A6) (32.5%),” “downloading doctor’s schedule (A7) (35.2%),” “doctor introduction (A8) (27.5%),” “schedule change notices (A9) (19.5%),” “hospital floor layout (A11) (23.63%),” “right-clicking the registration by doctor’s name (A13) (27.5%),” and “instant messaging (A15) (22.1%).”

2. Attractive quality (AQ)

“Q&A (A2) (25.50%)” and “English interface (A4) (12.30%)” were grouped as attractive quality in the secondary quality classification.

3. One-dimensional quality (OQ)

Five attributes were categorized as one-dimensional quality: “functional menu layout (A1) (28.0%),” “right-clicking the registration by symptom of a disease (A3) (20.3%),” “department and clinic code (A10) (24.9%),” “right-clicking the registration by doctor’s name (A14) (25.9%),” and “app (A16) (29.9%).”

On the basis of the second-priority quality classification, improving attributes in the attractive and one-dimensional categories can increase user satisfaction, while attributes in the must-be category are essential features for an online registration system.

Kano’s Customer Satisfaction Coefficient

To understand the relation between online registration system users’ satisfaction/dissatisfaction if their requirements are met/unmet and the priority of these requirements in the Kano model, this study adopted Kano’s customer satisfaction coefficient to reveal the most important quality element for increasing satisfaction. As shown in Table 7, “instant messaging (A15) (0.678),” “right-clicking the registration by department tab (A5) (0.590),” and “right-clicking the registration by symptom of a disease (A3) (0.588)” are the top three most important quality attributes for increasing satisfaction. Notably, A15, A5, and A3 are classified as one-dimensional quality, thereby indicating that a high satisfaction index (SI) corresponds to the high influence of the satisfaction level. With regard to the extent of dissatisfaction indices (DSIs), the negative sign represents a negative impact on user satisfaction if these attributes are unmet. Table 7 shows that “downloading doctor’s schedule (A7) (-0.844),” “right-clicking the registration by department tab (A5) (-0.827),” and “modifying or canceling one’s appointment (A6) (-0.776)” are the top three quality attributes for decreasing the dissatisfaction level. Similarly, A7, A5, and A6 are also grouped under one-dimensional quality, thereby indicating that a high absolute value of the DSI corresponds to high dissatisfaction if the attribute does not meet the requirement of users. Interestingly, “right-clicking the registration by department tab (A5)” has high SI and DSI, thereby indicating that this attribute should be viewed as the core component that can effectively satisfy system users if its performance is met.

Table 7
Customer satisfaction coefficient

Code	Attribute	Quality classification		Extent of satisfaction	Extent of dissatisfaction
		1st priority	2nd priority		
A1	Functional menu layout	IQ	OQ	0.384	-0.565
A2	Q & A	IQ	AQ	0.393	-0.290
A3	Site map	IQ	OQ	0.332	-0.383
A4	English interface	IQ	AQ	0.223	-0.188
A5	Right-clicking the registration by department tab	OQ	MQ	0.590	-0.827
A6	Modifying or canceling one's appointment	OQ	MQ	0.533	-0.796
A7	Downloading doctor's schedule	OQ	MQ	0.535	-0.844
A8	Doctor introduction	OQ	MQ	0.468	-0.619
A9	Schedule change notices	IQ	MQ	0.299	-0.372
A10	Department & clinic code	IQ	OQ	0.341	-0.474
A11	Hospital floor layout	IQ	MQ	0.352	-0.526
A12	Privacy notice of patients	IQ	MQ	0.311	-0.335
A13	Right-clicking the registration by symptom of a disease	OQ	MQ	0.588	-0.745
A14	Right-clicking the registration by doctor's name	IQ	OQ	0.369	-0.522
A15	Instant messaging	OQ	MQ	0.678	-0.775
A16	App	IQ	OQ	0.527	-0.400

Note: AQ: attractive quality; IQ: indifferent quality; MQ: must-be quality; OQ: one-dimensional quality

Figure 3 illustrates the impact on overall satisfaction with quality defined by the SI value on the x-axis and the absolute DSI value on the y-axis. Referring to Yao et al. [20], when the attribute quality is far from the origin point (0, 0), such an attribute has a greater influence on satisfaction. As shown in Part I of Fig. 3 (both SI and absolute DSI values greater than 0.5), "right-clicking the registration by department tab (A5)," "modifying or canceling one's appointment (A6)," "downloading doctor's schedule (A7)," "right-clicking the registration by doctor's name (A13)," and "instant messaging (A15)" are classified as one-dimensional attributes that can improve users' satisfaction and reduce their dissatisfaction by increasing quality

fulfillment. In Part II of Fig. 3 (SI value greater than 0.5 but absolute DSI value less than 0.5), “app (A16)” is the only attribute located in this section. If the quality of “app (A16)” is met, then it would have a greater influence on user satisfaction improvement but less influence on dissatisfaction decrease. By contrast, “functional menu layout (A1),” “doctor introduction (A8),” “hospital floor layout (A11),” and “right-clicking the registration by doctor’s name (A14)” are attributes in Part III of Fig. 3 (absolute DSI value greater than 0.5 but SI value less than 0.5) that would have greater impact on reducing user dissatisfaction but less impact on increasing user satisfaction if quality fulfillment increases. The rest of the attributes (A2, A3, A4, A9, A10, and A12) in Part IV of Fig. 3 (SI and absolute DSI values less than 0.5) have little impact on user satisfaction and dissatisfaction. Thus, improving the quality of these attributes might not be necessary.

Discussion

This study integrated the MEC and Kano models to reveal users’ preferences and perceptions toward the online registration system of hospitals. Through the integration of these two models, researchers can not only understand the implications of each A–C–V linkage of MEC but also further gain insight into the Kano’s quality classification of each attribute to provide hospital managers with insightful information for formulating effective system design and promotion strategies.

User preferences for online registration system design

Figure 4 illustrates the results of integrating the MEC and Kano analyses. For MEC analysis, strong linkages correspond to increased importance of the linkages. Consequently, “functional menu layout (A1),” “right-clicking the registration by department tab (A5),” “modifying or canceling one’s appointment (A6),” “downloading doctor’s schedule (A7),” “doctor introduction (A8),” “right-clicking the registration by doctor’s name (A13),” and “instant messaging (A15)” are the most important attributes perceived by the users of the hospital online registration system. Kano analysis indicates that users will have a high level of satisfaction if a product has more one-dimensional attributes or if such attributes have better performance. Through an integration of the strong linkages and one-dimensional classification, attributes highlighted with an orange box in Figure 4 (i.e., A5, A6, A7, A8, A13, and A15) should evidently be the focus of online registration system design. The use of attributes can yield “time-saving (C2),” “convenience (C3),” “availability (C7),” “not embarrassed (C8),” “informative (C10),” and “easy to use (C13)” feelings and lead to the achievement of “a sense of security (V1), “a sense of enjoyment (V4),” and “a sense of satisfaction (V3).”

Attribute quality classification and user cognitive structure

On the left-hand side of Figure 4, each attribute is classified as indifferent, attractive, one-dimensional, or must-be quality by the respondents’ first or second priority order. First and second priorities represent that at least 33% and 12% of respondents have the same point of view and classified the attribute into its related Kano’s quality classification, respectively. In Figure 4, six attributes (A1, A2, A3, A10, A11, and A16) are listed as first priority and classified as indifferent quality, but four of them (A1, A3, A10 and A16) listed as second priority were classified as one-dimensional quality, that is, system designers still need to pay attention to

“functional menu layout (A1),” site map (A3),” “department and clinic code (A10),” and “app (A16)” attributes, given that the performance of these attributes is highly related to customer satisfaction. Notably, “Q&A (A2)” in the second priority was grouped under attractive quality, representing that this attribute may produce additional satisfaction to users. “Hospital floor layout (A11)” in the second priority was classified as must-be quality, showing that at least 12% of respondents recognize this attribute as an essential feature of a registration system; without this attribute, they will feel the system is incomplete.

Conclusion

System planning

This study found that “right-clicking the registration by department tab (A5),” “modifying or canceling one’s appointment (A6),” “downloading doctor’s schedule (A7),” “doctor introduction (A8),” “right-clicking the registration by doctor’s name (A13),” and “instant messaging (A15)” are classified as one-dimensional quality in the first priority and as must-be quality in the second priority, which means that they are important for registration system design. Given that at least 33% of respondents viewed these attributes as one-dimensional quality, the high performance of these attributes corresponds to increased user satisfaction, and vice versa. These attributes were also classified under must-be quality, which means that if such attributes are missing, then users will be dissatisfied. Evidently, managers should focus on these attributes (A5, A6, A7, A8, A13, and A15) to formulate their system planning for enhancing the functions of their online registration system and increasing user satisfaction.

Promotion strategy

On the basis of the Kano–MEC hierarchical map (Figure 4), “efficient (C1),” “time-saving (C2),” “convenience (C3),” “availability (C7),” “not embarrassed (C8),” “informative (C10),” and “easy to use (C13)” are important consequences/benefits that users perceived upon utilizing the attributes of the registration system. Such consequences or benefits strongly link to “a sense of security (V1),” “a sense of enjoyment (V4),” and “a sense of satisfaction (V3),” showing that users’ values can be achieved via the consequences/benefits of using the attributes. As a result, hospitals can promote these benefits of using an online registration system to reduce the personal costs of hospital registration.

List Of Abbreviations

Abbreviation	Full form
A	Attribute
A–C–V	Attribute-consequence-value
AQ	Attractive quality
C	Consequence
DSI	Dissatisfaction index
HVM	Hierarchical value map
IQ	Indifferent quality
MEC	Means-end Chain
MQ	Must-be quality
OQ	One-dimensional quality
RQ	Reversal quality
SI	Satisfaction index
V	Value

Declarations

Ethics approval and consent to participate (Not applicable)

Consent for publication (Not applicable)

Availability of data and materials (The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.)

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Authors' contributions (YC examined and interpreted the data that were collected and analyzed by LS. CF summarized the results and constructed the figures. CS wrote the manuscript. All authors have read and approved the final manuscript.)

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Figures

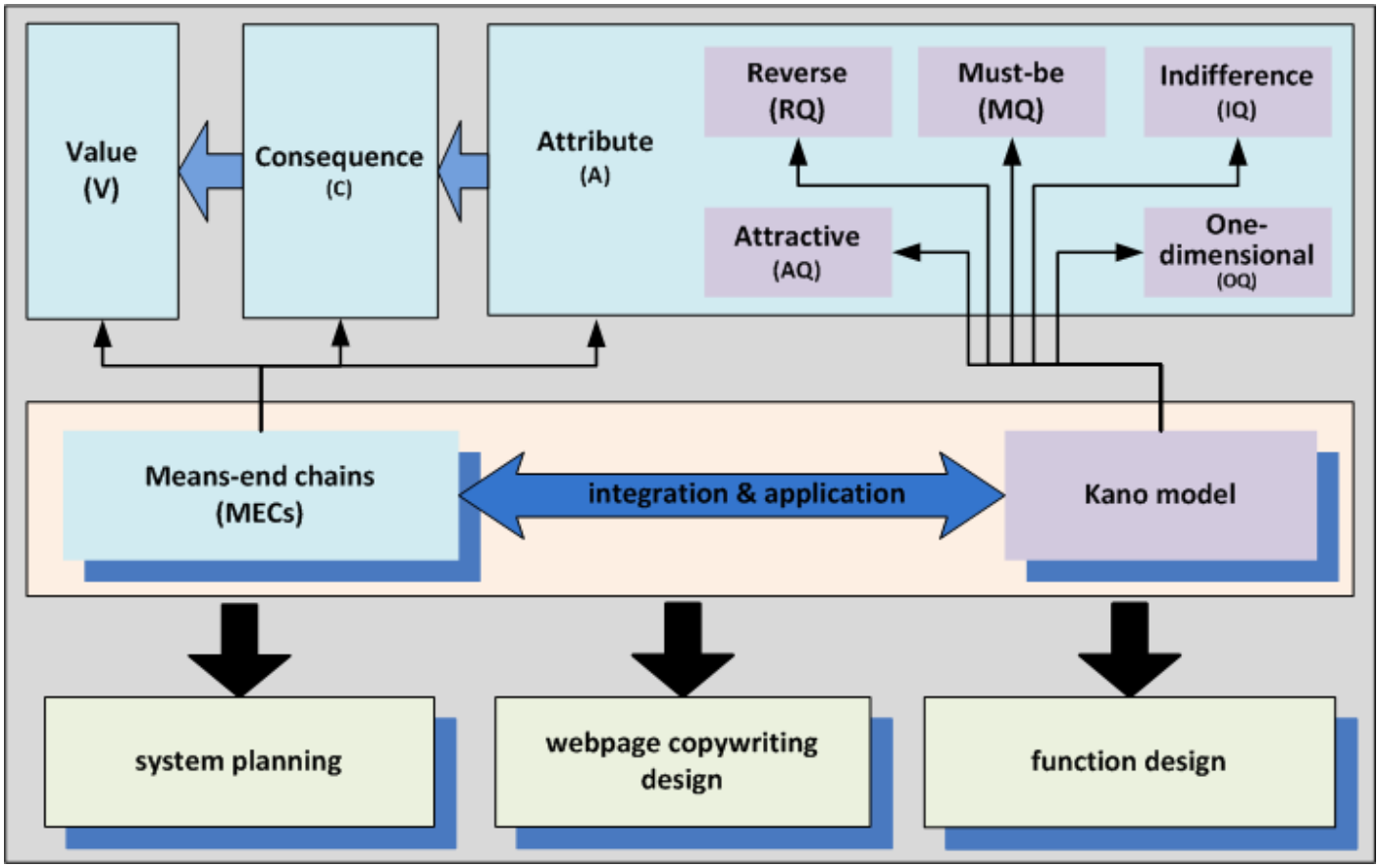

Figure 1

Research framework

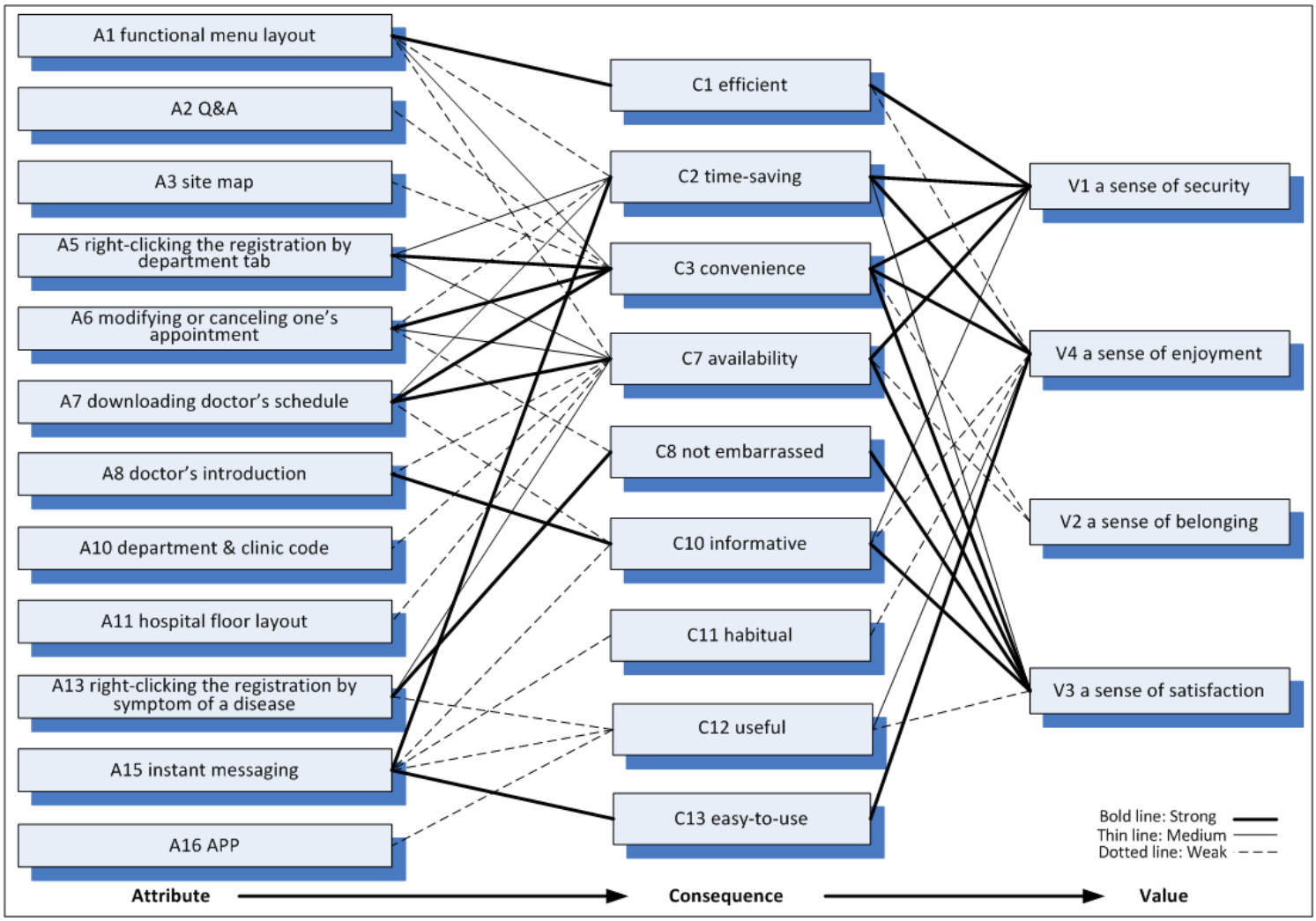

Figure 3

The hierarchical value map of hospital online registration system

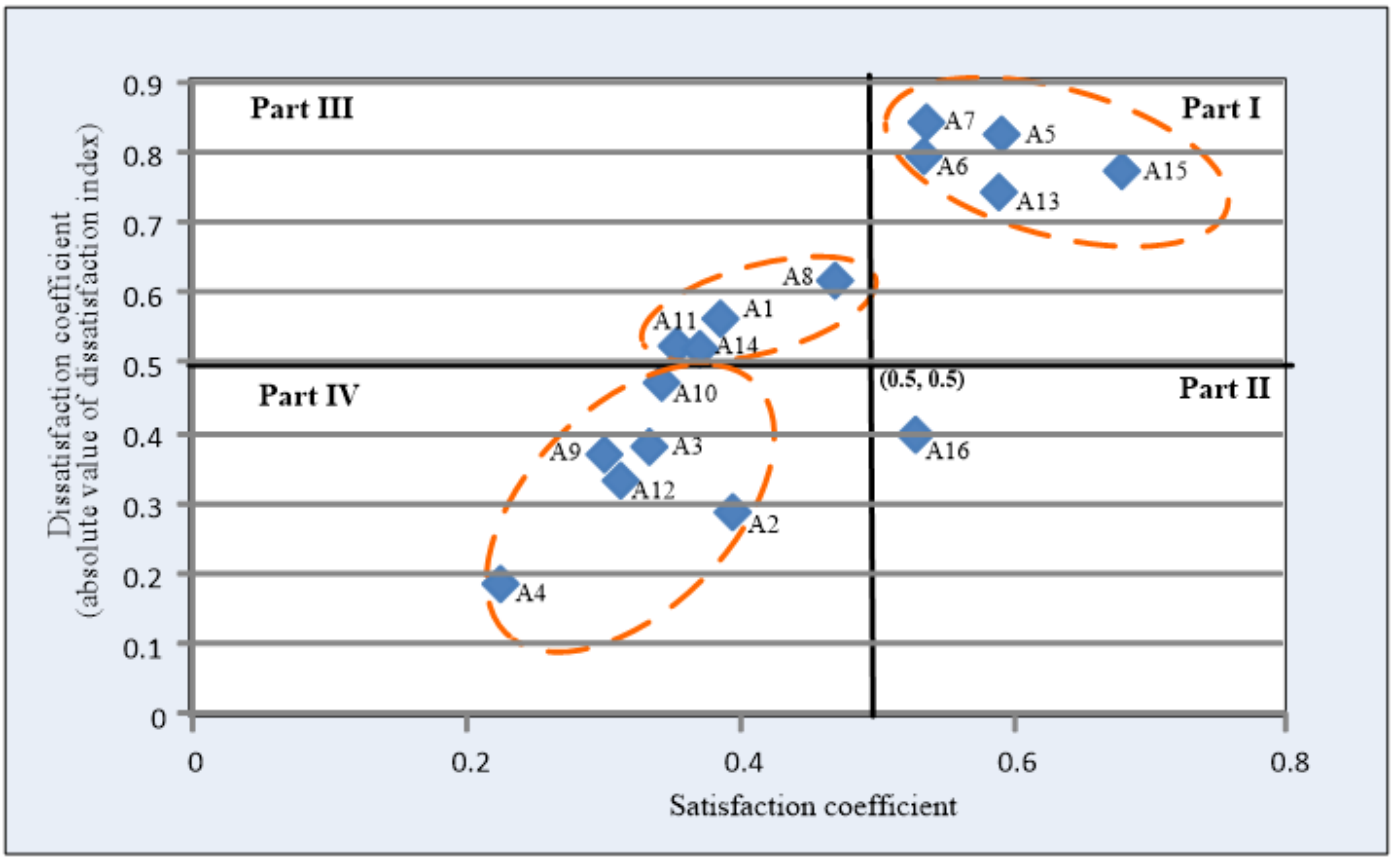

Figure 5

Satisfaction impact

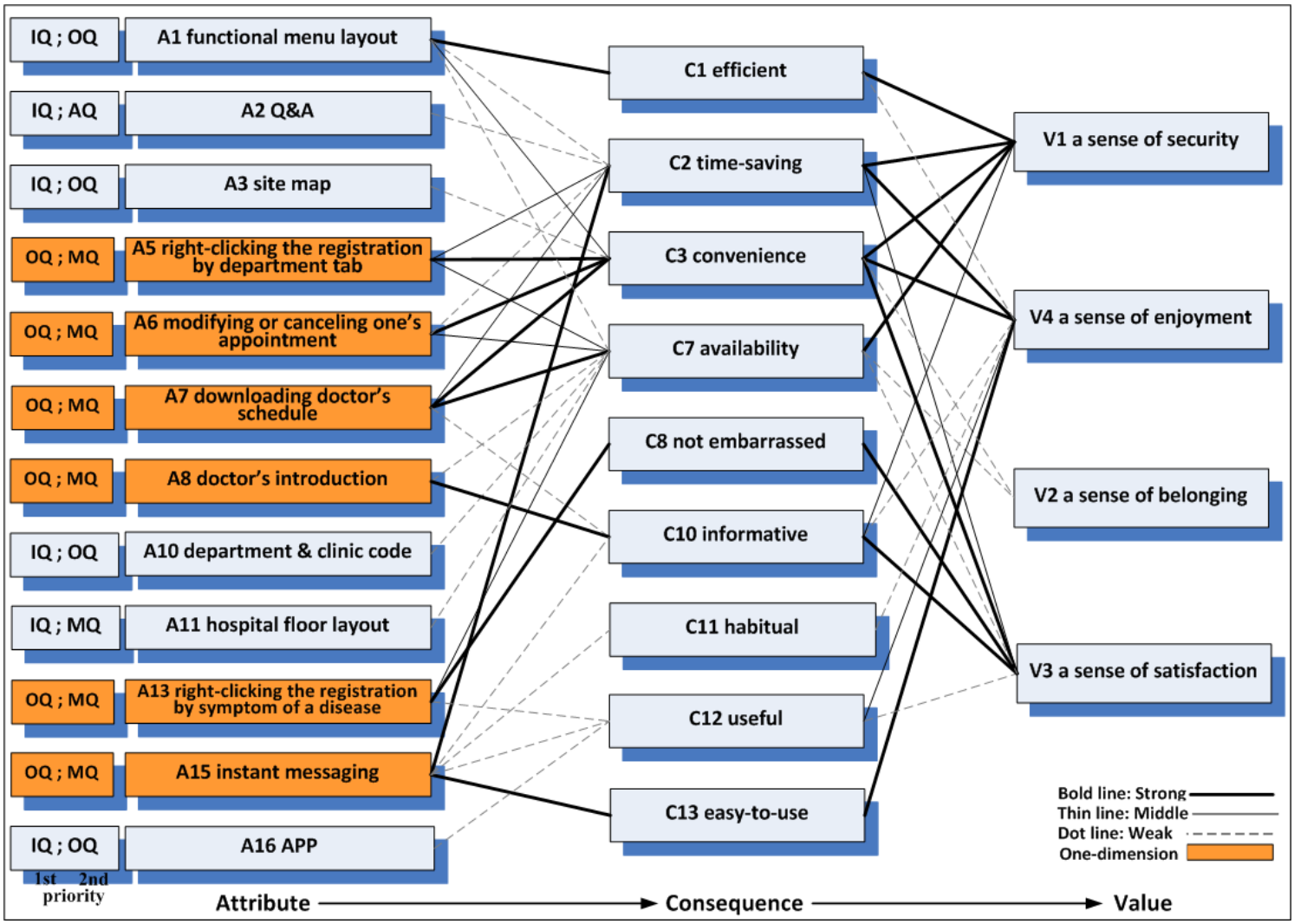

Figure 7

The Kano-MEC hierarchical map

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