

**Professor Emil SCARLAT, PhD**  
**E-mail: emil\_scarlat@yahoo.com**  
**Professor Nora CHIRITA, PhD**  
**E-mail:norachirita@yahoo.com**  
**Ioana-Alexandra BRADEA, PhD Student**  
**Department of Informatics and Economic Cybernetics**  
**The Bucharest Academy of Economic Studies**

## **INDICATORS AND METRICS USED IN THE ENTERPRISE RISK MANAGEMENT (ERM)**

**Abstract.** *The main objective of the paper is to discuss how indicators and metrics can be used in risk management. In introduction, there are presented some general ideas about enterprise risk management and its implementation using key risk indicators (KRIs). In Section, there are presented several definitions for KRI and the steps which must be followed for implementing a set of KRI. In Section 2, it is made the distinction between risk indicators and performance indicators. In Section 3, it is described the notion of risk metric. Section 4 refers to the importance of monitoring and measuring risks at any level of the company. In Section 5 there are exposed the benefits recorded by the enterprise, which are generated by an efficacious ERM. The last section targets the correlation between risks and the scoring models used for prediction of bankruptcy. The paper ends with some conclusions and with the list of references.*

**Key words:** *metrics, key risk indicators, management, risk, dashboard.*

**JEL Classification: C53, M10.**

### **1. Introduction:**

Enterprise Risk Management (ERM) represent the authority that is dealing with uncertainty for the enterprise. The importance of ERM consists on the need of managing the risks properly, in order to sustain operations and achieve the business objectives.

COSO's ERM Framework defines ERM as follows: "*Enterprise risk management is a process, effected by an entity's board of directors, management, and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within the risk appetite, to provide reasonable assurance regarding the achievement of entity objectives*".

Through ERM, every company will be able to have a holistic view of the potential events that may affect the achievement of the organization's objectives.

An efficient management will implement a set of indicators or metrics in order to monitor the changes in risk conditions and to identify new risks. This approach will allow a better management of risk events. Risk management involves attention, a future-oriented focus. Implementation of key risk indicators is a prerequisite to achieve goals.

All businesses have the difficult task of developing KRIs offering an early warning system of possible future problems. KRIs are the cornerstone of an effective risk management, are a critical part of the risk management process, that is why it is necessary to allocate time in order to create a set of reliable KRIs.

## 2. Key risk indicators (KRIs)

Many researchers have been concerned lately with the problem of risk indicators and how they help to detect and reduce the risk at an enterprise level. It have been developed many books and articles on this topic. There were elaborated a lot of definitions for this concept, definitions that will be presented in this Section.

A risk indicator provides a forward direction, and information about risk, which may or may not exist and is used as a warning system for future actions. With a KRI it can be monitored a specific risk and can be undertaken mitigation actions. Metrics are used to provide an early warning sign for increased exposure of risk in different aspects of the enterprise.

An indicator is a key indicator if it serves a very important statement and do it very well [**Jonathan Davies, Mike Finlay, Tara McLenaghan, Duncan Wilson, 2006**].

Key risk indicators are "Statistics or measurements that can provide a perspective into a company's risk position, tend to be revised periodically (monthly or quarterly) to alert the company about the changes that may indicate risks" [**Les Coleman, 2009**]. Key risk indicators are metrics that are used by management to show how risky an activity or investment project is.

Response time to changes taking place in the risk profile is critical. The faster a change is detected, the easier it is to take the necessary measures to remedy the situation.

Building a set of key risk indicators requires skill and expertise. Every person who is responsible with managing a risk must build a suitable set of KRIs for it. Those involved in collecting and aggregating data for KRIs must know all the definitions, conversions and standardization that will be used.

If the risk management department is not sure of the compliance of the measurements used, the aggregate information will lose robustness and induce unconfidence in the decision making. It is not enough to assume that the data are correct, it must be validated.

Determination of the risk varies from one enterprise to another, from one process to another and from one system to another. It is important to take into

account the events with low probability of occurrence, which can be extremely risky. Another mistake which can be done is to focus only on the probability of occurrence without considering the consequences [Ann Bostrom, Steven P. French, Sara J. Gotllieb (ed.), 2008].

The existence of a risk culture in the company represent the first step in the process of risk prevention. Implementation of key risk indicators is necessary because any business is in continual change. Obtaining current information offers the management an enhanced ability to lead effectively and to prevent undesirable results.

In the U.S., the Risk Management Association (RMA) manages an initiative that is designed for enterprises that want to improve their risk management. This project is called "Library Services and Key Risk Indicators", and aims to achieve a degree of consistency and standardization to allow comparison, analysis and reporting of key risk indicators at the corporate level. The library contains over 2500 indicators that have been developed to measure and monitor various types of risks. When were created these indicators, 50 financial institutions from all over the world and numerous teams of specialists contributed.

Using this library every person has the possibility to get specifications for metrics, to define customize indicators and to record observations on each indicator. RMA believes that this initiative will improve the efficiency of KRIs.

Thus, for a successful implementation of KRIs it must be ensured: the quantification of indicators, the use of standards and methodologies available, the continuous monitoring of progress indicators, the KRIs connection to business objectives and the correctness of the formula.

### **3. KRIs must not be confused with KPIs ( Key performance indicators)**

The two types of indicators should be implemented by any enterprise that wants to be effective in its management. Often, KPIs and KRIs are mistaken. It is very necessary for the risk manager to be able to distinguish between them.

The key performance indicators focus especially on the historical performance of the enterprise or its key operations, are important for a successful management. On the other hand, KRIs provide a real-time indicators that offers information about emerging risks. KRIs can be the key relationships that locates the emerging risks and opportunities that signals the need to act. The differences between KPIs and KRIs are that KPIs tell us if we will achieve our goals, and KRIs help us understand changes in risk profile, impact and likelihood to achieve our goals.

If the distinction is made between two types of key indicators, will be very clear about what types of questions we want to answer through these indicators and how we define these indicators to improve management quality and the clarity of results.

#### **4. Risk metrics**

Metrics are a gauge. Risk metrics can be considered KRIs, which help to determine the direction from where the risks are coming, so they are extremely useful in any enterprise. A key risk indicator is a measure which indicates the level or trend of risk.

The metric can identify the deviation or likely deviation from the target for a strategic objective of the enterprise. By measuring the value of metrics, risk metrics are used to warn in advance that the next strategic objective metric is unfavorable.

It is very important to choose the right number of metrics. If an enterprise implements too many metrics, managing these will steal from the time allocated for other tasks and will provide too much information to shareholders. They will end up not to distinguish critical information and the system will provide information of limited value. On the other hand, if too few metrics are implemented, the decision making process will be difficult, since there are no critical information.

Any metric requires a goal, a target, an interpretation and reporting structure. Metrics can not provide value only if are measured, because you can not control what you can not measure.

#### **5. Measuring and monitoring risk**

Risk indicators monitor the risk exposure, as early warning systems, performing actions to minimize losses. Monitoring risk in the enterprise is done through a Dashboard interface.

The purpose of dashboard is to display all of the required information on a single screen, clearly and without distraction, in order to be understood by every user. Using Dashboards for Risk Management assumes that it is clear what is being measured, especially the key risk indicators.



Figure 1

The risk is generated by uncertainty. It must be monitored using key risk indicators that do this while running the strategy chosen. Thresholds were set for KRI in order to trigger actions to adjust the chosen strategies to combat the risk. When strategies are reviewed, there are established new risk indicators and new trigger points. This procedure increases the chance of achieving the objectives and strategies chosen by management [Mark S. Beasley, Bruce C. Branson, Bonnie V. Hancock, 2010].

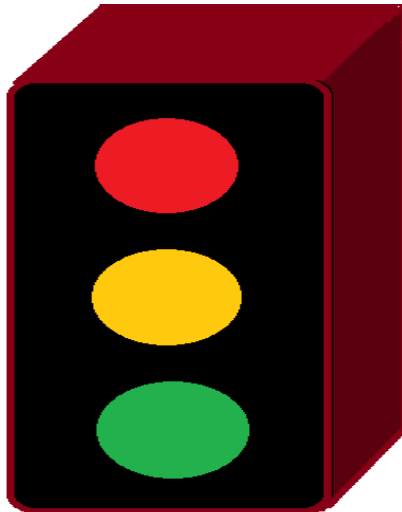
KRI reflects what is accepted or not and the inclination to risk of the enterprise. Since KRI can be measured, they help to communicate expectations to risk.

The frequency of the measurement is an important factor. Generally, the more frequently an indicator is revised, the more representative information will be obtained. There will be cases where frequent measurements of an indicator will show small changes in risk profile. In these situations it is important to consider the trend before drawing conclusion. The trend indicates if the exposure to a risk decreases or increases.

If a threshold was exceeded, the risk manager automatically receives a message, through which is ordered to undertake urgent remedial actions. The exceeding of thresholds is indicated by the yellow light of the monitoring risk semaphore. The threshold is the limit or the boundary that once passed alert the enterprise about the possibility of a significant change in the risk exposure. The risk management need attention when establish the thresholds.

When the risk is in the green or yellow area, risk management must take action to prevent that risk. If the situation is extremely unfavorable, and the risk is

in the red zone, the enterprise records significant losses, and risk management have to take actions in order to control these losses as possible.



**Figure 2**

It is very important to generate accurate information through KRI. Any indicator must find a balance between speed and accuracy of reporting. If reporting system generate delays, it is preferable to sacrifice some accuracy for the sake of speed.

When it is implemented a system of KRIs is necessary to consider the enterprise's objectives and the stakeholders. It is important to build KRIs for all the important risks that a company can face. KRIs must be continuously reviewed to provide value especially because there are changes in environment, in processes, in risks and data sources that can affect the relevance of KRIs.

## **6. Benefits of using an efficient ERM**

This paper reflects the benefits which are acquired by the enterprise when it is implemented an efficient risk management. Next are presented the main advantages:

**Improving Key Business Relationships:** The early warning system of risk management may perceive and react in time to the conditions that cause major risks, which rests the operation of a small and medium-sized enterprise (financial, operational, technological and regulatory). This will cause further the improvement of satisfaction and engagement across customers, employees and partners. By measuring the level of risk in different parts of the enterprise, using the introduced

metrics, will be possible to form a comprehensive picture of the interdependencies that form between the feedback processes that takes place in the enterprise and can generate different types of risks. Decisions will be monitored by the indicators calculated in the system and will be able to be evaluated in terms of their effects on the risks arising or likely to occur. Decision-makers may, under these circumstances, to act in those points where decisions are most effective and to assess, using Dashboard, the medium and long term effects of these decisions on the level of business risk. Thus, by controlling and risk reduction in the enterprise, they will be able to make business plans which have much lower associated risks.

**Increasing Revenues:** Between income derived by an enterprise and its operational risk, there is an inverse relationship, meaning that a company earns greater revenue to how the risks affecting different parts or activities are lower. Risk monitoring and reporting the causes of them, will make the enterprises able to focus their resources and creativity on the important issues that require the development of different internal or environmental activities. This leads on to a growth of revenue from safest business.

**Reduce Defection and Bankruptcy:** A key risk in any enterprise is bankruptcy risk. This risk is, however, consisted of the appearance of different types of risks that are signaled in time. If in the bankruptcy risk treatment were so far used data and information from past activities, the early warning system will provide the management tools with which not only this risk will be able to be seen in time, but will indicate the reasons that determines the risk of bankruptcy or defection (failure in some business).

**Prioritizing Decisions:** A main source of enterprise risk is the decisions that are either insufficient based, or too late adopted. Using Dashboards, we may enter an order in adopting important decisions in relation to the seriousness reported risks and the need to remove them. Prioritization of decisions will have beneficial effects on the efficient use of enterprise resources, meaning that they will be directed to those processes or business that take place under low risk, avoiding processes that may be affected by major risks, that if occur, leads to waste of a large amount of enterprise resources.

**Optimizing Critical Points:** Performance measurement in real time in key points of an enterprise will optimize the flow of information and knowledge, that formed within it, will enable storage, processing, sharing and efficient use of each information which is formed within the network connections and feedback processes of the company. This will lead to an improvement of methods of risk management in the enterprise by the emergence and development of more effective ways of action on the conditions that can lead to risks. Optimal distribution of these key points will make possible the intervention of management exactly where it is needed, to eliminate or reduce the developing conditions of risk.

**Creating a Risk Culture:** Every enterprise that is going to implement ERM will acquire a risk culture that will prevail within the organization. The risk culture can be highly conservative, highly aggressive, or essentially neutral. They create a situation in which promises are made, obligations are undertaken, and expectations are set. However, when we do not satisfy those obligations

operationally, then we create a situation of great dissatisfaction for customers. These situations can be avoided if the enterprise acts within the criteria of the risk culture that has been established. In other words, they will adhere to the established guidelines for promise dates and lead times. Whenever they depart from this pattern of behavior, they create a risk subculture that is unacceptable. When the risk culture is clearly established, everyone lives by the same rules, and no exceptions should be allowed.

## 6. Correlated risks. Building a risk map and a Dashboard

Risk management activities are gaining more and more ground today. Early detection of risks in the enterprise, risks that are producing negative effects in chain, resulting in other new risks, is a huge challenge for risk managers. Doing so illustrates the experience, professionalism and a good implementation of a risk culture within the organization, as well as a significant reduction of the probability of bankruptcy establishment. Risk culture assumes responsibility, identify and transmission of the problem and risks assumption.

Next we will sketch a map of risks that may affect the business, from specific risks of every department of the company: accounting, treasury, tax, legal, HR, IT, business planning, purchasing, sales and marketing, operations, production planning & control, engineering, receiving, inventory control, quality assurance, manufacturing departments, pick pack & stage, shipping & logistics, financial, debts. [Gregory H. Duckert, Practical Enterprise Risk Management, Wiley, 2010].

We will choose a significant risk from each department and will perform correlations among them.

<i>No.</i>	<i>Department</i>	<i>Key Risk Indicator</i>	<i>Risk</i>
1.	accounting	Unreconciled Balances	Manipulation of accounting data
2.	treasury	Interest rate on debts	Credit costs
3.	tax	Revaluation	Accuracy of accounting records
4.	legal	Number of litigation actions brought— trend	Number of litigation actions
5.	HR	ETO ( employee turnover)	Employee turnover
6.	IT	Network downtime	Old technology
7.	business planning	Return on investments	Bad investments
8.	purchasing	Excess inventories	Excess materials
9.	sales and marketing	Customer complaints / lost	Lost customers



Indicators and Metrics Used in the Enterprise Risk Management (ERM)

<b>10.</b>	<b>production planning &amp; control</b>	Percent of idle capacity	Percent of idle capacity
<b>11.</b>	<b>engineering</b>	Warranty claims/average useful life/customer complaints	Complaints
<b>12.</b>	<b>receiving</b>	Unanticipated stock outs in raw materials/shortages	Bad receiving
<b>13.</b>	<b>inventory control</b>	Obsolete and slow-moving/stockouts	Poor stock rotation
<b>14.</b>	<b>quality assurance</b>	Market share	Loss of market share
<b>15.</b>	<b>manufacturing departments</b>	Net quantity produced versus shop order requirements	Producing an uncorrelated quantity with demand
<b>16.</b>	<b>pick pack &amp; stage</b>	Expenditures for damaged goods	Expenditures for damaged goods
<b>17.</b>	<b>shipping &amp; logistics</b>	Expenditures for damaged goods in transit	Expenditures for damaged goods in transit
<b>18.</b>	<b>financial</b>	Average unit sales price declining	Price declining
<b>19.</b>	<b>debt</b>	Overall solvency ratio	Insolvency
<b>20.</b>	<b>management</b>	Managerial capacity	Weak managers

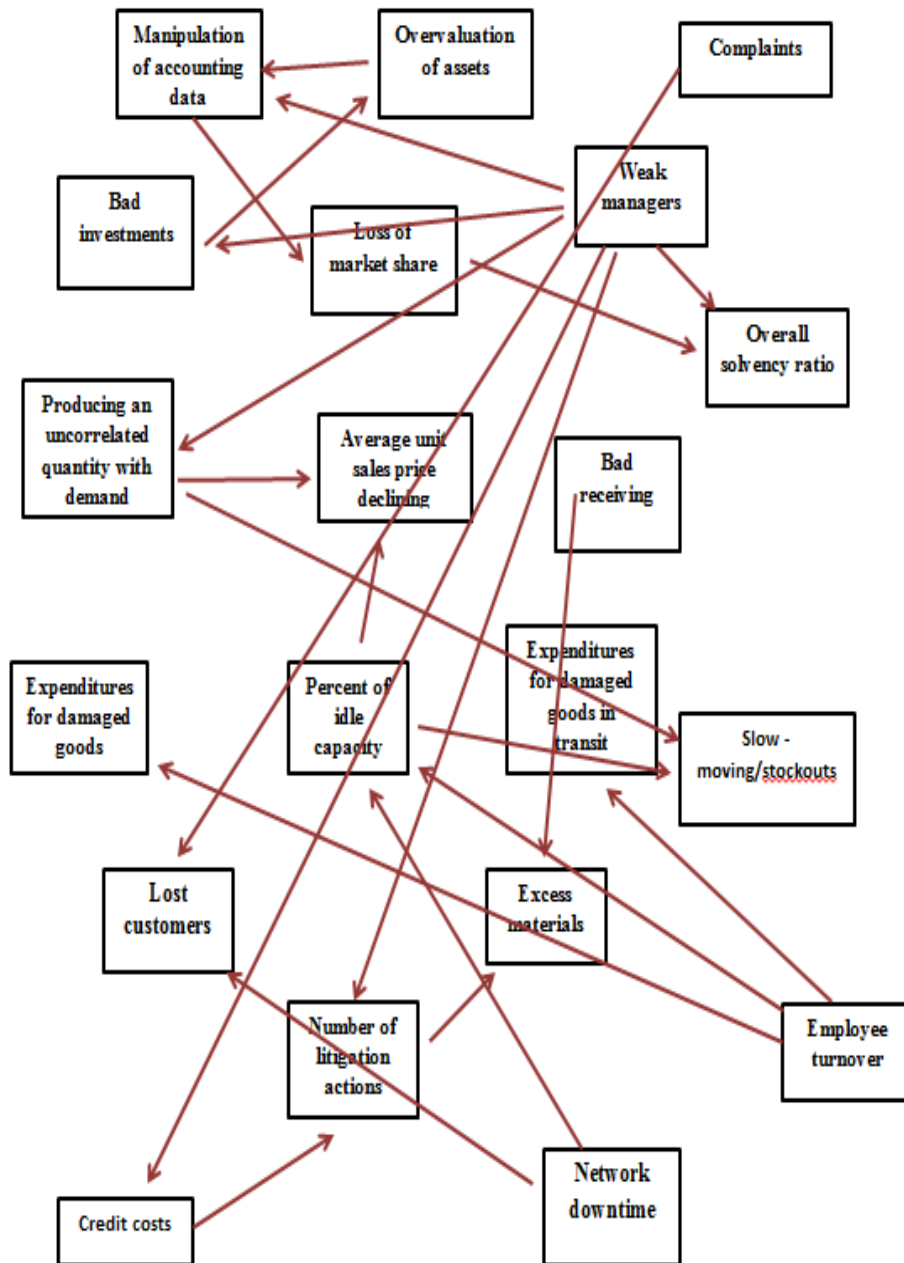


Figure 3

## Indicators and Metrics Used in the Enterprise Risk Management (ERM)

We can easily make correlations between risks previously chosen. However, most correlations are made between the only one selected qualitative indicator "management quality" and other indicators, that is why the importance of focusing on qualitative risk indicators during ERM process is essential.

Most dashboards are created in Excel. The dashboard puts the managers in touch with the business in real-time. The CEO of Verizon Communications said that „The more eyes that see the results we’re obtaining every day, the higher the quality of the decisions we can make” [Ron Person, p. 108].

Further we will present a dashboard built for some indicators which reflect the financial state of an enterprise which has as object of activity the gas transport, international transit for gas, gas dispatching and research-design gas transport. In this dashboard we will present the company status and the likelihood of bankruptcy, using scoring methods.

1968 is a critical year point for predicting bankruptcy, thanks to Altman who introduced the first method of scoring to separate the solvent enterprises from the companies at risk of bankruptcy. For developing this rating system, Altman introduced a statistical function using discriminant analysis and financial performance. After applying this method on a large sample of companies, Altman observed that he could predict more than 75% of bankruptcies in analyzes conducted two years prior to bankruptcy. This percentage reaches 95% in case of analysis conducted a year earlier and gradually decreases to 70% for those with five years before the onset of bankruptcy.

Another model is the scoring of Conan and Holder appeared in 1978, offering the possibility to identify the probability of introducing short-term bankruptcy.

	Model	
	Altman	Conan and Holder
<b>The description function of the model</b>	$Z = 3,3 x_1 + 1,0 x_2 + 0,6 x_3 + 1,4 x_4 + 1,2 x_5$ <p>x1 = Current result before tax / Total asset            x2 = Turnover / Total asset            x3 = Market capitalization / Loans            x4 = Reinvested earnings / Total Assets            x5 = Current assets /</p>	$Z = 0,16 x_1 + 0,22 x_2 - 0,87 x_3 - 0,10 x_4 + 0,24 x_5$ <p>x1 - partial solvency ratio            x2 – the rate of financial stability            x3 - financial expenses ratio            x4 - remuneration of staff ratio            x5 - the share of gross operating surplus in value added</p>

Emil Scarlat, Nora Chirita, Ioana – Alexandra Bradea

	Total Assets	
<b>Scoring</b>	Z < 1.8 - bankruptcy Z > 3 - good financial situation, the company is solvent; 1.8 < Z < 3 - The financial situation is difficult	Z < 0.04 - The financial situation is difficult 0.04 < Z < 0.09 - The financial situation is uncertain Z > 0.09 - good financial situation, the company is solvent;

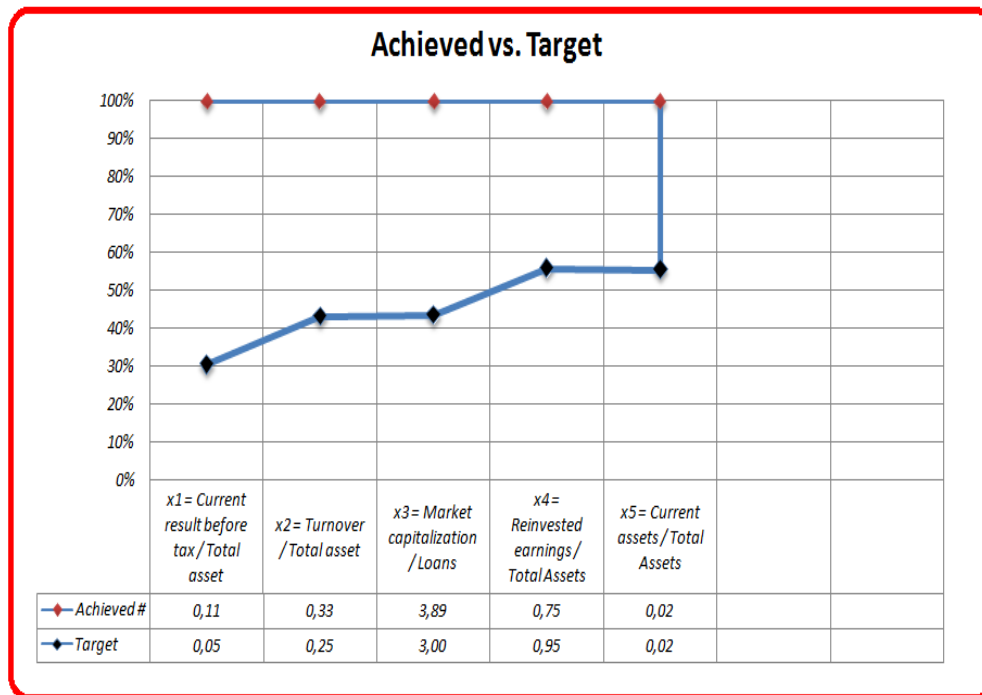
According to our calculations, there were obtained for each method applied a score reflecting a good financial situation of the company, placing it away from the risk of bankruptcy. The score Z for Altman Method is 4.1053 and for Conan and Holder is 0.42901.

Altman Model					
Indicators	Target	Achieved %	Achieved #	Coefficient	Points
x1 = Current result before tax / Total asset	0.05	2.26	0.113	3.3	0.3729
x2 = Turnover / Total asset	0.25	1.312	0.328	1	0.328
x3 = Market capitalization / Loans	3	1	3.892	0.6	2.3352
x4 = Reinvested earnings / Total Assets	0.95	0.789473684	0.75	1.4	1.05
x5 = Current assets / Total Assets	0.02	0.8	0.016	1.2	0.0192
<b>Total Score</b>					<b>4.1053</b>

Conan and Holder					
Indicators	Target	Achieved %	Achieved #	Coefficient	Points
partial solvency ratio	1	1.024	1.024	0.16	0.16384
the rate of financial stability	0.5	1.856	0.928	0.22	0.20416
financial expenses ratio	0.25	0.116	0.029	-0.87	-0.02523
remuneration of staff ratio	0.05	0.32	0.016	-0.1	-0.0016
gross operating surplus in value added	0.12	3.05	0.366	0.24	0.08784
<b>Total Score</b>					<b>0.42901</b>

## Indicators and Metrics Used in the Enterprise Risk Management (ERM)

It can be seen from the above tables that the total score places the company in a good position. This is indicated too by the green flag from the box.



**Figure 4**

### 7. Conclusions:

When we implement a system of KRI it is necessary to consider the enterprise's objectives and stakeholders. It is important to build KRI for the important risks that a company can face. KRI must be continuously reviewed to provide value.

The use of metrics offers multiple benefits for the company, among which are the following: early identification of trends and issues, represents a source of critical information for control, provides information about the likelihood of achieving target sites, if there is a sign of improvement or contrary a worsening of the situation, helps to make decisions based on information, helps in evaluating performance, leads to a proactive management, improves future estimates and performance, evaluates success and failure and improves customer satisfaction.

Businesses are constantly changing, like this modifying risk exposures. It may be that certain key risk indicators which were relevant last year but they might not be this year as well. The measurement of the risk indicators will provide added value to the company, if they are implemented in accordance with its operations, they will be reviewed and will be updated continuously.

## REFERENCES

- [1] Ann Bostrom, Steven P. French, Sara J. Gotllieb (2008), *Risk Assessment Modeling and Decision Support* . Springer Publishing, Berlin;
- [2]Jonathan Davies, Mike Finlay, Tara McLenaghan, Duncan Wilsonm(2006), *Key Risk Indicators – Their Role in Operational Risk Management and Measurement*. Risk Business International Limited;
- [3]Gregory H. Duckert (2010), *Practical Enterprise Risk Management – A Business Process Approach*. John Wiley & Sons, USA, p. 145 – 154;
- [4]Les Coleman (2009), *Risk Strategies – Dialling up Optimum Firm Risk*. Gower e-Book, Publishing, Burlington, USA;
- [5]Mark S. Beasley, Bruce C. Branson, Bonnie V. Hancock (2010), *Developing Key Risk Indicators to Strengthen Enterprise Risk Management*. Research Commissioned by COSO, December;
- [6]Ron Person (2009), *Balanced Scorecards and Operational Dashboards with Microsoft Excel* . Wiley Publishing, USA;
- [7]Gabriela Munteanu (2010), *Metode de analiză a riscului de faliment*. Romanian Statistical Review no. 12;
- [8]Scarlat, E., Popovici, I.F, Bolos, M. (2011), *Decision Model on Financing a Project Using Knowledge about Risk Areas*. Economic Computation and Economic Cybernetics Studies and Research , ASE Publishing, issue 2, vol. 45;
- [9]Web, <http://www.kriex.org/Public.KRILibrary.aspx>.