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INDICATORS AND MEASUREMENT OF INTEGRATED RISK MANAGEMENT IN SEA PORTS

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Нєнно І.М. Індикатори та виміри інтегрованого ризик-менеджменту в морських портах.

У статті узагальнено якісні та кількісні індикатори вимірювання ризиків, зокрема, показники очікуваної вартості, стандартного відхилення та коваріації, чистої поточної вартості із урахуванням ризику Якісну оцінку структуровано по фінансових операціях із визначенням вірогідності банкрутства. Розроблено модель, яка візуалізує результати за допомогою спектр-бального методу по фінансових показниках і показниках ймовірності банкрутства моделей Лиса, Спрінгейта, Ж. Конана і М. Ґолдера.

Ключові слова: індикатори ризик-менеджменту, якісна та кількісна оцінка ризиків, спектр-бальний метод, запобігання банкрутству

Ненно И.М. Индикаторы и измерения интегрированного риск-менеджмента в морских портах.

В статье обобщены качественные и количественные индикаторы измерения рисков, в частности, показатели ожидаемой стоимости, стандартного отклонения и ковариации, чистой текущей стоимости с учетом риска. Качественная оценка структурирована по финансовым операциям с определением вероятности банкротства. Разработана модель, которая визуализирует результаты с помощью спектр-бального метода по финансовым показателям и показателям вероятности банкротства моделей Лиса, Спрингейта, Ж. Конана и М. Ґолдера.

Ключевые слова: индикаторы риск-менеджмента, качественная и количественная оценка рисков, спектр-бальный метод, предотвращение банкротства

Nyenno I. Indicators and Metrics of the Sea Ports' Enterprise Risk Management.

The qualitative and quantitative indicators of measuring of risks are generalized in the article, in particular, indexes of the expected value, standard deviation and covariance, net present value under risk. Qualitative estimation is structured on financial operations with bankruptcy probability evaluation. A model which vizualizes the results of scale-grades method on the financial and measuring of bankruptcy probability of the models of Lis, Springeyt, G. Conan and M. Holder.

Keywords: risk-management indicators, qualitative and quantitative risk estimation, scale-grade method, prevention of bankruptcy

Integrated risk-management at the enterprise level, which was based in the science and practice of management in the late twentieth century provides the transition to a proactive or anticipatory management of risks where each risk is subject to management and is considered not only as the possibility of losses but also as a chance to gain profit and development. The aim of integrated risk-management is to prevent the implementation of the overall risk of bankruptcy.

Analysis of recent researches and publications

A comprehensive study of the system and process of management of seaport, held by the Ukrainian scientists G.B. Vilskym, J.H Goncharov, Y.Y. Kruk, E.D. Krushkinym [1]. The issue of risk assessment investigate Ukrainian scientists A.E Kuzmin, L.G. Verbitskaya, A.G. Melnik, A.O. Starostina, V.A. Kravchenko. Foreign scientists A.A. Lobanov, V.A. Chugunov, M.A. Rogov [2-5] focus on quantifying risks.

Unsolved aspects of the problem

Taking into account significant achievements of the scientists listed above, we emphasize that the Ukrainian scientific community lacks studies in which the risk object is the port. This trend is the newest and for foreign science. A comprehensive study of the environmental and political risks of ports observed for the last five years [6]. Arise specialized publications S.N. Srikanth, Ramesh Venkataraman, E. Scarlat, N. Chirita, I. Bradea. [7, 8].

The aim of this article is the formation of a systematic approach to risk assessment of seaport within the concept of integrated risk-management at the enterprise level. It was solved a number of tasks to achieve the goal:

— clarified the nature of quantitative and qualitative risk analysis of the Maritime trade port;
— systematized performance and risk measurement;
— founded, developed and interpreted in the form of a case study on the example of sea trade port of Ukraine the use of the software product assessments of financial risks and the overall risk of bankruptcy.

The main part

Quantitative risk analysis. There are two main approaches to quantitative or objective measurement of the probability (risk degree). One of them is a priori, by deduction, the second – posteriori by

statistical analysis of empirical data at the method of priori, the decision-maker, able to determine the probability of the result without experimentation or analysis of past experience. Instead, the probabilities are determined on the basis of deductive valid principles provided that the characteristics of possible cases is known in advance, for example, threw up a coin that has two sides, or may fall on one or the other side [9]. Assuming the coin is evenly balanced, deductive, we can conclude that there is an equal probability that the coin will fall or to the one or to the other side at any single tossing. Not necessarily toss a coin many times to discover that the comparative frequency of falling on one side or the other is 1/2 or one out of every two tosses. However, the estimated probability is not the final forecast for a specific result. The a priori method of risk assessment is suitable in the case where the decision-maker can calculate the probability of the result without relying on experimentation, sampling or past experience. If this is not possible, the decision-maker must use a posteriori method. In the method a priori we go from cause to consequence. In the method a posteriori we see the consequences through empirical measurements, and then try to establish the cause.

A posteriori method assumes that past experience is typical and that he will continue in the future. In order to set the dimension of probability, the decision-maker, begins with the observation of the frequency of occurrence of the event what is of interest, and dividing this frequency by the total number of observation. For example demand forecasting is carried out on the basis of demand curves and fluctuations of the past years. Statistical theory requires that data on the frequency meet three technical conditions: the data must provide a sufficient number of cases or observations to demonstrate stability; the observation should be repeated in the set of observations; the observations must be independent [10].

If these conditions are satisfied, the frequency distribution can be converted into a probability distribution. However, there is a difference between a frequency distribution and a probability distribution. The frequency distribution is fixing how many times there were certain events in the past. A probability distribution is fixing a possibility of occurrence of these events in the future in percent.

If conditions are such that the statistical probability of an event can be calculated objectively, the possibility of such an outcome should be classified as risk. Thus, insurance companies can predict with a high degree of probability of death, accidents and damage from fires. These probabilities help them to make decisions about levels and rates of insurance premiums. Although they cannot establish the probability that a particular person will die or that a particular house will burn, they may provide a margin of error, how many people in this age group will die in the next year or how many houses of this type located in a specific location, burn.

If the Manager-decision maker is faced with events or outcomes that suggest the presence of risk, its main task is to develop methods that are able to provide the ability to calculate, and in the future to minimize the risks inherent in a particular task. One of the methods used to achieve these goals consist that to calculate the probability distribution of possible outcomes from the block sample observations and then to calculate the probable cost.

In terms of risk the main criterion for the decision is the estimated cost, which is calculated as follows:

$$E(X) = P_1X_1 + P_2X_2 + ... + P_nX_n = \sum_{i=1}^{n} P_iX_i \quad (1)$$

where X_i – the cost of the i-th impact;

P_i – the probability of the i-th impact (which is equal to the probability of the i-th option).

From formula 1 it follows that the expected value of the strategy is the weighted average value, in which using the probability of returns as the weighting coefficients. Thus, we can say, if the strategy used many times in similar variants, then we could expect to receive average returns, equal to the estimated cost. When you evaluate the many strategies with the same value of an investment, manager-decision maker selects the strategy with the highest estimated cost. If the estimated costs of alternative strategies are the same, in order to make a choice between strategies should use a different criterion. This criterion may be the degree of risk. Since the estimated cost is the measurement of the main trend, the degree of risk can be defined as the degree of deviation of possible returns from the expected value. thus, the risk is considered to be secondary, or auxiliary, measuring perceived value and is expressed in the form of indicators such as the magnitude and standard deviation.

To assess the scope uses the following logic: intuitively, for the Manager it is clear that the farther from the mean value is the actual return, the riskier the project will be. Therefore, one way to measure the risk becomes a calculated dimension that represents the difference between the most extreme values of return. The scale is a useful preliminary assessment, but it takes into account only the extreme cost and does not include the cost located between them. If we assume the presence of a normal probability distribution, the more accurate the measurement will be statistics, which is called the mean square deviation which is a measure of the deviation of the return of the estimated cost. Standard deviation shows the rigidity of the probability distribution. The higher the standard deviation, the higher the probability of the possible impact and, consequently, the higher the risk. The calculation of the mean square deviation conduct as follows.

$$\sigma = \sqrt{\sum_{i=1}^{n} (X_i - \mu_X)^2 \, P_i} \quad (2)$$

where μ – represents the expected value.

The probability distribution is symmetrical about the mean for any normal distribution. The area under the curve represents the total probability, equal to 1.0, divided into two equal parts. Thus, the probability

(area) to the left of medium is 0.5 and the probability of the right side +0,5. If we refer to the table of the normal distribution, we can see that the value of Z=1.0 (meaning one standard deviation from the mean) corresponds to the scale 0,3413. Therefore, the magnitude between Z=-1,0 and Z=+1,0 is equal to 0,6826. That is, if there is a possibility that is 68,26%, the actual result will be within one standard deviation from the mean (in either direction). If you use the same procedure scale within ± 2 average quadratic deviations from the mean is equal to at 0.9544, or 95,44%, a span within ±3 mean square errors equal to 99,73% [10].

To measure the relative risk used coefficient of variation. Relative risk includes investments that are very different in size. Thus, the resulting indicator becomes an indicator of the level of risk in relation to currency investments. When we use the mean square deviation to measure the risk, we conclude in absolute value – indicator of the riskiness. Thus, larger and larger projects become more risky. But when you consider the average quadratic deviation relative size of the project, the relative risk may be lower for a larger project. In order to compare the riskiness of projects with different investment values, impact and perceived value, it is necessary to use relative rather than absolute measurements. The relative standard deviation (often called coefficient of variation) and represents the measurement.

The coefficient of variation is the ratio of the standard deviation to the expected value, or average. Calculated in percentage, it is an index of risk per dollar of profit and, thus, allows comparison of the relative risk of the strategies or projects that are very different value. The formula is as follows:

$$C = \frac{\sigma}{\mu}(100\%) \qquad (3)$$

where σ is the standard deviation;

μ – expected value (average value).

What strategy will choose the decision-maker depends on its attitude towards risk in connection with the recoil, as well as from other considerations, such as overall financial position of the person [12].

Well-known method of risk assessment is the analysis of discounted cash flow. In the calculation of the above capital future results of operations of the port a simple formula, the discount rate is changed via the parameter i to r, where r takes into account the industry average rate of return, the profitability of alternative investments (e.g., deposits) and the level of risk of the business project or business process [10].

$$NPV = \sum_{t=1}^{n} \frac{X_t}{(1+r)^t} - IC \qquad (4)$$

where *NPV* – net present value of the cash flow associated with investment;

X_t – the expected cash flow in period t under the influence of risk;

r – the required rate of return, taking into account the level of business and financial risk;

n – the number of periods that are considered;

IC (Invested Capital) – the amount of the initial investment.

In the calculation of the above capital on future performance of the organization , the formula for discounting can be also adjusted coefficient of certainty equivalent α [10]. To evaluate the expected results of the project with the NPV of the risk adjusted (multiplied) by a factor α .

$$NPV = \sum_{t=1}^{n} \frac{\alpha_t X_t}{(1+i)^t} - IC = \sum_{t=1}^{n} \frac{X_t^*}{(1+i)^t} \qquad (5)$$

where *NPV* – net present value of the cash flow associated with investment;

α_t – the coefficient of certainty equivalent for the period t;

X_t – the expected cash flow in period t under the influence of risk;

X_t^* – the risk-free equivalent volume cash in the period t;

i – risk-free rate of return or interest rate;

n – the number of periods that are considered;

IC (Invested Capital) - the amount of the initial investment.

Example: for an entrepreneur receiving income in the amount of 4,000UAH in 2015, equivalent to income in the amount of 5,000UAH in 2016. The factor equivalent certainty entrepreneur in 2015 equal: α = 4000/5000 = 0,8.

Qualitative risk analysis allows to reveal and identify the possible types of risks inherent in the enterprise. In the basis of risk assessment is the determination of the relation between certain sizes of losses of the business and likelihood of their occurrence. This dependence finds its expression in the construction of the curve of probability of occurrence of a certain level of losses (risk curve). To build a risk curve various methods: statistical, analysis of appropriateness of costs, method of expert evaluations; analytical method; method of analogies. For risk assessment in practice, most uses of expert (qualitative) methods based on subjective assessment of expected performance. For example, the financial condition of the port experts can evaluate with the division into high, medium and low risk classes in the context of the following components:

A) Using loans: a high level of risk if the company can not make the current activity without the use of borrowed funds ; the average level of risk, if the company needs investment loans for the development and expansion of business; low level of risk when the company does not use credits or use them occasionally.

B) The level of own working capital: the risk is high, if there are problems (deficits) working capital; average risk coefficient of security with own current assets is equal to the regulatory; risk of low – coefficient of security with own current assets above regulatory.

C) Liquidity of assets: a high level of risk associated with large excess stocks of raw materials,

finished goods in the warehouse, past-due accounts receivable.

D) Profitability: low profitability compared to industry average means high risk.

E) The level of accounts receivable: 60% of current assets, turnover of over 180 days – high risk, 40-60% of the current assets, the turnover period of less than 30 days – average risk; less than 40% of current assets, the turnover period of less than 30 days – low.

Financial investments of the company: if the share of financial investments in the assets is high, while return on assets was below the profitability of core business, therefore, the company was engaged in risky speculation, not justified expectations of high return.

G) The probability of bankruptcy is high; to exist; low [13].

The risk of port quantitatively characterized by a subjective assessment of the expected magnitude of maximum and minimum income or loss from investment.

Software product "the Analysis of financial risk (FR) and the overall risk of bankruptcy (ORB)" is intended to assess the financial risks and the overall risk of bankruptcy commercial sea port. It is designed with a synthesis of the contributions of a number of scientists [8] and consists of sheets of the Excel file in which the subject filling the first sheet with the name of Balance. It includes balance sheet, statement of profit and loss and the items of operating expenses. Data are entered as specified in the program codes of the financial statements. The program calculates financial ratios and displays the results using the range-ball method of analysis regarding consolidated financial condition and consolidated analysis of performance of bankruptcy, namely:

1. Financial soundness indicators: the ratio of financial independence or autonomy, the ratio of borrowed and own funds ratio own and borrowed funds.
2. Indicators of solvency: the absolute liquidity ratio, an intermediate ratio; the ratio of reserves to short-term liabilities.
3. Indicators of business activity: total turnover ratio; the ratio of stock turnover; turnover ratio of own funds.
4. Performance evaluation of the structure of the balance sheet: current ratio liquidity; security factor own means; the ratio of the net assets and authorized capital.
5. Profitability ratios: profitability ratio using total equity; utilization factor of own means; the coefficient of profitability of sales; profitability ratio at current costs.
6. Indicators of probability of bankruptcy: models of Lis, Springeyt, G. Conan and M. Holder.

The methodology and interpretation of calculations of the program "Analysis of financial risks and the overall risk of bankruptcy" in the case of a seaport listed in table 1.

Table 1. The methodology and interpretation of calculations of the program "Analysis of financial risks and the overall risk of bankruptcy"*

Index	Interpretation
1	2
1. Financial soundness indicators	
The ratio of financial independence or autonomy	Shows the share of equity to the total amount of liabilities. In 2011 was 0,90 in 2012 was 0.90. In 2013 - 0,95. This is due to the increase of own capital in the liabilities, and suggests that a more secure business (little risk of loss). Is calculated as the ratio of own funds to total liabilities. The recommended value is 65%. The need for own capital due to the requirements of self-financing of enterprises, which is the basis of their autonomy and independence. Feature of equity is that it is invested on a long term basis and most at risk. The higher its share in the liabilities, the higher is the buffer that protects creditors against losses, and, consequently, less risk of lost business.
The ratio of funds raised and own funds	The ratio of total long-term and short-term loans to own capital. In 2011 – 0,0014, in 2012 – 0,00, в 2013 – 0,00. The coefficient is equal to 0, because the sum of equity capital increases, there are no short-term and long-term loans
The ratio of own and borrowed funds	The ratio of total long-term and short-term debt to own capital. In 2011 – 0,11, in 2012 – 0,11, in 2013 – 0,05. The ratio is decreasing every year, because the amount of own capital increases. There is no long term commitments and current liabilities decrease.
2. Indicators of solvency	
The absolute liquidity ratio	Shows the share of short-term obligations can be immediately paid off by means of p/p. Is calculated as the ratio of cash to short-term liabilities. The optimal value is 0.4. Tends to decrease, this has a negative impact on the company. From 2,01 in 2011, in 2012 – 1,33, in 2013 – 0,44. This is occurs through reduction greater dynamics of the share of funds of short-term liabilities. If the liquidity ratios below the recommended values. And for the creditor and for the owner this means that there is a risk that the company will not be able to cope with your short term obligations.
Interim coverage ratio	Shows the share of short-term liabilities can be repaid by cash and receipts from debtors. Show studio the following in 2011 – 2,67 in 2012 to 1.87 in 2013 to 2.17. In 2012 the decrease is due to the decrease in cash and receivables on the background an increase in short-term liabilities. In 2013, the positive dynamics was achieved due to the increase in accounts receivable, reduced cash and short-term obligations
The ratio of provision reserves short-term obligations	Shows the share of short-term obligations can be paid off from reserves. Show studio the following in 2011 – 0,65, 2012 – 1,11, in 2013 is 0.86. In 2013 the decline is due to more dynamic dilution of stocks than short-term obligations.
3. Indicators of business activity	
The total turnover ratio	Shows the amount of revenue is generated from each hryvnia invested in assets, i.e. how many times will turn the assets into revenue.

Continuation of table 1

1	2
	There is a tendency of decrease in this indicator from 1.10 in 2011 to 0.47 in 2013 due to lower revenue of the enterprise. This suggests that investments have not been sufficiently effective. index must be increased to improve revenue (implemented). However, the decision on the sale of assets can be taken only after a comprehensive analysis of the coefficients of the turnover of each type of asset and liquidity of the enterprise.
The turnover ratio of reserves	From 2011 to 2012, the ratio decreased by 7,29 with 21,31 – the company too much money invested in reserves, excess and unproductive assets represent investments with low profitability. But by 2012, there is an increase to 12.63. The decrease in turnover can mean the following: 1. The company too much money invested in reserves, and excess and unproductive assets represent investments with low or zero profitability. 2. The company maintains a dated, illiquid reserves.
The turnover ratio of own funds	This indicator shows the rate of turnover of invested capital. There is a tendency of decrease in this indicator from 1.21 in 2011 to 0.50 in 2013 due to lower revenue of the enterprise. This suggests that investments have not been sufficiently effective. A low ratio indicates the omission of part of own funds. In this case, the rate of turnover of equity capital shows the need of investing in another, more suitable source of income.
4. Indicators of an estimation of balance sheet structure	
The current ratio liquidity	Shows the share of short-term liabilities that can be redeemed by implementing assets. This ratio decreased in 2012 to 2.99 in 2011 – 3,33 due to the decrease in working capital with the growth of short-term liabilities. In 2013. the indicator showed an increase up to 3,06 due to the greater decline in short-term liabilities.
Ratio provision of own funds	The coefficient of security with own current assets shows the presence of the company's own funds necessary for its financial stability. the ratio showed a slight decrease from 0.7 in 2011 to 0.67 in 2012. But did not show the dynamics of changes in 2013.
5. Indicators of profitability	
The coefficient of profitability of use of capital	The indicator, characterizing the efficiency of use of all assets. Shows the amount of profit gained per unit asset. In our case profitability of assets has decreased: in 2011 to 0.31 in 2012 to 0.16 in 2013 to (-0,08). The reason for this was the decline in profit in 2012. was quite a loss to the company in 2013. Applying this ratio, it is possible to make incorrect conclusions about the reduction of profitability of assets, if the enterprise has appeared the expensive equipment that is not used for product release. Or the return on assets can significantly exceed the branch indicator, if the assets on the balance sheet are carried at a price far below market.
The utilization ratio of own funds	Shows how much profit obtained per unit of capital invested by the owners, also tends to decrease. In 2011 – 0,34, in 2012 – 0,17, 2013 – (-0,09). The reason for this was the decline in profit in 2012 at 49%, and in 2013 and does the loss of the enterprise.
The coefficient of profitability of sales	Shows the amount of profit obtained per hryvnia of sold products. Is calculated as net profit divided by sales revenue for the corresponding period. For 3 years the return on sales decreased from 0.28 to (-0.18), due to the decrease in the company's profit.
The coefficient of profitability at current costs	Shows the value of profits earned on hryvnia of expenses. Calculated as ratio of net profit to the cost of the enterprise for the relevant period. In 2011 to 0.23 in 2012 – 0.20 in 2013 – (-0.16). The reason for this was the decline in profit in 2012 at 49%, and in 2013 and does the loss of the enterprise.
6. Indicators of probability of bankruptcy	
models of Lis	The formula to calculate this model of bankruptcy: Z = 0,063X1 + 0,092X2 + 0,057X3 + 0,001X4, where X1 = working capital / total assets; X2 = profit from sales / total assets; X3 = retained earnings / total assets; X4 = own capital / debt capital. Indicator models had trends of decline during 3 years: 2011 - 0,06, in 2012 – 0,04, in 2013 – 0,02. The main reason was the decrease of sales profit and net income, which have impacted on the weights of the model X1 and X2.
models of Springeyt	The formula to calculate this model of bankruptcy: Z = 1,03A + 3,07B + 0,66C + 0,4D, where A = own circulating assets / total assets; B = earnings before interest and taxes / total assets; C = profit before tax / current liabilities; D = revenue from sales / total assets. Indicator models had trends of decline during 3 years: 2011 – 3,73, in 2012 – 2,13, in 2013 – (-1,10). The main reason was the decrease of sales profit and net income, which have impacted on the weights of the model B and C.
models of G. Conan and M. Holder	The formula to calculate this model of bankruptcy: Z = -0,16X1 + 0,222X2 + 0,87X3 + 0,10X4-0,24X5, where X1 = the ratio of the sum of cash and receivables to the total balance; X2 = the ratio of the sum of equity and long term liabilities to the total balance; X3 = the ratio of servicing costs for borrowings to revenue from sales; X4 = the ratio of staff costs to income; X5 = the ratio of profit before interest and taxes to loan capital. The assessment of solvency: —If Z ≤ -0,164 the probability 10% —If Z from -0,164 to -0,131 the probability 20% —If Z from -0,131 to -0,107 the probability 30% —If Z from -0,107 to -0,087 the probability 40% —If Z from -0,087 to -0,068 the probability 50% —If Z from -0,068 to -0,026 the probability 70% —If Z from -0,026 to 0,002 the probability 80% —If Z from -0,002 to 0,048 the probability 90% —If Z ≥ 0,21 the probability 100% Indicator models had trends of decline during 3 years: 2011 – (-0,812), in 2012 – (-0,292), in 2013 – (-0,054). The main reason was the decrease of sales profit and net income, which have impacted on the weights of the model X4 i X5.

Conclusions

Thus, the article proposes a model that is based on procedures quantitative and qualitative risk assessment of marine trade port and summarizes the necessary risk indicators to prevent the overall risk of bankruptcy. Qualitative evaluation is an expert analysis of the level of risk: on deals of loan; the amount of own working capital; liquidity of assets; profitability; receivables; the volume of financial investments of the enterprise; the probability of bankruptcy. Quantitative assessment visualizes results by using range-ball method on indicators of financial sustainability; solvency; business activity; assessment indicators balance sheet structure; profitability; indicators of the probability of bankruptcy Model models of Lis, Springeyt, G. Conan and M. Holder. Given case with the use of risk measurement data of the Ukrainian sea trade port. Pesrpective for further research is the deployment of predictive indicators for integrated risk management unit as indicators of operational management in the activities of sea trade port.

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