SETTING UP PRECONDITIONS FOR LONG-TERM CUSTOMER SATISFACTION BY MEANS OF "OPEN BUILDING"

P.J. LAHDENPERÄ
VTT Building Technology, Construction and Facility Management, Tampere, Finland

U.A. TIURI
Helsinki University of Technology, Department of Architecture, Espoo, Finland

Abstract

Customer satisfaction is a key issue for any enterprise these days. In some cases it may be enough to improve the company's client service functions, but in the building industry the strive for customer satisfaction has a more radical and thorough meaning: there is an urgent need to reconsider the design methods and construction operations, to create entire new products and product families and, finally, to educate about the new service philosophies and implement corresponding procedures. Customer satisfaction should also be seen as a more life cycle-related issue than is usually the case. There is good reason to start a novel era by reorganising the industry and the process.

This paper is founded on further development of the Open Building philosophy, which is a partial solution to the needed improvement in customer-orientation. The paper sheds light on its principles involving decision-making on various levels, separation of the building's "support" and "infill", use of performance specification-based design, etc. As a result, customer satisfaction flourishes while the productivity of the building industry improves as well.

Moreover, the paper contributes by developing and setting practical criteria for Open Building projects. In addition, it analyses the Finnish housing market by presenting selected top-ranked projects and comparing them against the set criteria. Thus, the developed criteria offer a tool for steering the development in the housing industry by shifting the focus on the essential. The analysis also shows that the industry has a long way to go in terms of customer satisfaction.

Keywords: Customer involvement, Finland, life cycle, changeability, housing, market analysis, Open Building.

1 Why focus on customer satisfaction ?

Customer satisfaction is far too often taken to mean "listening" to the customer, making the deal "easy" for him/her and producing a traditional product without quality defects. This is absolutely not enough.

We should approach the question from a wider angle and understand the pursuit of customer-satisfaction as a transfer from one era to another. Its influence on the products and operational model of the building industry is much more radical than described above. The following trends (that are summarised from [1]) shed light on the scale and topicality:

- Along with the transition from the industrial society to the information and service society, the new building market has now reached a certain saturation point by volume, and thus, producers of new buildings are faced with a tougher situation. The result is a transition from seller's markets to buyer's markets.
- As a result of more general trends of democratisation and individualisation, the individuality and the influence of the inhabitants and clients will increase with respect to the end products of construction. This requires quality consciousness and consideration of individual needs and flexible solutions.
- The time span of decision making also grows longer and the maintenance of the building stock and life-cycle costs and revenues are emphasised at the expense of new investments. Markets also need more modifiable space due to changing needs.
- As a result of the significant development in technology, the share of building services increases while that of the building proper decreases in building construction. The services expand also the after-market, maintenance and repair of buildings, which is also a challenge to the implementers.
- The products of the industry should be of higher quality and produced more efficiently and economically to be more attractive for the client. Otherwise, demand will turn increasingly to consumer goods and other alternatives.

These facts mean quite a challenge to us. It is much bigger than providing "the good mood" and "zero defect quality" referred to above. The next section offers, however, a solution by presenting the so-called Open Building philosophy (Section 2). The philosophy itself is not new but the above-presented challenges make it high time to take full advantage of it.[1] Thus, on the basis of our earlier works [1] and [2], we have further developed the philosophy and composed the set of criteria for Open Building projects presented in Section 3. Section 4, again, examines Finnish state-of-the-art projects by applying these criteria. Section 5 summarises the gained new knowledge.

2 What do we mean by customer satisfaction ?

The ideas of Open Building have their origin in the '60s [3]. Since then those ideas have been researched, developed and even used by many in various countries. Below, the key ideas of the philosophy are presented by listing some of the weaknesses of the traditional practice, on the one hand, and the main solution principles, on the other. It is also important to notice that originally the Open Building philosophy focused on "needs and supply" issues in residential construction. This review involves also the quite recent developments and suggestions concerning operational modes, i.e. the building process.

From this viewpoint, the following arguments express **the major problems inherent in the traditional building process and technology** [4] [5] [6]:

- In a traditional building scheme **almost all decisions are made**, at least in principle, at a single point in time, **in the early stage of the project**. The manifestation of the building, the subdivision

---

[1] In addition to above presented facts, another concrete indication of the topicality of customer-orientation and the ideas of Open Building is that CIB (The International Council for Research and Innovation in Building and Construction) has established a Task Group on the theme recently—officially in early 1997, i.e. Open Building Implementation (TG 26).

of the spaces, the layout of the compartments and the details are all assessed at the same time and in their final shape. This way, **the individual needs of various customers cannot be taken into account** well enough, especially when the users are not known in this phase in many cases. The uniform product and quality offered doesn't meet the individual needs being either too high or too low or just the wrong type.

- **Design is detached from implementation** as a result of the decision-making process. Therefore it's not actually profitable for any of the parties to the building process to perform non-project-specific product development. The tradition of comprehensive predesign and the unprofitability of development combined with the emphasis on contract costs, typically lead to building from raw materials on site and thus also to wide **integration of various functional building systems**. The result is an enormous co-ordination mess and low productivity as all the numerous **tasks on site are highly interdependent**.
- The client is only **interested in the lowest building price, not the life-cycle-cost**, as was noted above. When we take into account the technical integration of various systems in the completed building, future changes (due to changing circumstances/tenant) and renovation (wear and tear) can be expected to be unnecessarily expensive due to **a lack of flexibility** when much heavy construction needs to be done. Also, the disturbances to occupants' everyday functions are unnecessarily great. Too much material, working capacity, time and money will be wasted.

The identification of such problems led to the introduction of the theory of the Open Building, which in its present state can be considered to involve the following features [4] [5] [6] [7]:

- The customer, the occupant or user himself, can decide how he wishes to live or work, etc. and **harmonisation of products and quality is discontinued**. The opinion of the customer (and various interest groups) is incorporated through **decision-making at various levels**: frame and envelope ("support"), compartment allocation and internal system ("infill"). Decision making at different levels presumes compliance with the idea of "**fixed and variable**", in others words, it means that decision makers just fix the matters of their level and leave the others alone. In the final stage of the project, the individual user (usually known only at the last moment) can have his say.
- Technologically the building's "**support**" **and** "**infill**" **are disconnected**. Thus the "support" can be fixed whereas the subdivision of the space within and the "infill" of each compartment or dwelling is variable. The layout and the equipment can also be adapted in much smaller steps than we are used to now. This offers a possibility for **individual solutions** and **avoidance of heavy repair**. In the design phase, **a performance specification** is made instead of a material specification. This **allows competition with a completed product** instead of implementation capacity and creates **preconditions for development** activities.
- **Modular co-ordination** of joints is developed and utilised to ensure the adaptability of various systems and products. It also increases the interest of companies for the **development of system products** and ensures the **replaceability of a product afterwards**. The work on site turns into installation of **prefabricated units.** The products of the infill (including installations) should be made as flexible as possible as regards later changes. Together with the disconnection of the support and infill, this means that a building no longer needs to be considered a finished and unchangeable product.

Thus, by combining original open building thinking based on need and supply ideology with these newer developments focussing on efficiency, true customer satisfaction can be achieved. This means, firstly, that the customer is able to get what he wants as an individual, and, at the same time, more efficiently and faster than earlier.

Secondly, the customer must be able to exercise his/her decision-making power throughout the building's life cycle and flexibility as regards changes must be affordable also in later stages. Thus, customer satisfaction is not only a matter related to the hand-out of a freshly completed building, but is also a life-cycle issue since there are likely to be many users and/or use conditions for the building (or for each of its compartments) during its life, which, as a sustainable objective, should be as long as possible. This is probably an issue, which cannot be overemphasised as far as the building industry and its prevailing modes and attitudes are concerned.

3 How to turn the ideas into practice ?

Currently, there are many projects that are focussing patterns of thought on commercial systems and formulating future implementation models (see [8]). At the same time, the principles, which were initially applied to housing, are showing themselves to be profitable in the construction of other kind of buildings as well.

We dare to claim, however, that full use of the above ideas is not made. This gives us reason to specify the related definitions, and moreover, to develop more concrete principles to serve as guidelines for the building industries. The presented principles are applicable to nearly all types of construction although the rest of the paper deals primarily with housing construction.

To start with, we have defined Open Building as follows:

> ***"Open Building"*** *refers to such a building mode where, firstly,* ***A)*** *the built environment is divided into various levels that include different physical elements according to their scale, customer group and assumed life-cycle, and secondly,* ***B)*** *the planning of these elements is distinguished by demand and supply parts/stages, and moreover,* ***C)*** *power of decision over any elements on various levels and stages is given to the party it concerns. Decisions on higher levels or on earlier stages do not restrict the solutions on lower levels or later stages unnecessarily, and, correspondingly, decisions and modifications related to the latter have no influence on the former.*

If we examine the first part of the definition (part A), we can think of the building as being made up of the necessary fixed components and modifiable internal sections of individual apartments or compartments. The general aim is a situation where the outward appearance and architectural character of the building are largely defined by the elements of the "support" while nevertheless attempting to preserve wide decision-making powers for the occupant as regards the interior of the apartment/compartment. Thus, the first subsidiary concept that needs to be defined is "infill":

> ***Infill*** *is the system comprising those elements and equipment of the building that allow creating or changing the arrangement and equipment of spaces of an apartment or compartment. Moreover, it may include parts of the facade that control the opening of the apartment or compartment.*

The bringing in, positioning or removal of elements of the infill from the apartment/compartment is decided by the user irrespective of who designs, produces, installs or owns these elements. The system elements can also be rearranged or replaced by a reasonable input of work that is smaller than people are accustomed to so that the user can exercise his or her decision-making power. User decisions concerning the infill also influence the price and/or rent of the apartment/compartment, but the user only pays for what he gets and not for choosing differently from the majority.

The ultimate objective of open building is that the floor plan of an apartment or a compartment would be to a large extent defined by infill elements with minimal restrictions imposed by the support, which thus, can be defined simply as follows:

> ***Support*** *comprises those parts of the building that are not part of the infill (assuming that there is an infill). As a main rule, support consists of the building's frame and envelope as well as of the main ducts of the building services.*

Division between support and infill is, however, case-specific. For instance, if sanitary equipment or spaces are fixed, they are considered part of the support in that specific case although, in general, the aim is added flexibility in the positioning and removal of these elements also.

As to the decision-making levels and the distinction between the building's support and infill, the above definitions adhere to the original ideas of the open building philosophy. The difference here is, however, that Habraken's philosophy [3] involves also the levels of "city-structure" and "urban tissue" that are not discussed here. Besides, the paper's definition emphasises also the latest developments in the open building strategy (part ***B)***). These ideas are related to practical implementation and making efficient construction possible. In practice, the client should be only interested in the compartment's or product's functioning and not how it is to be constructed which, thus, is the business of the supplier. This means utilisation of design criteria and/or performance specifications in planning instead of predescriptive specifications. This is a result of the fact that the realisation of an efficient and flexible process as well as product modularization and modifiability require a more industrialised building scheme.

On the other hand, as far as infill systems and their selection by an individual customer/user are concerned, these "design criteria" may just be a rough idea about an ideal solution while the diverse alternatives offered and visualised for the customer allow him/her to make up his/her mind.

All in all, these definitions are essential in order to understand the idea on the most general level. They are, however, just the beginning and therefore Table 1 presents the most important features of open building by listing the criteria that were developed for assessing experimental housing projects implemented in Finland for their open building characteristics. As was stated above, the following characteristics and criteria focus only on the levels of support and infill. They are applicable to multi-family housing projects, where the town plan level (i.e. "tissue") has already been drawn by the municipality. The criteria recognise the "open building" criteria proper (marked with A) and "development towards open building" as their alternatives (B) in order to get an idea of the state of the art of the industry still on its way toward better practice.

4 How is the Finnish building industry doing ?

To provide an idea about the state of development in Finland, Table 2 introduces a few selected housing projects and compares them against the above set criteria. The projects can be considered

state-of-the-art projects since only projects that were known to have received public financing due to their experimental nature, that were involved in open-building-related competition, or that were publicly known for their open building likeness, were selected for evaluation. In fact, the projects in Table 2 are the best of all evaluated projects and are introduced in detail by [9].

Although the projects selected for this analysis are among the most developed available in terms of open building, they are far from that. Considering the fact that these are experimental buildings, it is clear that the industry has a long way to go before it has even the capacity to satisfy customers.

The biggest impediment to development is perhaps the lack of proper infill systems—thus, even the basic groundwork is defective although the pace of development is clearly improving. Another problem are the sector's set procedures and territoriality: competitive bids are called for the implementation of an entire building with emphasis on low implementation price and the typically favoured contract form, the lump-sum contract. This state of affairs does not induce anyone to invest separately in the indoor work phase. Suppliers are even prohibited from presenting more advanced systems to the client after selection, although they could bring many advantages.

Table 1. Breakdown of Open Building criteria in housing on the levels of support and infill.

User as a decision-maker

Open Building:

A1 User or future users decide on the infill or the changes concerning the infill in their apartment relatively close to the point when moving in.

A2 The users can participate in decisions concerning the support level, especially concerning common facilities and common outdoor space.

Improvements towards Open Building:

B1 Users choices restricted to a few optional floor plans (i.e. absence of adaptable infill).

B2 User-participation for the first user in the design of his/hers apartment (i.e. absence of adaptable infill).

Open spatial structure

A3 Regulation of the distribution of spatial units (apartments) in the building by means of merging, division, redistribution or extension during construction or later.

A4 The elements defining the floor plan and the services inside apartments are at the infill level (meaning free configuration of the floor plan).

Separation of support and infill

A5 Open frame structures that can accommodate a variety of spatial divisions and different infill and building services systems.

A6 Distribution of building services independently to each potential spatial unit (apartment) on the support level.

A7 Intermediate floor or installation zones for the distribution of infill service systems inside a unit (accessible from the apartment or from common spaces).

A8 Infill systems for services in the apartment (service systems can be changed, complemented and disassembled, and controlled inside the apartment).

A9 Infill system for partitions (demountable partitions are a prerequisite for changing the floor plan).

A10 Infill systems for facades including the zone between interior and exterior (balconies, light conditions).

Open Building process

A11 Distinction between support and infill levels in decision-making and design (carried out in separate stages).

A12 Procedures for user participation like group meetings, professional assistance by architect for each household, method of visualisation of alternatives to the user, and method for immediate calculation of the price/rent implications of alternative choices.

A13 Functional and spatial design distinguished from technical solutions by using modularization of building parts and performance specifications (e.g. system-unit procurement).

A14 Separate procurement and assembly for the infill level is carried out unit by unit and postponed to as late as possible.

The solution is naturally increased development work especially in the area of building infill systems. On the other hand, used procedures must also be changed and the internal-works phase must be increasingly treated as a separate procurement entity within the building process. The third area in need of improvement is informing the public: self-initiated development work in construction is highly inadequate which means that the large clientele must be better informed about the existing possibilities. Thereby we can create the "demanding client" who starts to insist on what he so far has only dreamt of and in so doing speeds up the introduction of new practices.

5 Conclusions

This paper has contributed some new definitions. In addition, it presented strict criteria for the evaluation of a building project from the viewpoint of the preconditions for long-term customer satisfaction. The criteria offer a simple tool for measuring any single building project—or even national building industries as was made here by induction. As far as Finnish housing production is concerned, we must admit that many changes have to be done. On the other hand, the situation is, more or less, the same all over the world.

All in all, there is a long way to go before we really can say that the industry is operating in a way that even might create customer satisfaction as defined in this paper. Besides, implementation of the presented measures can only set preconditions for long-term customer satisfaction while the final outcome depends on the functioning of the industry.

As we urge the building industry to reconsider its products and operational modes, we want to finish by reminding that customer satisfaction is not only a matter related to the hand-out of a freshly completed building, but is a life-cycle issue which has to be taken into account already in the initial investment phase. One way to do this is to recognise the adaptable infill of the building as the next consumer product in the housing construction process. It is also a means for the building industry to build a product of higher quality more efficiently and economically—and to make it more attractive for the client. Otherwise, demand will turn increasingly to other consumer goods and alternatives.

Table 2. Finnish state of the art housing projects evaluated from the Open Building viewpoint. [9]

Characteristics \ Housing projects (incl. year of completion)	Laivalahdenkaari 18 -95	Villa Paavola -96	Laivalahdenportti 3 -96	Tammistonpiika -96	Lounaispuisto -96	Myllypelto -97	Meritähti -97	Laivalahdenkaari 9 -97	Linnanrakentajanpuisto -98	Rastipuisto -99	Tervasviita -99
User as a decision maker											
A1 User decides on floor plan with infill	□										
A2 User-participation at the support design level	□										
B1 Optional floor plans for the first user			■	■				■		■	■
B2 User-participation without changeability		□					■				
Open spatial structure											
A3 Regulation of the distribution of spatial units			□		□		■	■			□
A4 Free configuration of the floor plan	□	□	□		■	□	■	■	■	■	□
Separation of support and infill systems											
A5 Open frame structure	□	□	□		■	□	■	■	□	□	■
A6 Independent distribution of services to units		■	□		■		□	■	■	■	□
A7 Access floor or service zones		□			■			■	□	■	■
A8 Infill systems for services	□	□	□		□		□	□	□	□	□
A9 Infill system for partitions	■				■	■					□
A10 Infill systems for facades	■		□								□
Open building process											
A11 Distinction between support and infill	□			□							□
A12 Procedures for user participation	■	□					■				
A13 Functional and technical design distinguished	□		□							□	
A14 Implementation of infill separately per unit				■							

■ = criterium met
□ = criterium partly met

6 References

1. Lahdenperä, P. (1995) Reorganizing the building process. The holistic approach. Technical Research Centre of Finland (VTT), Espoo, 217 p. VTT Publications 258.
2. Tiuri, U. (1997) Asunnon muunneltavuus ja avoin rakentaminen [Adaptability of apartment house dwellings and design strategies based on Open Building principles], Helsinki University of Technology, Department of Architecture, 118 p. Tutkimuksia 1997/12. (in Finnish)
3. Habraken, N. (1972) Supports: An alternative to mass housing, The Architectural Press, London, 97 p.
4. Broos, P. 1989. Open building: Anticipating the individual's needs. Delft Outlook. No 1/89, pp. 16 - 20.
5. Dekker, K. 1991. The open building process. In: Louwe, J. & van Eck, M. Future organization of the building process. Inventory of Dutch studies. TNO Building and Construction Research, Delft, pp. 87 - 99.
6. Distinction support/infill brings living (and working) to your liking within reach... Open Bouwen, Foundation 'Open Building', Rotterdam, 8 p.
7. Randen, A. van 1992. Consumentgericht bouwen: baas over en achter de eigen voordeur/Consumer oriented building: in full control of and behind one's frontdoor. In: Vreedenburgh, E. (ed.) 1992. De bouw uit de knoop...?/Entangled building...? Technische Universiteit Delft, Werkgroep OBOM, Delft, pp. 71 - 115. (in Dutch / in English)
8. Kendall, S. & Teicher, J. (1999). Residential Open Building, E & FN Spon, London. (to be published)
9. Tiuri, U. & Hedman, M. (1998) Development towards Open Building in Finland, Helsinki University of Technology, Department of Architecture, 65 p. Publications 1998/50.