DECISION-MAKING PROCESS IN CREDIT GRANTIG

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ABSTRACT

In recent years many countries have experienced stagnation or even decline in the amount of mortgage credits granted to households. The credit-granting process has become significantly complicated, less transparent and excessively time consuming. This study seeks to define the improvement opportunities for credit granting through creation of a simple, transparent and accountable framework of decision-making process. To achieve this purpose the authors used qualitative method – structured interview and graphical tools – decision tree. The developed framework makes it possible to identify areas of the credit granting that might have potential for considerable improvements. The empirical results of the study indicate that decision-making process in credit granting has considerable potential for improvements. The developed framework is supposed to help commercial banks to improve the quality and efficiency of the decision-making process in the credit granting and reduce cost of credit granting process. This is possible to achieve by cutting down the duration time of alternative solutions with negative outcome – credit denial. This research introduces a valuable framework of transparent and accountable model of decision-making process in the credit granting. The authors have found that the introduced framework is suitable not only for commercial banks but also for a wide range of organizations having similar complicated and multiple staged decision-making processes.

KEY WORDS: *lending, credit granting, process analysis, decision making*

JEL CODES: C44, G21, M10

Introduction

In recent years many countries experienced stagnation or even decline in the amount of mortgage credits granted to households. Statistic data processed by the Financial and Capital Market Commission (FCMC) of Latvia indicates that commercial banks of Latvia experience a decrease of households mortgage credit portfolio by 4.96 % in 2009, 5.7 % in 2010 and by 7.4 % in the first half of 2011[5]. Partly his negative dynamic could be described by stiffened standards and regulation in credit granting over past three years.

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[5] Association of Commercial Banks of Latvia: Bank performance data 2007–2010. [on-line] Available at: http://www.bankasoc.lv/lka/statistika/bankas/index2.php

Households as well as bank officials admit that a credit-granting process has become more complicated, excessively time-consuming, and non-transparent compared to previous years. Bank officials explain it by significant changes that took place in commercial banks practices since the beginning of the crisis. Previously the power of credit granting decision-making was delegated to the middle managers of commercial banks, but currently a decision-making mandate is significantly reduced and only belongs to the credit committees.

This paper seeks to define an opportunity for improvements of the credit granting process in commercial banks through the creation of a simple, transparent and accountable framework of the decision-making process. The developed framework is supposed to help commercial banks to improve the quality and efficiency of the decision-making process in the credit granting and reduce cost of credit granting process.

The authors define the following objectives to reach the purpose of the study:

1. Transformation of complicated household mortgage credit granting process into a simple, transparent and accountable framework by using a graphical tool – a decision tree.
2. Identification of problem areas of decision-making process in credit granting.
3. Development of practical recommendations for commercial banks for improvement of the decision-making process in credit granting.
4. Assessment of potential of the developed framework.

To achieve the objectives of the study the authors defined four tasks:

1. Conduct structured interviews with loan officers from Latvian commercial banks.
2. Transform results of interviews to the credit granting decision-making tree and fix the time and probability of the each alternative solution.
3. Carry-out the verification of the developed credit granting decision-making tree.
4. Remark the results of the credit granting process decision-making tree.

The rest of the paper is structured in the following way: Section 1 presents background of the research. Section 2 introduces the experiment carried out by the authors. The results of the study are presented in section 3. And finally, section 4 is devoted to the conclusions.

1. Background of the research

The credit granting process, according to the structure suggested by the authors, consists of two inter-related components: credit granting policy (procedures) and decision-making. The credit granting policy (procedure) represents credit granting methodology to assess credit risk by establishing a wide range of requirements and standards for credit granting. Decision-making, in turns, represents a set of consistent and sequential actions that should be carried out by the loan officers in order to meet all standards and requirements established in the credit granting procedures. The main task of the decision-making process in credit granting is to obtain approval or denial of credit granting from relevant authority of commercial banks (in most cases – the credit committees).

The authors' intention is to research decision-making issues of the credit granting process, because this component usually is neglected by commercial banks. And to the mind of the authors it is a mistake, because this component might have considerable potential for improvements of the credit granting process and therefore should be properly reflected and resolved.

Credit granting is a trade-off between the perceived default risk of a credit applicant and potential returns from granting credit (Keasey, Veronesi, 2008: 18). "Trade-off" is a subjective and capacious criterion that is represented by credit risk management. Credit granting procedures of commercial banks include a wide range of requirements and standards aimed to establish boundaries on level of acceptable credit risk. Most of the requirements and standards of commercial banks are similar and include standards on market segment, quality and liquidity of property, its value, collaterals, loan limits, creditworthiness and credit reputation of a credit applicant.

Reverting to the decision-making process of the credit granting the authors have observed lack of proper analysis and documentation of it in the procedures of commercial banks. At best commercial banks have made an attempt to reflect the credit granting process either in descriptive or visual way. However used for this purpose techniques such as flow-charts and Entity-relationship model are not sophisticated enough to provide comprehensive precept of complicated, multiple staged and diversified process of decision-making in credit granting process.

Lack of proper reflection and documentation of decision-making process in credit granting implies that commercial banks have not paid detailed attention to that and might have little control over this process. As a result, the authors find that commercial banks might have opportunities for considerable improvement in decision-making process, which, in turns, would result in better efficiency of the whole credit granting process. Efficiency of the credit granting process could be measured by the time and labour costs spent on proceeding of a credit application. Knowledge and clear understanding of the decision-making process in credit granting could enlarge range of tools used by commercial banks to increase customer's satisfaction by achieving better efficiency and quality of the credit granting process.

By highlighting the lack of proper analysis of decision-making in credit granting the authors set a task to develop a framework of decision-making process in credit granting using a decision tree concept that would bring required simplicity, transparency and accountability.

After brief searching of current literature on credit granting process the authors have identified a lot of researches devoted to the credit risk management. At the same time there is a lack of researches devoted to the analysis of the decision-making process in credit granting. Therefore in this paper the authors introduce one of first empirical study on analysis of the decision-making process in credit granting and provide a valuable insight into acknowledgment of interdependencies, critical issues and areas for improvements in decision-making process of the credit granting. The finding of the study gives rise to a series of new researches.

The empirical study of this paper is limited to the development of the framework of credit granting process that relates to only mortgage credit granted to households. The aim of this paper is not to introduce any new standards and requirements in credit risk management. The aim of this paper is to examine the decision-making process as a set of consistent and sequential actions that is carried out to reach decision on approval or denial of granting a credit and state recommendations for its improvements opportunities.

2. The Experiment

Used by commercial banks techniques for reflection of the decision-making process such as flow-charts or Entity-relationship model are useful for training of new employees to introduce them with a general percept of the credit granting process. However, those techniques do not ensure feedback to commercial banks regarding time and resources spent to handle a credit application. But the weakest side of the used techniques is enclosed in their inability to describe whether the credit granting process is organized properly and in efficient way? And the authors find that a graphical tool, particularly a decision tree, as the proper concept that allows overcoming of drawbacks of above mentioned techniques. It enables transformation of the decision-making process of the credit granting into a simple, transparent and accountable framework. A ground of the authors' certainty in graphical tool's relevance for solution of the defined problem is knowledge that a decision tree is an instrument that explicitly interprets any process and can be stated as a strategy where actions of decision makers can be determined, in the same time the stochastic state of nature can be kept as given. The main purpose of creating a decision tree is that afterwards the decision makers can easily decide how to act in each decision node and follow their decision further in depth. In that case, the pace of the process execution depends mainly on the state of nature. A decision tree provides the opportunity for decision makers to analyze and compare different paths of a decision tree.

To achieve the task of the research, the authors have carried out the experiment based on the methodology provided by Reizinsh and Rutitis (Reizinsh, Rutitis, 2006: 324–329), who introduced formalization of experts' opinion method consisted of three iterations and reflected in Figure 1.
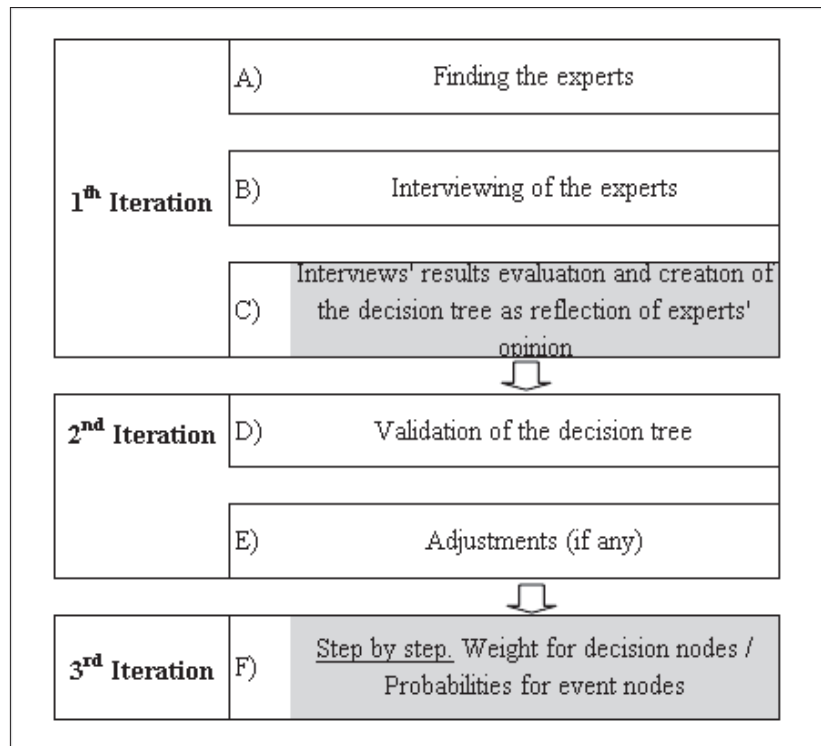
Figure 1. Formalization of the experts' opinion
Source: Reizinsh, Rutitis, 2006: 324–339.

The main goal of the experiment is to provide a theoretical background and develop a practically trustful and applicable transparent and accountable framework of decision-making process in credit granting.

Taking into account that adopted methodology include qualitative methods – structured interview with the experts. A structured interview is a valuable technique to gather as much information as possible, meanwhile sticking to the agenda of this research. So, the authors have interviewed the experts with more than 10 years of experience in credit granting field. Experts' extensive experience in banking sector allowed the authors to gather valuable information and understanding of the decision-making process in credit granting and decrease subjectivity error typical for qualitative methods.

During the *1st iteration* the expert performed a structured interview. During the interviews the selected experts provided the authors with the decisions that are involved in credit granting process. Results obtained from the interviews made it possible to draw an initial decision tree. The conducted interviews during the first iteration of experts' opinion formalization has provided the authors with the exact sequence of decisions that take place in the credit granting process of commercial banks. It appeared that the credit granting process consists of 6 phases – 1st appointment, 1st analysis of gathered data performed by a loan officer, intermediate, 2nd appointment, 2nd analysis of gathered data performed by loan officer, and, finally, credit committee which has mandate on credit approval or denial. There are numerous decisions in defined 6 phases of the decision-making process, which an applicant and a loan officer must carry out during each phase, before to reach approval and denial on credit granting. That makes a total of 40 statements to which an answer is required before decision-making process can be moved to the credit committee. At the end of the first iteration the authors have drawn an initial decision tree.

The *2nd iteration* starts with the validation of the decision tree drawn during the first iteration. During this formalization stage the authors' task is to define whether the developed initial decision-making tree corresponds to the decision-making process that takes place in credit granting. If not, proper adjustments had to been made. Validation of the drawn initial decision-making tree indicated certain difficulties with incorporation of dome of the experts' answers into a decision tree and highlighted the necessity of adjustment regarding

to the legislation issues. To overcome appeared drawbacks the authors were focused to trace adjustments and modifications that the experts had required under legislative framework. In addition, the experts were asked to paraphrase their statements that had been changed by the authors due to legislative framework during the first iteration. This stage of the formalization process proved to be most time-consuming, because before to come out with the validation results the authors had spend considerable amount of time on the explanation of the concept of a decision tree to the experts in order they can understand the task of validation. After the experts had been given the approval of the provided sequence of decisions in the credit granting process, the structure of the decision tree became stable and the third stage of the formalization can be performed.

The *3ʳᵈ iteration* is the essence of the carried experiment. During this stage the expert provided the authors with the empirical distribution of probabilities of each alternative branch of the developed decision tree. It was carried out through incremental evaluation and analysis of each of all 40 statements of the decision tree that belongs to a particular phase of the credit granting process. Afterwards a combined probability was formulated as a product of all probabilities enclosed in a particular decision tree branch. In the same way the experts shared their experience regarding the time required to perform tasks enclosed in each statement. In the end of the third iteration the authors calculated the cumulative time that describes particular decision tree branch.

The formalization process was finalized by the development of the decision tree, which bring desired and expected transparency and accountability of a decision-making process in credit granting.

3. Results of the credit granting decision tree

The carried out experiment brought clarity and complete understanding of the decision-making process, that take place in credit granting. Obtained knowledge allowed to develop a decision-making tree, which brought transparency and accountability to the decision-making process of the credit granting, as well as to define execution time of each particular outcome. The most important outcome gained from the transformation of the decision-making process into decision tree is development of a flexible framework, which encloses opportunity to analyze and evaluate decision-making process in credit granting from different sides.

The developed credit granting decision-making tree happens to be excessively voluminous, which make its displaying in full rather complicated. Giving this limitation the authors presents only a tiny fragment of the developed credit granting decision-making tree, corresponding to 1ˢᵗ appointment, in Figure 2. The developed decision-making tree of the credit granting process was subject of statistical and mathematical data processing.
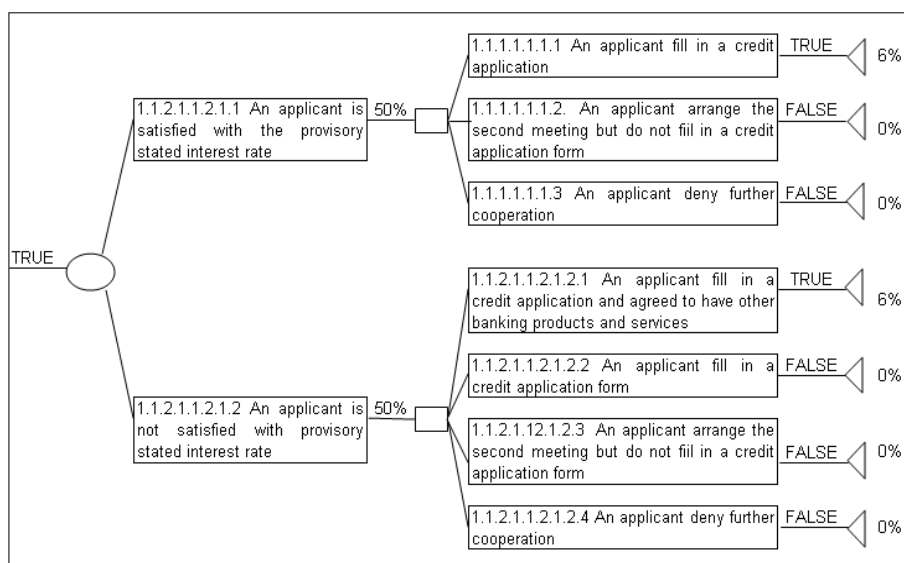

Figure 2. Graphical fragment of the credit granting decision-making tree

The decision-making tree of the credit granting process consists of the decision nodes and sections of the decision nodes. Every decision of the credit granting decision-making process is described in terms of time it takes to make (reach) it and fixed probability of occurrence.

The authors' analysis of the developed credit granting decision-making tree is based on exploration of the core alternative solutions of the decision-making process. Decision tree branches were measured by the probability of the node of each event. Values of the decision tree branches have been determined by the common time capacity. Values of the event nodes have been disclosed as time instants of the credit granting process.

The characteristics of the credit-granting decision tree shown in Table 1 illustrate that 35.02 % of alternative solutions are solutions that theoretically might take place in the credit granting process, but according to the experts' experience have never took place and their realization probability is close to zero. The authors called this group of alternative solutions as "empty sets" and have excluded them from further analyses due to lack of practical implementation.

The largest share of alternative solutions in the developed decision-making tree belongs to the alternatives solutions that have been rejected and represent 35.82 % form total number of alternative solutions. These alternatives solutions are characterized as alternative solutions that never take place in the credit granting process.

The alternatives solutions characterized as realized represent 29.17 % from the total number of the alternative solutions and are described as alternative solutions that are regular decisions in credit granting.

Table 1. Characteristics of the credit granting decision-making tree

Characteristics	Results
Rejected alternatives solutions	29.17 %
Realized alternative solutions	35.82 %
"Empty sets"	35.02 %

From the results of statistical analysis of the developed credit granting decision tree presented in Table 2 the authors found that a positive outcome, when credit granting is approved, take place in only 14.60 % of cases. This statistically obtained result required additional verification due to suspiciously small rate of positive outcome. To verify the obtained result the authors refer to the credit granting statistic data provided by the experts. The experts' statistic data on the credit granting identifies that 100 experts' meetings with the credit applicants per month turn into only 15 signed loan agreements. The conducted verification confirmed that the developed framework of the credit granting decision-making process is proper and truthful. This made possible to conclude that the derived results are valid and can be used as credible data for further analysis.

A negative outcome, when credit granting is denied, takes place in 85.40 % of cases. The authors suppose that the improvement of the credit granting process can be achieved by decrease of time spent on coming up with a negative decision. The relived time can be redirected to serve larger number of the credit applicants.

Table 2. Groups of alternative solutions

Indicator	Results
Positive outcome (approval of credit granting)	14.60 %
Negative outcome (denial of credit granting)	85.40 %

Implementation of the developed credit granting decision-making tree would help commercial banks to identify irrational and time-consuming alternatives solutions (branches) in the decision making process of the credit granting. Identification of such alternative solutions, in turns, encloses considerable opportunity to improve the credit granting process.

In order to set a time standard for optimal duration of the alternatives solutions, the authors have calculated several variables, including the maximum, the minimum, the average decision duration, the median, the

mode and the weighted average of the time consumed to come out with a decision. The results of calculation are shown in Table 3.

The calculated variables help to compare the decision-making duration of each alternative solution to other alternatives solutions in the same group or with alternative solutions form other group. Alternative solutions which decision-making duration exceeds the average duration have to become a subject for further analysis, because they are a source for improvements of whole decision-making performance in credit granting.

The maximum time necessary to come out with a decision is 4064 minutes (8.47 working days), while the minimum time – 3 minutes. The average time of decision-making duration of alternatives solutions is 2512 minutes (5 working days).

The maximum duration of alternative solutions to come out with a positive decision takes 4064 minutes (8.47 working days), the minimum duration – 564 minutes (1.18 days) and the average duration – 2412 minutes (5.23 working days). As it can be seen the dispersion between the maximum time and minimum time spent to come out with a positive decisions is considerable. The mode of the positive decision is 1591 minutes (3.31 working days) and the median – 2441 minutes or slightly more than 5 working days.

Table 3. Decision-making duration of alternative solutions in the credit granting

Groups of alternative solutions	Variable	Value	
		minutes	working days
Overall in the credit granting process	Maximum duration	4064	8.47
	Minimum duration	3	0.01
	Average duration	2512	5.23
Positive decisions	Maximum duration	4064	8.47
	Minimum duration	564	1.18
	Average duration	2412	5.03
	Mathematical expectation	782	1.63
	Median	2441	5.09
	Mode	1591	3.31
Negative decisions	Maximum duration	3764	7.84
	Minimum duration	3	0.01
	Average duration	2130	4.44
	Mathematical expectation	107.28	0.22
	Media	2081	4.33
	Mode	2431	5.07

The maximum duration of the alternative solution to come out with a negative decision takes 3764 minutes (7.84 working days), but the minimum duration constitutes to 3 minutes and the average duration – 2130 minutes (4.44 working days). The dispersion between the maximum and the minimum time consumed to come out with a negative decision is even bigger that in case with a positive decision. The mode of the negative decision of the alternatives solutions is 2431 minutes (5.07 working days) and the median – 2081 minutes (more than 4 working days).

The results demonstrate that the negative decision of alternative solutions can be reached faster that the positive decision of the alternative solutions (2412 minutes to 2130 minutes). The most frequently repeated duration time of the alternative solutions, presented by the mode, is considerably shorter for the alternatives solutions with a positive outcome than for the alternative solutions with a negative outcome (1591 minutes to 2431 minutes).

As it was mentioned earlier so considerable dispersion between the maximum and the minimum duration time of the alternatives solutions is appropriate for both – positive and negative decision branches. Therefore

in order to set standards for optimal duration time of the alternative solutions, new variable should be introduced. The authors have calculated variable that is supposed to identify the highest probability and represent the most common duration time of the alternative solutions to reach the final decision – credit granting approval or denial. The authors entitled this variable as the "mathematical expectation". According to the data provided in Table 3 the mathematical expectation for the alternative solutions with a positive decision corresponds to 782 minutes or 1.63 working days, but in case of a negative decision corresponds to 107 minutes. These ranges should be considered as a standard for optimal duration of the alternatives solutions to come out with a decision. The alternative solutions that exceed the value of the mathematical expectation are subject to further detailed analysis and a source for improvements of the decision-making in credit granting process. The main agenda of the suggested analysis is determination of reasons that cause an increase of decision-making duration and develop recommendation for overcoming those challenges.
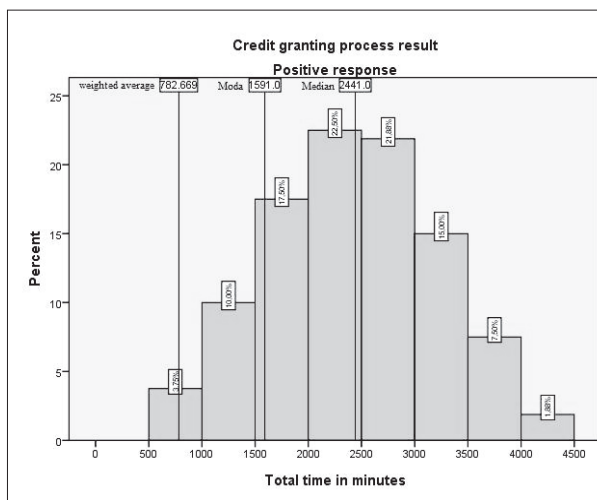

Figure 3. Graphical representation of positive decisions in credit granting process
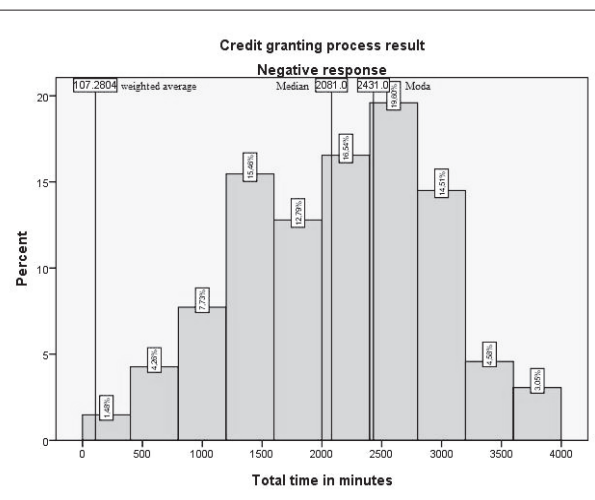
Figure 4. Graphical representation of negative decisions in credit granting process

The value of mathematical expectation of positive decisions and negative decisions of the alternative solutions indicates that a negative decision can be achieved faster than a positive decision. This should be considered as reasonable approach, because each minute spent to come out with a decision generates expenses and can be defined as a waste of time for both participants of the credit granting process – commercial banks and credit applicants. A negative decision of the alternative solutions does not generate income for commercial banks and is waste of time for credit applicants. Therefore duration time of the alternatives solutions with a negative decision should take as less time as possible to ensure efficiency of the credit granting process.

Conclusions

In the framework of this research the authors have elaborated a decision-making tree provides an opportunity to analyze and evaluate the whole credit granting process. The experiment that was carried out demonstrates that the provided methodology of transformation of the complicated credit granting process into a decision tree is appropriate and relevant. The conducted verification of the developed decision-making tree proves that this way of reflection is credible and valuable for practical implementation by commercial banks.

The reflection of the credit granting process as a decision tree ensures its transformation into easily understandable graphical diagram. The applied method made it possible to calculate the decision-making duration of each node, the cumulative time of each alternatives solution, as well as the probability of occurrence for each alternative solution's outcome.

The developed credit granting decision tree provides a significant material for further analysis of the credit granting process, which might result in a wider range of recommendation for improvements of the process itself, process quality, efficiency and customer satisfaction.

When a drawn decision tree becomes excessively voluminous and it graphical visualization is rather complicated, it can be revert to numerical matrix and its further analysis can be performed mathematically.

The applied approach of the credit granting process's reflection made it possible to express a decision-making duration of each alternative solution in time units. This opportunity ensures accountability of the whole credit granting process and let to compare and evaluate a decision-making duration of alternative solutions in different profiles. The authors suggest comparing of decision-making duration of alternative solutions to a value of the mathematical expectation. Alternative solutions which cumulative time exceeds a value of the mathematical expectation for particular group of the alternative solutions (positive or negative outcome) most likely contains opportunities for improvements. Therefore, the improvement of the credit granting process can be achieved by finding, understanding and negotiating the reason of a decision-making duration of alternative solution that exceed the mathematical expectation.

Main benefit of the elaborated framework is achieved transparency and accountability of the credit granting decision-making process and opportunities for its improvement. Time component of the credit granting process introduced by the authors is a key indicator in assessment of the costs caused by the process to commercial banks. Costs of the credit granting process can be expressed also in labour cost per hour. Adding the labour cost component to the credit granting decision-making tree makes it possible to calculate and set boundaries for costs that alternative solutions can generate within the credit granting process.

This study presents one of a few researches of decision-making process analysis in the credit granting and provides material for further analysis and researches. The authors find that the presented framework of the credit granting process is helpful tool to overcome part of challenges existing in the credit granting process.

The authors recommend using the introduced approach not only for the transformation of the credit granting decision-making process in commercial banks, but also in other organizations having the same multiple staged and complex decision-making process, for example in insurance, auditing companies and universities.

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SPRENDIMŲ PRIĖMIMO PROCESAS TEIKIANT KREDITUS

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Santrauka

Pastaraisiais metais dauguma valstybių išgyveno stagnaciją, kuri susijusi su kreditų nekilnojamajam turtui išdavimu namų ūkiams. Pripažįstama, kad kredito išdavimo procedūra dabar ilgesnė, sudėtingesnė ir ne tokia skaidri kaip anksčiau. Šiame straipsnyje, siekiant patobulinti kredito išdavimo procesą komerciniuose bankuose, sukurta paprasta ir suprantama sprendimų priėmimo schema.

Šiame tyrime autoriai pateikia sprendimo priėmimo medį, kuris leidžia išanalizuoti ir įvertinti visą kredito išdavimo procesą. Atliktas eksperimentas parodė, kad sprendimų medžio taikymas vietoj sudėtingų kredito išdavimo procedūrų yra patikimas ir tinka taikyti komerciniuose bankuose.

Sprendimų medžio analizė paremta alternatyvių sprendimų vertinimu sprendimo priėmimo procese, ji padeda nustatyti, kodėl pailgėjo sprendimo priėmimo procesas, ir parengti rekomendacijas, kaip to išvengti. Neigiamas sprendimas komerciniams bankams neduoda pelno ir nesuteikia išteklių asmenims, kurie siekia gauti kreditą. Taigi laikas, skirtas neigiamų sprendimų alternatyvoms svarstyti, turėtų būti kuo trumpesnis.

Autoriai nurodo, kad pateikta kredito išdavimo schema tinka taikyti, siekiant įveikti kai kurias kredito išdavimo sprendimo priėmimo procese kylančias problemas. Autoriai rekomenduoja pateiktą prieigą naudoti ne tik sprendimo priėmimo dėl kredito išdavimo komerciniuose bankuose procese, bet ir kitose organizacijose, kurios taiko panašius daugiaetapius sprendimo priėmimo procesus, kur sąveikauja bent dvi šalys, pavyzdžiui, draudimo, audito bendrovėse ir universitetuose.

PAGRINDINIAI ŽODŽIAI: *paskolos, paskolų išdavimas, proceso analize, sprendimų priėmimas.*

JEL KLASIFIKACIJA: C44, G21, M10