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Procedia Economics and Finance 24 (2015) 156 – 165

Procedia Economics and Finance

www.elsevier.com/locate/procedia

International Conference on Applied Economics, ICOAE 2015, 2-4 July 2015, Kazan, Russia

Problems Of Evaluation And Management Of Operational Risks In Banks

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Abstract

In article shortcomings of the existing methods and approaches to an assessment of operational risk, a problem of the sphere of an author's technique by determination of susceptibility of banks to operational risks, and in particular V. G. Imayev's technique are analyzed. Authors suggested improving V. G. Imayev's technique by means of modification of calculation of the indicators used in indicators of susceptibility of bank to operational risks, of structure of indicators and in distribution of scales of indicators. And also development of a control system of operational risks taking into account application of Bayesian networks was offered.

Selection and/or peer-review under responsibility of the Organizing Committee of ICOAE 2015.

Keywords: operational risks; V. G. Imayev's technique; bank risks; assessment of operational risk; bank; risk; Bayesian networks; indicators

There are complex problems of practical-methodological nature in the system evaluation and decision-making on operational risk management.

In particular, the Basel Committee and the Central Bank of the Russian Federation says strictly about approaches to the assessment of operational risk, while its impact on the activity of a bank is not mentioned at all. Therefore, in our opinion, one of the key shortcomings of existing methods and approaches to the assessment of operational risk is absence of an integrated methodological framework for the assessment of negative impact of operational risk on the financial results of credit institutions.

In particular, the methodological basis in field of the operational risk coefficient and index analysis is insufficiently. Considering that any typically bank risk has to assume the main and spare buffer of a covering.

Under operational risk, the credit organizations also can and have to form certain reserves, for a covering of this type of risk, however funds may be not enough, then the risk can also be covered by net profit. Therefore, possibility of covering of operational risks due to net profit has to become an important aspect for expansion of methodical base in the field of an assessment and the economic analysis of operational risks. Therefore, it is possible

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Selection and/or peer-review under responsibility of the Organizing Committee of ICOAE 2015.
doi:10.1016/S2212-5671(15)00637-1

to calculate indicator, which can be conventionally represented as a ratio of operational risk (K1).

$$K1 = OR / NP * 100\%, \quad (1)$$

where: NP - net profit of the credit institution;
OR - operational risk of commercial bank.

Measurement of this indicator certainly has to be in the dynamics. The domestic credit institutions operational risk measure twice a year, therefore, ratio of operational risk should also be considered and analyzed twice a year.Respectively, the relation of reporting ratio of operational risk to basic will be called as an index of a rate of operational risk (I1) which can be evaluated as the following formula:

$$I1 = KPor1 / KPor0, \quad (2)$$

where: KPor1, KPor0 - coefficients of a rate of operational risk of commercial bank for reporting and previous dates.

On the basis of indexes of a rate of operational risk, it is possible to judge correctness and flexibility of credit organization policy for decrease and management of operational risk, and also estimate possibility of extraction from this additional income.

It is difficult to suggest liminal and recommended values in relation to the index and rate of operational risk, the only thing we can note that if $0 < I1 < 1$, it means that in dynamics commercial bank have solved the problem of covering of operational risk due to net profit. If - $I1 > 1$, it means that operational risk management in commercial bank in the reporting period has been inefficiently, and due to net profit credit organization could has covered less operational risk than before. However, it is important to understand that the financial results of bank can be negative; therefore I1 can also be negative. Accordingly, if $0 > I1 > -1$, it means that the dynamics of the credit institution has worsened its policy on receiving profit, and has received a loss. If at the end of the reporting period there is $I1 < -1$, it means that the bank has corrected negative situation and at the end of the reporting period, the financial result has been transformed from a loss at beginning of period on profit for the reporting period.

Other coefficients similar to the ratio of operational risk may be coefficients that will reflect the degree of covering operational risk by equity and total assets of the credit institution. Accordingly, the coefficients K2 and K3 can be calculated using the following formulas:

$$K2 = OR / BC \quad (3)$$

where: BC - bank's own capital.

$$K3 = OR / A \quad (4)$$

where: A - total assets of the credit institution.

As in the case of the K1 liminal values of these coefficients are difficult to suggest. However, you can go the other way - we can try to delineate interval for valid and critical values. Of course, the ideal value of K1 when it in dynamic trends to zero, as well as other coefficients will trend to zero.Thus if the coefficient of K1 is negative, it means that operational risks are not covered by net profit.

Returning to liminal values, we should start from the fact that net income is a component of credit institution equity, therefore, K1 must be higher than the K2. Considering that according to the law of the balance sheet assets are equal to liabilities which consist of obligations and the capital, K2has to be higher than K3.In addition, it is also necessary to consider the recommended values from determination of financial reliability and stability of commercial bank, in particular the indicator H1 must to be not less than 10%, profitability of assets and the capital, have to be from 2% to 10% and from 10% to 20% respectively [7, p. 292]

Preceding from it through operational risks it is possible to build the recommended liminal values of the relations of coefficients to each other, such as:

- K2must be at least more K3 by 10 times;
- K1 must be at least more K2 by 10 times;
- K1must be at least more K3 by 50 times.

Another important problem regarding methodical base on measurement and definitions of influence of operational risk on other key indicators of commercial bank is lack of study of a problem of decrease in H1 due to of operational risk. The credit organizations, perhaps, don't think that due to high-quality and appropriate management of operational risk it is possible to raise capital adequacy.

In addition to the above described problems and shortcomings of area of methodical approaches on influence of operational risks on other indicators of commercial bank there are problems and in the sphere of an author's technique by determination of susceptibility of banks to operational risks.

In particular it should be noted that V. G. Imayev's technique was developed in 2007. Since then there were many changes in the legal acts regulating the activities of credit institutions and in calculation of operational risks: the structure of the profit and loss report in the form of 0409102 changed, the Central Bank of the Russian Federation adopted the method of estimation of operational risks. We propose to update and improve V. G. Imayev's technique by means of modification of calculation of the indicators used in the indicators of the bank's exposure to operational risk, in the structure of the indicators and the distribution of the indicator's weights.

We will give the offered changes in calculation of the main indicators below:

- not to include operational risk management costs in thestatement of the profit and loss report in a form 0409102 characterizing losses from realization of operational risks. In other words, to separate losses from expenses connected only with of operational risk management: expenses for protection, audit, insurance, preparation and retraining of personnel, etc.;
- instead of total expenses of the credit organization to use the indicator equal to the sum of an operating and other expenses: all items of expenditure used for the analysis of operational risks are taken from the sixth and seventh sections of the head «Expenses» of the profit and loss report in a form 0409102. It would be possible to compare operational losses and operational risks management costs with total expenses of the credit organizations only for these two sections, but they are not so well characterized scales of activity of commercial bank as a total operating and other expenses of the credit organization. Thus, we exclude from the analysis expenses on bank operations and other transactions and we leave only those expenses that are connected with intrabank processes, transactions processes, ensuring work of commercial bank;
-to count the income of the credit organizations by a technique of the Central bank of the Russian Federation.

Formulas for calculation of these indicators are presented in Table 1.

Table 1

The indicators used in an advanced technique of V. G. Imayev

Indicator	Calculation (symbols of the profit and loss report in a form 0409102 and lines of the profit and loss report in a form 0409807)
1. The expenses connected with operational risks management	26401 + 26403 + 26406 + 26408 + 26409 + 26410
2. Losses from realization of operational risks	26407 + 27100 + 27200 + 27301 + 27302 + 27303 + 27304 + 27307
3. Operating expenses	20002 + 27000
4. Income	4.1 + 4.2 + 4.3 + 4.4 + 4.5 + 4.6
4.1. Net interest income	11000 - 11601 - 11602 - 11605 - 11606 + 12401 + 12405 + 17101 - 21000 - 22201 - 27201
4.2. Net income from operations with the securities estimated at fair value through profit or a loss	13100 + 15101 + 15200 + 16100 - 23100 - 24101 - 24200 - 25100
4.3. Netincomefromoperationswithforeign currency	12200 + 15202 + 16103 - 22100 - 24202 - 25103

4.4. Incomefromparticipationinthecapitalofotherlegalentities	14100 + 14200 + 14300 + 14400
4.5. Net commission income	12100 + 12300 + 16200 - 25200
4.6. Other operating income	12403 + 15103 + 16302 + 16304 + 12402 + 16306 + 16303 + 17202 + 17203 + 12406 + 13200 + 12404 + 16301 + 15201 + 15203 + 15207
4.7. Financial result (profit to the taxation)	01000

The description of changes in a set of indicators is presented in Table 2.

Table 2

Description of changes in indicators

Indicator old/new	Old formula	Changes
IND 1/IND 6	the relation of losses from realization of operational risks to total expenses of bank	total expenses change for the sum of an operating and other expenses
IND 2/IND 7	the relation of the expenses connected with operational risks management to total expenses	the new indicator is entered: the profit relation to the taxation to costs of operational risks management
IND 3/IND 8	the relation of the expenses connected with operational risks management to the capital of bank	two indicators are replaced with one: in numerator a difference between the operational risk found by a technique of the Central bank of the Russian Federation and losses from realization of operational risks, and in a denominator the capital of bank
ING 4/IND 8	relation of 15% of the income of bank to the capital of bank	
IND5	relation of assets to number of points of sales of bank	the indicator doesn't change

The new set of indicators is given below:

$$IND\ 6 = \frac{Lor}{E}, (5)$$

where: Lor – only losses from realization of operational risks;
E – operating and other expenses of the credit organization.

This indicator is synchronous. It reflects only the level of losses from realization of risks in comparison with other expenses of bank.

$$IND\ 7\ = \frac{P}{OPE}, (6)$$

where: P - profit of the credit organization to the taxation;
ORE – operational risks management expenses.

This indicator is advancing: it reflects the cost effectiveness of risk management (profitability), and shows how much profitto the taxation is per 1 ruble of operational risk management expenses.

$$IND\ 8 = \frac{\frac{15\% \cdot \sum_{1}^{3} I}{3} - L_{or}}{C}, \quad (7)$$

where: I - income credit institution, calculated by the method of the Central Bank of the Russian Federation;
C - capital of credit institutions.

Assuming that the commercial bank reserves funds in the amount of calculated by the method of the Central Bank of the Russian Federation operational risk, the numerator IND 8 - excessively created reserve, because L_{or} reflects the realized losses from operational risks. IND 8 can be measured in two ways: on the one hand, if the credit institution has large surplus reserve, which means that it is weakly exposed to operational risks, on the other hand, excessively created reserve could be used more efficiently. For purposes of comparison, the commercial banks on the level of exposure to operational risk the first aspect of the question is important: the more is the value of IND 8, the less the credit institution is exposed to operational risk and the lower is the score. This indicator indirectly reflects the effectiveness of control and it can be considered advancing.

$$IND\ 5 = \frac{A}{1 + N_{br} + 0{,}9 \times N_{sbr} + 0{,}8 \times N_{oco}}, \quad (8)$$

where: A - assets of the credit institution;
Nbr - the number of branches of credit institutions;
Nsbr - the number of sub-branches of the credit institution;
Noco - the number of operating cash offices of the credit institution.

IND 5 isthe indicator of inherent risk as it indirectly reflects the level of the bank of operational risk accepted by each point of sales.

Total level of susceptibility of the credit organization to operational risk (LSor) is calculated as follows:

$$LS_{OR} = 0{,}2 \times IND\ 6 + 0{,}3 \times IND\ 7 + 0{,}4 \times IND\ 8 + 0{,}1 \times IND\ 5 \quad (9)$$

If the original method, almost all indicators were synchronous and represented the proportion of a single indicator in the other, the improved method has advancing indicators and is more sensitive to changes in the parameters of commercial banks. The weightsof indicators in the formula ofLSor are distributed so that synchronous (IND 5 and 6) has third of weight, and the share of the advancing indicators (IND 7 and 8) –has two thirds of weight in the general level of susceptibility to operational risks.

Operational risk management in commercial bank is an important part of financial management, reducing operating losses and providing the acceptable level of financial stability.

Bank risk management is considered as organizational complex actions of [3, p.42]:

-identifications, measurements and determination of the acceptable level of bank risks, typical opportunities of an incurring by bank of losses;

-continuous supervision over bank risks;

-taking measures to maintenance of bank risks at the level which isn't menacing to financial stability of the credit organization and interests of creditors and investors.

In large commercial banks the special division – Department or Directorate of risk analysis is engaged in all these questions. The main spheres of its responsibility regarding of operational risks management often are:

- interaction with divisions of commercial bank concerning identification of operational risks and collection of information in a database of losses;
- structuring database;
- participation in a regulation of key business processes;
- analysis of the current legislation;

- development of key indicators of operational risk;
- monitoring of operational risks on the basis of these indicators.

So, in practice feature of JSC AK BARS Bank as the largest credit organization of the Republic of Tatarstan lead to emergence of the operational risks which are shown through mistakes and abuses of bank's employees, inadequate organization of activities, insufficient efficiency of the existing mechanisms of operations and their control.

Only at third of commercial banks of the Republic of Tatarstan (9 of 22) between of operational risks management costs and losses from realization of operational risks trace inverse relationship: with a growth of expenses losses fall and vice versa.

The Bayesian network is the probabilistic model representing a set of variables and their probabilistic dependences [2, p.5]. Bayesian networks can be used in many areas of science: in medicine, meteorology, law, economy, etc. In economy by means of Bayesian networks it is possible to model process of making decision to invest in a particular project, it is possible to estimate solvency of the borrower in such parameters as the present and future income, profitability of a profession, property of the borrower, debt to commercial bank, credit history, reliability, age, etc.

There are a set of software products by means of which it is possible to construct Bayesian networks. All models in this research are constructed with use of the GeNIe 2.0 program. It provides an opportunity to build Bayesian networks with use of nodescalledchance, value, decision, deterministic,equation and submodel. Connection between nodes is established by means of drawing arrows from the operating nodes by operated.

All its possible states and probability of each state are specified in properties of each node-accident (aprioristic if nothing influences an event of this node, and conditional if the event of this node occurs under the influence of any other event). The solution-node includes all possible decisions on any question: to make investments in any project or not, to issue the credit or to refrain from it. Nodes-values define quantitatively usefulness of each of possible combinations of results of parental nodes.

On model of losses as a result of non-execution by service provider of the obligations which is shown in Figure 1, the principles of work with Bayesian networks in relation to operational risks of bank will be visually illustrated.

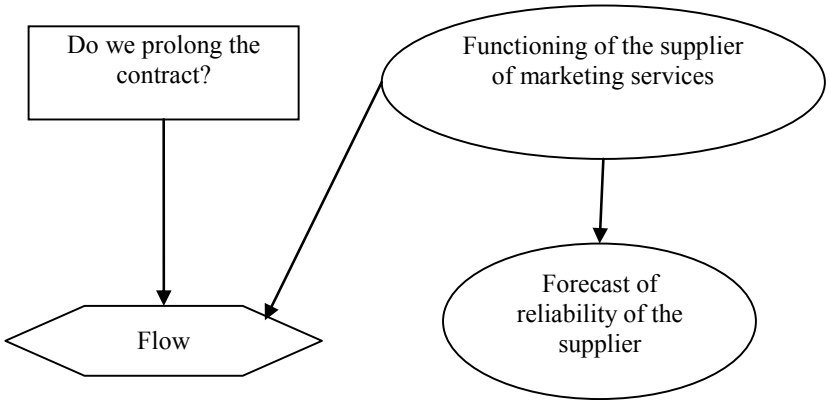

Fig. 1. The simplified model of making decision of cooperation with the supplier of marketing services

The oval node accident under the name «Functioning of the supplier of marketing services» has two states: successful and unsuccessful functioning. Aprioristic probabilities of successful and unsuccessful functioning in this case are defined by the expert way and are equal 0,75 and 0,25 respectively. This node is subordinate to another node-accident called «Forecast reliable supplier», which receives state: good, average, poor. In this case we will deal with conditional probabilities which are presented in Table 3.

Table 3

Node properties «Forecast of reliable of the supplier"»

in units

Functioning of the supplier / Forecast	Successful	Unsuccessful
Good	0,55	0,11
Avarage	0,36	0,23
Poor	0,09	0,66

The model also has a hexagonal node-value called «Flow of funds», whose properties are shown in Table 4, and the rectangular node-decision «Do we prolong the contract?», which has two states: yes or no. If you do not prolong the contract, the flow of funds from the bank will not, but he will remain those of 50 000 rubles, he could pay the supplier.

Table 4

Node properties «Flow of funds»

in rubles

Do we prolong the contract?	Yes		No	
Functioning of the supplier of marketing services	Successful	Unsuccessful	Successful	Unsuccessful
Flow of funds	124 000	- 29 000	50 000	50 000

Bayes's theorem assumes that after a choice of any condition of the forecast of reliability of the supplier node, for example, «average», probabilities of successful and unsuccessful functioning of the supplier will change, that is the Bayesian network gives to analysts the ability to move in the opposite direction and to estimate probability of events after a fulfillment of their consequences. We will calculate on Bayes's formula as the probability of successful functioning of the supplier if experts give the uncertain (average) forecast will change. Bayes's formula has the following appearance [4, p.52]:

$$P_m(s) = \frac{P(s) \cdot P_s(m)}{P(m)}, \quad (10)$$

where: $P_m(s)$ - probability of successful functioning of the supplier (success) at the uncertain (average) forecast (moderate);

$P(s)$ - aprioristic probability of successful functioning of the supplier (regardless of forecasts);

$P_s(m)$ - conditional probability of the uncertain forecast at successful functioning of the supplier;

$P(m)$ - total probability of those experts will give the uncertain forecast.

We set aprioristic probability $P(s)$ and conditional probability $P_s(m)$ at creation of model: they are equal 0,75 and 0,36 respectively. We will designate aprioristic probability of unsuccessful functioning (failure) of the supplier of P(f), and conditional probability of the uncertain forecast in this case $P_f(m)$. Then the total probability $P(m)$ will represent the sum of works of probabilities of conditions of the «Functioning of the supplier of marketing services» and the corresponding conditional probabilities of the uncertain forecast:

$$P(m) = P(s) \cdot P_s(m) + P(f) \cdot P_f(m) = 0{,}75 * 0{,}36 + 0{,}25 * 0{,}23 = 0{,}3275 \qquad (11)$$

Substituting all received values in Bayes's formula, we will find posteriorly probability of successful functioning of the supplier, which is in the presence of the uncertain forecast of experts. It will increase from 75% to 82%. Multiplying posteriorly probabilities of success and failure of the supplier on the corresponding values of node-value, we will receive the most probable cash flow depending on our decision. If the bank decides to prolong the contract with the supplier, the cash flow will make 97 137 rubles, if the contract isn't prolonged, the bank still will have only those 50 000 rubles which it could invest in the supplier.

It should be noted that the considered model is the simplest Bayesian network which can only be constructed: it has only two nodes-accidents. Addition at least of one new node considerably will complicate calculations therefore further all calculations will be carried out on the basis of the GeNIe 2.0 software product.

It is possible to construct more difficult a Bayesian network which can be used for the analysis of one of a set of operational risks: risk of failure of a computer network of this or that department of bank.

This network contains 21 nodes-accidents and 1 node-value. In the center of model there is a node «Failure of a Computer Network of Department» which can have two states: «truth» (the event occurred) and «false» (the event didn't occur). Four main reasons for this event presented in model in the form of the following nodes-accidents are allocated: «Attack of hackers», «Deliberate actions of the employee», «Inadvertent mistake of the employee» and «Force majeure» – each of which has states «truth» and «false», and also the parental nodes. So, for example, the probability of commission by the employee of an inadvertent mistake depends on security of system from such mistakes that includes existence of system of passwords and existence/absence of the rights of the administrator at ordinary employees, and level of computer literacy of employees. Also other reasons of the central event were in the same way analyzed. In other words, the model represents the expanding network from the center (consequence) to the periphery (factors).

Because of that the central node having two states includes four nodes which also have two states, it was necessary to register 32 probabilities that it is shown on Table 5 in properties of the central node. Model based on Bayesian networks allow to calculate the risks under different scenarios, calculate the probability of occurrence of operational losses, provided that the probability of occurrence of the causes of these losses has either an expert or statistical way.

Table 5

Node properties «Failure of the computer network of department»

Inadvertent mistake of the employee	True								False							
Deliberate actions of the employee	True				False				True				False			
Attack of hackers	True		False		True		False		True		False		True		False	
Force majeure	True	False	True	False	True	False	True	False	True	False	True	False	True	False	True	False
True	0,74	0,53	0,6	0,28	0,68	0,42	0,51	0,1	0,71	0,48	0,56	0,2	0,64	0,35	0,45	0,01
False	0,26	0,47	0,4	0,72	0,32	0,58	0,49	0,9	0,29	0,52	0,44	0,8	0,36	0,65	0,55	0,99

The analysis of operational risks is carried out by means of the constructed model as follows: in the GeNIe 2.0 software product it is possible to choose for all or only parts of events any one of their states and to update model that will lead to recalculation of probabilities of all nodes of model. It should be noted that recalculation on Bayes's formula is made only at the movement in a network in the opposite direction: from affiliated nodes to the parental. At the movement from parental nodes to affiliate in the program usual formulas are used.

For example, to the building in which the head office of JSC AK BARS Bank is located more than 15 years, the last repair in one of departments was carried out 4 years ago, the premises of this department are located not on the top floor, on computers the antivirus and a firewall are established, there is a system of passwords, ordinary workers have no rights of the administrator, the computer network of department is checked regularly by special employees of bank.We can appoint to the corresponding nodes of model these states. As without special intrabank tests and interviews it is impossible to know the level of computer literacy of staff of the analyzed department, and also degree of satisfaction of employees with working conditions, we won't appoint to these two

nodes any states.Because of a lack of information the node «Dishonest Actions of Competitors» also remains free.By assigning nodes state and having updated it by pressing of the special button, it is possible to find probability of failure of a computer network of the chosen by us department of JSC AK BARS Bank.At this set of known and unknown factors it will make 9%, and expenses of time for elimination of a malfunction – 1 hour 20 minutes.

But we will use calculations for Bayes's formula: we will establish to the central event a state «truth» and we learn because of what, most likely, there was a failure of a computer network of department: an inadvertent mistake of the employee – 13,4%, force majeur – 33,6%, deliberate actions of the employee – 6,3%, attack of hackers – 60,8%.

If look at other nodes, it is possible to see that most likely to the bank building from is 5 to 15 years, the last repair in it was made from 1 to 3 years ago, the results for JSC AK BARS Bank showed that the reasons of network failure and their probability will be the following: inadvertent mistake of the employee – 12,3%, force majeure – 48,7%, deliberate actions of the employee – 7,6%, attack of hackers – 38,2%. Most likely, it is necessary to spend for restoration of a network of department 6 hours.

It should be noted that at the first construction the Bayesian network quite accepts expert estimates of probabilities (this method was used and in this work). When the bank collects enough information on probability of these or those risk events in the database, it is possible to specify the originally expert estimates.The value of Bayesian networks consists of opportunity to constantlydevelop model as quantitatively (expanding a network of events), and qualitative (increasing the accuracy of estimates). According to I. Pearl, «the most important aspect of Bayesian networks – that they represent a direct picture of the world, but not results of conclusions» [2, p. 2].

For banking activities becomes very important application of qualitative methods of the analysis which at an assessment of operational risks are used now only by a small number of banks [3, p. 16]. Internal control of operational risks has to combine as elements of both quantitative and qualitative assessments, and then to unite them in a whole [6, p. 30]. The model of operational risks on the basis of a Bayesian network naturally connects diverse quantitative and qualitative, objective and subjective elements of risksassessment, environments of control, administrative decisions.

Therefore, we suggest the Tatarstan credit organizations to introduce system of the analysis of operational risks by means of Bayesian networks. Comparison of various modes of work with Bayesian networks is presented in Table 6.

Table 6

Time expenses at different ways of analysis by means of a Bayesian network of average complexity (20 objects)

in the min.

Operation	Method		
	Manually	EXCEL	GeNIe
Definition of a set of events	60	40	40
Their transfer in system		10	10
Purpose of communications between objects of model		90	2
Start of a database	5	5	5
Selection of the necessary data	15	15	15
Transfer of data in the used system (purpose of characteristics to events)	45	60	35
Carrying out calculations for five scenarios	420	60	5
Total it is spent time	545	280	112

Thus, carrying out the analysis by means of a Bayesian network of average complexity manually will take 9 hours 5 minutes, by means of software package an EXCEL – 4 hours 40 minutes, with use of the specialized GeNIe program – 1 hour 52 minutes.

In connection with the offer to apply Bayesian networks to the analysis of operational risks it is worth raising the question of determination of the demanded level of complexity of a control system of operational risks:

the scale of such system has to correspond to the scale of bank activity. For example, the small regional bank (for example in Tatarstan is JSC Avtocreditbank, JSC ANKOR BANK, JSC Bulgar Bank, JSC JSB Kara Altyn and others) which is carrying out a narrow range of operations can strongly save on expenses, having refused excessively difficult system operational risk management.The economy at JSC AK BARS of Bank and JSC AIKB Tatfondbank, the using difficult expensive systems, on the contrary, will be reached due to avoidance of large losses from realization of operational risks.Risk analysis by means of Bayesian networks is the labor-intensive process demanding from employees of banks of intellectual efforts, a broad outlook and good imagination: these qualities can help during the work connected with a large number of cases and the reasons of realization of these or those risks.

Summarizing, it is possible to note that we carried out the comparative analysis of model and measuring tools of operational risk on the basis of which results and the established features expediency of application of Bayesian technologies when modeling operational risk is proved.Thus, process of modeling of events of operational risk by means of Bayesian technologies, in fact, represents two-unity of the analysis and synthesis.In the beginning the studied object – operational risk – is dismembered on some structural levels: the object, sources, and an event of risk, a consequence that makes possible its system representation and facilitates perception. At the following stage the allocated structural elements unite by means of provisions of the probability theory providing a solvency of system in general.

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