USING THE KANO MODEL TO IDENTIFY CUSTOMER VALUE

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ABSTRACT

Purpose: In lean management, productivity is increased by doing the right things and minimising the unnecessary ones. To achieve this, the 'right things' need to be identified. Customer value provides us with a mindset about how to gain a deeper understanding of what should be delivered. In this paper, a method called the Kano model is used to define customer value. The aim is to define how customers perceive the value and, thus, to assist in identifying the right things. The customers are the nursing companies and their nursing staff in Finland and special focus is given to the value potentials that building information modelling (BIM) as well as improved environmental performance might offer to the customers.

Method: An in-depth understanding of customer value as it relates to nursing homes was studied by conducting 20 structured customer interviews that contained a Kano model-based questionnaire and open-ended oral questions.

Findings: The data shows that details really matter for the customer: design errors and construction flaws were seen to impact vitally on the daily nursing activities. The value that could be delivered through BIM to prevent design errors was perceived as being highly attractive. However, in addition to the traditional value attributes, such as error-free design and better communication, the customers found that if BIM could be utilized to improve the actual nursing processes, and not just to match the facilities with the requirements of the current processes, richer customer value could be delivered. Traditional construction process flow improvements, such as a faster construction process, are no longer enough for creating richer customer value.

Implications: The new understanding of customers' perceptions of BIM reduces some of the doubts and uncertainties regarding the utility of BIM. The results clearly indicate that through BIM, construction companies would have an opportunity to improve their value delivery for the customers.

KEYWORDS

value, BIM, Kano model, nursing homes

INTRODUCTION

One of the central ideas of lean management is waste elimination. However, through waste elimination it is only possible to achieve efficiency, not effectiveness. When the persons in question know what should be produced, it is possible to structure a production system in which the right things are done. Therefore, in this paper the focus is on customer value in a nursing home development project. The aim is to

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understand how nursing companies and their nursing staff perceive the value related to nursing home development projects and, thus, to assist in identifying the right things that need to be done. Lately, the Finnish media has been critical of numerous incorrect activities are occur when it comes to taking care of the elderly. The care of elderly people will continue to be an important issue because of the aging population; according to the Finnish Ministry of Labour (2007), the proportion of people over 65 year of age in Finland will double by the year 2025.

In this research, building information modelling (BIM) and environmental issues are selected as specific themes when defining customer value in a nursing home development project. When comparing BIM to Koskela's (2000) TFV theory, it can be argued that BIM can be used from two perspectives. From a flow (F) view, BIM can be used to improve the process flow by reducing the waste during the actual construction, development or other phases. From a value (V) view, BIM can be used not only to minimize waste, but also to capture the actual customer value. In this study, focus is on utilising BIM from the V view by establishing out-of-the-box ideas, i.e. ideas about how BIM could deliver value to the customer. Therefore, this paper concentrates on describing how customers perceive the value that could be delivered through BIM. It is not argued that the value could be delivered as of yet.

The paper is divided into five parts. In the theory part, the background to the customer value is described and a method, i.e. the Kano model, for defining customer value is introduced. Next, we present the research design along with the research process is presented. In the results section, the perceived customer value related to nursing homes is described. Finally, conclusions are drawn.

THEORY – HOW TO DEFINE CUSTOMER VALUE?

Customer value has received more and more attention in lean construction literature. Koskela (2000) introduced the value generation view in the TFV model and many authors have subsequently adapted the V view in their research. For example, Tzortzopoulos and Formoso (1999), Leinonen and Huovila (2000), and Miron and Formosa (2003) have applied V view in construction projects. Also, authors such as Bertelsel and Koskela (2002), Salvatierra-Garrido and Pasquire (2011), and Emmit et al. (2005) have consolidated the theoretical foundation of the customer value concept.

Despite the increasing interest in customer value, there is a lack of methods for actually defining customer value (Björnfot and Sardén 2006). Niemi and Lindholm (2010) found that construction companies, landlords, consultants and other service providers do not have proper tools for identifying and evaluating the needs of customers. They concluded that one of the methods that is used most often to identify the needs of the customer is direct, informal interviews with customer representatives. They also found that oftentimes the needs of the customer are defined without the customer having a voice. The existing literature also shows that much effort has been aimed at measuring customer satisfaction (e.g., Leifer 1998, Kärnä et al. 2009), and for landlords, constructors, and other service providers this has become a common way to show that they care about their customers. Although satisfaction surveys are a valuable way to track the success of a company's business performance, the satisfaction measurements only focus on the past and, thus, offer only limited information about what should be delivered in the future.

Better tools for capturing customer value are needed and one solution for this might be offered by the Kano model. Appel-Meulenbroek (2008) used the ideas of the

model when presenting the so-called keep, push and pull factors, which where originally introduced in Pen's dissertation in 2002. Despite the above-mentioned studies, the model has not been used often in the built environment sector, but it has been used in other sectors. Löfgren and Witel (2008) have noted that the ideas of the model have been used, e.g., in banking services, care and education services, electronic devices (such as TVs), e-services, logistics and health care services.

Löfgren and Witell (2008) described the Kano model through five quality dimensions depending not only on customer satisfaction but also on the performance of the attribute (Figure 1). The dimensions of the model enable construction companies to have a greater understanding of the product or service features that they should be investing in and the features that they should be giving less attention (Matzler et al. 1996). The dimensions are called attractive, one-dimensional, reverse, must-be and indifferent (Kano et al. 1984, Löfgren and Witel 2008).

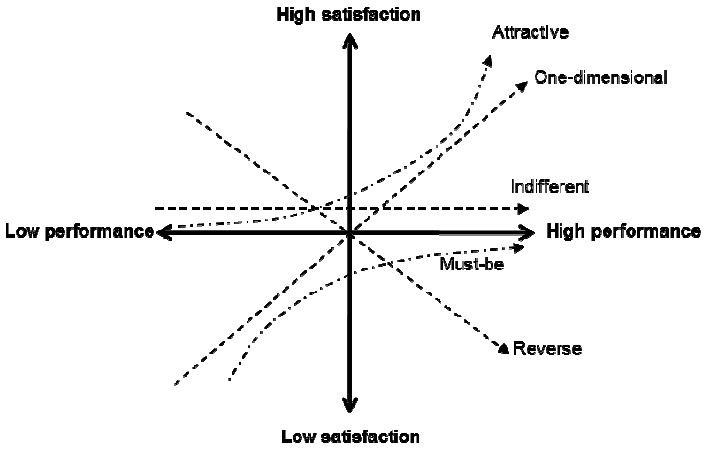

Figure 1: Kano model with five quality dimensions (e.g., Kano et al. 1984, Löfgren and Witell, 2008)

Since the customer is not aware of attractive attributes and does not expect them, they cannot cause dissatisfaction. However, when they are fully realized, they can generate high customer satisfaction. One-dimensional attributes are also called the-more-the-better attributes: the more there is a certain attribute, the better. Reverse attributes work the other way around: the more there is such an attribute, the more dissatisfied the customer will be. The must-be attributes describe the minimum level of quality of a product or service. If the quality is not met, the customer will be dissatisfied. Finally, the indifferent attributes describe the types of product or service features that do not have an impact on customer satisfaction. Sometimes a great deal of effort is aimed at issues that could be neglected. Instead, the wasted resources could be re-directed to providing customer value through attractive and one-dimensional attributes. The attributes are not stable; the dimensions of the attributes can change at any time. For example, an attribute that customers might at first perceive as attractive may in turn become a must-be attribute. With the five-dimensional Kano model, a duo of questions with five alternative answers categorises

the value attributes into five dimensions. An example of the questions, answers and their evaluation is presented in Figure 2.

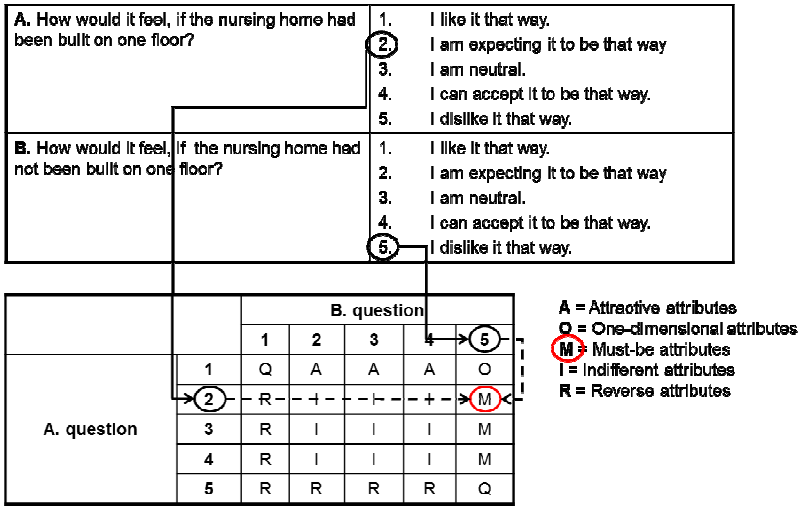

Figure 2: Evaluation table for the Kano model (adapted from Löfgren and Witell 2008)

RESEARCH DESIGN

This study on how to identify customer value is part of a larger research project, which assesses how a construction company, i.e. the value provider, creates and manages value in a nursing home development project for the nursing companies and their nursing staff, who are defined at its customers. The actual occupants, the elderly, could not be directly included in the research project due to confidentiality issues. In order to follow how the value creation is managed, customer value should be identified. Therefore, in this paper the focus is on the first phase of the research project. Next, the entire research process is briefly described and the phase, during which customer value is studied, is discussed in more detail.

RESEARCH PROCESS

The research process has several phases. First, a general understanding of the current research setting was gained through three preliminary interviews and meetings. After coming to an understanding about the setting, two parallel data collection processes were initiated: the first aimed to understand how the customer perceives the value of nursing homes and the second how the value creation is currently structured. The current value creation was studied in a case study setting, but the customer value data represents the entire private nursing home business in Finland: it includes all the major nursing companies and some of the minor companies.

The perceived customer value was studied through a series of 20 customer interviews, which included open-ended questions and a questionnaire survey based on the Kano model with five quality dimensions. The 20 customer interviews were conducted with 10 different companies. Two people from each nursing company were interviewed: one from the management level and one from the operational level (i.e. nurses, nursing home directors or others who had close contact with daily life in a

nursing home). In the customer interviews a visual model that simulated a hospital environment was presented to the customers so that they could better understand the visual impact of BIM before answering the questionnaire and open-ended questions.

Before the customer interviews, the Kano model based questionnaire was developed using five steps. First, current understandings regarding the potentials of BIM to deliver value was gathered through assessing the extant literature and by interviewing three specialists in the nursing home business, BIM and the construction sector. During this phase, the so-called traditional value attributes related to the construction project were gathered together, but also other, out-of-the-box value attributes, such as the value of using BIM to reduce movements during the nursing process, were assessed. In total, 44 value attributes were then presented in a draft of the Kano model questionnaire, which was critically revised in a meeting with three representatives from the construction company. After preparing a new updated version of the questionnaire, two project company representatives commented on it. Finally, the questionnaire was tested using six outsiders, and then it was finalized.

Parallel to the customer value data collection process, another data collection process was conducted to understand how value for the customer was currently being delivered. The understanding was gained by interviewing 12 value producers, such as architects and project managers, i.e. people who were actually working to create value for the customers. The current value creation processes and practices were illustrated through value stream mapping and related detailed descriptions.

After the two parallel data collection processes and pre-analysis, the results of the customer value and the value creation process were then supplemented and validated in a workshop in March 2011 with the customer representative and the construction company. After the workshop, the research team suggested lean-management-based guidelines for delivering the identified customer value to the construction company.

STRUCTURE OF THE KANO BASED QUESTIONNAIRE

In the questionnaire, attributes were categorized originally under eight sections. There were 48 attributes for the management and 35 attributes for the staff - the staff was not asked to give their response to eight cost-related or other monetary-related attributes. In this paper, the results for six of the sections are presented via four themes with 24 attributes. Two sections are left out of examination because they belong to another topic with a broader survey sample. The themes presented here are 1) *Common features* relating to the whole nursing home, such as its location, size and storage spaces in the nursing home; 2) *rooms for the elderly*, such as their size and access to the outside; 3) *the use of BIM* in a nursing home construction project, such as studying the movements of the staff and elderly and guiding them on how to use the nursing home; and 4) *environmental impacts*, such as keeping track of the consumption of water, electricity and heating.

RESULTS – PERCEIVED CUSTOMER VALUE

A summary of the data from the Kano model is illustrated in Table 1. Detailed data are presented in Table 2; it shows which of the five quality dimensions received the most responses in relation to each of the value attributes. The dimension that received 75 per cent or more of the total responses ($x \geq 75\%$) related to each value attribute is marked in dark grey. The dimension that received more than half but less than 75 per

cent of the responses (50% ≤ x < 75%) is marked in light grey. White indicates the dimension that received less than half of the responses (x < 50%). In this paper, special attention is given to the one-dimensional or attractive dimensions; if they are marked in light or dark grey, it indicates that there is an investment potential. With must-be attributes, it is enough to achieve a level that satisfies the customer, but the attribute cannot be used to increase the overall satisfaction. The indifferent attributes can be given less attention and the reverse attributes should be avoided.

DATA PRESENTATION

The attractive dimension received most of the responses (Table 1). Although the must-be or indifferent dimensions received almost 35 per cent of the responses, the indifferent dimension only received the majority of responses in terms of one attribute (Table 2, row 3). The reverse dimension received the lowest number of responses.

Table 1: Summary of the responses

	One-dimensional	Attractive	Must-be	Reverse	Indifferent
Responses	33	268	74	11	92
Per cent share	7%	56%	15%	2%	19%

According to the Table 2, the responses are more scattered for the first two themes, *Common features* and *Rooms for the elderly*, than for the last two themes, *The use of BIM* and *Environmental impacts*. Next, the data from the Kano model and open-ended questions are briefly presented for each theme.

Common features and *Rooms for the elderly*. Among the respondents, there were no strongly shared opinions regarding the dimension to which each attribute in the *Common features* and *Rooms for the elderly* groups would belong. For example, the number of rooms in the nursing home divided the responses into four dimensions (Table 2, row 3). Same kind of pattern is found from in the open-ended questions. Neither was there strong unanimity when asking on the size of the storage spaces; the responses in the questionnaire were divided into all the five dimensions (Table 2, row 5). The open discussion provided more in depth explanations for the variations. All the interviewees agreed that storage spaces are needed during the nursing processes, but they could not agreed upon how much storage space is an optimal amount and where the storage space should be located; some prefer to have a large centralised storage space, whereas others prefer smaller intermediate storage spaces and the rest prefer to use the storage spaces in the rooms for the elderly. However, the respondents strongly agreed on some issues, such as accessibility in the nursing home and the suitability of the materials used for the floors and walls.

The use of BIM. Unlike with the previous two themes, the respondents were even more unanimous about the dimension to which most of the attributes in the *use of the BIM* group would belong. The results of the questionnaire survey show that nursing home operators and staff perceive the potential value of BIM as clearly being attractive. They have a high interest in using BIM in the original conceptual design, and later in the operation of the nursing home. For example, the interviewees felt that virtual models offer attractive qualities that supporting evacuation guidance for the

nursing home (Table 1, row 17). Also, they viewed virtual models as a useful approach for introducing the facilities and its activities to outsiders (Table 1, row 16), such as relatives or the elderly (Table 1, row 18).

Table 2: Data from the Kano model-based questionnaire

	VALUE ATTRIBUTES	One-dimensional	Attractive	Must-be	Reverse	Indifferent
	Common features					
1	Nursing home should be located near services in the city centre	Mgmt 0 Staff 0	Mgmt 3 Staff 8	Mgmt 2 Staff 0	Mgmt 0 Staff 0	Mgmt 4 Staff 1
2	Nursing home should be built in one floor	Mgmt 0 Staff 1	Mgmt 7 Staff 7	Mgmt 0 Staff 1	Mgmt 0 Staff 0	Mgmt 3 Staff 1
3	Nursing home should have more than 30 rooms	Mgmt 0 Staff 0	Mgmt 3 Staff 2	Mgmt 2 Staff 2	Mgmt 0 Staff 1	Mgmt 5 Staff 5
4	Nursing home should have a separate space for gymnastic exercises	Mgmt 0 Staff 0	Mgmt 4 Staff 7	Mgmt 2 Staff 2	Mgmt 0 Staff 0	Mgmt 4 Staff 1
5	Nursing home should have more than 15 m2 storage space for one group of rooms	Mgmt 0 Staff 3	Mgmt 4 Staff 3	Mgmt 2 Staff 4	Mgmt 1 Staff 0	Mgmt 3 Staff 0
6	Nursing home should have extra storage space for the elderly for service fee	Mgmt 0 Staff 3	Mgmt 3 Staff 3	Mgmt 0 Staff 3	Mgmt 0 Staff 1	Mgmt 7 Staff 0
	Rooms for the elderly					
7	A single room should be larger than an average room	Mgmt 0 Staff 0	Mgmt 0 Staff 6	Mgmt 0 Staff 0	Mgmt 3 Staff 2	Mgmt 7 Staff 2
8	A single room shoul be over 20 sq m	Mgmt 0 Staff 1	Mgmt 1 Staff 4	Mgmt 6 Staff 2	Mgmt 0 Staff 1	Mgmt 3 Staff 2
9	Elderly should have access to go out independently from the first floor into a garden	Mgmt 1 Staff 3	Mgmt 2 Staff 0	Mgmt 5 Staff 4	Mgmt 0 Staff 0	Mgmt 2 Staff 3
10	Elderly should have access to a garden or balcony from their rooms	Mgmt 0 Staff 0	Mgmt 3 Staff 10	Mgmt 4 Staff 0	Mgmt 0 Staff 0	Mgmt 3 Staff 0
	The use of BIM					
11	Motions of the staff inside nursing home should be studied via BIM during the planning	Mgmt 0 Staff 3	Mgmt 10 Staff 7	Mgmt 0 Staff 0	Mgmt 0 Staff 0	Mgmt 0 Staff 0
12	Motions of the elderly inside nursing home should be studied via BIM during the planning	Mgmt 0 Staff 3	Mgmt 10 Staff 6	Mgmt 0 Staff 1	Mgmt 0 Staff 0	Mgmt 0 Staff 0
13	Motions of the elderly in the neighbourhood should be studied via BIM during the planning	Mgmt 0 Staff 2	Mgmt 8 Staff 5	Mgmt 0 Staff 0	Mgmt 0 Staff 0	Mgmt 2 Staff 3
14	BIM should also be used for guiding the staff in the use of the nursing home	Mgmt 0 Staff 0	Mgmt 10 Staff 8	Mgmt 0 Staff 0	Mgmt 0 Staff 0	Mgmt 0 Staff 2
15	BIM should be also be used for guiding the elderly in the use of the nursing home	Mgmt 0 Staff 0	Mgmt 7 Staff 6	Mgmt 0 Staff 0	Mgmt 0 Staff 0	Mgmt 3 Staff 4
16	BIM should be also used for guiding the outsiders in the use of the nursing home	Mgmt 0 Staff 0	Mgmt 6 Staff 7	Mgmt 0 Staff 0	Mgmt 0 Staff 1	Mgmt 4 Staff 2
17	The evacuation of the nursing home should be guided for the staff and elderly also by BIM	Mgmt 0 Staff 2	Mgmt 10 Staff 5	Mgmt 0 Staff 2	Mgmt 0 Staff 0	Mgmt 0 Staff 1
18	There should be a visual virtual room for the elderly as an introduction	Mgmt 0 Staff 0	Mgmt 10 Staff 8	Mgmt 0 Staff 1	Mgmt 0 Staff 0	Mgmt 0 Staff 1
19	There should be a virtual presentation on the nursing home in the web pages	Mgmt 2 Staff 0	Mgmt 7 Staff 6	Mgmt 0 Staff 2	Mgmt 1 Staff 0	Mgmt 0 Staff 2
	Environmental impacts					
20	To know the carbon footprint of the nursing home while it is being used	Mgmt 1 Staff 0	Mgmt 6 Staff 8	Mgmt 0 Staff 2	Mgmt 0 Staff 0	Mgmt 3 Staff 0
21	To advise how to decrease the carbon footprint of nursing home while being used	Mgmt 1 Staff 1	Mgmt 8 Staff 4	Mgmt 1 Staff 4	Mgmt 0 Staff 0	Mgmt 0 Staff 1
22	Environmental impacts of the construction should be calculated	Mgmt 0 Staff 1	Mgmt 6 Staff 5	Mgmt 1 Staff 4	Mgmt 0 Staff 0	Mgmt 3 Staff 0
23	Environmental impacts of the construction should be decreased	Mgmt 2 Staff 2	Mgmt 3 Staff 2	Mgmt 3 Staff 4	Mgmt 0 Staff 0	Mgmt 2 Staff 2
24	To follow on the use of water, electricity and heating	Mgmt 0 Staff 1	Mgmt 7 Staff 3	Mgmt 2 Staff 6	Mgmt 0 Staff 0	Mgmt 1 Staff 0
			white	0% ≤ x < 49% of total resp.		
			light grey	50% ≤ x < 75% of total resp.		
			dark grey	x ≤ 75% of total resp.		

Environmental issues. A difference in how the staff and management perceive the value of environmental issues was found via open-ended questions: the staff valued environmental actions more highly than the management. Some signs of this can be

found in the Kano questionnaire. For example, the majority of the staff defined the follow-up for the consumption of water, electricity and heating (Table 2, row 24) as a must-be attribute, while the management merely felt it was attractive, i.e. they do not expect it. However, the respondents understood the environmental questions on many levels: some only gave examples of recycling and possibilities for saving energy, while others suggested more strategic, long-term solutions.

DATA ANALYSIS

The data analysis can be summarized in four points. Two of the four are related to the crucial role of details in the nursing home facilities and the other two are related to the attractiveness of the simulation possibilities offered by BIM.

Based on the customer interviews, it can be argued that details are important for the customer. To support daily life in a nursing home, (1) the technical details in the nursing facilities should be properly arranged. For example, if a grip in a toilet is 2 cm too far, it does not make daily life easy. In addition to the technical details, there are also (2) functional details that are derived from the nursing processes. Based on the analysis, the functional details are linked to the way the actual nursing processes are organized; there are also fundamental differences in how customers perceive an optimal nursing process. The location and use of storage space described earlier is a good example of this. If a nursing home is tailored for the specific needs of one company, it does not necessarily fit everyone's needs.

The remaining two points are related to BIM. To avoid design errors and, thus, not create friction for the designed nursing processes, (3) customers saw BIM with visualisation possibilities as an attractive way of enhancing seamless communication between the customer, the construction company and the architect. Customers felt that BIM offers a way to get the details into the right places. The interviewees emphasized the idea of working in a trio to boost a genuine sense of co-operation instead of providing information within isolated contexts. However, value losses will not be avoided simply by delivering an error-free building. The interviewees found the idea using BIM directly attractive (4) for enhancing the actual nursing processes, i.e. their own core business, in the nursing home facilities. For example, all the management level respondents found the idea of studying the movements of the staff and the elderly through BIM during the design phase to be attractive (Table 2, row 13) in order to minimise wasted movements and, thus, improve the nursing processes.

DISCUSSION

Among the respondents, BIM was clearly seen as an attractive value attribute. The value that BIM would offer to customers exceeds the current expectations of the customers. Woksepp (2005) has already argued that due to its visualization possibilities, BIM could be utilized to better identify customers' requirements during the phase of the construction project when it is most important for them to communicate needs, wishes and preferences. The visualization aspect of BIM offers a possibility for customer integration (Kumar et al. 2007); it delivers what is needed without design errors. From a lean management perspective, it offers the construction company a great competitive advantage: if it could utilize the potential of richer customer value, the right things would be done. However, it is not possible, based on this research, to suggest the most effective way to deliver the richer value. Modularity,

as an example, might offer one solution. In addition to cost minimization, modularity offers customization possibilities (Kumar et al. 2007), which would help not only to fix the details, but also to deliver richer customer value by improving the nursing processes in the nursing home facilities. However, this requires further studies.

Even though the sample of nursing companies is representative of the nursing business sector in Finland, this study also has limitations. First, the way in which the caretaking for the elderly is organized is affected by cultural differences in different areas and countries. Just the term nursing home brings with it different associations for different people. Second, it must be emphasised that this paper only describes how customers perceive the value that could be delivered through BIM. The limitations of the current techniques used in BIM were not taken into close examination in this study. Finally, using the Kano model does create challenges. Although customers stated that they found it easy to answer the Kano model-based questionnaire, the heavy structure of the questionnaire limits its use: each value attribute requires two questions. The conclusions of this paper would not have been possible without the open-ended questions. While using the Kano model is a great way to initially position oneself with the customers, it does not preclude the use of other methods.

CONCLUSIONS

More and more new nursing home facilities are being constructed in Finland all the time due to the aging Finnish population and outsourcing policies of the municipalities. This creates new business opportunities for construction companies. This study describes how nursing companies and their nursing staff as customers perceive the value of the facilities in order to assist in identifying the right things that should be done to increase the perceived value in this growing business sector. Special attention was given to BIM and environmental issues. The data was collected through a series of 20 interviews including the Kano model-based questionnaire survey and open-ended oral questions.

The data shows that both technical and functional details are important for the customer. Small technical details, such as grips, the colours of the skirting boards and the height of the windows, should be designed without errors. Similarly, customers also view the functional details as vital, even though each customer sees an optimal nursing home differently; one solution does not fit everyone. Due to the crucial role of details, BIM was seen as an attractive tool for getting the technical and functional details right. However, the value that customers perceive in BIM is not solely related to the potential for eliminating design errors. The customers felt that richer customer value could be delivered if BIM could be utilized to improve the flow in their nursing processes. This indicates that through BIM, construction companies could have an opportunity to improve their value delivery for the customers

The Kano model showed a new way to define customer value. It provides indication for the future: what should be provided and what should be avoided so as to keep customers satisfied or even exceed their expectations. Using the Kano model is not an established practice in the built environment sector, and in the future more studies will be required to better understand its applicability and usability.

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