

Tenant participation in sustainable renovation projects: using AHP and case studies

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Abstract

By law it is stated that in most cases 70% of the tenants have to participate before the renovation plans can be executed in the Netherlands. For housing associations this participation level can be a problem with the consequence that sustainable renovation projects are postponed or stopped. In order to realize the best policy, this research investigated the content of the project plans and their influence on the tenant participation. To obtain data a survey was distributed to project managers including five case studies. The most important factor is the level of rent increase, even though the aim of the sustainable renovation project is to lower the energy costs and thus lower the integral housing costs for the tenant. This research ends with a checklist with tips for project managers to give substance to the sustainable renovation plans.

Keywords: tenant participation, sustainable transformation, AHP, case study

1. Introduction

1.1 Energy labels and large housing portfolio's in the Netherlands

As a response to worldwide environmental issues, a new subject has become increasingly important for the built environment: energy (Sunikka, 2006; Tambach et al., 2010). Within the European Union the energy use by the built environment is over 40% of the total energy consumption and 30% of the total CO₂ emission (EnergyCouncil, 2002). In 2008, the Dutch government responded to the energy topic and the Energy Performance on Buildings Directive – EPBD (Dalen et al., 2007) by making it obligatory for Dutch dwelling owners to have an energy label for their dwelling. An energy label shows the energy performance of the dwelling and can only be determined by an authorized certified advisor. The label of a dwelling can vary from A: 44 points and thus highly energy efficient to G: 0 points and thus not energy efficient. The points are based on several characteristics of the dwelling that influence the energy efficiency. For example the size, window surface, materials and installations. An energy label is made obligatory to stimulate energy reducing measures for all house owners that also include the Dutch housing associations, huge social housing portfolio owners. For these housing associations, an additional covenant was created by the Ministry of Spatial Planning and Environment in collaboration with the housing association sector. This covenant includes agreements on goals on energy saving improvements (Ministry of Internal Affairs, 2012). Within this covenant it is suggested that an average energy label B for the stock of a housing associations is the target in 2020. These ambitions are high and ask for solutions for the whole building stock of housing associations.

1.2 Sustainable renovation projects and tenants participation

To increase the energy performance of their dwellings, housing associations perform sustainable renovation projects. In this study sustainable renovation is defined as a renovation to transform an existing building to fulfill the requirements on the field of the energetic performance and the health and comfort of its users while achieving economic viability. With sustainable renovation, housing associations are able to increase the energy performance of their dwellings. When a housing association wants to perform a renovation, it is stated by law that 70% of the tenants which have to deal with the renovation on which the project has an effect on the service costs and/or the rent have to give their permission (Hoppe et.al, 2008). According to a research performed by Atrienis (2012) the implementation of sustainable policies faces problems, with the result that the covenant goals are not reached. Even when the association has implemented an energy policy, they are not always convinced about meeting the goals. Several barriers were investigated and one of the main problems is that non-commitment of tenants and the intensive process to convince the tenants leads to delay or a stop of the

sustainable renovation project. This research focuses on factors that influence this participation with the aim to improve the project plans of sustainable renovation projects in such a way that tenants are more willing to participate.

For housing association it is of importance to get more insight in how they can give content to their project plans and encourage their tenants to participate. Herewith, the projects can be designed in a more efficient way. Because the effort to convince tenants afterwards will be less and more dwellings can be renovated at once. This will also lead to a higher satisfaction of the tenants, because a smoother execution of the sustainable renovation projects is also in their benefit.

Although tenant participation is elaborated in several studies (Arnstein, 1969; Borst et al., 2006; Dijkstra and Brower, 2010; Groot et al., 2008), little attention has been provided from the viewpoint of project managers. Besides that their experience is of great importance, they are also the key players in the decision making process of the sustainable renovation projects. It is the responsibility of the housing association to convince enough tenants, so it is relevant to seek for manager's role and their means to give content to the renovation plans.

1.3 Evaluating project criteria

Assuming that the responsibility of convincing the tenants to participate in the sustainable renovation project lies with the housing association, this study had the aim to improve the participation of tenants in these sustainable renovation projects. Therefore, the influential factors on tenant participation are reviewed by literature study. Further, the effect of the project plan on the tenant participation will be researched using the Analytic Hierarchy Process (AHP) and comparison with the case study results.

2. Analytic Hierarchy Process (AHP) and tenant participation

The analytic hierarchy process (AHP), developed by Saaty (1980), is a popular decision support tool because of its robustness, simplicity, and potential of being utilized for a group decision-making process that involves multiple actors, scenarios, and decision elements (criteria, sub criteria and alternatives). The AHP requires a well-structured problem represented as a hierarchy with the goal at the top. The subsequent levels contain criteria and sub criteria, while alternatives lie at the bottom of the hierarchy. The AHP determines the relative importance of set of (sub) criteria by employing pair-wise comparisons of the hierarchy elements at all levels following the rule that a given hierarchy level, elements are compared with respect to the element in the higher level by using a fundamental importance scale (Saaty, 1980). At the end, a ranking of the alternatives is made by multiplying the criteria specific idealized or normalized weight of the alternatives with the corresponding relative importance of the criteria and summing up the results to obtain the final composition of the alternatives' priorities with respect to the goal. The highest value of the normalized weight indicates the best ranked alternative (Srdjevic et al., 2013).

In this research, the analytic hierarchy process will be combined with case study. Five case studies represent the alternatives in the hierarchy model. Elaboration of these case studies, the weights of the criteria and sub criteria with respect to these cases and the idealization of the weights will therefore be described.

2.1 Hierarchy of key criteria for tenant participation in reconstruction projects

The table below (Table 1) represents the most important project decisions which have an influence on the tenant participation, consisting of four main criteria derived from literature survey (Guerra Santin et al., 2009; Otter, 2009; Quirijns, 2011; Schalkwijk, 2009; Spank, 2013; Straub and Vijverberg, 2002; Werf, 2011). A positive influence means that a 'high' score on this criterion has a participation increasing influence. A negative influence means that a 'high' score on this criterion decreases the participation rate.

Table 1. Description of criteria

Criteria	Description	Influence
<i>C1 Dwelling renovation</i>		
C1.1 lay-out improvement	The reconfiguration of the floor plan and/or expansion of living space	Positive
C1.2 improvement facility spaces	The possibility to renovate the kitchen and/or bathroom and/or toilet	Positive
C1.3 improvement energy performance	The improvement of the energy performance of the dwelling expressed in the energy index	Positive
<i>C2 Financial aspects</i>		
C2.1 level of tenant compensation	The number of Euros a tenants gets as compensation for the nuisance/participation	Positive
C2.2 level of energy costs saving	The number of Euros the energy bill of the tenant is expected to decrease	Positive
C2.3 level of rent increase	The number of Euros the rent increases after the project is applied	Negative
<i>C3 Tenant approach</i>		
C3.1 frequency of communication	The number of communication moments	Positive
C3.2 type of communication	The type of the communication in which the impact of the type is determined by the experts.	Positive
C3.3 level of tenants say	The extent to which tenant have a say in the project	Positive
<i>C4 Nuisance</i>		
C4.1 duration	The number of days the project takes per house	Negative
C4.2 decrease living convenience	The decrease of possibilities to wash and/or cook and/or sleep, up to temporarily moving	Negative
C4.3 preparatory activities	The activities the tenant has to do before the renovation. For example moving furniture	Negative

2.2 Procedure for selecting the best policy for renovation project

The AHP method is applied in different disciplines (Adamcsek, 2008), in construction projects for example to find the best value-bid for a tender (e.g. Marzouk et. al, 2003; Lin et. al, 2008), to assess risks and uncertainties of real estate and construction projects (Chen and Khumpaisal 2009; Zayed et. al, 2008) or to determine the best project contracting approach (Khalil, 2002). The AHP is used in urban redevelopment studies as well (Chang et al. 2009; Wey and Wu 2008). In this research, the hierarchy is structured with respect to the overarching goal: choose the best policy for successful tenant participation. Therefore, this study looked at project aspects that have influence only on the tenant participation.

The AHP method will be applied to determine the project managers' perspective on tenant participation and the results will be compared to case study. This could provide a better insight in the decision making process of project managers and validity of their decisions. The overview of the procedural steps is shown below (Table 2).

Table 2. Application of AHP in steps

Procedural step	Description
Hierarchy design	Structuring the overarching goal into criteria and sub-criteria.
Pair-wise comparison	Estimate the most important criteria according to the respondent.
Alternative weighting	Weight the cases with respect to the criteria.
Alternative/case ranking	Calculate the score of each alternative - case. These scores form a mutual comparison between the performances of the cases according to the respondents. These performances can be compared to the real performances of the cases.
Comparison	Rank the cases and compare this ranking with the case study ranking.

2.2 Participant Characteristics

To get data on the relative importance of the criteria with respect to the tenant participation, a survey was conducted among a focus group of project managers of sustainable renovation projects.

Besides their preferences on various criteria (Table 1), the respondents were asked to provide their years of experience. The experience of the respondents with sustainable renovation lay between the 2 and 15 year making it an average of 6.08 year of experience. The respondents were divided into two groups, project managers with 2 to 5 year experience (none of the respondents had less than 2 year experience) and project managers with more than 5 years of experience. The division is made on 5 year experience because half of the respondent has more and half has less experience. A respondent consistency ratio of 0.15 (15%) is maintained. The group consisting of project managers with 2 – 5 year experience consisted of 11 respondents and had a group consistency of 0.095 (9.5%). The group consisting of project managers with more than 5 year experience consisted of 12 respondents and had a group consistency of 0.082 (8.2%).

Additionally, based on their email addresses it was possible to link the respondents to a certain housing association, more precise the size of the housing association. The division was made between respondents related to housing associations with more than and less than 10.000 housing units. A respondent consistency ratio of 0.15 (15%) was maintained. The group of project managers from housing associations with less than 10.00 housing units consists of 10 respondents with a group consistency of 0.093 (9.3%). The other group coming from housing associations with more than 10.000 housing units consists of 7 respondents with a group consistency of 0.080 (8.0 %). There was no information for the rest of respondents.

However, no significant deviation of these two groups' preferences was identified. Therefore, no special attention is provided on assumed division in further text.

2.3 Questionnaire design

During the pair-wise comparison, every criterion is compared to the other criteria of the same level with respect to the element in the higher level by using the importance scale. For this research this means that there are 5 groups of (sub) criteria (Table 1) which are compared with each other. The first are the criteria with respect to the goal, and the other four are the sub criteria with respect to the criteria. A shown example, the respondent could fill in their answers for pair-wise comparison (Figure 1).

3. Results

3.1 Survey response rate

A list of 125 experts was composed with the appropriate task description within Dutch housing associations. The survey was post on-line and designed with *Berg Enquête System © 2007*. In the period from June 19th up till July 3th 36 respondents filled in the survey. This means that a respondent rate of 29% was gained.

The data has to satisfy two conditions. The consistency ratio has to be below 0.10 (10%) for the criteria matrices and below 0.15 (15%) for overall respondent matrices. This led to the exclusions of 14 respondents (39%) and 45 inconsistent matrices from consistent respondents.

3.2 Relative weights and importance of criteria

The relative importance of every criterion was calculated on the basis of the procedural steps (Table 2). Below the relative importance of the (sub) criteria is shown (Figure 2).

Bewonersparticipatie bij duurzame renovatieprojecten

Bewonersbenadering

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Vergelijk de invloed van de variabelen ten opzichte van de bewonersbenadering, welke variabele is volgens u meer van belang?

	heel veel meer invloed	veel meer invloed	meer invloed	iets meer invloed	even veel invloed	iets meer invloed	meer invloed	veel meer invloed	heel veel meer invloed	
Aantal communicatiemomenten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Type communicatiemomenten
Aantal communicatiemomenten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hoeveelheid invloed
Type communicatiemomenten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Hoeveelheid invloed

vorige

volgende

Bewonersbenadering

- *het aantal communicatiemomenten*: het aantal momenten waarop georganiseerde communicatie is tussen de bewoner en de corporatie over de renovatieplannen.

- *het type communicatiemomenten*: de vorm van de momenten van communicatie, bijvoorbeeld via een enquête over de woonwensen, op een bewonersavond of via een modelwoning.

- *de hoeveelheid inspraak die bewoners hebben*: het inspraakniveau, bijvoorbeeld 'de bewoners hebben geen inspraak', 'de bewoners mogen meedenken via een bewonerscommissie', 'de bewoners mogen gedeeltelijk meebeslissen'.

Figure 1. Pair-wise comparison in questionnaire

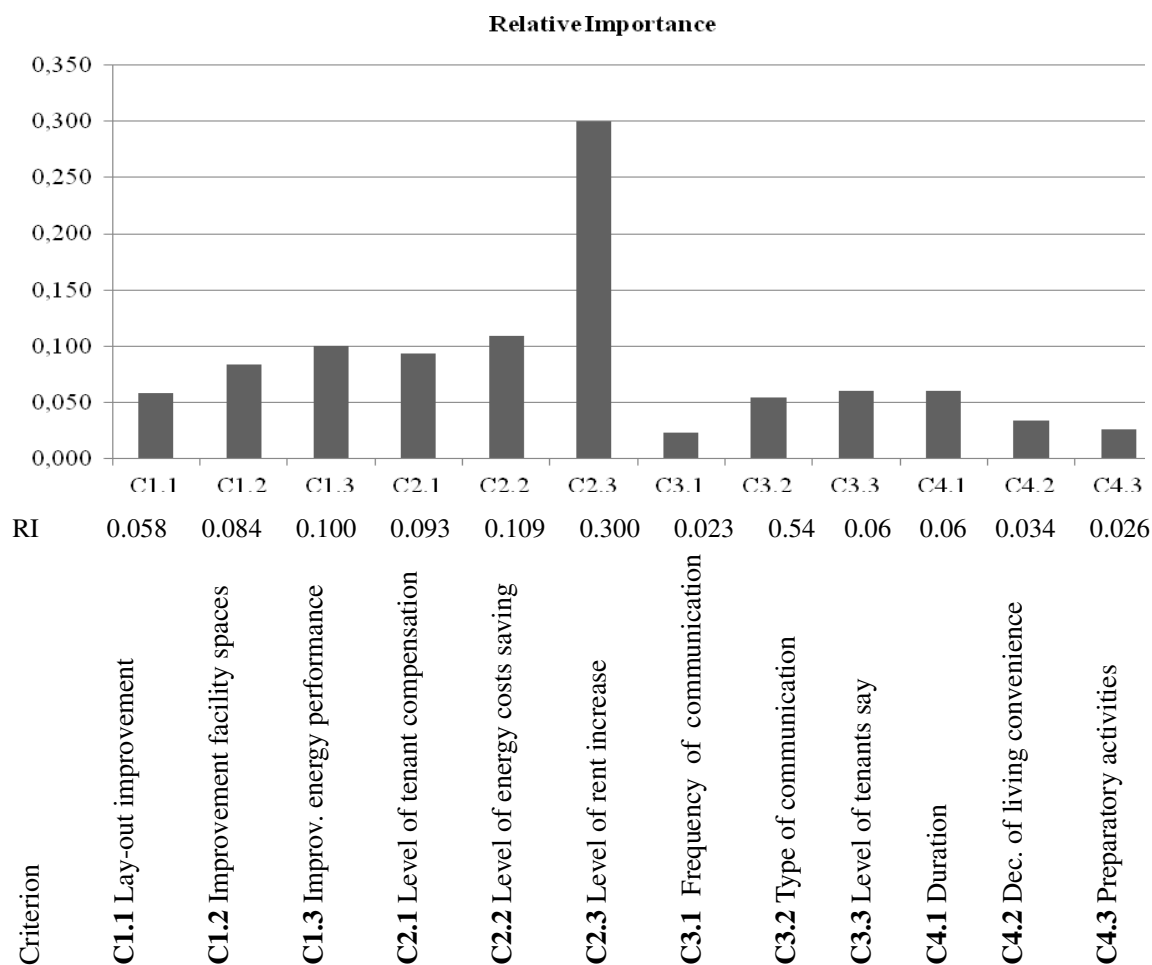


Figure 2. Relative importance of criteria

C2.3 (level of rent increase) is by far seen as the criterion with the biggest influence on the tenant participation

according to the project managers. In this figure, the division of the importance between the main criteria is still visible. Generally, C1 (dwelling renovation) and C2 (financial aspects) are seen to be more important than C3 (tenant approach) and C4 (nuisance).

3.3 Comparison of AHP and recorded tenant's participation

To derive the ranking of cases, the weights have to be distributed through all hierarchy (Table 3).

Table 3. Scores per criterion

Criteria	Case 1	Case 2	Case 3	Case 4	Case 5
<i>C1 Dwelling renovation</i>					
C1.1 lay-out improvement	0.0000	0.0000	0.0580	0.0000	0.0000
C1.2 improvement facility spaces	0.0000	0.0000	0.0837	0.0000	0.0000
C1.3 improvement energy performance	0.0329	0.0998	0.0998	0.0669	0.0998
<i>C2 Financial aspects</i>					
C2.1 level of tenant compensation	0.0000	0.0243	0.0935	0.0000	0.0000
C2.2 level of energy costs saving	0.0207	0.0458	0.0458	0.1088	0.0367
C2.3 level of rent increase	0.2749	0.2396	0.0000	0.1911	0.2479
<i>C3 Tenant approach</i>					
C3.1 frequency of communication	0.0232	0.0186	0.0186	0.0232	0.0186
C3.2 type of communication	0.0432	0.0486	0.0486	0.0378	0.0216
C3.3 level of tenants say	0.0540	0.0300	0.0300	0.0480	0.0060
<i>C4 Nuisance</i>					
C4.1 duration	0.0559	0.0302	0.0000	0.0544	0.0529
C4.2 decrease living convenience	0.0134	0.0101	0.0034	0.0101	0.0134
C4.3 preparatory activities	0.0128	0.0077	0.0000	0.0051	0.0128
TOTAL	0.5310	0.5546	0.4813	0.5454	0.5097
Normalized TOTAL	0.2025	0.2115	0.1836	0.2080	0.1943
Rank by project managers' weights	3	1	5	2	4
Tenant participation	92 %	100 %	100 %	83 %	23%
Rank by tenant participation	3	1	2	4	5

Table 3 shows a rank of case 2 as the best, then case 4, case 1, case 5 and case 3. However, scores over all five cases are between 0.48 and 0.55, the scores are close to each other. When the calculated rank and the real rank are compared, it shows that the ranking is not the same.

Although the cases were quite diverse, the scores of the cases are close to each other. One explanation for this could be that different criteria balance each other out. For example, when the sustainable renovation project has a big increase of the dwelling improvements, which means that the quality of the dwelling will be greatly improved, this causes a long duration or an increase of other nuisance aspects. This situation was shown in case 3. The opposite was shown in case 1. This case has the least nuisance for the tenants; also the rent increase was the lowest. However, opposite was that case 1 had the lowest dwelling improvement of all cases.

Another aspect which should be mentioned is that although the rent increase is states as being the most important

criterion, people are willing to pay for a sustainable renovation. This was shown in all the cases. In the cases the rent increase was between €7.60 and €92.50, but all the project plans lead eventually to a sufficient participation rate.

Case 5 shows that a case with low tenant participation (23%) can have a score which is quite average compared to the other cases with a high tenant participation. Another exception is case 3, which has the lowest score but a real tenant participation rate of 100%. This difference can be explained by external circumstances. As mentioned, the tenants in case 3 were in favor of the sustainable renovation project. In case 5 the opposite was shown, a group of refusing tenants influenced the other tenants to non-participation.

The calculated scores of the cases are close to each other but the rank is not the same as the rank of the calculated scores. Because the scores are so close to each other, it is of interest to know the sensitivity of the cases on the weights of the criteria.

The final scores of the alternatives are dependent on the relative importance of the criteria and sub criteria. Changes in the relative importance of the criteria can therefore cause changes on the final ranking (Chang et.al, 2007). Since the relative importance of the criteria is based on the opinion of the project managers, which are subjective judgments, it is of interest to test the stability of the ranking under varying relative importance. For this purpose, sensitivity analysis is performed. Through increasing or decreasing the relative importance of the individual criteria, the resulting changes of the scores and the ranking of the alternatives can be observed. Sensitivity analysis therefore provides information on the stability of the ranking. If the ranking is highly sensitive to small changes in the relative importance, a careful review of the weights is recommended (Chang et.al, 2007). For this purpose, the relative importance of the main criteria and the most important sub criteria (C2.3 level of rent increase) are separately increased and decreased with 30% (note that the relative importance of the other criteria change accordingly, because the sum of the relative importance should be 1). In table below (Table 4) the outcomes of the sensitivity analysis is shown. When the number of the ranking is bold, italic and underlined, the rank differs from the base ranking.

Table 4. Sensitivity analysis

Adaptation	Case1	Case2	Case3	Case4	Case5	Case 1	Case 2	Case 3	Case 4	Case 5
						3	1	5	2	4
C1 -30%	0,566	0,567	0,436	0,569	0,518	<u>3</u>	<u>2</u>	<u>5</u>	<u>1</u>	<u>4</u>
C1 +30%	0,515	0,544	0,499	0,532	0,500	3	1	5	2	4
C2 -30%	0,519	0,542	0,522	0,535	0,498	<u>4</u>	<u>1</u>	<u>3</u>	<u>2</u>	<u>5</u>
C2 +30%	0,539	0,564	0,452	0,553	0,518	3	1	5	2	4
C3 -30%	0,515	0,547	0,471	0,534	0,518	<u>4</u>	<u>1</u>	<u>5</u>	<u>2</u>	<u>3</u>
C3 +30%	0,546	0,561	0,491	0,556	0,502	3	1	5	2	4
C4 -30%	0,525	0,561	0,500	0,544	0,503	3	1	5	2	4
C4 +30%	0,537	0,549	0,464	0,547	0,515	3	1	5	2	4
C2.3 -30%	0,488	0,528	0,535	0,535	0,474	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>5</u>
C2.3 +30%	0,566	0,577	0,438	0,554	0,538	<u>2</u>	<u>1</u>	<u>5</u>	<u>3</u>	<u>4</u>

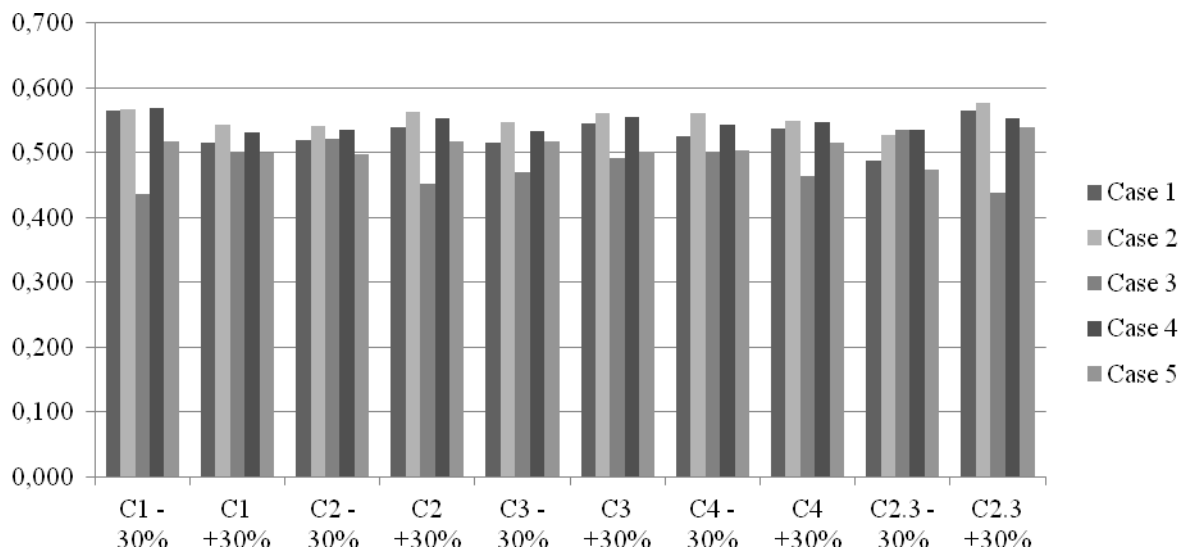


Figure 3. Sensitivity analysis

As shown in Table 4 and Figure 3, five out of ten analyses change the rank. This means that the rank of the cases is very dependent on the relative importance of the criteria. The sensitivity of the cases is very high.

4. Implementation and Discussion

This study on the influential factors on tenant participation related to the content of sustainable renovation project was based on literature study, valuation of project managers, and five case studies with their measured tenant participation. Based on this study, several recommendations can be formulated aiming at improved project plans to persuade tenants to participate in a more effective way.

The first recommendation is based on the conclusion that a project plan should focus on the tenants' needs. This means that tenants have to understand, want, and be able to deal with the sustainable renovation, in order to participate. This is shown in figure below (Figure 4). The integrated living costs can be achieved and measured with 3 main factors: savings by the tenant, energy costs and rent increase.

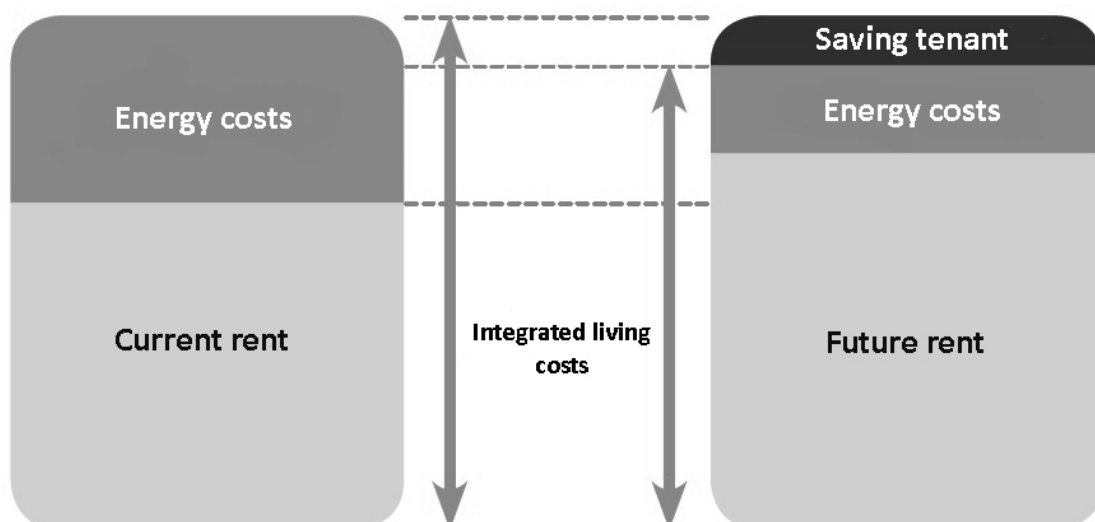


Figure 4. Integrated living costs

Every aspect of the project plan should follow the path of the arrows. Hereby, especially the financial factors should be taken into account. For a tenant, the total picture of the plan should fit also. The benefits should be in balance with the nuisance. Tenants are willing to pay for rent increase when on the other hand the benefits like a

decrease of energy costs and increase of living comfort are present. When the housing association had plans for a building complex of which the tenants do not think they are immediately necessary, it is important to try to convince the tenant that it is important. The following policy notes could be adopted to successfully achieve required tenants' participation:

1. Understand - Keep a clear structure of the information leaflets and letters
 - Do not use pretentious language
 - Create a low threshold for questions or comments from the tenant about the project
2. Want - Argue from the problem of the tenant and show them the need for the improvement
 - Give the tenants the feeling they have a say
 - Be honest about the financial consequences and keep the financial risk for the tenant low
 - Invest in a good relationship between the tenant and the housing association
 - Show the improvements in a model dwelling
3. Be able to - Match the financial risk with the financial circumstances of the tenant
 - Adapt the help to the tenants' characteristics and limit the nuisance
 - Work in one dwelling as short as possible
 - Guarantee the safety of the tenant and their property

In addition, a procedure aiming at the implementation of the needs of the tenant helps improving the project plan. This is helpful because the project plan definitely has influence on the decision of the tenant to participate or not. When a housing association wants to perform a sustainable renovation project and they need the participation of tenants, they have to keep in mind that it is their responsibility to convince the tenants. By the following checklist based on the findings of this research, project managers are helped to improve their project plan with the aim to get enough tenant participation in an efficient way:

1. Before intern
 - What do you know about the tenants and their needs?
 - Make an inventory within the organization, what is the history of and experience with the building complex and their tenants?
 - Are limitations due to the tenant type, age, financial situation, young children, etc.?
 - To what extent do you want to involve the tenants? Is there already a residents committee?
2. Before extern
 - Make an inventory via a survey to the tenant about the needs and complaints of the tenants
 - Is there a collective opinion among the tenants?
 - To what extent do the tenants want to be involved?
3. During the design
 - Does the project plan match with the needs of the tenant?
 - What are the main subjects to communicate?
 - What are you going to do in the building complex, how long does this take?
 - What is the reason to do this renovation?
 - Why should tenants participate?
 - What is the result if they participate in terms of finance, living comfort and nuisance?
 - Does the description fit on one paper?
 - Look again at the financial part
 - Is it clear that the tenant benefits from the renovation?
 - Is it understandable?
 - Is the rent increase adapted to the energy use of the household? Should it be?

- Include a telephone number for questions
4. During the execution
- Use a focus group for (at least) consultation
 - Check if the tenants understand what is going on and what is expected of them
 - Be accessible for questions and comments
 - Be service oriented and help tenants when necessary
 - Ask afterwards if the tenants are satisfied

After this study is performed, it is important to keep in mind possible pitfalls in the research. The first discussion point is the use of AHP in this research. AHP is originally a method to identify the best choice within a group of alternatives, based on the preferences of the stakeholders. In this research the AHP method is used in an alternative way. First by asking the project managers about how they estimate the opinion of another group of persons, the tenants, and second by not searching for the best alternative but using the information to assess cases. Although it is an original approach, it is possible that some other method could perform better.

The next discussion point is the differences in the opinion of the project managers. Because of this large diversity, the question rises how random the answers are. The fact that project managers have such different opinions based on their experience questions the quality of the combined outcomes.

The last discussion point is the relation of the influence between the criteria and the tenant participation. In the research this relation is stated as unilateral (positive or negative) and linear. It is discussable to what extent this is correct. For example the level of rent increases. It is thinkable that for a tenant the difference between € 10,- and € 20,- influences their decision in another way than a difference between € 40,- and € 50,- .

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