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Complex model of evaluation of long-term housing financing instruments

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ABSTRACT

The aim of this research is to develop a complex model for evaluating the benefits of long-term housing financing instruments and to determine the indications of appropriate instruments for Latvia.
Research methodology: Analytic hierarchy process method, Delphi method, document analysis method, statistical methods.
The findings of the research show that it is important to develop existing long-term housing financing instruments and create new instruments in Latvia to attract investment to the housing sector and improve the housing situation in Latvia. The authorities responsible for housing policy in Latvia should conduct detailed research on possibilities for the implementation of new long-term housing financing instruments, especially in the form of green bonds and energy efficiency investment funds.
The novelty of the research comprises the complex model developed to determine appropriate long-term housing financing instruments for Latvia.
Keywords: long-term housing financing instruments, benefits, instrument evaluation, complex model, Latvia.

INTRODUCTION

The housing sector's specifics require large investments and a long payback period. The housing situation in Latvia in general is characterized by the poor technical condition of apartment houses and small new constructions. Long-term housing financing instruments play a very important role for housing policy issues, helping to attract investments and improve the housing sector. The subject of the paper is the benefits of long-term housing financial instruments. The aim of the research is to develop a complex model for evaluating the benefits of long-term housing financial instruments and to determine the indications of appropriate instruments for Latvia. To achieve this goal, the authors put forward the following main tasks: 1) to develop a theoretical model for evaluating long-term housing financing instruments through the analytic hierarchy process method; 2) to develop a complex model for evaluating long-term financing instruments for housing in complicated decision-making; 3) to evaluate the benefits of long-term financing instruments for housing in Latvia using the complex model; 4) to evaluate the public administration costs of long-term financing instruments for housing in Latvia.

The research paper is structured in three parts. In the first part the authors characterize and analyze the main aspects of decision-making methods, especially the analytic hierarchy process method, and develop the theoretical model for evaluating long-term housing financing instruments according to the analytic hierarchy process method. In the second part the authors analyze the results of evaluating the benefits of long-term financing instruments for housing in Latvia using a complex model. In the third part the authors analyze the results of public administration costs of long-term financing instruments for housing in Latvia.

In conclusion we make proposals for the government, municipalities and banks for developing existing long-term housing financial instruments and preparing and implementing new ones.

In our research paper we apply the analytic hierarchy process method, the Delphi method, the document analysis method, and statistical methods.

THEORETICAL MODEL FOR EVALUATING LONG-TERM HOUSING FINANCING INSTRUMENTS

In any decision-making process different methods are applied in the assessment of benefits and costs. While their number is enormous and options for their application are broad, researchers highlight the decision-making methods that are considered the most widely used and popular.

In analyzing the decision-making process in public administration, *Starling G*. (1999) examines several analytical decision-making methods (theories), highlighting the following as the main ones: *multi-criteria decision-making analysis (hereinafter – MCDM theory), cost-benefit analysis (hereinafter – CBA*

method), *cost effectiveness analysis (hereinafter – CEA method).*

MCDM theory can be applied to the assessment of costs and benefits in the process of developing and implementing state policy. In many aspects, this theory is similar to the *CBA method* and the *CEA method,* but it uses various efficiency indicators/criteria (both qualitative and quantitative) in different measurement units, which are standardized through conversion into indicators and summarization using the *weighting* procedure, as the researchers *Pearce, Atkinson, Mourato* highlight in their research (2006). In MCDM theory, as in the *CBA method* and the *CEA method*, one of the indicators is the costs of the policy.

The following are the main steps in the application of *MCDM theory*:

1. the project objectives to be met must be expressed in measurable components or criteria evidencing that the objective has been achieved;
2. each component must be weighted according to its importance. The total weight should be 1;
3. the correspondence of each project or alternative to a particular criterion on a given scale should be assessed;
4. the total weight should be calculated and alternatives should be compared.

Taking into account that in complicated decision-making processes, different criteria should be considered, including those that may conflict with each other, MCDM is considered to be an appropriate method for assessing the benefits in a variety of areas such as investment analysis, production planning, and finances (Valsts kanceleja, 2005).

Kendall (1988) and other authors consider that *MCDM* is the instrument for identifying the best alternative and that it helps in exploring how decision-makers justify their decisions and opinions, thus allowing one to synthesize opinions and establish priorities and performance indicators.

MCDM theory considers the expediency of the alternative from various aspects, giving its own weight to each of them. The method is useful, for example, for identifying policy priorities in any field, but it can also be used as an addition to the cost-benefit analysis if the decision-makers also need to consider factors that cannot be assessed by the *CBA method* or the *CEA method*, such as social justice when introducing tariff changes for a particular service (Valsts kanceleja, 2005).

Stremikiene, PlikSniene (2007) highlight the role of *MCDM theory* in making complicated decisions when a variety of criteria is used. This theory is a good instrument for clarifying the best alternative and explores how decision-makers justify their decisions and opinions.

The authors agree with *Hobbs and Meier (2000)* that *MCDM theory* is not an instrument that can ensure the right solution in decision-making; rather, it is a way for decision-makers to use the information available to them, to think about possible consequences, to evaluate their desires and minimize the potential negative consequences after making a decision.

The most creative task in the decision-making process is to choose the factors that are most important to the decision, as *Saaty* (1990) emphasizes. In multi-criteria analysis in the decision-making process, all factors influencing the decision are hierarchically structured.

Guhnemann, Laird and Pearman (2012) emphasize that one of the most important advantages of *MCDM theory* is the ability to combine criteria/factors that

simply cannot be expressed in monetary terms or criteria that cannot be quantified, such as environmental benefits. The option to add various criteria during the analysis process was also highlighted by researchers such as *Macharis and Bernardini* (2015) and *Barford, Salling and Leleur* (2015). According to *Beria, Maltese and Mariotti* (2012), the most important disadvantages of *MCDM theory* are the subjectivity of the results and the double accounting effect.

In making complicated decisions, many other theories are used, such as *multiple objective decision-making, multi-attribute value theory,* etc.

Multiple objective decision-making provides for an analysis of decisions with several objectives that are often mutually contradictory and entail different criteria that can affect each other and the objectives to be achieved in different ways *(Gal, 1980).*

Multi-attribute value theory can be used to solve problems related to policy with limited and discrete alternatives that needs to be evaluated based on conflicting objectives. For any given purpose, one or more different attributes or criteria are used to evaluate the performance in relation to it. The impact of all alternative options on the attributes is explained in the so-called assessment table. Attributes are usually measured on different measurement scales *(Sharifi and Herwijnen, 2002)*. This theory is similar to *MCDM theory*; however, the main difference is that decision-makers assign numerical values to reflect the relative importance of each criterion (for example, assigning 100 points of importance to different criteria using a cardinal scale). It should be noted that the correction factors reflect differences among alternatives for each criterion *(Mustajoki and Hamalainen, 2000).*

The *analytic hierarchy process method* (hereinafter – *AHP method)* was developed by *Saaty* from 1970-1975 and has been improved several times since. The aim is to solve problems in complicated multi-criteria decisions *(Saaty, 1987).* It is a group decision-making method based on mathematical and psychological science and it is widely used in practice throughout the world in decision-making processes in government, business, healthcare, shipbuilding and education (Saaty, 2008; *Saracoglu*, 2013). *Krupesh, Chauhan, Shah and Venkata (2008) and Schniederjans, Marc* emphasize the importance of using the method in housing sector projects to identify the best alternative.

Saaty (2008) defines the *AHP method* as the *theory of measurement* made through *pairwise comparison* elements*,* based on expert assessments on priority scales. The comparison should be made using an absolute measurement scale, which shows the extent to which one element dominates the other with respect to the given feature using the nine-point assessment system. *Saaty* (1999), in one of his studies, emphasizes that the decision-maker must determine the importance of each criterion and then the benefits to each alternative by assessing them according to the relevant criterion. The advantage of this method is the ranking of the alternatives based on an assessment of all choices made by the decision-maker. This method allows the decision-maker to disclose his or her personal choice and subjective decision on various aspects of the multi-criteria decision. The advantage of the method is that it can be used in situations where the individual decision-maker has to adopt unique, subjective judgments, which are an important part of the decision-making process. *Bhushan and Kanwai* (2004) point out the importance of using the *AHP method* in team decision-making processes, emphasizing that the method plays an important role in making very

complicated decisions that require the opinion of many individuals and that the decision taken will have long-term consequences for a particular industry, sector, etc.

Saaty divides the procedure of *AHP method* application into several stages *(Saaty, 2009; Saaty, 1992; Saaty, 2010; Saaty, 1999)* and the essence of the method is shown in the form of a diagram in Figure 1:

1. Problem modelling in the form of a hierarchy, containing the objective of a decision, possible alternatives for achieving the objective and criteria for assessing alternatives. The hierarchy is a stratified system of ranking and organizing things, ideas, etc., in which each element of the system, with the exception of the top one, is subjected to one or another element. The hierarchy conception can be reflected in an easily perceivable way, described mathematically, and it consists of the main objective, the alternative for achieving the group's objective, and a group of criteria relating to alternatives for achieving the objective. Criteria can be further divided into sub-criteria and in an even more detailed manner as needed for resolving the issue. Development of the hierarchy for each *AHP method* depends not only on the nature of the problem addressed, but also on knowledge, assessment, opinion, values, capabilities and the needs of participants involved in the decision-making process.

2. Defining priorities through hierarchical elements by performing a series of assessments based on pair comparison. This is a very important task for the decision-maker, since it directly affects the outcome of the final decision. Priorities are characterized by values for each node of the hierarchy and they show the relative weight for the node for each group. For example, in Figure 1, it can be seen that the weight for criterion 5 is twice as big at the assessment of alternatives than for criterion 1. In accordance with the definition, the target priority is 1.0. Priorities are numbers associated with the hierarchy node. They represent the relative weight of the node in each group. Priorities are absolute digits from zero to one, whereas the node is expressed in decimal places. The priorities of the alternatives always reach 1.0 in total, as do the priorities of the criteria.

3. Synthesizing of these judgements to yield a set of overall priorities for the hierarchy, and inspection of the consistency of the judgements obtained.

4. Final decision-making based on the results of this process.

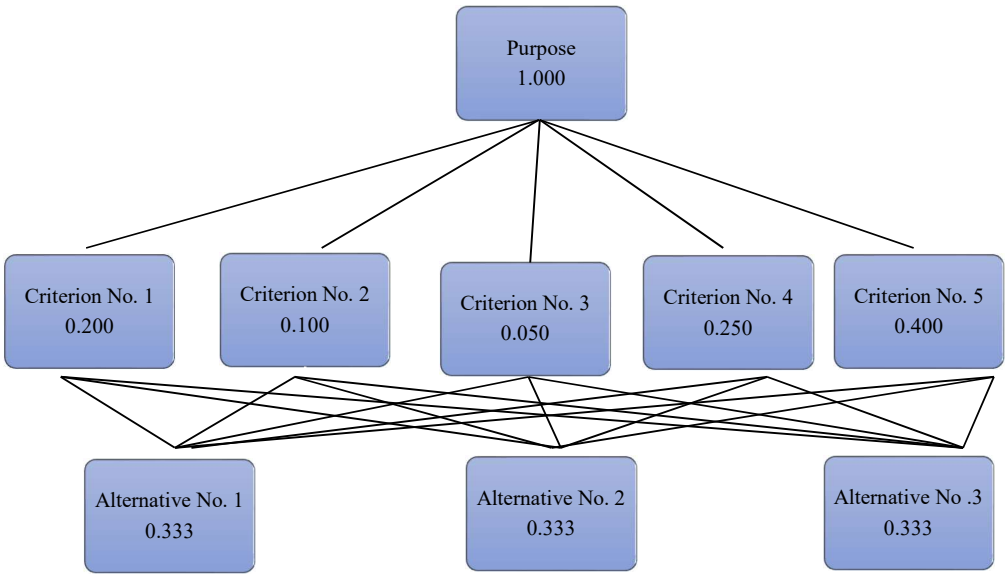

Figure 1. The essence of the AHP method
(Source: created by the authors in accordance with Saaty (1992, 2010; 2009))

Figure 1 shows that at the top of the hierarchy there is a goal, three possible alternatives to achieve the goal, and five criteria according to which the alternatives should be assessed. In this way, a pair of elements for comparison is formed, for example, alternative 1 is assessed according to criterion 1 and criterion 2, i.e. becoming pair 1.1.2, then alternative 1 is assessed according to criteria 1 and 3, i.e., 1.1.3, etc.) *(Saaty, 2001).*

After the hierarchy is created, a transition from a hierarchical structure to a tabular structure and a pair comparison should be performed, a process where the relative importance (advantages) of two elements on one level are compared with another element that is on the next level. The pair comparison results are described in the form of a matrix. The *AHP method* foresees *(Saaty, 1980*) inspection of the consistency of the assessment obtained or calculation of the consistency ratio (hereinafter – CR), which shows whether the results of the *AHP method*, in comparing alternatives according to a particular criterion, are objective. The results are considered to be objective if CR≤10%. In case CR≥10%, then expert judgements used in the calculation should be reviewed and corrections should be made.

CR is calculated by the following formula:

$$CR=CI/RI \qquad (1.1)$$

In formula (1.1) CI is the consistency index and RI is the random consistency index.

The consistency index (CI) is calculated by the following formula:

$$CI=(\lambda_{max}-n)/(n-1) \qquad (1.2)$$

In formula (1.2) λ_{max} is the highest value of the criteria matrix, and n is the number of alternatives.

The highest value of the criteria matrix λ_{max} is calculated by the following formula:

$$\lambda_{max=} = \sum_{i=1}^{n} Si * xi \qquad (1.3)$$

In formula (1.2) S_i is the weighting factor of criterion i; x_i is the numerical value of criterion i.

The random consistency index RI, indicated in formula (1.1), is based on experimental data obtained by *T. L. Saaty* for cases of up to 15 alternatives.

In a paper by *Alonso and Lamata* (2006) RI was calculated for 39 alternatives. On the basis of the theoretical foundation of the *AHP method* and the aim of the research, the authors developed a theoretical model for assessing the benefits of long-term housing financing instruments in accordance with the *AHP method* in Figure 2.

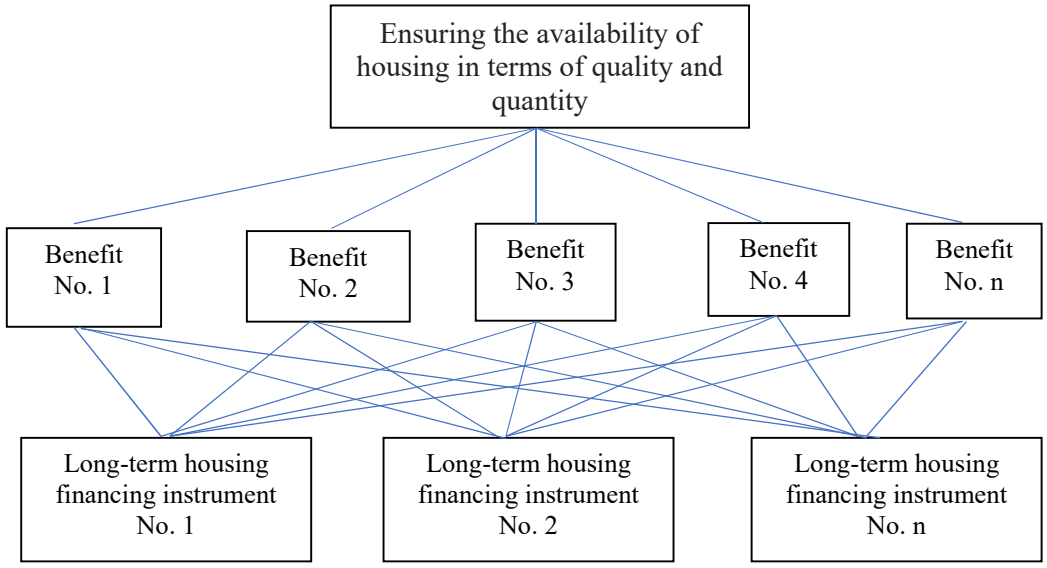

Figure 2. Theoretical model for assessing the benefits of long-term housing financing instruments in accordance with the AHP method

Notes:
Benefit No. n – the n-th benefit
Long-term housing financing instrument
No. n – the n-th long-term housing financing instrument

(Source: created by the authors)

The theoretical model developed by the authors based on *MCDM theory* in accordance with the *AHP method* serves, in Part 2 of the research, to evaluate long-term housing financing instruments in terms of their benefits. In order to obtain data that can be used to assess the benefits of long-term housing financing instruments in the model of the *AHP method*, the authors conducted expert surveys using the *Delphi method.*

EVALUATION OF THE BENEFITS OF LONG-TERM FINANCING INSTRUMENTS FOR HOUSING IN LATVIA USING A COMPLEX MODEL

The authors emphasize that in making any decision, it is important to assess the benefits and losses, especially if the decision is complicated, for example, when deciding which long-term financing instruments for housing should be implemented in the near future.

The authors have developed a complex model for assessing the benefits of long-term housing financing instruments during complicated decision-making processes (see Figure 3) on the basis of the theoretical model developed in the first section of the paper (Figure 2) as well as previous research by the authors on 9 long-term housing financing instruments in Latvia, 8 potential new long-term housing financing instruments in Latvia *(Henilane and Skiltere, 2017 a)*, 29 potential benefits on the state and local government level, and 12 housing and resident-level benefits *(Henilane and Skiltere, 2017 b*).

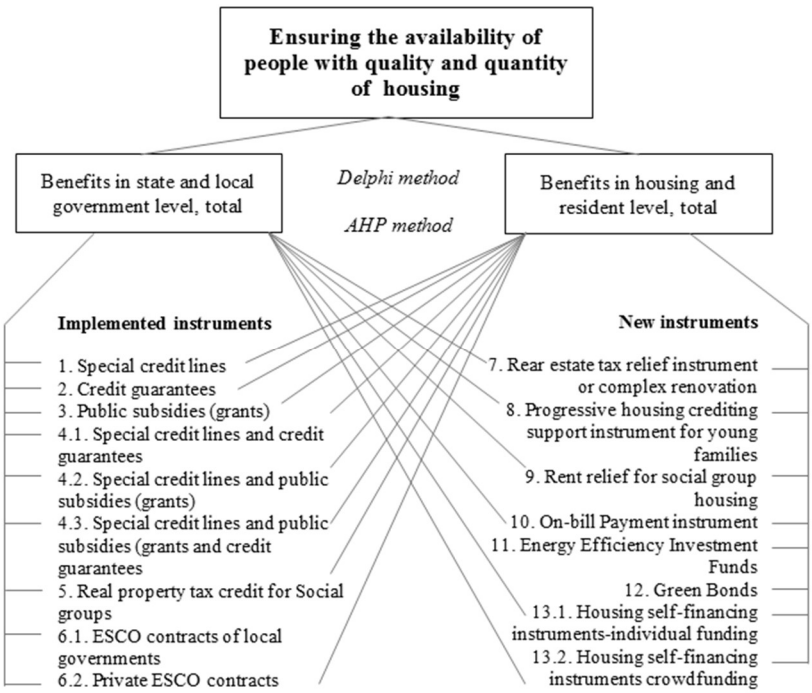

Figure 3. The complex model for assessing benefits when selecting long-term housing financing instruments *(Source: developed by the authors)*

The complex model is based on the AHP method and the Delphi method. The Delphi method has been used to carry out expert surveys for an assessment of the benefits on the state and local government level and on the level of residents and housing for each of the 17 long-term housing financing instruments.

The authors prepared expert surveys to assess long-term housing financing instruments: *the expert survey for assessing the benefits of instruments* (24 experts surveyed using the Delphi method, including 7 experts using the AHP method) and *the expert survey for indicative assessment of public administration costs* (15 experts surveyed using the Delphi method, including 6 experts using the AHP method). The authors went on to define the criteria for expert selection and to select the experts.

The results of the expert survey for indicative assessment of public administration costs are described in Part 3 of the research.

In Table 1 the authors summarize the results of the weighting procedure, which characterizes the impact of two criteria, i.e., the total benefits on the state and local government level and the total benefits on the housing and residential level for each of the long-term housing financing instruments.

Table 1

Calculations of the weighting procedure for the assessment of long-term housing financing instruments in the complex model

Instrument No.	Instrument name	Total benefits on the state and local government level, %	Total benefits on the housing and resident level, %
Instrument No. 1	Dedicated credit lines	10.8%	8.2%
Instrument No. 2	Credit guarantees	2.6%	2.2%
Instrument No. 3	Public subsidies (grants)	5.2%	6.6%
Instrument No. 4.1	Special credit line and credit guarantees (combined instrument)	9.9%	10.5%
Instrument No. 4.1	Special credit line and public subsidies (combined instrument)	12.7%	14.1%
Instrument No. 4.3	Special credit line, public subsidies and credit guarantees (combined instrument)	14.9%	14.1%
Instrument No. 5	Real property tax credit instrument for social groups	0.7%	1.0%
Instrument No. 6.1	Municipality ESCO contracts	4.7%	3.8%
Instrument No. 6.2	Private ESCO contracts	5.1%	3.0%
Instrument No. 7	Real estate tax relief instrument for complex renovation	3.7%	14.0%
Instrument No. 8	Progressive housing crediting support instrument for young families	4.2%	6.4%
Instrument No. 9	Rent relief for social group housing	0.9%	3.0%
Instrument No. 10	On-bill repayment instrument	1.7%	1.8%
Instrument No. 11	Energy efficiency investment funds	8.1%	4.7%
Instrument No. 12	Green bonds	12.0%	4.2%
Instrument No. 13.1	Housing self-financing instruments – individual funding	1.3%	0.7%
Instrument No. 13.2	Housing self-financing instruments – crowdfunding	1.6%	1.6%

(Source: developed by the authors)

The authors tested the calculations' objectivity by checking the evaluation consistency or the calculation of the coherence ratio. In accordance with formulas specified in sub-section 1 of the research (1.1), (1.2) and (1.3), λ max, CI and CR values were obtained by assessing 17 long-term housing financing instruments (alternatives) in terms of the criterion "Total benefits on the state and local government level" and the criterion "Total benefits on the housing and residential level". These are summarized in Table 2.

Table 2

Results of the consistency check

Indicator	Comparison of alternatives (instruments) according to the criterion "Total benefits on the state and local government level"	Comparison of alternatives (instruments) according to the criterion "Total benefits on the housing and resident level"
λ max	18.4334	18.9915
CI	0.0896	0.1245
CR	**5.569%**	**7.74%**

(Source: developed by the authors)

As mentioned in sub-section 1 of the research on the theoretical aspects of the *AHP method*, the results should be considered as objective if CR≤10%.

Taking into account the above, the results of the complex model are considered as objective, since in assessing the instruments according to "benefits on the state and local government level" and "housing and resident-level benefits" the CR values comprise 5.569% and 7.74%, respectively, which is less than 10%.

In Table 3, the authors created a criteria matrix, where the percentage effect of each criterion is shown.

Table 3

Criteria matrix of the complex model for assessing the benefits of long-term housing financing instruments

	Absolute value	Absolute value in percentage
Total benefits on the state and local government level	613.62	68.70%
Total benefits on the housing and resident level	279.57	31.30%
Total	893.19	100%

(Source: developed by the authors)

In accordance with the theoretical aspects of the AHP method, the authors combined the matrices obtained in Table 1 and Table 3 using the Excel function "mmult", thus carrying out the calculations and assessing the outcomes of the results for the suitability of 17 long-term housing financing instruments for Latvia's conditions. This is summarized in Table 4.

Table 4

Assessment of the benefits of long-term housing financing instruments: results of the complex model

Instrument No.	Instrument name	Instrument rank according to the Delphi method (evaluations from 24 experts)	Complex model results (evaluations from 7 experts)	
			Results of calculations	Rank
Instr. 1	Dedicated credit lines	8	10.01%	**3**
Instr. 2	Credit guarantees	12	2.47%	**12**
Instr. 3	Public subsidies (grants)	10	5.62%	**8**
Instr. 4.1	Special credit line and credit guarantees (combined instrument)	5	10.07%	**4**
Instr. 4.2	Special credit line and public subsidies (combined instrument)	2	13.17%	**2**
Instr. 4.3	Special credit line, public subsidies and credit guarantees (combined instrument)	1	14.65%	**1**
Instr. 5	Real property tax credit instrument for social groups	16	0.79%	**17**
Instr. 6.1	Municipality ESCO contracts	6	4.40%	**11**
Instr. 6.2	Private ESCO contracts	9	4.43%	**10**
Instr. 7	Real estate tax relief instrument for complex renovation	7	6.93%	**7**
Instr. 8	Progressive housing crediting support instrument for young families	11	4.89%	**9**
Instr. 9	Rent relief for social group housing	17	1.52%	**15**
Instr. 10	On-bill repayment instrument	15	1.76%	**13**
Instr. 11	Energy efficiency investment funds	3	7.00%	**6**
Instr. 12	Green bonds	4	9.56%	**5**
Instr. 13.1	Housing self-financing instruments – individual funding	14	1.10%	**16**
Instr. 13.2	Housing self-financing instruments – crowdfunding	13	1.62%	**14**

(Source: developed by the authors)

The results obtained from the complex model show that among the long-term housing financing instruments implemented so far, *special credit lines, public subsidies and credit guarantees* take 1st place in terms of benefits, *special credit lines and public subsidies* take 2nd place, *special credit lines* take 3rd place, and *special credit lines and credit guarantees* take 4th place. The new long-term housing financing instruments

green bonds take 5th place in terms of benefits, *energy efficiency investment funds* take 6th place, and the *real estate tax relief instrument in case of complex renovation* takes 7th place.

EVALUATION OF THE PUBLIC ADMINISTRATION COSTS OF LONG-TERM FINANCING INSTRUMENTS FOR HOUSING IN LATVIA

Taking into account that when choosing long-term financing instruments for housing, it is important to determine how much public resources might be required in order to implement one or another instrument, the authors also made calculations on the most appropriate long-term housing financing instruments according to their public administration costs. The calculations included the estimates of experts' evaluations concerning the benefits of long-term housing financing instruments for the calculation of the complex model (in accordance with Table 5).

In order to assess the indicative administration costs of the long-term housing financing instruments that have been implemented so far and of the new ones, it is essential to determine the financial impact of their implementation on public resources; therefore, the authors carried out *the expert survey for assessing the indicative public administration costs for the instruments*. Although public information on the public administration costs for long-term housing financing instruments implemented so far is limited in Latvia and depends on the nature, size and other aspects of the instrument, the authors have included in *the expert survey for assessing the indicative public administration costs for the instruments* the cost intervals for possible public administration costs of the instruments based on various publicly available sources of information (Ekonomikas ministrija 2015; Majoklu attastabas kreditesanas programma (II posms), 2002; Anotacija MK rikojumam Nr.54, 2015).

Table 5

Indicative public administration costs for the instrument in Latvia,euro / average per year

No costs	Up to 100 000	100 000 – 500 000	500 000 – 1 000 000	1 000 000 or more

(Expert survey for assessing the indicative public administration costs for the instruments, created by the authors from publicly available data (Ekonomikas ministrija, 2015; Majoklu attistibas kreditesanas programma (II etaps), 2002; Anotacija MK rikojumam Nr.54, 2015).

Although the issue of the administration costs for long-term housing financing instruments is highly sensitive and more relevant to public sector experts, who are the main implementers of housing and financial policies, and budget planners and administrators of various instruments, opinions were also provided by some of the local government and financial experts.

Taking into account that when choosing long-term financing instruments for housing, it is important to determine how much public resources might be

required in order to implement one or another instrument, the authors also made calculations on the most appropriate long-term housing financing instruments according to their *public administration costs*. The calculations included the estimates of experts' evaluations concerning the benefits of long-term housing financing instruments for the calculation of the complex model (in accordance with Table 6).

Evaluations from 6 experts were used. The results obtained in the assessment of the public administration costs for long-term housing financing instruments are summarized in Table 6.

Table 6

Assessment of the indicative public administration costs of the long-term financing instruments (according to evaluations from 6 experts)

Instrument name	Public administration costs, euros per year	Rank
Housing self-financing instruments – crowdfunding	50 000	1
Housing self-financing instruments – individual funding	58 333	2 and 3
Private ESCO contracts	58 333	2 and 3
Green bonds	66 667	4
On-bill repayment instrument	175 000	5
Municipality ESCO contracts	208 333	6 and 7
Rent relief for social group housing	208 333	6 and 7
Energy efficiency investment funds	220 833	8
Rent relief for social group housing	308 333	9
Progressive housing crediting support instrument for young families	400 000	10
Dedicated credit lines	408 333	11
Special credit line and credit guarantees (combined instrument)	416 667	12
Real estate tax relief instrument for complex renovation	433 333	13
Special credit line and public subsidies (combined instrument)	600 000	14
Special credit line, public subsidies and credit guarantees (combined instrument)	641 667	15

(Source: developed by the authors from evaluations by 6 experts from the expert survey for assessing the indicative public administration costs for the instruments)

The authors conclude that despite *special credit lines, public subsidies and credit guarantees* taking 1st place in terms of benefits, it is the most expensive instrument in terms of administration (15th place), while *special credit lines and public subsidies* takes 2nd place in terms of benefits, and it is the second most expensive instrument in terms of administration (14th place). *Special credit lines* then takes 3rd place in terms of benefits and is the fifth most expensive instrument in terms of administration (11th place), and *special credit lines and credit guarantees* takes 4th place in terms of benefits and is the fourth most expensive instrument in terms of administration (12th place). Regarding long-term financing instruments for new housing, *green bonds* takes 5th place in terms of benefits and 4th place as one of the cheapest instruments in terms of administration, while *energy efficiency investment funds* takes sixth place in terms of benefits and 8th place in terms of administration costs. The authors would like to emphasize the potential of private ESCO contracts and of local government ESCO contracts; even though these instruments take 10th and 11th place, respectively, in terms of benefits, they take 2nd and 3rd place in terms of lowest public administration costs.

CONCLUSIONS

Considering the research results obtained, the authors draw the following conclusions:

1. The results of the complex model show that despite special credit lines, public subsidies and credit guarantees taking 1st place in terms of benefits, it is the most expensive instrument in terms of administration (15th place), while special credit lines and public subsidies takes 2nd place in terms of benefits, and it is the second most expensive instrument in terms of administration (14th place). Special credit lines then takes 3rd place in terms of benefits and is the fifth most expensive instrument in terms of administration (11th place), and special credit lines and credit guarantees takes 4th place in terms of benefits and is the fourth most expensive instrument in terms of administration (12th place). Regarding long-term financing instruments for new housing, green bonds takes 5th place in terms of benefits and 4th place as one of the cheapest instruments in terms of administration, while energy efficiency investment funds takes sixth place in terms of benefits and 8th place in terms of administration costs.

2. The authors would like to emphasize the potential of private ESCO contracts and of local government ESCO contracts; even though these instruments take 10th and 11th place, respectively, in terms of benefits, they take 2nd and 3rd place in terms of lowest public administration costs.

3. The authors see the potential of introducing long-term financing instruments for new housing with regard to green bonds, energy efficiency investment funds, local government ESCO contracts and private ESCO contracts, the implementation of which is based more on private investments than public resources.

The authors make the following proposals:

1. Proposals for the Ministry of Economics:

1.1. To evaluate in a more detailed manner the instrument of green bonds, including the experience of other EU member states regarding potential participants in

the green bond market (banks, ALTUM, etc.), the necessary changes to the regulatory framework and public resources, and other aspects;

1.2. To evaluate in a more detailed manner the instrument of energy efficiency investment funds and the possibility to develop this as a state or municipal institution (for example as a state or municipal capital company) with the principle of rotation of resources and to attract additional funds from international financial institutions.

1.3. To identify and evaluate the reason why private ESCOs are not created in Latvia and to create conditions for the development of private ESCOs in the country.

2. Proposals for local governments:

2.1. To organize public information campaigns and other informative events for apartment house owners, explaining financing attraction possibilities from EU funds for the 2014-2020 planning period within the framework of the programme SAM 4.2.1.1, thus helping housing owners to understand the maintenance and improvement of their housing.

2.2. To evaluate in a more detailed manner, prepare and develop long-term financing instruments for new housing, including local government ESCO and local government energy efficiency investment funds.

3. Proposals for banks:

To evaluate the ability to issue green bonds for purposes related to housing, energy efficiency or renewable energy.

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