

STRATEGIES FOR THE COST-EFFECTIVE TECHNICAL MANAGEMENT OF HOUSING STOCKS

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Abstract

The paper presents an empirical study of investment activities on existing buildings and their dependencies on corporate strategic factors. The study is based on almost 3000 activities carried out from 2003 to 2007 on a typical characteristic housing stock in Germany. The stock is managed by a strategically positioned housing company.

First the state of the art in the research field is presented. The research concept is introduced. Using the methods of descriptive statistics key cost values of the investment activities are presented in accordance with the company's strategic factors. The cost values are compared with the investments of appropriate other German housing companies. In compliance with the obligations of the technical management, strategic recommendations are derived to control costs. The benefits of the strategic recommendations are evaluated with the identification of potential cost savings. The investment minimum of technical management is derived from the key cost values minus the cost saving potential. The minimum investment is discussed in comparison with the investment of other representative German housing companies. The strategic recommendations are incorporated in a concept for the selection of future activities.

Keywords: technical management, housing stock, strategies, existing buildings

INTRODUCTION

The investment activities on existing residential buildings are an important business sector in the German housing industry. As a research field, these residential buildings have been underestimated so far.

Since 2000, the volume of the investment on existing residential buildings is higher than the volume of the investment on new residential buildings (DIW Berlin, pp. 30-31). In 2007 the members of the Association of German Housing Companies (GdW) invested 77 % of their investments in the activities on existing residential buildings (GdW 2008, p. 154). These activities indicate construction work performed to maintain or modify the residential properties (residential building, outdoor areas) and their elements (Figure 1) (Kalusche 2007, pp.128-129).

By focusing on the existing residential buildings, the technical management of housing stock has become the most important task of the construction departments in German housing companies. The technical support of new construction plays only a minor role.

Basis for a rational and cost-effective technical management of the housing stock is the knowledge of the characteristics of the investment activities on existing buildings and their dependencies on corporate strategic factors. Rußig (2006, p. 20) notes, however, that in Germany as well as in other European countries there are only few reliable data concerning the performed technical investment activities and their dependencies.

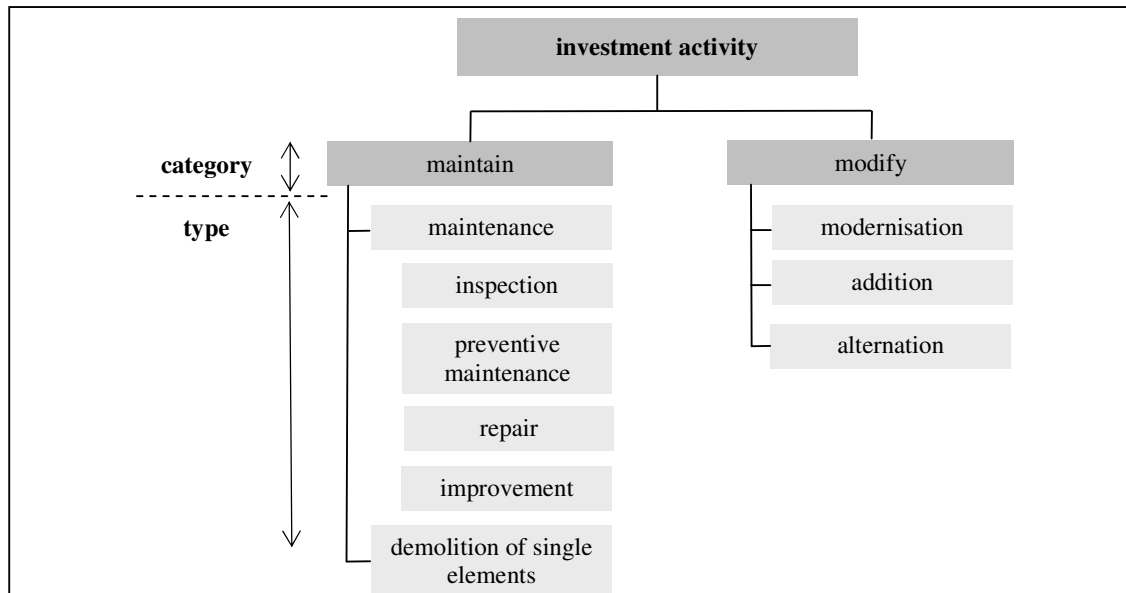


Figure 1: categories and types of investment activities

Lohse and Pfnür (2009, pp. 35, 50, 56-60, 101, 104) show in a survey that the implementation of strategic investment activities on existing residential buildings is one out of five key challenges for the German housing companies.

Currently, there are no scientific studies that use the experience from past activities (Figure 1) on existing residential buildings for a rational and systematic selection of future activities. Therefore the objective of the study is to develop strategies for the cost-effective technical management of housing stock.

STATE OF THE ART

The empirical study on investment activities on existing residential buildings is an emerging research field. First studies were conducted in the 1960s and 1970s by Mrosek (1972) and Zschirnt (1975). To date, there is quite a number of research projects available.

Still those projects show some deficits concerning their method or their content. The investigations have limited significance and are only qualitative. This results from the specific samples, the individual operationalizations, or the consideration of selected single criteria. The qualitative character is given for example in the research by the Statistisches

Bundesamt (2009), Klingenberger (2005), Aikivuori (1994) or Leather et al. (1998).

The novelty of the presented approach is characterized by a thorough multi-criteria analysis of the investment activities on a typical housing stock sample. The gained knowledge is used in order to systematically select appropriate future investment activities.

So far, the development of strategic recommendations is focused on the user-oriented management, the economic management and the damage (structural damage, personal injury) prevention and removing.

Up to now the recommended strategies for user-oriented management refer to user requirements in general and to some very specific requirements like accessibility, energy efficiency or sustainability. They refer to certain owner segments or to special age groups of the buildings. They are mostly based on case studies, expert interviews or surveys. Examples are found in Finkenbusch (2008) or Kirchhoff and Jacobs (2005).

The strategies for the economic management seek to find an economic alternative instead of the minimum investment level. They can be derived by cost-benefit analysis, by methods of investment analysis or by the adoption of entrepreneurial activities. The data are usually obtained by the analysis of case studies or surveys. The statistical analysis of in-company data is rare. The strategies are designed for specific user groups. Examples are found in Kirchhoff and Jacobs (2007), Vesper et al (2007) or Kortmann (2008).

Strategies to prevent and repair damage (structural damage, personal injury) are developed component-based or process-related. They are mostly based on the analysis of case studies, expert interviews or the statistical analysis of damage cases (structural damages, accident reports, insurance claims). Examples are the investigations of Schrepfer and Gscheidle (2007), Rizkallah et al. (2003) and Schüler and Röbenack (1996).

The novelty of the presented approach is to meet the obligations of the technical management and to ensure an appropriate minimum investment level.

RESEARCH METHODOLOGY

The research is structured into the following steps:

- Sample selection
- Operationalization of the investment activities
- Data collection
- Data analysis

Sample selection

The study focuses on the analysis of investment activities carried out on a typical housing stock of one housing company. The in-depth study provides a thorough and detailed analysis of all its activities. The investigated period is from 2003 to 2007.

In the study 2939 investment activities have been investigated, which were managed by the technical department of the company. Therewith, about 90 % of all executed activities had been recorded.

For the realization of these activities, according to DIN 276 (2008), preparation, planning and construction work are required. In this study, only the construction items are considered. According to VOB/A (2010), § 1, construction work is defined as work of any type to create, maintain, modify or remove a structure.

The housing stock includes 2164 dwellings with a total living space of 152.755 m². The dwellings are located in 251 multi-family houses of different age in major cities in West Germany.

The comparison of the dwellings of the research sample with the unit distribution within the member companies of the GdW shows that the years "1960 to 1970" are overrepresented in the sample (Figure 2). In all other regards, the examined housing stock shows the typical age distribution of the dwellings of the GdW member companies in West Germany. The typical West German age distribution is confirmed by the comparison of the studied units with the rental units recorded by Statistisches Bundesamt (Destatis) (GdW 2006, pp. 153-154; Statistisches Bundesamt 2008, pp. 12-13).

The analysed housing company is privately owned. Private owners manage 4.06 million dwellings. These are approximately 47 % of the 8.69 million professionally owned dwellings and about 10 % of all dwellings in Germany (BBR, 2006, p. 23; Veser et al., 2007, p. 26.).

The housing stock is managed by a housing company, which has adapted to changing market conditions by diversification (Kühne-Büning, pp. 123-124; Nordalm 2003, pp. 34-36). Since the late 1990s, the business segments management and marketing of existing housing stocks were supplemented with the segments purchase, sale and privatisation of existing housing stock as well as the management and marketing of purchased and privatized housing stock.

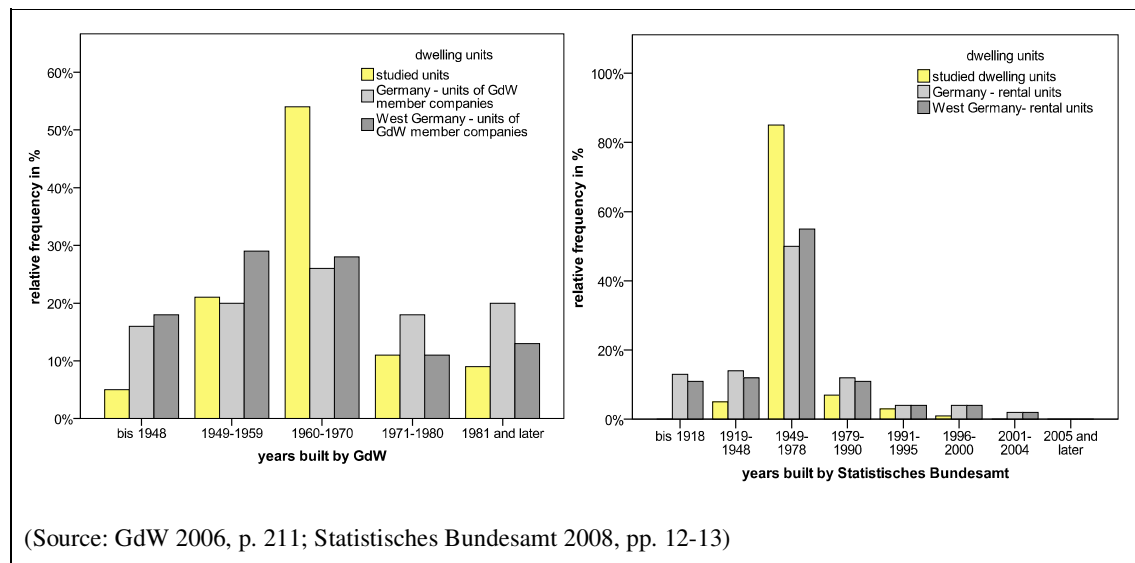


Figure 2: comparison of dwelling units

Operationalization of the investment activities

As part of the operationalization, the recorded investment activities have been classified by the following six features:

- Category

- Investment package
- Management concept
- Area
- Cause
- Cost (€)

The variables and their categories are defined on the basis of participant observation and by literature review. Their definitions and categories are described as follows:

Variable category of activities

According to Figure 1 the investments are classified in maintenance and modification activities. Maintenance activities secure the functional use of the objects. They lead to retain, restore or improve the required functions of the objects and their elements. Modification activities are usually associated with a distinct change in building design (DIN 276 2008, p. 3; Kalusche 2007, pp. 128-129; Zeitner 2006, p. 137).

Variable investment package

The investment activities fit into the three investment packages shown in Table 1.

Table 1: variable investment packages

no	package	explanation
1	immediate measures	day-to-day activities carried out straight after the notification of dysfunction or failure
2	planned actions	predetermined activities carried out in accordance with a yearly prepared action plan
3	complete renovations	a bundle of activities carried out in the temporarily unoccupied or lately added units

Variable area

The technical management of the housing stocks is different for the dwelling and for the common areas. The definition of the area categories is chosen following the Condominium Act (WoEigG 2009).

The *dwelling area* includes the spaces and building structures that are privately owned property.

The *common area* includes the spaces and building structures that are common property.

Variable management concept

The investment activities can be derived from the strategic perspective on different management concepts. The concepts are focused on the three management approaches (Hegewald et al 2009, pp. 19-20):

- *Renting*: sustain the letting and liveability of the residential property
- *Privatisation*: sales design of the residential property (increasing the quality for the sake of marketing, meeting the requirements of future users)
- *Condominium*: sustain the use of the privately and individually owned residential property

The management concepts are applied in the dwelling and common areas. The application depends on the different ownership status as shown in Table 2.

To study the influence of the company's strategy on the entire property, the management concepts in the dwelling and common areas (e. g. renting + renting) are taken together.

Table 2: variable management concepts by area

area	management concept	owner status/responsibilities	explanation
dwelling area	renting	housing company is the only owner of the tenement (all dwellings and common area)	preparing the dwelling areas for renting
	privatisation	housing company owns unit in condominium	preparing the dwelling areas owned by the housing company for sale
	condominium	housing company owns unit in condominium	preparing the dwelling areas owned by the housing company for renting
common area	renting	housing company is the only owner of the tenement (all dwellings and common area)	preparing the common areas for renting
	privatisation	housing company changes the form of ownership from tenement to condominium	preparing the common areas for privatisation
	condominium	housing company manages the common property of the condominium	preparing the common areas for the condominium management in connection to the privatisation

Variable cause

The cause of an activity describes the event leading to that activity (Table 3).

Table 3: variable causes

	no	cause	explanation
material	1	maintaining functionality and usability	Functionality and usability are verified. Small changes in functionality and usability are removed.
	2	limited functionality and usability	Damages, limiting the functionality and usability are fixed.
	3	component failure	Failed components are retained in a functional and usable state.
immaterial	4	user demands	Functional, environmental and hygiene requirements are met. Architectural trends are realized.
	5	changed and new laws, standards and codes of practice	Legal or technical constraints or health issues are met (requirements of the Energy Conservation Act, health hazards due to asbestos).
	6	increase profitability, balance sheet aspects	Activities are carried out to increase the earning capacity of the housing stock.
materiell + immateriell	7	limited functionality and usability and user demands	Same as no 2 and no 4
	8	user demands and increase profitability, balance sheet aspects	Same as no 4 and no 6

(Source: Möschwitzer 2008, pp. 95-96)

The causes can be divided into three groups:

- material cause (due to material wear)
- immaterial cause (due to non material wear)
- material/immaterial cause (due to material and non material wear)

Variable costs

The costs of the studied activities describe the expenses for the building work (Möller 2001, pp. 98-99) in accordance with DIN 276 (2008, p. 4). The costs of the activities are recorded as billed gross building work.

Data collection

The data have been collected in two steps: in the first step, secondary in-company data were collected. In the second step, the compiled data have been supplemented with additional variables by assignment and assessment.

Data analysis

Using the methods of descriptive statistics, key cost values (€ per m² of living space) of the investment activities are presented in accordance with the management concepts. The values are calculated for each investment package in the dwelling areas as well as for the common areas (Table 2).

The derived values of the housing company are used to calculate comparative figures (whole property = dwelling and common area) in total and by management concept. The values are used to compare the investment behaviour of the housing company with the investment of comparable other German housing companies.

The benefits of strategic recommendations are evaluated with the identification of potential cost savings (€ per m² of living space). The investment minimum of technical management (target key cost value) is calculated from the key cost value minus the cost saving potential per m².

The determined minimum investments are used to calculate the target comparison values. The target comparison values are used to compare the investments of the studied housing company with the investments of selected other German housing companies.

RESULTS

Key cost values

The investment activities lead to total costs of € 25,878,492.32 (Table 4). According to the definition of the different action packages in Table 1, the *complete renovations* (€ 4,639,083.53) represent the cost situation for the *dwelling areas*. The *planned actions* (€ 20,528,593.94) represent the cost situation for the *common areas*. The *recorded immediate measures* (*dwelling and common areas*) lead to relatively low costs (€ 710,814.85).

Table 4: costs of all studied activities (2003 to 2007)

area	cost							
	total		immediate measures		complete renovations		planned actions	
	total (€)	(%)	total (€)	(%)	total (€)	(%)	total (€)	(%)
dwelling area	4,960,333.77	100.0	321,250.25	6.5	4,639,083.53	93.5	0.00	0.0
common area	20,918,158.54	100.0	389,564.60	1.9	0.00	0.0	20,528,593.94	98.1
total cost	25,878,492.32	100.0	710,814.85	2.7	4,639,083.53	17.9	20,528,593.94	79.3

The key cost values in the *dwelling and common areas* vary depending on the management concept (Table 5, Table 6).

The highest key values occur, when the management concept *privatisation* is applied (Table 5, Table 6). Here it is more likely to invest in expensive maintenance and modification activities in order to increase the quality and to meet the requirements of future users (Hegewald 2009).

Table 5: key cost values of complete renovations by management concept (dwelling area) (2003 to 2007)

management concept	total costs (€)	costs (€/unit)	key cost value (€/m ² of living space)
renting	1,321,739.27	8,418.72	133.84
privatisation	3,052,823.99	9,393.30	149.34
condominium	264,520.26	4,007.88	63.72

Table 6: key cost values of planned actions by management concept (common area) (2003 to 2007)

management concept	total costs (€)	key cost value (€/m ² of living space)
renting	2,346,226.72	20.29
privatisation	18,046,603.08	176.23
condominium	135,764.14	1.33

The key cost values of the management concepts *renting* and *condominium* are significant lower than the values of the concept *privatisation*.

Within the *renting* management more cost-effective maintenance and modification investment activities are carried out. They are used to remove wear, adjust the property to the technical standards or fulfil tenants' requirements (Hegewald 2009).

In the *condominium* management especially cost-efficient maintenance investment activities are carried out. They focus on guaranteeing the habitability. The cost-intensive activities are or will be carried out only in connection with the *privatisation* strategy (Hegewald 2009).

Investments in comparison

The investment activities of the housing company (*dwelling* and *common area*) can be compared with the investment activities of the GdW member companies in West Germany and also with the investment activities of the member companies of the Association of North German Housing Companies (VNW) (Veser et al. 2007, pp. 61-62).

When comparing with those appropriate values from literature, the calculated key cost values are well above the benchmark (Figure 3). Overall, the analysed housing company is investing twice as much in its housing stock as the representative housing companies on average. The high level of investment is mainly due to the concept *privatisation*. The investment in *privatisation* is 2.3 times as high as the investment of the average GdW member company in West Germany.

This raises the question, which investment activities must be carried out on the existing housing stock and which not.

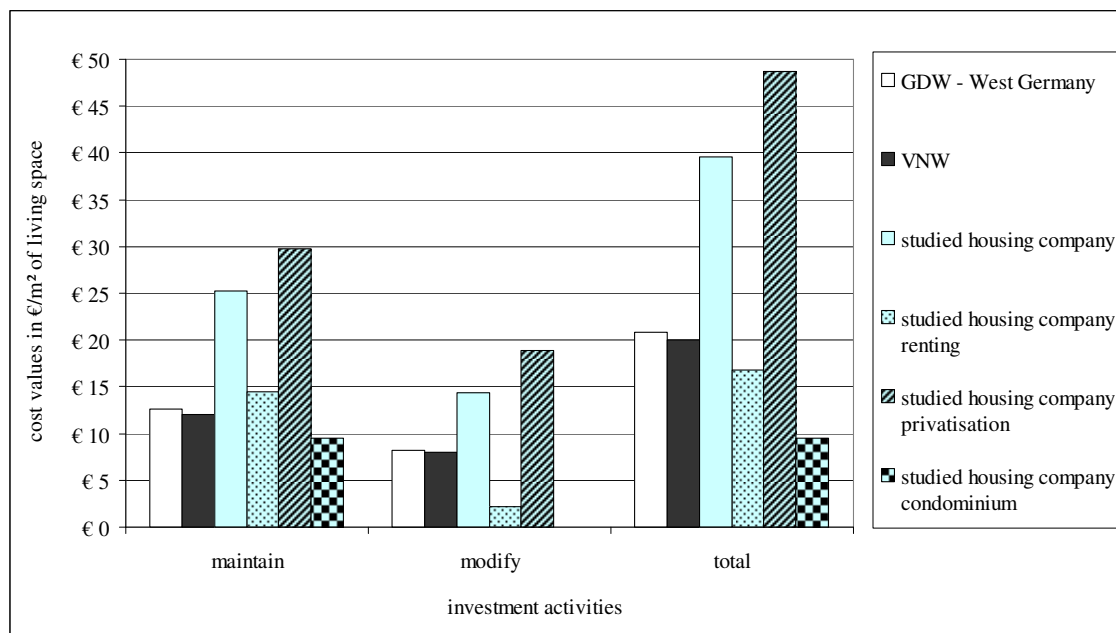


Figure 3: comparison of the investments (key cost values per year)

Duties of the technical management

With the investment activities the duties of the technical management have to be met. The duties are divided into the maintenance and adaptation requirements.

The maintenance requirements include the duty to obtain the housing stock in a functional and hazard-free condition. They can be derived from the law of tenancy, condominium law and the duty to implement safety precautions and to ensure upkeep of the property.

The tenancy's maintenance requirements are defined in the Civil Code (Bürgerliches Gesetzbuch) (BGB, 2009). They result out of § 535 (1) Civil Code (BGB, 2009) (TÜV

Rheinland Group 2008, p.28). According to it it's the duty of the landlord to keep the tenant's property in a suitable, contractually fixed condition.

The committed maintenance investment activities of the law of tenancy include, as stated by Blank (2005, p. 397-399) and Palandt/Bassenge (2009, pp. 728-729):

- activities to prevent and remedy structural defects
- activities to maintain and restore the contractually fixed condition
- preventive maintenance
- improvements, that result from the maintenance and restoration of the contractually fixed condition

The maintenance requirements for property owners and their managers are derived from the Condominium Act (Wohnungseigentumsgesetz – WoEigG) (WoEigG 2009). They are described in §§ 14, 21 and 27.

The committed maintenance activities are, as written by Stürzer (2007, pp.65-66), the work done to conserve and restore the original condition or functionality of the residential property.

The duty to implement safety precautions and to ensure property upkeep results from § 823 (1) Civil Code (BGB, 2009) (Damm 2005, pp. 4, 6). It is the owner's duty to eliminate threats posed by the residential property or counteract them to prevent injury to others (Blankenstein 2008, p. 736).

Monitoring obligations arising from the implementation of safety precautions and property upkeep can be fulfilled by certain activities. These monitoring obligations and activities are derived e. g. from laws, regulations, or from the general state of the art (Damm 2005, p. 4). Detailed descriptions can be found in Damm (2005).

The adaptation requirements arise, when the protection of the existing use is restricted or has been repealed. They include the duty to adapt the residential property to changed or new legal regulations.

The protection of the existing use secures the residential property owner's right to use and maintain its property, even if it does no longer reflect the current applicable building regulations (Frankenstein 2006, p. 1081). The protection of the existing use is derived from article 14 (1) of the German Constitution (Grundgesetz) (Harlfinger 2006, p. 25).

On one hand, the protection of the existing use is limited or omitted by carrying out activities that implement a significant change in stocks or change in use, according to the wording of the building law (Harlfinger 2006, pp. 25-26). In these cases, an adjustment is required to meet the current building regulations. Maintenance activities are in general covered by the protection of the existing use. Möschwitzer (2007, pp. 21-26) describes this in detail.

On the other hand, the protection of the existing use is limited by the planning law, the building law (fire and safety measures) and others (energy measures (EnEV)). This requires an adjustment to meet the current legal regulations (Harlfinger 2006, p. 26-27).

Strategies

The investment activities are considered technically necessary, if they meet the maintenance and adaptation requirements of the management. Cost reduction potentials have those investment activities that reach beyond the responsibilities of technical management. These are named technically unnecessary investments.

The requirements for the technical management can be assessed with reference to the causes of the activities (Table 3). The assessment of the causes leads to the following strategies:

- Respond to those causes that are associated with the duties of technical management: the duties will be secured with the response to the three material causes, the material/immaterial cause and the immaterial cause “changed and new laws, standards and codes of practice”.
- Do not respond to those causes that are not associated with the duties of the technical management: cost saving potential is evident in the response to the immaterial causes “user demands” and “user demands plus increase profitability, balance sheet aspects”.

Cost saving potential

The cost saving potential is calculated for the two in Table 1 defined investment packages *complete renovations* and *planned actions* by cause (Table 7). The *immediate measures* are not considered, because they only meet maintenance requirements.

Table 7: cost saving potential of the investment packages by causes (2003 to 2007)

cause	complete renovations		planned actions	
	cost (€)	(%)	cost (€)	(%)
maintaining functionality and usability	26,547.38	0.6	613,556.54	3.0
limited functionality and usability	1,643,592.38	35.4	7,391,453.84	36.0
component failure	64,958.07	1.4	108,434.81	0.5
limited functionality and usability + user demands	2,660,269.38	57.3	2,289,717.63	11.2
changed and new laws, standards and codes of practice	118,421.42	2.6	1,498,623.50	7.3
<i>user demands</i>	<i>54,830.10</i>	<i>1.2</i>	<i>449,013.95</i>	<i>2.2</i>
<i>user demands + increase profitability, balance sheet aspects</i>	<i>70,464.80</i>	<i>1.5</i>	<i>8,177,793.68</i>	<i>39.8</i>
total	4,639,083.53	100.0	20,528,593.94	100.0
Cost saving potential is in grey and italics				

The cost shares of the technically unnecessary investments are typical for the management of the *common areas* (Table 7). In the management of the *dwelling areas*, the costs of those investments are low. Thus the cost saving potential focuses on the *planned actions*. 42 % of these total costs can be saved from a technical perspective, whereas only 2.7 % of the total costs of the *complete renovations* belong to the technically unnecessary investments.

In the management of the *common areas* the cost saving potential differs depending on the management concept (Table 8).

The cost shares of the technically unnecessary investments are typical for the management concepts *renting* (37.7 %) and *privatisation* (42.9 %) (Table 8). The response to those investments shows a cost saving potential up to 7.66 €/m² of living space for *renting*. For *privatisation* the cost saving potential is up to 75.60 €/m² of living space.

Within the management concept *condominium*, no technically unnecessary investments occur. Here no cost-reducing opportunities exist.

Table 8: cost saving potential of the planned actions by management concept (2003 to 2007)

cause	renting		privatisation		condominium	
	costs €/m ² of living space (€)	(%)	costs €/m ² of living space (€)	(%)	costs €/m ² of living space (€)	(%)
maintaining functionality and usability	0.81 (93,404.78)	4.0	4.95 (506,532.84)	2.8	0.13 (13,618.92)	10.0
limited functionality and usability	7.59 (877,060.70)	37.4	62.57 (6,407,421.62)	35.5	1.04 (106,971.52)	78.8
component failure	0.45 (52,267.01)	2.2	0.40 (40,994.10)	0.2	0.15 (15,173.70)	11.2
limited functionality and usability + user demands	1.56 (180,000.90)	7.7	20.60 (2,109,716.73)	11.7	0.00	0.0
changed and new laws, standards and codes of practice	2.23 (257,885.93)	11.0	12.12 (1,240,737.57)	6.9	0.00	0.0
<i>user demands</i>	<i>0.15</i> <i>(17,039.39)</i>	<i>0.7</i>	<i>4.22</i> <i>(431,974.56)</i>	<i>2.4</i>	<i>0.00</i>	<i>0.0</i>
<i>user demands + increase profitability, balance sheet aspects</i>	<i>7.51</i> <i>(868,568.01)</i>	<i>37.0</i>	<i>71.38</i> <i>(7,309,225.66)</i>	<i>40.5</i>	<i>0.00</i>	<i>0.0</i>
total	20.29 (2,346,226.72)	100.0	176.23 (18,046,603.08)	100.0	1.33 (135,764.14)	100.0
Cost saving potential is in grey areas and in italics						

Minimum investment of the technical management

In the management of the *dwelling areas* only low cost saving potential is shown. The determined key cost values (Table 5) of the *complete renovations* are therefore equivalent to the minimum investment of the technical management.

In the management of *common areas*, the application of the strategic recommendations results in a significant cost reduction potential of 42 %. The minimum investment differs from the determined key cost values (Table 6).

The minimum investment is characterised by the values of the management concept *privatisation* (Figure 4). The target key cost value of the concept *privatisation* is 100.63 €/m² of living space. The target key cost value of the concept *renting* (12.63 €/m² of living space) is eight times lower than the value of the concept *privatisation*. The target key cost value of the concept *condominium* (1.33 €/m² of living space) is almost 10 times lower than the corresponding value of the concept *renting*.

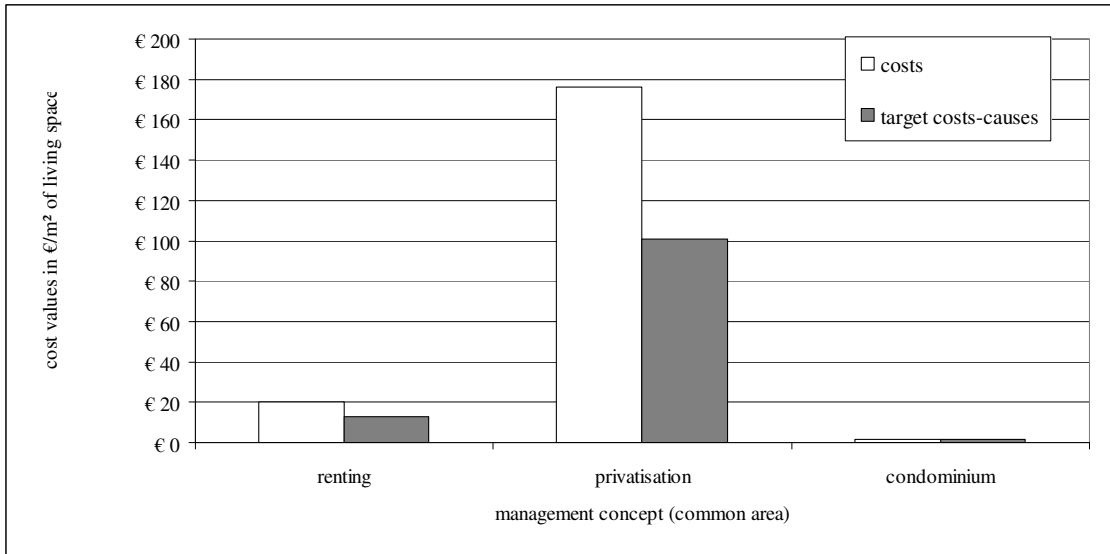


Figure 4: key and target key cost values of planned activities by management concept (2003 to 2007)

Minimum investment in comparison

The minimum investment (dwelling and common area) is higher than the representative member companies' average investment (Figure 5). The minimum investment is about 35 % higher than the average investment of the GdW member companies in West Germany. It is about 40 % above the average investment of the member companies of the VNW.

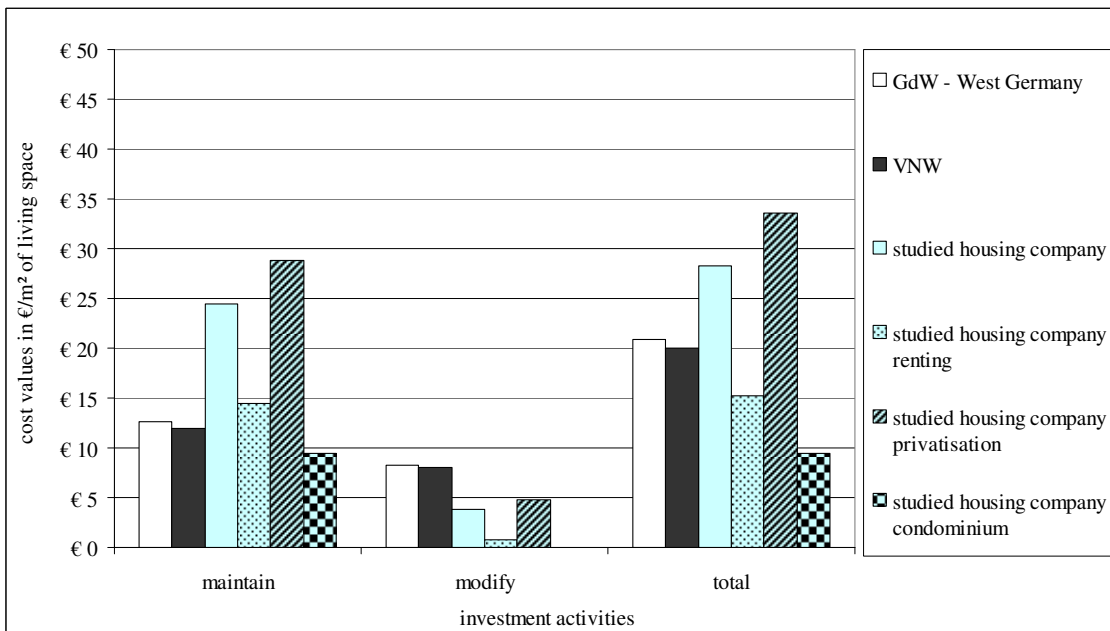


Figure 5: Comparison of the investments (target key cost values per year)

It might be supposed that the investment level of the representative companies could be too low for a long-term guaranteed housing stock quality. But Morgan Stanley mentions in Vesper et al. (2007, p. 62) 16 to 20 €/m² of living space as sufficient for this purpose. The comparative values are 20.87 €/m² of living space (member companies of GdW) and 20.00 €/m² of living space (member companies of VNW).

Instead, it can be assumed that the studied housing company's proactive role, particularly in the context of *privatisation*, causes a considerably higher investment level. The technically necessary investment is performed more extensively as needed in order to avoid further investments. Therefore, the minimum investment in *privatisation* is 1.6 times higher than the investment of the GdW member companies on average.

The minimum investment of the concepts *renting* and *condominium* is lower than the average investment by the compared housing company members. Compared with the data from Morgan Stanley in Vesper et al. (2007, p. 62) the investment in *renting* (15.22 €/m² of living space) is sufficiently high to ensure to keep the stock in a good quality. Even so, the investment in the concept *condominium* (9.46 €/m² of living space) is classified as adequate at the transition to an intensive phase of *privatisation*.

CONCLUSION – CONCEPT FOR THE RATIONAL SELECTION OF ACTIVITIES

To identify potential cost reductions by thorough analysis of the cost distribution is an important opportunity to derive a concept for the rational selection of the investment activities on housing stock. The analysis is able to answer the question, which investment activities have to be carried out and which not.

The derived concept refers to the investment activities classified as belonging to the *planned actions* (Table 1), whereas investment activities classified as belonging to the *immediate measures* and *complete renovations* are generally recommended to be carried out. They are realized in the context of the ordinary duties of the technical management.

The *planned actions* can be categorized into technically necessary and technically unnecessary investments. For the assessment of the recorded *planned actions* the causes and the resulting strategies can be used.

The technically necessary investments are generally recommended to be carried out. A temporary interruption of the technically unnecessary investments is possible without the risk of considerably damaging the stock values. But the general omission of the technically unnecessary investments is deemed critical for long-term user-oriented operation.

With the technically necessary investments all security and functional requirements are met, whereas the technically unnecessary investments customize the housing stock. They fulfil personal, social, aesthetic and efficiency demands (Preiser 1983).

To avoid possible vacancy, additional technically unnecessary investments might be appropriate to be carried out. Therefore, it is proposed that these unnecessary investments are evaluated by using a multi-criteria decision making model (AHP and cost-effectiveness analysis). With the help of the model, then the investment activities with the best cost-benefit ratios are candidates for implementation according to the available overall budget of the company.

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