Strategies for an Integrated Sustainable Renovation Process: Focus on the Swedish Housing stock 'People's Home'

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Summary

This paper presents a model to identify and describe both material and immaterial parameters which need to be known, valued and balanced in integrated sustainable renovation of the People's Home housing stock, i.e. period 1945-1960 in Sweden. The model covers ten value areas: (a) general description, (b) architectural quality, (c) social quality, (d) cultural quality, (e) technical description, (f) technical performance, (g) functional performance, (h) environmental performance, (i) economic performance, and (j) renovation process quality. A special attention is given to our exploration to define and describe immaterial values such as architectural quality.

Keywords: differentiated strategies, integrated renovation, sustainable building, post-war housing, People's home, energy efficiency, cultural value, architectural value, social value

1. Introduction

In the coming years, building activities in the field of maintenance, renovation and transformation of existing buildings will increase. While there is a large amount of literature on energy related and economic renovation, there are few integrated, long-term value conservation approaches of the whole building stock. Recent studies indicate positive synergetic effect of combining energy efficient and environmental up-grading, dwelling renovations and social transformations processes, and the benefit for managers, tenants, and society as a whole. Renovation and especially major-renovation is more complex and risky in terms of decisions-making, planning and execution than new construction. The qualities and the deficiencies of the existing building need to be known and regards have to be taken to occupants. While housing managers have methods for handling environmental declarations of materials, and energy saving, i.e. material values (technical, environmental and economic), the immaterial values of the built environment such as architectural, cultural and social values are fuzzy and difficult to handle.

The aim of this paper is to propose an integrated model which enables balancing of material and immaterial values. The following questions are in focus: What important parameters describe material and immaterial values? How can they be structured, understood and communicated, in order to be useful for a large spectrum of stakeholders (owners, managers, consultants, users, conservators)? The paper is based on a review of relevant literature with a focus on (i) 'People's Home' and its background in terms of political ideas, architectural influences, and significant qualities, and (ii) standards and existing models for sustainable building performance.

2. Development of a tentative model for People's Home housing stock

This paper focuses on strategies for sustainable renovation of culturally valuable pre-boom multi-family building stock from the People's Home period 1945-1960 in Göteborg, Sweden. The technical knowledge of this stock is less developed than knowledge about e.g. the stocks of the boom era and later, as is the knowledge about and recognition of their invaluable immaterial qualities. The People's Home is the result of a combination of political will and functionalist and modernistic ideals for architecture. The political ideas for a 'People's Home' were presented already in the end of the 1920s, made operational in the 1930s, and implemented and built after the WWII. The starting point for the People's Home was that citizens should have the right to a good dwelling to a low price. Generous loans were installed for housing construction. The People's Home architecture was not a search for special effects but for the best functional quality with available resources.

We have developed a tentative model framework for the Swedish People's Home multi-family housing stock comprising ten value areas and their main parameters to describe these values. The model derived from a list of criteria we identified in beforehand and from analysis of existing models and methods. Ten value areas are then defined for our tentative model: (a) general description, (b) architectural quality, (c) social quality, (d) cultural quality, (e) technical description, (f) technical performance, (g) functional performance, (h) environmental performance, (i) economic performance, and (j) renovation process quality. The logical hierarchy of the model is based on different levels of detail, what we call parameter level (PL) 1-4, where level 4 represents the highest resolution. These parameters will provide the foundation for development of long-term scenarios for the People's Home stock in Göteborg; scenarios which in turn provide an integrated renovation strategy for property managers and other involved stakeholders in the renovation process. We also give an example of characteristics on the PL4 for the value area 'architectural quality' to illustrate how the parameters are measured and what kind of data is included.

3. Discussion

The next step is to test the model using and analysing data for Göteborg, i.e. collect the data for the identified parameters on the PL4 level, to discuss and evaluate it together with our stakeholders in a local transdisciplinary collaboration arena. Data sources will be manifold and differ for each value area. For 'architectural quality', for example, main sources are observations, study of drawings and plans, literature studies. However, all data will have a spatial reference, see value 'general data description' to support a high degree of visualisation and, by that, ease discussions and communication between different stakeholders.

So far, the model framework lacks a description of the interlinkages between the value areas. This is a deliberate step since on the one hand the links will differ depending on what stakeholder perspective is taken and on the other hand what question is in focus.

A crucial part of the parameter discussion is the balancing of the values in general, and balancing of the parameters in particular, since they are crucial for different renovation scenarios. An assessment of the criteria should include a weighting of the parameters on PL1-PL4.

Our model is adapted for the People's home housing stock – it might be necessary to modify the model in order to make it function as a more general model. However, we believe that many of the solutions in the People's Home housing are according to modern ambitions for sustainable housing and should be safeguarded.

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Summary

This study focuses on elaboration of scenario parameters to support strategies for an integrated renovation process of culturally valuable pre-boom housing stock from the People's Home (Folkhemmet) period i.e. 1945-1960 in Sweden. This stock, now in focus for renovations, combines older craftsmanship with thorough planning on a neighbourhood level. Their qualities refer to aesthetics, material use, living qualities and efficient use of space. Present renovation strategies often reduce the complexity of the problem to technological and energy saving measures in a short-term perspective. Integrated and differentiated strategies are needed in order to improve energy efficiency and environmental performance, whilst respecting and safeguarding potential loss of invaluable cultural, architectural and social values (immaterial values). This paper presents a model to identify and describe both material and immaterial parameters which need to be known, valued and balanced in integrated sustainable renovation of the People's Home housing stock. The model covers ten areas: (a) general description, (b) architectural quality, (c) social quality, (d) cultural quality, (e) technical description, (f) technical performance, (g) functional performance, (h) environmental performance, (i) economic performance, and (j) renovation process quality. A special attention is given to our exploration to define and describe immaterial values such as architectural, cultural and social qualities.

Keywords: differentiated strategies, integrated renovation, sustainable building, post-war housing, People's home, energy efficiency, cultural value, architectural value, social value

1. Introduction

1.1 Problem area

In the coming years, we will see a substantial increase in building activities in the field of maintenance, renovation and transformation of existing buildings. Europe has a mature building stock, and the upcoming strengthened EU directives will set pressure on property owners to take actions for energy efficiency. The old building stock in Europe represents invaluable cultural heritage. Concern have been raised that up-scaled actions for renovation can represent a threat to long-term sustainable management of stocks, the safeguard of our architectural and cultural heritage, and a challenge to sustain and develop social values in the built environment. Recently, sustainable building has developed in the direction of a single-issue matter of energy saving. Energy is easily discussed in economic terms and energy efficient technologies are becoming praxis, in most new construction [1]. Renovation and especially major-renovation is more complex

and risky in terms of decisions-making, planning and execution than new construction [2]. The qualities and the deficiencies of the existing building need to be known and regards have to be taken to occupants, if there are any. While housing managers have available methods for environmental declarations of materials, and energy saving, the immaterial values of the built environment such as architectural, cultural and social values are fuzzy and thus difficult to handle. This implies a considerable risk to older parts of stocks, e.g. when elements of high material, technical and artistic value are replaced by industrial low quality products with considerably shorter life-span. It also represents a risk for underestimation of existing social values. Some housing managers have strategies for building adapted renovation, i.e. per building [3], other use more industrial approaches, i.e. one 'standard' solution for a whole stock, where cultural heritage legislation can hinder the renovation process [4]. Housing managers and architects need support for synthesized decision-making in order to balance different material and immaterial values in management of the built environment. While there is a large amount of literature on energy related and economic renovation, there are few integrated, long-term value conservation approaches of the whole building stock [5]. Recent studies indicate positive synergetic effect of combining energy efficient and environmental up-grading, dwelling renovations and social transformations processes [6], and the benefit for managers, tenants (e.g. well-being, fuel poverty), and society as a whole [7].

1.2 Research context

This paper is based on a research project, denominated ReBo, which focuses on strategies for sustainable renovation of culturally valuable pre-boom multi-family building stock from the People's Home period (Folkhemmet) i.e. 1945-1960 in Göteborg, Sweden. The technical knowledge of this stock is less developed than knowledge about e.g. the stocks of the boom era and later, as is the knowledge about and recognition of their invaluable immaterial qualities. In the ReBo project approaches are developed to bridge gaps between socio-cultural, environmental and economic aspects of renovation by elaborating scenarios based on assessments of architectural quality; analysis of energy, mass and monetary flows in a life cycle perspective; living quality; and relating to implementation (technical issues, affordability, user acceptance of technology etc). The project is carried out in a local transdisciplinary arena in which industry (housing managers, architects, technical consultants and entrepreneurs), academia (architects, engineer and conservator) and a number of other stakeholders (tenants organisations, Göteborg City Museum) collaborate for the problem definition, data collection and knowledge production. The project is part of the Ercaobuild call for Sustainable Renovation and collaborates with ETH-Zürch and TU Vienna for more generic knowledge on integrated sustainable renovation of existing housing stock.

1.3 Aim and method

The aim of this paper is to develop/propose an integrated model which enables balancing of crucial values identified in the ReBo project. The following questions are in focus:

- What important parameters describe material and immaterial values?
- How can they be structured, understood and communicated, in order to be useful for a large spectrum of stakeholders (owners, managers, consultants, users, conservators)?

The paper is based on a review of relevant literature with a focus on (i) 'People's Home' and its background in terms of political ideas, architectural influences, and significant qualities, and (ii) standards and existing models for sustainable building performance. The literature describing the political and architectural programme of the People's Home is broad and vast. The literature studied has made possible identification and structuring of numerous parameters in relation to ten value areas describing the People's Home housing stock. For each of the ten value areas the specific literature has been studied, and examples of characteristic parameters have been outlined. Due to the limited length of this paper, all ten areas cannot be presented in detail. We have chosen to exemplify the use of the model on the People's Home multi-family housing stock in the area of architectural design qualities. Full description of the model and its application on the People's Home will soon be available in a report in English [8].

1.4 Outline of paper

In chapter 1 an introduction to the problem area and research context is presented. In chapter 2 a short introduction to the building stock from the People's Home period is given. In chapter 3 a model framework is elaborated to describe parameters of building performance for integrated renovation within ten value areas. A special attention is given to the definition of immaterial values. In Chapter 4 the model is discussed, and its generic value to describe housing stock is analysed.

2. Introducing the People's Home 1945-1960

The People's Home represents an important architectural and political period in Swedish history. It has been described as a 'golden age' of the 20th century architecture [9]. The political ideas for a 'People's Home' were presented already in the end of the 1920s, debated and made operational in the 1930s, and implemented and built after the WWII. The starting point for the People's Home is the Social Housing Investigation (Bostadssociala utredningen) commissioned by the Government in 1933 and published in 1945 [10]. The investigation proclaimed that citizens should have the right to a good dwelling to a low price. As a means to implement the objectives generous loans were installed for housing construction. The loans were available for all kinds of housing developers although semi-public housing companies could profit from a higher percentage of loan, up to as much as 90% of the construction costs during some periods [9, 11]. Another instrument to fulfil the objective was the rent regulation that put a limit to the rent levels. The generous loans were given under the conditions of delivering some quality standard in the dwellings, e.g. bathrooms and kitchens in each apartment which was not standard at the time. Since 1946, Sweden has a building regulation with requirements for heat insulation for the climate envelope [12].

The People's Home is the result of a combination of political will and functionalist and modernistic ideals for architecture. The new neighbourhoods were often located in the outskirts of the old city centres and based on principles of the German Siedlung and the British garden city. The buildings are carefully incorporated in the natural landscape following the heights and leaving the trees and rocks untouched. As a reaction against earlier urban design principles, large open recreation areas were planned which also enabled a maximum of sunlight in the dwellings. The social ambitions with the 'People's Home' led to the planning of local service and retail centres often with a community hall.

The building design was driven by ambitions for resource efficiency, low-costs, and good housing quality. It was important to produce housing of high quality, and to dissociate 'People's Home' from the image of low quality social housing. The consideration for resource efficiency was influenced by the scarcity of building materials before and during WWII. In combination with thorough functional studies of the use of dwellings, the result was housing design based on insights in functional everyday life. The People's Home architecture was not a search for special effects but for the best functional quality with available resources. The task to design the People's Home attracted some of the best among contemporary Swedish architects.

The People's Home was also an era of many experiments in production, material use, building design and planning process. There are examples of open layout of apartments, moveable walls, and 'elastic' apartments to which smaller units could be added or removed to conform to user needs. In conclusion, many of the solutions in the People's Home housing are according to modern ambitions for sustainable housing.

The number of dwellings in multi-family houses from this period amount to 550 000 apartments on the national level [13]. In Göteborg there are 54 000 apartments in multi-family houses built from 1941 to 1960 [14]. The typical forms of tenure for multi-family houses are tenancy or cooperative ownership where the former is dominant.

3. Development of a model for describing different values of building-performance

3.1 List of criteria

There exist a multitude of different aspects and qualities of building performance relating to sustainable development and there is a strong need to reduce the complexity to concentrate on a set of indicators. These indicators should be understood, and possible to be used, by different actors and stakeholder (managers, architects, users, antiquarians etc.) but without simplifying and risk the loss of the richness of values. The basis for our descriptive model and scenario parameters to be developed is constituted by a set of criteria deriving from the ReBo research project:

- Integrated view on values such as architectural, social, cultural, technical, functional, environmental, and economic.
- Focus is on management and specifically on renovation process quality
- Thorough general description of the housing stock
- Lifecycle perspective
- Applicable for long term scenarios
- Transdisciplinary collaboration arena involving actors from industry, public, academia, etc.
- Description of performances must be open to qualities and possible deficiencies
- Aim for a visual model preferable in a GIS (Geographic Information System) framework

3.2 Defining values for the tentative ReBo model

In order to develop a model to describe the material and immaterial values of the multi-family buildings of the People's Home period we have analysed existing standards and models and found the following of specific relevance: ISO/TS 21929-1:2006 [15]; Lorenz et al. [16]; and CABE [17].

The purpose of ISO 2006 is to define a framework for sustainability indicators of buildings. A set of social aspects is defined on the building level: quality of buildings as a place to live and work; building-related effects on health and safety of users; barrier-free use of buildings; access to services needed by users of a building; user satisfaction; architectural quality of buildings; and protection of cultural heritage [15]. Lorenz et al. [16] present a number of aspects of building performance in an overall system partly based on the collection of standardisation activities involving technical, functional, social, environmental and economic aspects, and adding design and process qualities. The UK Commission for Architecture and the Built Environment, CABE, has in their work to develop a practical guide for public sector organisations to support integrated property valuation defined six values of property [17]: exchange, use, image, social, environmental, and cultural values. Based on the list of criteria defined in chapter 3.1 and the standards and models described above we have elaborated a tentative model which defines ten value areas (Fig 1).

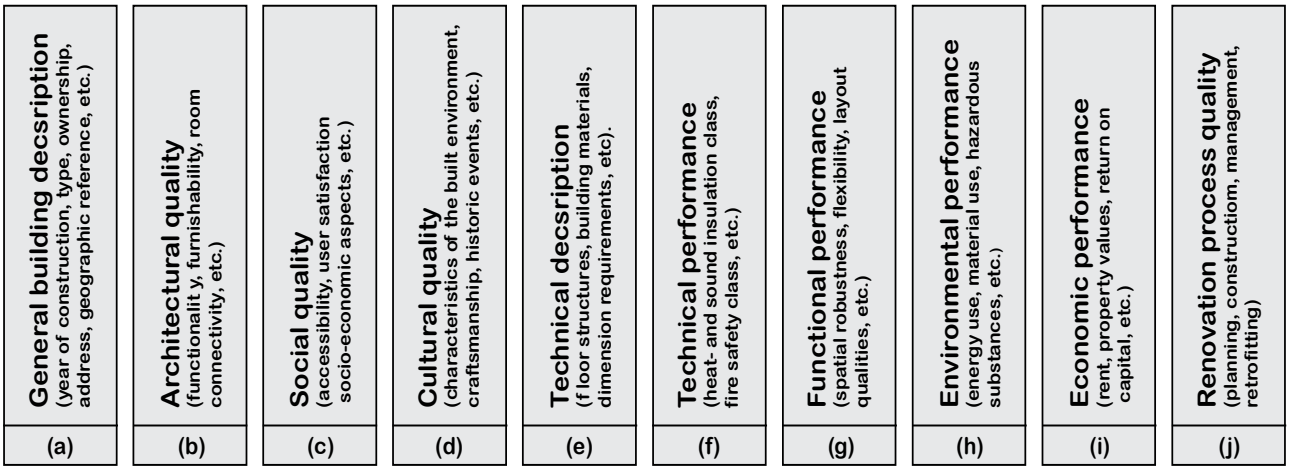

Fig. 1 Framework of ten value areas in the ReBo model

The design of the ReBo model is influenced by the logics and approaches of the earlier models. However, we choose to recognise architectural and cultural values as areas in their own merit, thus adding values that have not been part of the earlier models (Table 1). The ReBo model proposes a broader range of actors, i.e. housing managers, users, architects, technical consultants, entrepreneurs, and antiquarians, whereas Lorenz et al. [16] focus on valuation professionals, and CABE [17] on public sector organisations.

The list of values in Table 1, their meaning, and the outline of data-sources constitute a tentative methodological framework for our model. The aim is to cover issues of generic value as well as of relevance to the built environment of the People's Home.

(a) **General description** provides acurate information about the object based on systematic collection of data, i.e. year of construction, typ of building, and ownership from relevant sources such as the building itself, cadastre, municipal building archive, managers' archive, drawings, etc. A lot of these data have a spatial reference, and hence it is preferable to organise the information in a GIS-framework.

(b) **Architectural quality** concerns aesthetics, function, usability, etc. On neighbourhood level the qualities can be described in terms of urban layout, accessibility to amenities and recreation areas, infrastructure and connectivity etc. On the building level architectural qualities concern spatial organisation, openings and daylight, usability and function, materials and detailing, etc. The data sources are manifold and include the architectural fabric and design, drawings, the place and its context, etc.

(c) **Social quality** in built environment is related to interaction between people, and empowerment of people. Issues adressed are comfort, health, safety, etc. and described by parameters such as indoor air quality, emissions, accessibility, and functionality. Data may be collected by interviews, articles in media, demographic statistics, etc.

(d) **Cultural quality** in terms of historic, artistic and place-making significances, physical characteristics, etc. contributes to the compex tapestry of a town or city, comprising material and immaterial values. Narratives, traces of significant characteristics in the built environment, materials, historic events, etc are examples relevant of data sources.

(e) and (f) **Technical description and performance** provide information about the technical status, type of structure, building components and materials, dimensioning requirements, etc. Parameters such as heat- and sound isolation, ventilation, indoor air quality, fire safety, accessibility, are measured by certified building inspectors and documented in protocols.

(g) **Functional performance** concerns the building and its functions in terms of serviceability and adaptability to changing needs in management and user perspectives. Parameters comprise spatial robustness, flexibility, layout qualities, structural and infrastructural possibilities and constraints. These can be described by analysing plans, the building and its supporting technical systems.

(h) **Environmental performance** of a building include life-cycle principles, long-term management, assessment of the impact on the environment, resource efficiency, control of emissions and pollution, etc. Use of energy, material, and water, CO2 emissions, hazardous substances are some of the parameters to be measured.

(i) **Economic performance** can be understood by the support of LCC-methods and other tools to assess investments. In many cases buildings are considered as a commodity to be traded, whose commercial value is measured by the price that the market is willing to pay. Development of cash-flow, market value, book value, rent income, return on capital, asset portfolio, etc. are parameters to be measured. They also cover issues such as ease of letting and disposability.

(j) **Renovation process quality** is closely related to applied renovation strategies, organisational capacities, client capacity, etc. Parameters of interest are owner directives, decision making,

maintenance plans, etc. An inquiry into different capacities within housing management is likely to provide a fairly accurate understanding of a company's potential to execute sustainable renovation measures guided by viable strategies.

The logical hierarchy of the model is based on different levels of detail, what we call parameter level (PL), see Table 1. A higher resolution of information (higher level of detail) is indicated by increasing numbers (PL1, PL2, etc.).

Table 1: Defining and measuring different parameters of building performance for integrated renovation

Type of value (PL 1)	**What does it mean? (PL 2)**	**How is it described or measured? (PL 3)**
(a) General description	Cadastral information, evolution and changes, function, future property development	Ownership, tenure, location, dimensions and area, year of construction, value, property development plans (managers), land use planning (municipal)
(b) Architectural quality	Neighbourhood level (spatial planning, place-making characteristics, amenities, infrastructure, connectivity, safety, parks, landscape design) Building level (spatial organisation, openings and daylight, usability, materials and detailing)	Type of services, streets, pedestrian lines, greenery, proportions, variety of building typologies, dimensions, distribution of windows and doors, materials. Functionality and accessibility, furnishability, easy cleaning, room connectivity
(c) Social quality	Comfort, health, safety, user, image, occupant satisfaction, community interaction, demography	indoor air quality, emissions, accessibility, functionality, types of services, transport, tenure, socio-economic parameters
(d) Cultural quality	Cultural historical values, historic values, artistic values, building technology values, narratives	Significant characteristics of the built environment, urban landscape, user perspectives, craftsmanship, materials, historic events, traces of older society and lives
(e) Technical description	Type of structure, building components, building materials, dimensioning requirements	Floor structures, building materials, dimensioning requirements
(f) Technical performance	The building and its technical systems	Heat- and sound isolation, ventilation, indoor air quality, fire safety, accessibility, structure, wind-load, demands from building regulation, operation and maintenance qualities
(g) Functional performance	The building and its functions in terms of serviceability and adaptability to changing needs (management and user perspectives)	Spatial robustness, flexibility, layout qualities, structural and infrastructural possibilities and constraints
(h) Environmental performance	Life-cycle thinking, impact on the environment, resource efficiency, emissions and pollution, biodiversity	CO_2, energy use, water use, hazardous substances, material use
(i) Economic performance	Life-cycle thinking, development of cash-flow, market value	Book value, rent income, return on capital, LCC and other tools to assess investments, location, asset portfolio
(j) Renovation process quality	Renovation strategies, organisational capacities, client capacity,	Owner directives, decision making on renovation, maintenance plans, management team, knowledge and competence, routines

3.3 Architectural qualities

Whereas cultural historical values of buildings and the built environment has extensively been defined in the field of architectural conservation, the discipline of architecture have been less involved in defining architectural qualities of the built environment. In the models for assessing cultural historical values, architectural values are mainly treated as artistic or aesthetic values and/or as a sub value amongst others such as building technology values and historical values [18,19]. However, architectural quality is defined as much more than aesthetics: function, usability, comfort are some of the attributes of architectural quality.

Since, 1998, Sweden has a national action programme for architecture and design. The programme defines architecture and design as a good balance between different functions and demand that can even be contradictory e.g. usability, resource efficiency, good form, optimal use of technology and cost-efficiency. The National Board for Housing, Building and Planning, Sweden [20] characterises good architecture by completeness and coherence. Also, the specific qualities in housing stock of the 1940s and 1950s have been and still are largely appreciated [21]:

- High qualitative entrances and entrance doors
- Daylight in entrance stairs and in bathrooms
- Efficient layout of dwellings
- Daylight and views in the apartments from at least two directions
- Well proportioned, light apartments that are easy to furniture
- Balconies and French windows
- Bow-windows (1950s)
- Often 2,70 indoor height (1940s)

Some lacks according to modern standards:

- Small entrance halls in apartments (1940s)
- Not enough storage space (1940s)
- Small bathrooms and kitchens regarding modern standards (1940s)
- Not accessible – no elevators or small elevators
- Not energy efficient

Data for the analysis of the design quality are based on descriptions in literature e.g. [22] and on personal observations. Nylander [23] has made groundbreaking research to define high quality residential architecture. This quality is maintained with a balance between measureable and non-measureable properties in seven fields: materials and detailing, axiality, enclosure, movement, spatial form, light, and spatial organisation. In our model (Table 2) we have decided to extend the ideas of Nylander but also to leave out some properties not applicable to the People's Home, or to the level of detailing possible on a whole stock. For example, axiality and enclosure (open/closed spaces), movement and spatial form relate to experienced/symbolic values are too detailed to describe. In our model, these values have been incorporated in spatial organisation. There are other important functional and sustainable values in People's Home dwellings which are not covered by Nylander, which have been added. For example, the surrounding represents significant qualities in the People's Home.

Table 2. Architectural qualities with examples from the People's Home

Criteria (PL 2)	Units (PL 3)	Example of characteristics (PL 4)
Neighbourhood level		
Community	Community centres	Mix of housing, local services and community facilities/halls.
Area layout	Layout of building volumes	Adaptation to natural terrain, Buildings in curves. Traffic separation
	Recreation space	Open car free green close to dwelling, football terrains, playgrounds etc. Sunlight. The natural landscape is safeguarded. Fully grown trees/plants.
	Volumes (size, form, height, colour)	Human scale, diverse stock - size, heights and form, varying façades and colour schemes, window forms
Connectivity	Transport system	Garages, (somtimes limited) public transport, pathways follow natural landscape
Safety		Traffic separation
Building level		
Spatial organisation	Resource efficiency	Small well designed apartments, open space solutions, building form that allow several well designed apartments with common staircase
	Views and daylight	Maximise daylight from at least two directions (Starhouses, thin houses). Most flats have balconies.
	Flexibility and elasticity	Moveable walls, possibility to add/remove rooms – make small separate apartments
Openings and daylight	Windows, size, exposure and quality of opening and light transition	Daylight in staircases, in bathrooms and storerooms, Bedrooms to the north, living rooms to the south. Ground-level flats - balcony doors to the surrounding.
Usability		Well designed from the point of view of arranging furniture. Easy to clean – lean surfaces
Materials and detailing	Authenticity and care/mastery in execution	Details and material in original entrances, staircases, balcony railings. Kitchen if still original.

4. Discussion and concluding remarks

We started our paper with two main questions: What important parameters describe material and immaterial values? How can they be structured, understood and communicated, in order to be useful for a large spectrum of stakeholders (owners, managers, consultants, users, conservators)? Departing from these questions we have developed a tentative model framework for the Swedish People's Home multi-family housing stock comprising ten value areas and their main parameters to describe these values. The model derived from a list of criteria we identified in beforehand and from analysis of existing models and methods. The logical hierarchy of the model is based on different levels of detail, what we call parameter level (PL) 1-4, where level 4 represents the highest resolution. These parameters will provide the foundation for development of long-term scenarios for the People's Home stock in Göteborg; scenarios which in turn provide an integrated renovation strategy for property managers and other involved stakeholders in the renovation process. We also give an example of characteristics on the PL4 for the value area 'architectural quality' to illustrate how the parameters are measured and what kind of data is included (Table 2). Data sources will be manifold and differ for each value area. For 'architectural quality', for example, main sources are observations, study of drawings and plans, literature studies. However, all data will have a spatial reference, see value 'general data description' to support a high degree of visualisation and, by that, ease discussions and communication between different stakeholders. The next step is to test the model using and analysing data for Göteborg, i.e. collect the data for the identified parameters on the PL4 level, to discuss and evaluate it together with our stakeholders in the local transdisciplinary ReBo arena.

So far, the model framework lacks a description of the interlinkages between the value areas (Figure 1). This is a deliberate step since on the one hand the links will differ depending on what stakeholder perspective is taken and on the other hand what question is in focus.

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