Aleksandras V. Rutkauskas, Vytautas Rutkauskas, Algita Miečinskienë

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Aleksandras V. Rutkauskas
Vytautas Rutkauskas
Algita Miečinskienė
Vilnius Gediminas Technical University

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Introduction

The main goals of this paper are discussion of the fundamental principles of the regional business risk informative system (REGBRIS) and presentation of some basic elements of it. Regional business risk monitoring (REGBRMON), which possible structure is discussed in the paper, must occur as a significant element of the REGBRIS. Monitoring of the region business risk is an important factor creating the presumptions of risk management. There are several basic functions of the region business risk monitoring: settled out conceptions, verification and improvement of criteria and models of risk management; specification of the risk factors influence on a particular hierarchy of objects, more precise methods and degrees; accumulation and arrangement of information in order to meet the needs of decision making.

The paper covers the following related topics:

– risk structuring as information accumulation stage, which is needed for analysis and management;

– principles of region business risk monitoring;

– practical aspects of implementation of risk monitoring.

Main conceptions of the regional business informative system

There are no doubts, that best chances for survival had only those biological species, which managed to react in the most flexible way to the changes in environment. The ability to use information is the most valuable asset of any social system. Capacity to provide and use adequate information is the most important component of any individual's intellectual capital.

However, the concept of information is not perceived homogeneously, thus it should be constantly improved by further development of its content. This category should become a constructive instrument for systems' interaction research. At the moment information category is objectified increasingly separating its content from simply entire data. When separating information and data, it's very important to consider qualities – knowledge (intelligence) of the subject, which is using it. Perhaps the best way of depicting this process would be the simple scheme (Figure 1) reflecting data collection, information development and knowledge. Herein information is perceived as a tool, which converts data into knowledge and deepens the level of an individual knows. Adequate requirements of information expansion and perception of regularity are necessary for the preparation of the right information system development strategy. An exceptional quality of informative system is considered capability to convert internal and external data into knowledge, assure information accumulation, and create conditions for optimal decisions making.

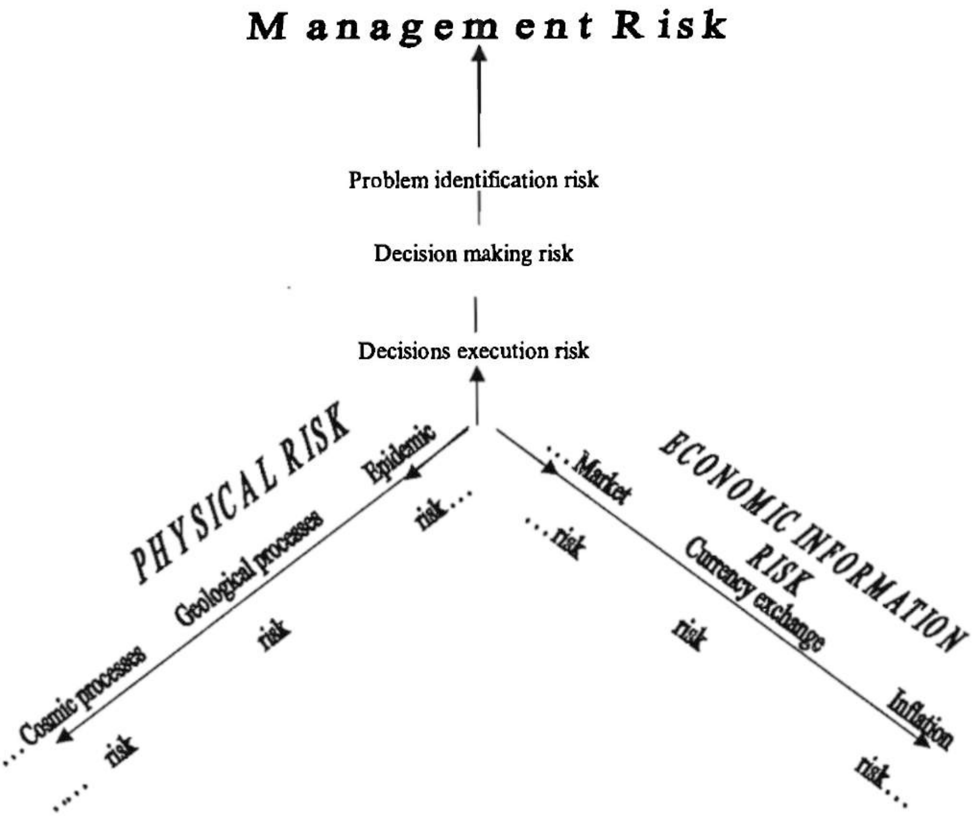

Figure 1. Management risk and its environment

Three functions of business informative systems are usually emphasized: improvement in interaction of business operations; deepening of knowledge for decision-making process; amelioration of business competitiveness.

Any business is inevitably related to risk. Risk could be stipulated by uncertainty of present and future activities' as well as by possibly wrong decisions of business managers. Management of risk requires exceptionally good specific knowledge concerning risk factors and ways of influence. Successful risk management leads to the effective use of regions' resources as well as to connections with external partners. Thus, REGBRIS development requires a heuristic approach, it should emphasize correct formulations of system objects and operation principals, presumptions and practical ways of implementation prevision. Only after all these problems are properly solved, we could talk about successful execution of developed functions of risk informative system. Herein we will analyze in more detail risk structuring, as information required for risk management, and region's business risk monitoring, as the main region's business informative structure.

Risk structuring as a stage of information accumulation that is needed for the risk analysis and management

Today the risk conception penetrates practically into all human activities and field of life. To tell the truth, it often has quite different meanings. This variety of risk concepts causes a need to study the basic aspects of that variety, in order to make preliminary assumptions of risk management. A special means of different risk aspects comparison can be the scheme of risk structuring (it is presented in the Figure 1). Here are separated three risk aspects: physical risk, decision result risk and economic information risk.

In many cases people's interests and benefit formation are based on economic information. The mechanism of fulfillment of these interests is understood as a complex of economic means oriented to that goal. That is why the risk of non-adequate economic and financial information has strong and direct impact on risks of human decisions, which in turn can influence the factors of physical risk. Therefore, even in such fields of activities as ecology, environment, etc., in most cases financial or economic factors are recognized as the basic (initial) risk factors.

Classification of operation risk as a means of management system of a risky activity. Today it is rather difficult to point the fields of activity that are risk free. The problems of risk classification, which are studied further, concern practically the majority of activities. The risk of an activity (or business) influences the process of activity and threatens to decrease its effectiveness. When we classify the risks, it is necessary to take into account the risk structuring to avoid losing the information about the risk nature and the activity process, and to understand consequences of choosing a particular mechanism of risk management.

We can manage the operation risk by using different means which allow forecasting the occurrence of an event, and use different means to decrease the scope of risk consequences. The reasonableness of risk classifications determine the effectiveness of risk management. Conceptually based risk classification allows to define clearly the position of each risk in the whole system and to reveal the possible effect of risk on the activity and possibilities of the risk management. The successful risk classification allows to use properly the corresponding management methods. Every risk is related to its own system of the risk management. One of the possible schemes of risk classification is presented in the Figure 2. It is often used in practice of risk management.

The kinds of bank risk. Despite presenting a long list of kinds of risk in the first two examples, and the fact that their interaction schemes are rather universal, further analysis leads to understanding that the variety of risks often cannot be placed in any lists or universal schemes of their interactions. The example can be bank risks. The classification of bank risk is presented in the 3rd figure. We see that risk factors, faced by banks and financial institutions, differ by their nature and character, by the kind of activity, which is exposed to risk, by the risks interactions and management possibilities.

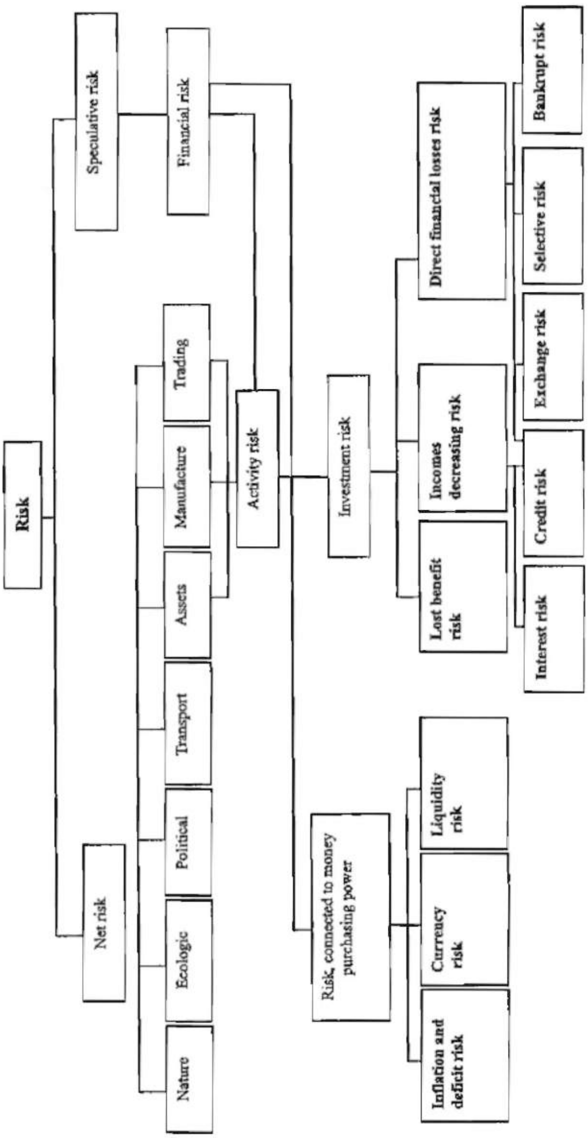

Figure 2. Risk classification

Besides this, all risk factors are interactive and synergically acting on the banks' activity. When one of risk factors becomes more influential, also several other factors often become more active. It makes the task of determination of the risk degree and analysis of its scope difficult and complicated.

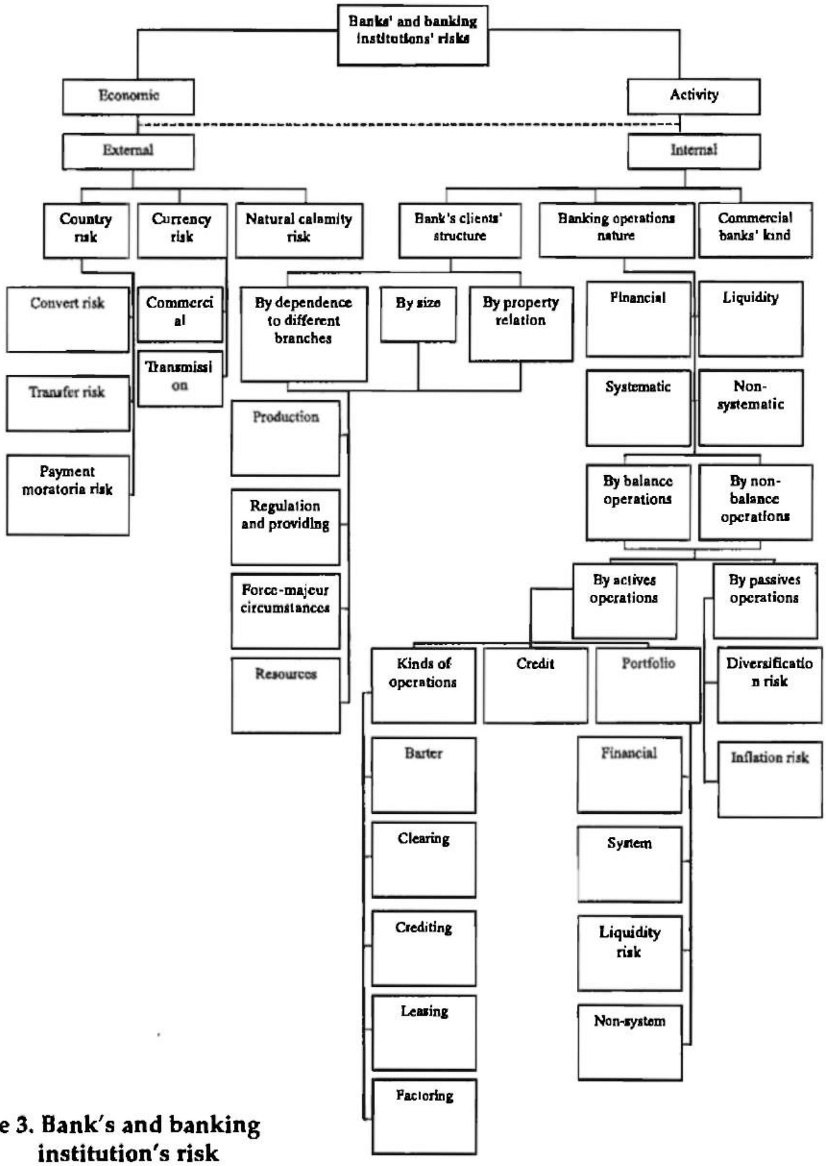

Figure 3. Bank's and banking institution's risk

Concerning presented (see Figures 1-3) risk factors variety and their interactions complexity, variety of objects and means of risk impact, it is needed to recognize the necessity of region business risk monitoring as a system. The system is created to observe risk factors of different region business objects, to create and verify models of effect estimation, to evaluate the consequences, to generate another information, which is needed for management decisions.

Formation of principles and goals of monitoring the region business risk

The monitoring concept is rather widespread in today's political, social, environmental and other activities terminologies, although it has a different sense of interpretation. The category of monitoring is often understood as a computer term monitor program, which has a precise meaning. This is a computing device's program, which observes, regulates, controls and verifies the data that is being generated. The category of monitoring is also widespread in the literature of risk problems, though often it is understood as reports of periodical surveys.

In the Lithuanian literature the category of monitoring as a systemic category was used in the environment field. Here, already in 1989 the Committee of nature protection passed the resolution about the organisation of complex monitoring and creating informative system "Ecology" for nature environment conditions. Later the monitoring program was prepared, and the term "ecology monitoring" was replaced by "environment monitoring". The environment monitoring is the part of the management system of environment quality which can provide a real basis for solution of various environment tasks. The goal of these tasks is to ensure normal conditions for coexistence of the nature and human beings. The integrated monitoring consists of the following tasks:

– to observe the state of ecosystem and provide information about the causes of changes, providing the basis of science emission control;

– to develop and use models assigned for descriptions of changes in the ecosystem and balance of material masses;

– to develop monitoring as an observation and forecasting system of natural changes.[1]

The term of risk monitoring as a system observing objects exposed to risk , evaluating consequences of risk impact, preparing the information needed for decision making or risk managing, also is used for region risk analysis and management problems.[2] The region risk monitoring is understood as identification of the basic risk exposed objects in the region, observation and evaluation of a level and scale of risk in the region as well as evaluation of the primary risk factors in the region. The regional risk management system could be organised following identification of risk exposed objects and evaluation of risk factors.

In further discussion, risk monitoring will be understood as a constant observation of risk and, first of all, as influence of the primary risk factors on region risk objects. The main tasks of regional risk monitoring would be:

1. To distinguish basic risk influenced objects in the region;

2. To distinguish basic risk factors in the region, first of all the primary ones;

3. To create analytical models which would allow to observe and evaluate level of risk of different region objects by different risk factors;

4. To prepare and arrange the information which would allow to create the risk management strategy.

There is no doubt that several different kinds of risks factors can influence one or another objects in the region. Thus, it is not always easy to recognize "the basic" risk factors. In addition, when the object is influenced by several risks in one time, it is difficult to evaluate their interactions effect, though it can be rather significant.

The data obtained through monitoring would be used to evaluate the level of risk of the region and to forecast possible changes in the risk. It would be valuable information for investors, especially foreign ones, whose decisions often depends on very common facts and information. The information, which is obtained by observing the region risk and changes, would be useful for managing risk of different objects and the whole region risk management as well as for planning the means of the long-term risk management.

Regional business risk monitoring should be executed on the basis of the complex monitoring system. This system would allow monitoring changes in level of risk of the region and analysing reasons of these changes in order to improve models and methods designed for generation and collection of information, necessary for decision making. It would also help to develop a strategy of business risk management which will facilitate maximisation of efficiency of that management in the whole region. In practise creation of a complex or systemic regional monitoring of business risk has to include:

– identification of primary risk factors and their impact on objects;

– identification of recipients of regional risk impact;

– preparation of means and instruments of the system of risk management and the strategy of risk management.

Thus, according to the basis of the complex monitoring concept, it would be expedient first of all to identify the primary (basic) region risk factors. The basic groups are:

1. Finances and business risk.

2. Physical risk.

3. Management risk.

Each of these groups of risk factors includes several actual primary risk factors. Primary (basic) factors are those which practically do not depend on another factors. However, study on financial processes shows that such factors are rather hard to pinpoint in reality. In the paper we understood as primary risk factors those which predetermine other risk factors with respect to particular risk influenced objects or their groups. The primary risk factors in financial and business risks, are:

- exchange rate risk
- interest rate risk
- inflation risk
- market risk
- capital expenditure risk

The primary risk factors in physical risks are:

- risk related to natural disasters
- risk related to changes in environment and human and fauna genetic properties.

The primary risk factors in management are:

- technological risk
- risk related to managerial decisions
- risk related to political decisions .

After identification of primary risk factors one needs to study the main risk exposed objects in the region. Such objects of risk influence in the region could be distinguished through:

1. Financial instruments.
2. Subjects of economics.
3. Functions of state business management.
3. Region resources.

These risk exposure groups can be detailed as follows:

1. Financial instruments include: currency, debt means, investment means, and financial transactions.

2. Subjects of economics include: financial institutions (domestic, foreign and mixed), subjects of other activity (domestic, foreign and mixed).

3. Functions of state business management include: budget, internal debt, foreign debt, balance of payments, and social stability.

4. Region resources include: natural resources, people and their assets created by them.

In a common case region business risk monitoring could be presented as the aggregated scheme as it was showed in the Figure 1.

Practical aspects of risk monitoring execution

As we have mentioned in the previous chapter, there are various financial assets or their portfolios between risk influenced objects. A portfolio is a set of different kinds of assets, owned by any institution or an individual. A financial portfolio is a set of financial assets. The content of a portfolio can vary greatly. Besides the portfolio of assets, there can be a portfolio of liabilities or a compound one.

In this chapter we would like to try to present the principles of making and optimising a modern investment portfolio. We will study limitation of a modern portfolio and problems concerning its use in practice, together with suggestions of a portfolio model to evaluate multi-possibility of outcome. We will also determine the specific risk factor, concerning the portfolio as a typical risk influenced object, i.e. an influence of interdependence of assets on portfolio properties.

We say, if a portfolio includes $A_1, A_2, \ldots, A_n$ assets, its structure is $w_1, w_2, \ldots, w_n$ ($w_i > 0$, $w_1 + w_2 + \ldots + w_n = 1$), then the portfolio value is $v = w_1a_1 + w_2a_2 + \ldots + w_na_n$, where a_i is the i^{th} asset value. The theory of securities portfolio is the means for an investor to get theoretically the largest profit from different - risky and non-risky - sets of securities. The key problems, solved by the portfolio theory, are determining all possible portfolios, finding the most effective portfolio line (efficiency line), and choosing the optimal portfolio for each investor.

In order to understand better the decision method for the mentioned problems, we need to go deeper into their geometry, and more precisely - in their plane, into which the decision criteria are introduced. Let us assume, that the average values of portfolio profit are presented on the axis of ordinates, and the standard deviation - the measure of volatility of the same profit - is presented on the axis of abscissas. So we put the mean and the standard deviation of the same probability distribution on different co-ordinate axes. When we choose a set of assets with known values of their profitability and average standard deviation, considering, that every asset in the investor portfolio can take any share from 0 to 1, we have the set of all portfolios (see Figure 4a). Such form of a portfolio set is obtained purely because of mathematical random values and their weighted sums' properties. The efficiency line YB is the part of the convex curve AB. They have a very significant meaning in studies of separate portfolio properties.

We already have mentioned that the mission of a portfolio as a instrument of investment is finding the structure $w_1, w_2, \ldots, w_n$ of a particular investment set, which allows to maximise the average portfolio profitability when there is a particular risk level, or to minimise risk, when there is a chosen particular average profitability level. When we study these things further, it is necessary to remember that common risk is divided into system and non-system risk. We know the fact, that when there is rather large amount of investments in the portfolio only the system risk its characteristic, i.e. that part of risk, which is characteristic of all economic system (of a country, region, or the world). Further we will study only the component of the system common risk.

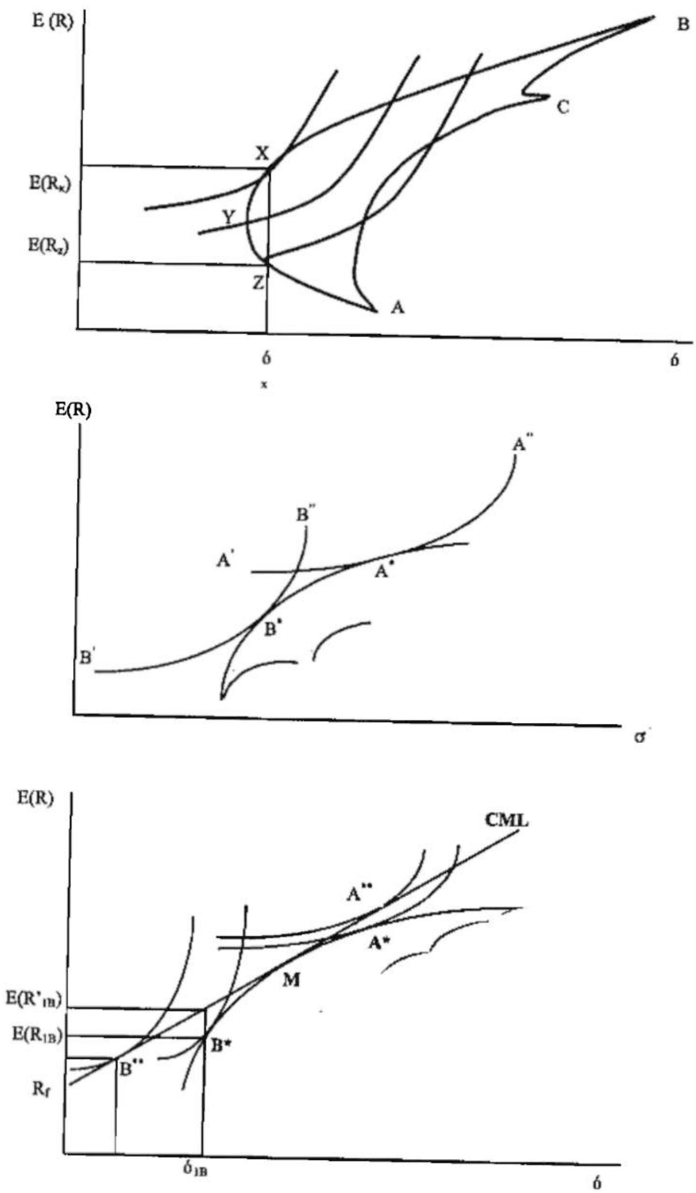

Figure 4. Optimising modern investment portfolio

It was mentioned that one of the three basic problems solved by applying the portfolio theory is choosing the optimal portfolio of all portfolios set for an individual investor. Indeed, it is very important to emphasize that investments in the portfolio theory are not studied in the impartial environment for the investor, but they take into account the investor's benefit. It is the specific feature of maximising criteria of the portfolio theory.

In the modern portfolio theory it is accepted to use the simplified phase of the usefulness function – indifference curves. The concept on an indifference curve came from the consumption theory, where it expresses the combination of two goods, when these goods are of the same use for a consumer. In the portfolio theory an indifference curve defines the combination of a profit and risk, which are equally acceptable for a consumer. We see from Figure 4a how the investor should choose the most profitable portfolio, taking into account the set of possible portfolios and its usefulness function (indifference curve).

The Figure 4b can help us to develop the idea about portfolio theory maximisation principles oriented towards increasing of common usefulness. It illustrates how investors, which have different indifference curves A'A" and B'B", choose different optimal portfolios maximising both: their and common usefulness.

However, such portfolio optimising logic is correct in case, when there are risky investments in the portfolio only. It is correct in case, when there are the most gainful portfolios, which are from the set of possible portfolios and which are on the map of indifference. But this assumption of risky investments alone does not detect the investor's possibilities in the real investment world, where there are also non-risky securities – such as government bonds. And, if it happens, then the investor has a possibility to achieve higher usefulness point than A* and B* in the indifference map. This is illustrated in the Figure 4c. These results already are a half-century-old.[3]

The rate of non-risky short-term government securities is shown as a R_f point. Every investor can distribute his money in particular conditions among risky investments, presented by the point M on the effectiveness line, and non-risky securities - in the R_f point. We get such linear expression:

$w_m M + (1 - w_m)B$,

where: M – parameters of risky investments; B – parameters of non-risky investments; w_m - a part of risky investments.

All points representing this linear combination of risky and non-risky securities have to be on a straight line, joining points R_f and M. If an investor chooses the lower risk, then his position will be closer to point R_f; if the investor choose the higher risk, his position will be closer to M point or above it.

Let's turn back to the investor B. There are no possibilities to invest in non-risky assets, and he is in the position B* with the risk s_{1B} and possible Profit $E(R_{1B})$.

When there is a possibility to acquire non-risky assets, the investor B can distribute his assets among M and B in such way, that he gains the largest profit $E(R'_{1B})$ with the same risk. However, the investor B practically should give priority to the movement to the point B**, in which the profit is decreasing by a certain amount, but the risk is significantly lower. We know, that the investor gives an advantage to this position (less profit and significantly lower risk) for the reason that the impartial (indifference) curve intersecting R_fM in the point B** is of higher level than the indifference curve which goes through the point B*. This is represented also in the graph by the investor's indifference curve.

If we turn back to the investor A we can see that he takes a bigger increase in risk. His indifference map shifts his choice beyond the point M. He is not distributing his money between M and B now. He borrows non-risky price R_f instead, and then he invests this money and that which he already has in order to achieve the point A**. That straight line, which we were talking about, is named capital market line (CML). The clear separation of risky and non-risky capital allows to get the result, which is known as J. Tobin separation theorem.

Now let us study the M portfolio. The investor A uses this combination of risky assets portfolio. The investor B also does so. It is clear that every investor, knowing the advantages of this portfolio, includes it in his combination of investments. This is the only portfolio of equilibrium, which has every risk adverse investor. When we say 'risk adverse investor', we do not keep in mind that the investor does not risk at all; this means that in case of two investments with the same profit but with different risk the preference will be given to the lower risk. That's why it becomes the market portfolio and in the condition of equilibrium it must represent all possible risky investments and in ratio of proportional representation of all investments.

The **classic scheme** of analysis, management or other use of portfolio is rather clear and convenient for practical application but the way towards this simplicity is quite sophisticated. The functional expression of effectiveness and envelope (convex) curves, which is necessary in the practical portfolio use, is not obvious in common case. But if we want to choose and manage a portfolio, it is necessary to present (imagine) different states of that portfolio, to describe the interactions of those states or to study another properties of the portfolio. The portfolio, when it is presented only by its average profit and standard deviation in some sense is no more a stochastic one, and gives no possibility to evaluate reliability of many events related to the portfolio.

Moreover, the **scheme of modern portfolio** selection is not yet adequate for some urgent needs of portfolio owners:

1. Many of risk recipients could hardly present its own indifference curve while some kind of utility function is quite understandable.

2. Profit expectation, which in modern portfolio theory is identified with mean profit, is not the most expected profitability value, i.e. it doesn't have the highest profitability.

3. Assurance of the needed level of reliability – for this -purpose it is necessary to select portfolios not only on the basis of two targeted indicators as in the modern portfolio scheme – mean and standard deviation, but for all levels of quintile – standard deviation combinations.

4. For defining efficiency zone, i.e. the zone which shows all profit possibilities under every risk (standard deviation) level.

Of course, today several investigations[4] are directed towards solution of similar problems.

Now let us return our attention to portfolios geometry. We see, that averages of a random profit are put onto the ordinates axis, and square deviations of these magnitudes are put onto abscissas axis. Thus, we have a very evident geometric illustration of the basic analysis results of the portfolio. This geometric evidence will not disappear if, instead of averages or dispersion, we take their linear functions, i.e. push them in the same direction on the ordinates/abscissas axes.

Having in mind the profitability descriptions of portfolio, or, more exactly, investments which belong to the portfolio, we have to agree that the average portfolio profit value is not the best index for evaluation of portfolio's state. Average profitability is a generalised state of profit possibilities of all investment. However, it is just one of many possibilities, it often does not attract such attention, as a quintile of a certain level (for example 95%). In every specific case the profit will be just one of profit possibilities, which are comprehensively defined by their probability distribution. The necessity of interpretation of portfolio profitability as a random variable affirms the circumstance, that the price of separate investments (bonds, stocks, projects and so on) and portfolio price are random magnitudes. So we can have the whole view of possibilities of a portfolio profit only after presenting this profit as a random variable, which is like a logic financial-mathematical model of this profit.

Thus, study on an investment portfolio with appliance of classic methods, and based on the concept of the average profit arises the problem –whether the portfolio is adequate for management needs. We can forecast a profitability average in the future and also describe it quantitatively by categories of random values' only. In its turn only such description of a portfolio's profit possibilities allows to find out the interaction between profit possibilities', volatility and investor's usefulness function. This is necessary for systematic evaluation of risk and creation of its adequate management model. Moreover, the same shape of a portfolio geometric picture will remain if the mean value of the portfolio profitability will be substituted by its median, mode or any level quintile on the ordinates axis (see Figure

2). Of course, these figures also provide information about dependency of portfolio envelope curve and efficiency line on the quintile reliability level as well as on type of the portfolio profitability probability distribution.

We also need to remember that the system of co-ordinates, in which the geometry of the portfolio is studied, is pre-determined in such a way. There are averages of random variables or another linear functions of values of those variables in the ordinate axis, and there are standard deviations or their linear functions on the axis of abscissas. That is why facts similar to classic portfolio, such as existence of a set of possible portfolios, effectiveness lines, envelope curves and their properties, etc., are also applicable for every portfolio's profit characteristic similar to the average. But as it was mentioned earlier, if we want to take in to account all portfolios' possibilities of profit, we will have to study not the effectiveness line, but the whole efficiency zone.

So the further study of a portfolio should be moved from rather obvious coordinates system (see Figure 4) of a portfolio profit's standard deviation and this profit expected values (averages) to a more complex one. But incomparably adequate system of co-ordinates, where average standard deviations of a portfolio's profit are put onto the abscissas axis, and corresponding efficiency zone. The latter one is the set of efficiency lines for various (all) levels of quintile of the set of the portfolios or the set of maximums of these quintiles values under fixed standard deviation value. So, by its vertical efficiency, zone is the set of efficiency lines for all quintiles of the set of the portfolios profit abilities probability distribution functions and by its horizontal efficiency zone is the family of probability distribution functions, arranged according increasing value of standard deviation of these distributions.

As was mentioned before, according to the modern portfolio theory, the investor should be interested only in those portfolios which are located on the efficiency line. The efficiency line is understood as a set of maximal possible values of profits (averages), calculated for the particular standard deviation magnitude of portfolios set. Joining the existing investments into a portfolio in all possible proportions creates the set of possible portfolios; and, total portfolio's profit averages and the standard deviations are evaluated.

However, in reality investments are observed and realised not by their profit averages, but by the possible values, which depend on investments market and purchasing price. Thus, it is important for the investor to see not only the portfolios, which are on the efficiency line but all sets of portfolio's profit possibilities. Thus, the investor is interested in the whole efficiency zone, which is understood as the set of efficiency lines for all possible quintiles. So studying the efficiency line, on which we have the portfolios maximal averages, for every meaning of possible portfolios standard deviation, is changed into studying the efficiency zone. In turn, the investor's indifference curves should be changed (widen) into the usefulness functions. As a result, we have the scheme of study on the complex portfolio risk.

Summarising this stage, it is important to notice once again those basic differences which arise when applying the classic portfolio theory (which is often named 'modern' in literature) and the adequate portfolio theory proposing here. They are presented in Table 1.

Table 1. Classic and adequate portfolio theory – differences

Classic portfolio theory	Adequate portfolio theory
1. Determines the efficiency line in which portfolios have maximal averaged profitability among all portfolios with given level of risk from possible portfolios set.	1. Determines the efficiency zone, in which there is a probability distribu tion of maximal possibilities of all quintiles for every level of risk of possible portfolios set.
2. The indifference curve of every investor allows to choose a portfolio, with which the largest profitability can be accessed.	2. Allows to choose a level of risk and a maximal distribution of possibilities for usefulness function of every investor, which maximises both benefits of the individual investor and investment.
3. Profitability of separate investments as well as portfolios as a whole are considered only by means of interaction of the averages and the standard deviations.	3. All profitability possibilities for separate investment as well as for portfolios as a whole are considered altogether with risk recipients utility functions, which also encounter all portfolio profitability possibilities.

Concise analysis on results of practical application of the adequate model

There was no phenomenon of values or processes interdependency among the primary risk factors mentioned in the second chapter. Moreover, studies in which the process of interdependency is considered as a management object are rather scarce in financial literature. Further we will talk about a statistical interdependency of financial assets as the primary risk factor in the region. This choice is caused by the following circumstances:

– the level of statistical interdependency of different system acts strongly on the volatility (risk) of the whole system;

– a primary risk factor is a suitable view for the statistical interdependency;

– the management of most of financial phenomena is based on the management of interdependency separate processes;

- the interdependency of separate financial assets or their sets - portfolios - just for evaluation possibilities has to be understood as a stochastic variable;

- probability theory and mathematical statistics, which are the basic instruments for studying finances and investment, give unlimited dependency of possibilities and its influence on the other processes.

Lithuanian Stock Exchange helped to execute the suggested model of the adequate portfolio and created digital solution imitative technology in practice. Clustering of the set of stocks was tried a way ensuring independent groups of assets. We could not separate all stocks into groups, which would be statistically independent, however, after refusing of about half of all stocks, the left part was separated in 4 groups, which are statistically independent, i.e. their correlation matrix C_{ij} is similar to the following diagonal matrix:

$$C_{ij} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Averaged profitability and risk (volatility) of these four sets, which have no common stocks, were evaluated, and they were considered as assets, which were the basis for the constructed set of possible portfolios. With the help of imitative technologies the efficiency zone, and also main characteristics of that zone: probability distributions of maximum possibilities of portfolios, under the given risk of possible portfolios set; minimal and maximal profitability's levels, 5% and 95% reliability lines, and also curves of means and medians values were determined.

For evaluation of the increasing/decreasing statistical interdependency of separate investments influence on a portfolio's probability's possibilities, it was approved, that the statistical interdependency appears between chosen groups, i.e. the data were transformed in such way, that group's profitability means and standard deviations were left the same, but the former matrix of correlation changed in such a way:

$$C_{ij} = \begin{pmatrix} 1 & 0{,}95 & 0{,}95 & 0{,}95 \\ 0{,}95 & 1 & 0{,}95 & 0{,}95 \\ 0{,}95 & 0{,}95 & 1 & 0{,}95 \\ 0{,}95 & 0{,}95 & 0{,}95 & 1 \end{pmatrix}.$$

Indeed, between Lithuanian National Stock Exchange assets it was possible to separate groups, which have such correlation matrix, and even to choose different assets, which individually have such a dependency. But it is clear, that if we take another assets and compare them with initially chosen ones or their groups, calculations and comparison will lose their meaning. For that reason the efficiency zone, as well as its basic characteristics of possible portfolios' set for the selected groups of assets under presumption about staying the same average profit abilities and standard deviations of the assets and about changes in their interdependency according to mentioned matrix were estimated. As in the case of independent groups, we define the efficiency zone and its properties.

Before starting the quantitative analysis, we have to notice, that we are not able to use very powerful computers which are needed to solve such tasks absolutely exactly. However, the results are very satisfactory, and the following views can serve as the conclusions:

1. The efficiency zone, after appearance of interdependency of separate assets, moved in "south-east" direction – i.e. moved to the bottom and to the right.

2. Distributions of maximal possibilities of portfolios' profitability:

a) left constant (normal) in the case of independent actives, but changed their form from normal to gamma when the risk of portfolios set was increasing;

b) standard deviation was increasing rapidly when the dispersion of possible portfolios increased, in both cases - independence and dependence - though in the second case standard deviation increased slower;

c) both - the scale of the efficiency zone (the difference between the maximal and minimal values) and the standard deviation - were larger in the case of dependent assets.

They are the "understandable" results from the common point of probability theory. However, the solution we have found does not only confirm the comprehensive truth but also allows to execute some quantitative valuations. And we would also like to remind, that it is rather difficult to find a solution with usual methods of mathematical analysis, linear programming, geometry, probability theory, etc. Having in mind that portfolio assets' profit possibilities can follow the probability distributions of different functional form, and their interactions mechanism can be determined by particular regulations, it is not difficult to imagine situations, when tasks become practically indecisive with help of the above mentioned methods. That is why computerised imitative technologies become in many cases the unchangeable part of portfolio decisions.

Conclusions and presumptions

1. Negative results of unmanaged risk influence are noticed not only in financial activity, but in many fields of society life.

2. Necessity to create regional informative system of business risk is gaining importance.

3. The management of risks as a non clear-cut structured system is particularly complex and demands new conception basis and entirely new methods of information management.

4. Regional monitoring of business risk, understood as a system of observation of risk influence, evaluation of consequences of risk emergency and collection of information needed for decision making, should become the source of RIS, understood as informative and management system.

5. The development of methods revealing the adequate risk influence on various business subjects and processes is urgently necessary. The portfolio model adequate for multi-valued profitability possibilities, suggested in the paper, could serve as methodological basis for such development.

6. We need a new method for generation of information, related to risk influence on different subjects and processes, as well as for models describing this influence. There are also necessary new methods of decision-making in such complicated situations. In many cases imitative technologies of decision finding, suggested in the article, allow to make exact decision in such fields , where the usual methods of programming, analysis and probability theory are difficult to use.

Notes

[1] Enviromnent monitoring 1993–1995, Vilnius: LRAAM, 1996.

[2] See: E. J. Vaughan, Risk Management, Willey & Sons Inc., New York 1997.

[3] For example see: J. Tobin, The Theory of Portfolio Selection, in: F.H. Hahn and F.R.P. Brechling (eds), The Theory of Interest Rate, Macmillan, London 1965; W.F. Sharpe, A Simplified Model for Portfolio Analysis, "Management Science", January 1963; W.F. Sharp, Capital Asset Price: A Theory of Market Equilibrium under Conditions of Risk, "Journal of Finance" No 29(3) September, 1964, and J. Lintner, The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budget, "Review of Economics and Statistics", February 1965.

[4] J. Dupacova, Portfolio Optimization via Stochastic Programming: Methods of Output Analysis, "Mathematical Methods of Operations Research", Vol. 50, 1999, p. 245-270; K. Hiroshi, A. Wijayanayake, Portfolio Optimization Problem under Concave Transaction Cost and Minimal Transaction Constraints, "Mathematical Programming", Vol. 89, 2001, p. 233-250; K. Dieter, R. Zagst, Portfolio Optimization: Volatility Constraints versus Shortfall Constraints, "OR Spectrum", Vol. 21, 1999, p. 97-122; F.E. Benth, K.H. Karlsen, K. Reikvam, Optimal Portfolio Management Rules in a Non-Gaus-

sian Market with Durability and Inter-temporal Substitution, "Finance and Stochastics", Vol. 5, 2001, p. 447-467; K. Heyeng Keun, Consumption and Portfolio Selection with Labor Income: A Discrete-time Approach, "Mathematical Methods of Operations Research", Vol. 50, 1999, p. 219-243; S. Browne, Beating a Moving target: Optimal Portfolio Strategies for Outperforming a Stochastic, "Finance and Stochastic", Vol. 03, 1999, p. 275-294.