Weighing alternatives
decision support systems for housing management in the Netherlands

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ABSTRACT

Under nowadays market conditions housing quality will be a major issue for the management of the housing stock. Even under the existing housing shortness in the Netherlands vacancy and demolition of post-war housing blocks is not any more a rare incident. In most cases the reason of depreciation and decay is found in a mismatch between supply and demand, caused by either an inadequate design or shifted market conditions. To cure the problems a range of possible interventions has been developed, varying from neglect and minor changes to radical redesign and demolition. Recently some decision support systems are developed to overview and compare the consequences of different concepts and strategies. Our paper provides an overview of recent Dutch tools and systems for this purpose, partly including computer software. Special attention is paid to the weighing of alternative interventions and practical experiences.

1 INTRODUCTION

More than half of the Dutch housing stock is rented property. The bulk of this stock is managed by housing corporations, non profit institutions chartered by law (Housing Act), comparable with the British housing association. Since World War II the share of the housing corporations has been growing steadily, answering the huge post-war housing shortage. The relatively high percentage is the result of a lasting high demand for dwellings because of demographic trends, combined with a strong financial support by the government. The relatively stable environment in which housing corporations have been functioning stimulated them to a 'technical approach' of housing management, based on standard budgets and to a 'subsidy-oriented' approach, following the subsidy rules.

But the world is changing. In the eighties the shortages in some parts of the housing market decreased. The absorption of new dwellings by the market was not guaranteed any more. The political environment changed too: the Dutch government started a programme to reorganize the welfare state and to reduce its financial contribution to it. Almost all the subsidies on new construction and renovation of dwellings were deleted and the existing financial ties between the housing corporations and the government were broken. Housing corporations are being transformed into self depending 'social enterprises'. They have to act market-oriented, and to meet the demand on the market they have to manage their stock efficiently, based on long term
strategies. As a result of these changes they need procedures and systems to develop strategies and interventions and to support decisions.

The starting point for housing corporations to introduce such systems was relatively good. They have become medium size companies with a substantial professional staff; there are 800 housing corporations with an average stock of 3000 dwellings, but over 50 corporations are managing 10 000 dwellings or more. Their average staff is eight persons per 1000 dwellings and their average operating reserve is Dfl. 12 000 per dwelling, corresponding with a solvency-rate of approx. 10% (1994). So, when needed, housing corporations had the means and capacity to introduce systems to support decision making in housing management.

Decision support systems for housing and planning purposes are not a new issue in the Netherlands. Our experience with those systems dates from the urban renewal in the seventies and eighties when alternatives were discussed to stop the rude reconstruction of old neighbourhoods. Since then costs/value weighing methods to compare alternative interventions e.g. renovation and new construction are an essential part of the skills of housing and planning professionals and their education. Combined with the rationalisation of housing management by housing corporations, this resulted in a choice of computerised support systems in this field. We were involved in one of the first models (Graafland et al. 1985) and the further development into computer applications (SBR 1988, 1989).

In this paper we will discuss the use of decision support systems for housing management in the Netherlands, or briefly systems, as a specific kind of 'management information systems' (Davis and Olson 1988, ref. Beemelsnans 1991).

After a short introduction on housing management we will give an overview of recent Dutch support systems. We will give special attention to decision support systems in a more strict sense, used for the weighing of alternative interventions, discuss the two most used systems and end with some general remarks and conclusions.

2 MANAGEMENT OF THE HOUSING STOCK

2.1 Integral and strategic

Van der Schaar (1977) defines housing management rather narrow as "the decisions and activities regarding the letting of dwellings, the buying and selling of dwellings, the maintenance and improvement of dwellings, the financing of buying, maintaining and improving dwellings and the demolishing of them." When the housing market is less tight the demand does not relate to the dwelling alone but also to the environment of the dwelling. So ten years later we find definitions which stress the integral aspect of housing management: "the activities needed for the maintenance and/or adjustment of the qualities of an area for the function for which the area is or will be destined" (Hoenderdos et al. 1989).
Since the mid eighties housing management attains a strategic dimension: goals are set explicitly, means and terms are selected. Growing attention is paid to methods used in business administration for developing market strategies. Following Ansoff (1973) Keuning distinguishes the next steps in the process of strategy development: the determination of the strategic profile of an organisation: the goals of the organization and fields it is working on; the analysis of the environment and the internal analysis, the analysis of the strong (S) and weak (W) points and the opportunities (O) and threats (T): the SWOT analysis; the determination of the strategic gap: the difference between on the one hand the goals of an organization and on the other the strong and weak points and the threats and opportunities it is facing; the formulation of strategies; evaluation and choice of a strategy; implementation of the strategy (Keuning and Eppink 1993, van Eeghen 1994).

This general model can be found in a lot of methods for the development of strategies for housing management. DHV Bouw, a leading consulting company on housing management, points out five steps: definition of the object on which information will be collected; internal and external analysis (SWOT); strategy development on three levels: the company, the neighbourhood and the project or the product-market combination; assessment, and implementation in schemes for the product-market combinations (van Leent et al. 1992b). Based on a survey of the literature Van den Broeke (1994) mentions the next steps in his model: determination of the main objectives of the organization; determination of starting points and analysis of the environment (portfolio-analysis); prioritizing; formulation of (quantitative) goals; development of strategies and alternatives; assessment; choice and implementation and feedback.

Levels and strategies

Strategies are developed on three levels: the local or regional housing market where housing corporations are pursuing their company strategy, the neighbourhood where housing corporations are developing strategies together with the municipality and other participants and the product-market combination. The decision-making on the three levels is linked: the objectives of the company on the market-level set limits for the schemes on the level of the product-market combination. The durability of the dwellings affects the goals a housing corporation may pursue on the neighbourhood--level and the local level. The need to cooperate with the municipality on the neighbourhood-level influences the interventions on the level of the product-market combination, and so on. Table 1 shows the relation between the process of policy development on housing management and the three levels of decision-making.

On the company-level the housing corporation has to set objectives about the markets to serve (target groups), the product to supply (quality) and the assets to realise (solvency). On the other two levels the housing corporation may choose from several strategies. Van Leent et al. (1992b) mention four possible strategies on the neighbourhood-level: expanding -trying to get a leading position in the market; social entrepeneuring -expanding for the target group; waiting -maintaining the stock but no large investments; retreating -selling the properties or exchanging them for properties in other neighbourhoods.
Table 1: Routing of policy development: relation between levels of decision-making and policy development on housing management

<table>
<thead>
<tr>
<th></th>
<th>Project/PMC</th>
<th>Neighbourhood</th>
<th>Corporation</th>
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<tbody>
<tr>
<td>Analysis</td>
<td>XX ———&gt; XX ———&gt; XX</td>
<td></td>
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</tr>
<tr>
<td>Strategy dev.</td>
<td>XX &lt;—— XX &lt;—— XX</td>
<td>&lt;—— XX &lt;——</td>
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<tr>
<td>Assessment</td>
<td>&gt; XX ———&gt; XX ———&gt; XX</td>
<td></td>
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<tr>
<td>Decision-making</td>
<td>&lt;—— XX &lt;——</td>
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Source: van Leent et al. 1992b

On the level of the product-market-combination they distinguish: consolidation - keeping price and quality on the same level; improvement - adding quality for the actual target-group; price-reduction or price-increase - lowering or raising the charge for the present target-group; adaption for new target-groups; raising the price for new target-groups; selling; replacement by new constructions; exchange.

This short overview shows that strategies for housing management are developed in steps and at different levels. For all steps and at all levels information is needed. The kind of information which is needed and the systems which may be used to produce the information will be discussed in the next section.

3 DECISION SUPPORT SYSTEMS IN HOUSING MANAGEMENT

To develop strategies and to decide on them housing corporations need information on at least three subjects: the market: characteristics of the groups they want to accommodate (target-groups); the product: characteristics of the dwellings they are or will be managing, and their financial position: operational results, liquidity, solvency and so on. This information may be static, characteristics at one moment or dynamic, concerning changes in characteristics in time. There are several types of systems which produce this information, decision support systems. Table 2 may be used to classify them. Though not strictly a matter of policy development we add registration as a basic operation of management.

Systems used for registration are static databases with information on the market, the product or the financial position and dynamic systems which monitor developments on these subjects. They may be used at the three relevant levels of decisions on housing management: project/PMC, neighbourhood and company/corporation.
Table 2: Housing management information systems

<table>
<thead>
<tr>
<th></th>
<th>Project/PMC</th>
<th>Neighbourhood</th>
<th>Corporation</th>
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<tbody>
<tr>
<td>Registration</td>
<td>static databases and monitoring systems</td>
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<td></td>
</tr>
<tr>
<td>Analysis</td>
<td>signalizing and simulation systems</td>
<td></td>
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<tr>
<td>Strategy dev.</td>
<td>expert systems</td>
<td></td>
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<tr>
<td>Assessment</td>
<td>weighing systems</td>
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</table>

For analysis systems are used which signalize changes in the market, the product or the financial position above a certain threshold or systems which simulate changes. For the development of strategies (expert) systems might be used which systematically combine interventions in the market, the product and the financial position. In fact no such systems are used; strategies are based on experience or are selected from lists like the above mentioned one of DHV Bouw. Strategies may be formulated on the three levels.

To assess strategies and interventions, systems are used which confront information on the market, with information on the product and on the financial position in order to weigh alternative strategies or interventions. Bemelmans distinguishes transaction processing systems or registrative systems and decision support systems. According to his definition only the last three types: signalizing/simulation system, expert systems and weighing systems, should be determined as decision support systems (Bemelmans 1991).

In the last decade a variety of decision support systems for housing management have been developed. As noted before, our contribution is directed to systems used for the management of rented stock. Systems more generally developed for facility management and portfolio analyses of real estate property are left aside, though they may have inspired some of the systems described below. Based on a recent survey on innovative housing management by corporations, Van den Broeke (1995) lists ten systems currently available on the Dutch market. We will give a short description of the systems and compare them on application level (table 3), main orientation (table 4) and main operational objective (table 5).

(1) Anymo (DHV Bouw)

Anymo has been developed by DHV Bouw, a major consulting company in the Netherlands. It produces information on the market position of dwellings. The quality of the dwellings is valued from the point of view of different target groups, the potential rent of the dwellings is determined and the performance is calculated (Van Leent et al. 1992a).
(2) BWS model (DHV Bouw)
This system has been developed to compare alternative interventions in housing property by the constant value of investments and running costs. Input data are building costs and exploitation parameters (interest, rent, inflation) for different scenarios. A simple module for planning and calculation of maintenance costs is included (Potting et al. 1990).

(3) Portfolio (NCIV, NWR)
The NCIV -one of the two national organizations of housing corporations- has developed a system for port-folio analysis for housing management. Based on estimates of the price/quality ratio and lettability the market position of dwellings is determined in four categories i.e. low/high combinations of lettability and price/quality ratio. According to the category a strategy may be selected (Hofland et al. 1992). The NWR -the other national organization- has developed a similar system.

(4) Minsom (NCIV)
With Minsom housing corporations can determine the minimum needed increase of the rents. Minsom can also calculate the effects of a differentiation in the increase of rents on the level of project/FMC’s and dwellings. The model may be used to develop a market-oriented rent policy (NCIV 1993).

(5) BAS (Akro Consult)
AKRO Consult, a consultant on housing management, has developed BAS as a model for policy analysis. The system is based on the idea that a lot of information is already available but stored in separated databases. The model is capable of selecting relevant databases in an area and linking them. It is meant to signalize trends and to simulate developments (AKRO Consult 1992).

(6) Bosdymo (OTB)
The OTB, a research and consultancy institute for policy analyses of the Delft University of Technology, has developed Bosdymo as a support system for the preservation of dwellings during vacancy. The system enables a flexible response to the changing demand on the local housing market. The system has three steps: signalizing, determining the market position of the dwelling; testing -based on consumers preferences, life time endurance and potential rent; and implementation in intervention programmes (Coolen et al. 1991).

(7) BOS (University of Groningen)
The support system BOS, developed by the University of Groningen, contains a model of the housing market. It is meant for analysis of developments on this market and for simulation. The system simulates the effects of alternative programmes for the construction of new dwellings, using various scenarios on income, interest etc. (Oosterhoff et al. 1992).
(8) BRON (NWR)
The NWR (see 3) has developed BRON. This system computes the constant value of running costs of interventions. It is similar to (2) BWS, but enables specified outcomes for various participants e.g. corporations and tenants. A special planning module for maintenance is not included (Postig et al. 1990).

(9) Companas (Companen)
Companas has been developed by Companen, a consulting company for housing management. It contains a model of the housing market. Using Companas, local authorities and housing corporations may compare the effects of changes in the housing market on Neighbourhood level (or corresponding systems for regional and project/PMC level) (Companen 1993).

(10) Quatro (INRO TNO)
Quatro, developed by the semi-public research organization INRO TNO, contains a model of the housing market to simulate the dynamic process of starting and filtering on the housing market. It is used to back up programmes on the construction of new dwellings (Heida et al. 1989 and 1994).

Table 3: Information systems for housing management: application levels (=X)

<table>
<thead>
<tr>
<th>System nr. Level:</th>
<th>System nr. Level:</th>
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<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Project/PMC</td>
<td>X</td>
</tr>
<tr>
<td>Corporation</td>
<td>X</td>
</tr>
<tr>
<td>Regional</td>
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Table 3 shows that most systems are directed at the PMC-level, though aggregation of the results on the corporate level is also possible and in some systems a built-in feature. Three systems are only practical on regional level and therefore not of interest in this paper.

Table 4: Information systems for housing management: main orientation (=X)

<table>
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<tr>
<th>System nr. Orientation:</th>
<th>System nr. Orientation:</th>
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<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Market</td>
<td>X</td>
</tr>
<tr>
<td>Product</td>
<td>X</td>
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<td>Assets</td>
<td>X</td>
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</table>

Table 4 shows that most systems are primarily market-oriented. Four systems are based on an explicit confrontation between product and market or assets; four are partly asset-oriented, of which (2) BWS, (4) Minsom and (8) BRON contain an explicit
weighing between product/intervention and assets, and (6) Bosdymo between market/ performance and assets. We consider a confrontation with financial consequences i.e. assets essential for decision support on housing management. The balance between quality and costs is bound to the history of the Dutch housing policy: 'affordable and efficient' has always been the mission of the social housing sector.

Table 5: Information systems for housing management: main operational objectives (= X)

<table>
<thead>
<tr>
<th>System nr. Orientation:</th>
<th>(1) Anymo</th>
<th>(2) BWS</th>
<th>(3) Prof.</th>
<th>(4) Moin</th>
<th>(5) BAS</th>
<th>(6) Bosdymo</th>
<th>(7) ROS</th>
<th>(8) BRON</th>
<th>(9) Copes</th>
<th>(10) Qno</th>
</tr>
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<tbody>
<tr>
<td>Registration</td>
<td>X</td>
<td></td>
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<td></td>
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<tr>
<td>Analysis</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<td>Strategy dev.</td>
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<tr>
<td>Assessment</td>
<td>X</td>
<td>X</td>
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Table 5 shows that eight of the ten systems described are used for analytical purposes: signaling or simulating. Only four are systems for assessment: weighing strategies and interventions: Anymo (1), BWS (2), Bosdymo (6) and BRON (8). There are no (expert) systems for the systematic development of strategies. Housing corporations are using the above mentioned systems on a small scale. Van den Broeke supposes that most housing corporations are using their own methods or methods which have been developed especially for them (Hoenderdos 1994). As Anymo is a well known system, the use may increase in the near future (van den Broeke 1994). For weighing alternative intervention strategies on project level, as is the objective of this paper, (1) Anymo, (2) BWS, (6) Bosdymo and (8) BRON are the most useful choice. In the next section we will discuss our experience with these systems. As (2) BWS and (8) BRON are similar systems and (6) Bosdymo is a rather specific system and in some aspects similar to Anymo, we will concentrate on experiences with Anymo and BWS resp. BRON. In the next section we will give a more detailed description of these systems and discuss our experience.

4 DISCUSSION

4.1 Weighing systems

Weighing systems may be used in different stages of the project development process: 
- the initial survey, often related to the planning and programming phase on neighbourhood level;
- the programming phase, preceding the design on project level
- the design phase, for optimisation and control.
The basic principle of weighing systems is the weighing of quality and costs. Quality may be valued from different points of view: from the supply-side, as product-related conditions and features, and from the demand-side: as market-related conditions, based on the needs and preferences of households and the market performance of dwellings. Costs are not limited to initial building costs, but should comprise the total life cycle costs, most often computed as constant value.

In practice two basic types of weighing systems have been developed: asset-oriented systems, with a strong accent on life cycle costs, following the demand for rationalisation of the housing management (e.g. BWS and BRON), and market-oriented systems, with a strong accent on market-performance, following the demand for a more market-oriented management (e.g. Anymo).

We draw our experience with nowadays systems from research and education. Anymo (1), BWS (2) and BRON (3) are used as courseware and for analysis by graduates and research staff in our department.

Postig et al. (1990) described some criteria for the evaluation of weighing system. We concentrate on the effectiveness of the systems, referring to the following initial goals:
- a more rational basis for the decision making process
- a more efficient use of budgets and recourses
- a more transparent view on development process and effects
- a more open and democratic control
- a better use of professional skills.

Anymo is not developed as a plain weighing system but as computer software for portfolio analyses of rented housing stock. The systems evaluates the market position and performance of 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 the potential gross rents and assets are estimated. The output may be produced in relative scores, numeric values and graphics.

A special feature of the system is the option of different target group related results, as different target groups e.g. elderly, families with young children and singles have different preferences. The idea is that in some cases it may be more efficient to modify the target group instead of the dwelling.

The system does not enable a direct confrontation between costs and benefits; financial effects are simulated as assets. It is clearly market- and product-oriented and may best be applied for weighing alternative interventions regarding the market performance on project/PMC level, but also for portfolio and rent differentiation on neighbourhood level.

The BWS-model and BRON are developed as weighing systems to compare alternative interventions like renovation schemes on different levels and new construction. Basic
determinants are the (re)investment and the running costs. Input data are the costs of reinvestment (building costs etc.), exploitation costs (maintenance, management but also subsidies), exploitation parameters (interest, rent, inflation) for different scenarios and the planned exploitation period in years. Maintenance costs may be estimated or inserted by means of a simple planning module (BWS only). Earlier models also included operating costs like heating and individual grants, thus enabling integral weighing of all costs for landlord and tenant (SBR 1989). This turned out to be more fair than useful.

The output consists in principal of the total exploitation result and may be produced as annual costs or (net) constant value in absolute or relative scores and graphics. BRON enables results based on expenses per participant (corporation, tenant) including rent subsidies.

The significance of these calculations is limited by the choice of unpredictable parameters (inflation, interest) and the comparability of different exploitation periods c.q. planning horizons. The use of different scenario’s is therefor essential and serves two purposes: it enables feasibility studies to estimate the risks attached to alternative interventions under various economical prospects, but it also enables impact-analysis to identify the influence of different parameter values.

For weighing costs and quality, a quality score may be used, derived from the WWS (Dwelling Valuation System, a vital part of the quality related Dutch rent control legislation, and in fact an very simple and general accepted valuation system). Though the WWS is a widely accepted, the scope of quality aspects is limited.

Table 6 shows a rough and arbitrary comparison on the foregoing criteria: the effectivity of the systems referring to the initial goals, using a five point 'consumers test' scale.

<table>
<thead>
<tr>
<th>Table 6: Anymo and BWS, compared on initial goals</th>
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<tbody>
<tr>
<td>Rational basis for decisions</td>
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<tr>
<td>Efficient use of resources</td>
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<tr>
<td>Transparency of effects</td>
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<tr>
<td>Open democratic decision control</td>
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<tr>
<td>Use of professional skills</td>
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</table>

++ = very good; + = good; o = fair; - = poor; -- = very poor

4.2 Conditions and restrictions

Does this comparison indicate that the BWS-model is better than Anymo?
Definitely not. It only illustrates the differences of the two systems, and the problems and restrictions connected with the use of weighing systems.

Rational basis for decisions:
As a rational basis for decisions Anymo scores a bit less than the BWS-model, due to the rather arbitrary valuation of the housing quality. A weak point of market-oriented systems is the fact that market indicators are rather soft and fluctuating; often they are just symptoms for deficits that could be neglected in the planning and decision making.

But the rationality and transparency of the BWS-model is connected to the hazardous choice of unpredictable and unstable economic parameters and the poor comparability of different exploitation periods c.q planning horizons. And apart from that: ratio is not the only ground for decisions. It is wise to take into account that weighing processes in practice are influenced by a lot more, often irrational, items than people like to admit.

Efficient use of resources:
Both systems enable a more efficient use of resources. But the use of weighing systems 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. Decision support means: finding the optimum considering different alternatives. Our experience is that, after the principal decisions are made, the systems are hardly used for optimisation.

Transparency of effects:
Both systems enable a better transparency of effects, provided the presence of proper professional skills. Weighing systems are expected to reduce the dynamic complexity of decision-making, but the result could be a false simplification of reality. Weighing alternative interventions should be based on comparable and realistic conditions c.q. programs. Comparable implies for example: serving the same target group, and realistic implies financial as well as social and political feasibility.

Open democratic decision control:
Due to the arbitrary valuation of the housing quality, Anymo scores only fair on open and democratic decision control. But this valuation is more complete than the quality score of the BWS-model. Weighing qualitative aspects depends largely on the weighing factor used to express the different weights. And some qualitative aspects are simply incomparable and hardly valuable in financial terms, making a computation of costs/quality ratio’s almost impossible. Incomparable aspects should therefore be kept apart and discussed using a separate checklist.

Measuring and rating housing quality is a complex and demanding task, and the subjectivity of the results seems to contrast with the accuracy of costs. On the other hand this ambivalence is inherent to weighing systems, whose seemingly accurate results should always be suspected, or better: discussed.

Use of professional skills:
The selection of relevant information and parameter values is a matter of profound professional knowledge of housing management and economics and is therefore the
most tricky part of the system. Systems for experts may also be used to hide the absence of knowledge and skills, or worse: to generate and proof desired results. Also for this it is essential to keep an open and controllable check on input, throughput and output.

4.3 outlook

Regarding the further development of weighing systems there are several trends to be mentioned.

The position of the consumer will be an issue of growing importance. To meet the preferences of decisive consumers, housing corporations are forced to adapt their housing stock, while on the other hand the needs of the target-group urges for a decent and affordable provision. Further knowledge and support tools to analyze the PMC potentials of housing units and to discuss and negotiat the rent/quality rate will be needed.

The rapid growth of digital data systems for housing management is changing the organisation and activities of housing corporations thoroughly. As a consequence of the need to organize and integrate the growing flow of information, management support tools and expert systems will be developed for all kind of industries and trades, including housing management. From the technical viewpoint the rapidly increasing impact of graphic database systems: CAD, GIS etc. will give new challenges for integrated information systems and new analyzing techniques, and for weighing systems.

Developing strategies implies the reduction of doubts. Decision support systems can help to diminish uncertainty and sharpen the awareness for risky factors, but even the smartest system cannot give a guaranteed solution.

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