19 EX ANTE PERFORMANCE EVALUATION OF HOUSING

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In several stages of the design process performance checks are needed: either for decisions about the feasibility of the programme and, later in the process, of the draft design; or to check and trim, to optimise, the final plan. The first stage enables the maximum adaptability of the plans with scant information. Towards the final realisation of the building information about the performance grows to a maximum and adaptability diminishes to almost zero. It is, therefore, essential to achieve results of performance evaluation as early in the design process as possible. Ex-ante performance evaluation proves to be a useful approach. It is based in principle on anticipation of future performance using broad and long term experience with similar products. This makes it useful for application to serially produced housing projects.

However, major difficulties are to be solved regarding measurement and assessment of performance as well as practical utilisation.

19.1 MEASURING PERFORMANCE

For performance evaluation a large number of methods is available, varying from Post Occupancy Evaluation (POE) and user enquiry surveys to various kinds of benchmarking. Most often they are based on quality/cost ratings. For early design and development stages simple and ready to use quality/cost rating-methods are most suitable. We will discuss both variables: quality and cost.

19.2 MEASURING FUNCTIONAL QUALITY

Performance of housing products depend mainly on satisfying residents, since this determines the market position of housing estates. Resident satisfaction depends upon a mix of mainly functional qualities (e.g. usable floor space) and subjective preferences (e.g. location). Though quite some research is available regarding resident satisfaction, translation and implementation of functional users preferences in evaluation criteria of built construction are meeting a couple of problems:

The translation of functional preferences, based on dwelling activities, in building construction characteristics. For instance: the activity 'cooking' implicates not only functional criteria for the kitchen floor plan and equipment, but also for heating, ventilation, relation to dining room/table, to be differentiated depending on household type and size etc.

The implementation of a large number of incomparable and partly contradictory aspects in a useful and practicable system. Solving this problem encounters a dilemma. One has to choose between very complicated compiled scorings, leading to insignificant non-transparent results, and simple but questionable undifferentiated results. As a research project targeted at the development of a consumer's test for housing products showed though, a useful and practicable system like the Dutch *Woning Waarderings Stelsel* (Dwelling Assessment System) is largely to be favoured, since it is widely used and recognised as a comparison gauge.[a] Regarding its nature, quality assessment must always be considered a rough and doubtful approximation of the many facets of the reality.

19.3 THE DUTCH RESIDENTIAL ASSESSMENT SYSTEM WWS

The Dutch residential assessment system *Woning Waardering Stelsel*, abbreviated WWS, is an instrument used by Dutch government to determine the quality of a domicile. Determining a reasonable rent is one of its purposes. Quality is expressed in points per quality aspect. The points for shared rooms and facilities, like a laundry room or heating, shared in apartment buildings, are proportionately distributed over the number of domiciles, regardless of size. Per aspect the following points can be 'earned' maximally:

a Thomsen, A.F. (1992) *Towards a consumers test for houses, surveying users-preferences and functional quality;* Thomsen, A.F. (1995) *Woonconsument en woningkwaliteit, prestatiemeting van woningen met behulp van vergelijkend warenonderzoek*.

1	*surface of spaces*	
	(rooms, kitchen, bathroom, shower)	1 pnt. / m^2
2	*surface additional spaces*	
	(kitchen extension, storage, attic, garage)	0,75 pnt. / m^2
3	*heating*	
	per heated space	2 pnt.
	private furnace in cellar	3 pnt.
	private high yield furnace	5 pnt.
	collective high yield furnace	1 pnt.
	radiator taps per space	0,25 pnt. per tap, max 2 pnt.
	heating elements outside rooms	1 pnt.,
	per space	max 4 pnt
	central heating combination	1 pnt.
	water meter	1 pnt.
4	thermal isolation	max 15 pnt.
5	*kitchen*	
	length table top near sink up	
	to 1 metre	0 pnt.
	1 to 2 metre	4 pnt.
	2 metres and more	7 pnt.
6	*sanitary facilities*	
	toilet	3 pnt.
	washing basin	1 pnt.
	shower	4 pnt.
	bath	6 pnt.
	bath plus shower	7 pnt.
6a	*facilities for people with disabilities*	
	per Dfl 500 of the costs incurred by the owner to establish them	1 pnt.

7	*out-of-date*	max. -30 pnt.
8	*private outside spaces*	
	up to 25 m^2	2 pnt.
	25 to 50 m^2	4 pnt.
	50 to 75 m^2	6 pnt.
	75 to 100 m^2	8 pnt.
	100 m^2 and more	10-15 pnt.
	no private outside space	5 pnt. deduct
	carport	2 pnt.
9	*type of domicile*	
	a) single family houses	
	non-attached house	17 pnt.
	corner of house	15 pnt.
	position in between / last of block	12 pnt.
	b) flats in shared buildings	
	ground floor without elevator	6 pnt.
	ground floor with elevator	6 pnt.
	1st floor without elevator	3 pnt.
	1st floor with elevator	5 pnt.
	2nd floor without elevator	1 pnt.
	2nd floor with elevator	4 pnt.
	3rd floor without elevator	0 pnt.
	3rd floor with elevator	4 pnt.
	4th floor and higher without elevator	0 pnt.
	4th floor and higher with elevator	4 pnt.
	16 or less flats per elevator shaft	2 pnt. extra
	c) duplex residences	
	upstairs	1 pnt.
	ground floor	4 pnt.

10	*surroundings*	
	1. trees, flower beds	0 - 1 pnt.
	2. public green	0 - 2 pnt.
	3. playing space young children	0 - 0,5 pnt.
	4. playing space older children	0 - 0,5 pnt.
	5. elementary schools	0 - 1 pnt.
	6. shops for daily provisions	0 - 2 pnt.
	7. urban facilities	0 - 2 pnt.
	8. accessibility of residence	0 - 1 pnt.
	9. public parking	0 - 1 pnt.
	10. stop public transportation	0 - 2 pnt.
	11. traffic load and unsafety	0 - 1 pnt.
	12. state of maintenance	0 - 2 pnt.
	13. distance to industrial buildings	0 - 1 pnt.
	14. attractiveness	0 - 4 pnt.
	15. population density	0 - 1 pnt.
	16. safety	0 - 3 pnt.
11	*noxious situations*	max.40 p. deduct
	serious decline neighbourhood	20 pnt. deduct
	city renovation activities	20 pnt. deduct
	serious noise (industry, air traffic)	35 pnt. deduct
	direct pollution soil or air	40 pnt. deduct
	other soil pollution	20 pnt. deduct
12	*special facilities*	
	exclusively with service flat residences	35% of total 1 t/m 11

Explanation

1,2 Surface
It holds for all spaces that one could stand on them, that they are at least 2 m^2 large and the height of the ceiling minimally 1,5 metre. Spaces of circulation (corridors) do not count. Absence of a fixed flight of stairs to the attic results in 5 points less.

3 Heating
Each heated space scores 2 point, excepting the 'remaining spaces' (attic, sheds, cellars, garages, etc.). For specific elements of appraisal extra points may result; for instance 3 points extra for a private central heating installation, a quarter point per space extra for the temperature control by thermostat (with a maximum of two points per residence).

4 Thermal isolation
- Double glass 0,4 point per m^2
- Roof isolation 2 points per residence
- Wall isolation 1 point per residence
- Wall isolation front 6 points per residence
- Floor isolation 2 points per residence
- Maximally 15 points per residence

5 Kitchen
The length of the working surface near the sink determines the number of points. Built-in sinks count, built-in stove tops do not. Depending on the quality the points may be doubled maximally (1 point per Dfl. 500 investment).

6 Sanitary equipment
Facilities present determine the number of points. Spaces for bathing and showering can only get points if the walls and floor are sufficiently water-tight, if there is access to hot and cold water and if the shower is equipped with the necessary utilities.

7 Out-of-date
Maximally 30 points reduction for ageing and wear; 0,4 point per (calendar)year following the construction of the building. For major maintenance and renovation work after 1970 a compensation applies of the reduction of points (per Dfl. 1000 investment 0,2 point less).

8 Private space outside
These spaces only count if they are minimally 1,5 metre wide and broad.

9 Type of domicile
If the floor of the main living-room of a ground floor residence lies 1,5 metre or more above street level it is regarded as a flat on the first floor. If there are 16 or less flats per elevator shaft this yields 2 points per flat extra. A duplex house is a one-family residence outfitted in such a way that two families can live in it. A domicile that is not free (with a shared flight of stairs and/ or landing) is rated a duplex house. The lower part scores 4 points, the higher part 1. For a dwelling that is not free on the second floor or higher no points are given.

10 Environment
For inconvenient situations up to 40 points are deducted:
- For very serious hindrance of noise by road, rail or air traffic or by industry maximally 35 points.
- For serious decline of the neighbourhood maximally 20 points.
- For urban renovation activities maximally 20 points
- For very serious soil or air pollution in the direct environment of the residence maximally 40 points when the cleaning-up starts within four years
- For other soil pollution a maximal reduction of 20 points.

12 Service flat costs supplement
A service flat is an independent living unit with minimally an emergency installation in it, meals provided by the owner in addition to simple medical or paramedical care and use of spaces for recreation and guest-rooms. For this type of residence the total number of points may be increased up to a maximum of 35%.

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19.4 THE RESIDENTIAL CONSUMER'S TEST

The WWS system of assessing homes is often applied in The Netherlands for judging the capability and the price/ performance ratio of residential facilities. WWS is mainly applied ex post; parts of it are also useful ex ante. Since WWS does not agree well with preferences of occupants an effort was undertaken in the nineties to develop an alternative instrument, the so-called 'residential consumer's test'; in analogy with comparative study of consumer's products, as they were performed for years by consumer organisations in order to test the price/ quality ratio of products on the consumer market.

Comparative study of products consists largely in a product information system listing the main characteristics of comparable products. A relative evaluation is made then on the basis of formulated criteria, testing levels and weighting factors per aspect, with the interest of the consumer as a decisive force. Usually the final judgement is termed 'Best Buy' and 'Best in Test' for products with the highest score, and 'Money Saver' for products with the best price/ performance ratio. The basis for the development of the test was a design of a quality test, founded on study of sources and interviews. Weak points in this testing method: valuation and weighing are not sufficiently based on occupants' preferences of the several quality aspects; the unsatisfactory way the total score was calculated; and lack of a relation to WWS.

Due to this criticism a new study started, structured in 3 stages:

- Occupants' preferences: a study of relevant quality properties and the degree in which these are related to the domestic properties according to housing consumers;
- Development of the test: the development of a test of housing quality based on the methodology developed during the early stage of the study;
- Operationalisation in practice: 'testing the test' and transfer of the testing methodology.

The essential point of departure for the test to be developed was the preference of occupants, rather than physical properties of housing of most existing methods of housing appraisal: the two should be regarded as independent variables. Searching for a relation between physical performance properties of homes (the objective component) and the preferences of occupants (the subjective component) linked to them; and what is more,a relation that may be measured, is the Achilles heel of this study.

An important conclusion of the first stage was that standard preferences of the occupant do not exist. Wishes and preferences of occupants differ according to composition of the family, age, income perspective, dependence on care, and life-style. In addition realising the preferences of occupants, the 'action space', strongly depends on socio-economical position and conditions prevailing on the real estate market. It proved to be too optimistic to expect that existing study data would be sufficiently available to serve as a basis for the testing methodology.

In Stage 2 – development of the test – determining criteria, testing values and weighting factors stood central. An extensive analysis of existing methodologies was conducted in order to establish criteria and testing values; complemented with technical norms of reference of housing from the available literature. On housing-technical (minimal) norms it was decidedly rich. Based upon it, a comprehensive survey was made, expressed in conditions and boundary values for individual domestic activities. Associating them with importance, in this case with weighting factors based on occupants' preferences (the subjective component) had to face the problem already signalled in stage 1, that can only be solved by conducting the (experimental) testing and the occupants' interviews concurrently. Because of the complexity involved, the decision was made to postpone the working-out of the residential environment as a testing object to later.

aspect / partial aspect	S	W
1. usefulness of spaces		
1.1 bedrooms		
1.2 living-rooms		
1.3 kitchen-rooms		
1.4 sanitary/ bath-rooms		
1.5 traffic space		
1.6 storage/ hobby space		
1.7 space outside		
2. flexibility / potential for change		
2.1 flexibility of use		
2.2 adaptability of layout		
3. connections and connectedness		
3.1 direct relations		
3.2 seclusion and privacy		
3.3 care relation		
3.4 Accessibility		
4. installations		
4.1 heating		
4.2 hot water		
4.3 ventilation		
4.4 shades		
4.5 thermal isolation		
4.6 sound isolation		
4.7 energy connection / plugs / metering cabinet		
5. sun and daylight		
5.1 living-rooms		
5.2 other rooms of residence		
5.3 kitchen		
5.4 daylight other spaces		
5.5 space outside		
6. maintenance		
6.1 maintenance of usage		
6.2 maintenance of installations		
6.3 architectural maintenance		
7. access, safety and living environment		
7.1 access		
7.2 safety		
7.3 neighbourhood and living environment		
7.4 outside / inconvenient situations		

S = score, W = weight

147 Survey main scores

During Stage 3 the housing quality test was tried out in two housing complexes in Delft. The testing concept used is a compromise between mutually contradictory requirements with regard to completeness and practibility. It is mainly a checking list of seven functional quality aspects considered important by occupants. Together they determine the quality of usage of a home.

Next interviews with occupants was the basis for assigning the weighting factors. The usefulness of spaces is measured by 'function mats', linked to activities and dependent on capacity. For the remaining partial aspects scoring instructions are provided.

Via a questionnaire to fill in the test results in a schema of quality aspects in which after weighing of the separate scores a total score can be calculated. The weighting factors are based on the results of the occupants poll, in which each partial aspect is scrutinised in terms of the interest of it to the occupant as well as in the one of valuation judgement. Finally, the price / performance ratio can be determined by relating the total score to the costs incurred by occupying the home.

The outcome of the experimental testing demonstrated that the test developed is viable and that the results are reasonably valid. Although the interest scores proved to be sufficiently useful for assigning weights, the question remains whether an occupants' poll is also sufficiently useful for determining the generally valid weights in a test.

All in all, developing the test proved to be much more complicated than was expected in the preliminary study. Although the development of a 'working' test succeeded, doubt as to reaching the aims formulated sufficiently increased. The concept still shows important shortcomings in two respects:

- the test is too complicated;
- the scoring results are for the time being insufficiently useful as unequivocal yardstick of performance

Given the large amount of different and dis-similar properties, the complexity does not surprise. During development, therefore, the well-considered choice was made to work from complete to simple; that is the only way to find out experimentally which aspects and for what households are in which situation of minor importance and might as well be left out, or get, on the other hand, a greater weight. This way it is also possible to trace systematically differences between different types of households that might not show up while working 'from coarse to fine'. However, the consequence of this choice is that it lasts this way (too) long before the developmental stage results in a practically useful instrument.

The second shortcoming concerns the structural problem of the weighting factors: in this case the relationship between subjective preferences, mainly with a functional character, and the physical properties of the object of those preferences. Only for neutral properties *vis-à-vis* household and income a match that can be implemented can be made.

Finally, question marks could be put with regard to a strong focus on valuation of the quality of usage. Efficiency in use plays a rôle; particularly in the case of cramped blueprints. When the living surface per occupant increases, possibilities of usage also increases and shortcomings become masked and/ or compensated.

Towards a new WWS

Looking back at the results, the two central problems: complexity of a 'responsible' method, and the needed 'match' between preferences and object-properties, seem to be a hurdle difficult to take for the time being for application in practice. On the short term, variants of WWS offer a reasonable alternative. Admittedly, they have the disadvantage that the judgement of occupants gets not sufficient weight in them. However, that seems to lead to unsatisfactory results only in a limited number of aspects; furthermore, it can be compensated by simply

asking occupants themselves what they think of those aspects. It is an important advantage of WWS that there is a lot of experience with its application and that it is, by and large, - the objective surface and facilities part – accepted by the various parties as a bias for valuation. It is obvious to keep, in any case, that part of the bias without worrying too much about the more subjective part: if the judgement of occupants must be asked in any case, in order to make the match and the new rental policy pre-supposes negotiation between both parties, why should valuation on these points not be made dependent on that negotiation? This way a basic valuation that can be objectified, with surface and facilities, emerges. The points do have a reasonable relation to building performance and may be maintained as a yardstick of points in government ruling. It is certainly desirable to check regularly by study whether the weight attribution in points sufficiently reflects the preferences of occupants. Multiplied by the average price of point on the level of rental or real estate markets a basic rent or reference rent can be calculated. The more subjective part can be replaced by a negotiation margin, the margin of valuation. This is globally in accordance with the other part of the present WWS, where no formal scoring precept is demanded, but at most a margin in percentage of the basic valuation.

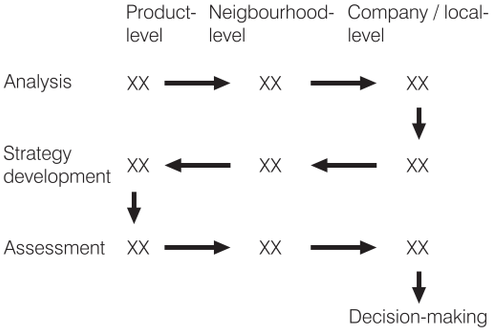
19.5 MEASURING COSTS

Though most often used in building construction practice, investment costs are not practicable for assessing performance, optimisation and weighing alternatives. Running costs like maintenance, energy and management costs should be considered just as important as initial building costs. To compare different (re)design and (re)development alternatives a Life Cycle Costs approach using net present value is necessary.[a]

Methods and tools

In recent years a variety of design and decision-making tools was developed based on some kind of quality/cost assessment.[b] They are used for ex ante performance evaluation in the early project development and design stage; and focus on different levels of scale: product-level, neighbourhood-level and company/local-level, and different purposes: analysis, strategy development and assessment. Figure 148 shows the relation between them in the routing of project- (and policy-) development.

Most of these tools are software applications developed for building and planning consultancy. They calculate integral life cycle costs to compare with qualitative variables, resulting in a performance score. Though practical for quick scan and weighing alternatives, the qualitative variable is the weak component. This can be seen, for instance, in the rather sophisticated Anymo-system, developed as computer software for portfolio analyses of rented dwellings.[d] The system evaluates the market position and performance of the dwellings. Basic determinants are the quality and the rent. Input data are quality aspects, derived from a list of criteria, and scored by a panel of managing staff and or surveyors. Based on the quality score potential gross rents and assets are estimated. The system is clearly market- and product-orientated and may best be applied for weighing alternative interventions regarding the market position of dwellings. The weak point of these market-orientated systems is that market-indicators are rather soft and fluctuating; often just symptoms for deficits to be neglected in decision making.



148 Routing of project-development[c]

19.6 CONDITIONS AND RESTRICTIONS

Using these tools we should keep in mind conditions and restrictions. According to Potting *et al.* the tools may be reviewed referring to the following initial goals:[e]

a. rational basis for decisions;
b. efficient use of resources;
c. transparency of effects;

a See Ruegg, R.T. and H.E. Marshall (1990) *Building economics*.
b Flier, C.L. van der and A.F. Thomsen (1996) *Matching alternatives, Design & Decision Support Systems for the management of existing housing stock;* Broeke, R. van den (1998) *Strategisch voorraadbeleid van woningcorporaties, informatievoorziening en instrumenten*.
c Leent, M. van and J.M. van Vliet (1992) *Strategisch woonbeheer*.
d Idem.
e Potting, A. and M. del Canho (1990) *Behelpen als hulpmiddel*.

d. open democratic decision control (discussion of this goal is beyond the scope of this article: see the contribution of Van Loon on page 293);
e. use of professional skills.

a) The tools are meant to offer a rational basis for decision making on programs and plans. As seen above, the qualitative variable is often a weak point. And, apart from that, ratio is not the only ground for decisions. It is wise to take into account that assessment of alternatives in practice is influenced a lot more often by 'irrational' items than people like to admit.
b) The tools should enable more efficient use of budgets and resources. But, the use of them is a matter of optimisation: a rather good decision is not enough, one perfect solution does not exist and there is often more than one good alternative.
c) The tools should give a transparent view of the design process and the effects of programs and plans. This pre-supposes the presence of proper professional skills (see below). They are expected to reduce the complexity of decision making, but the result can be a false simplification of reality. Weighing alternatives should be based on comparable and realistic conditions or programs.
d) The tools should make use of professional skills. The selection of relevant information and parameter values is a matter of profound professional knowledge of housing management and economics: the most tricky part of the system. This includes minimal comparability and knowledge of use and misuse of evaluation methods.[a] Systems for experts may also be used to hide the absence of knowledge and skills, or worse: to generate and proof desired results. It is essential to keep an open and controllable check on input, throughput and output.

Ex-ante performance evaluation of dwellings implies reduction of doubts. Design and decision tools can help to diminish uncertainty and sharpen awareness of risky elements. But, even the smartest tools cannot give a guaranteed solution performing well.

a Lans, W (2000) *Housing evaluation, some methodological considerations*.