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INFORMATION TECHNOLOGY FOR RISK MANAGEMENT SUPPORT

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ABSTRACT: In the contemporary conditions understanding of the technological changes is an issue of development and survival of insurance companies. This paper is pointing out the opportunities and risks in the insurance sector that new technologies carry with them. Risk managers have to make many decisions, usually on the base of relationship between costs and benefits in order to select the best financial effect, or alternatives that would financially have the most positive final result. In making such decisions many variables and factors that affect risks should be considered. In this sense, the application of modern information technology has become a necessity.
KEYWORDS: information technology, risk management, insurance

❖ INTRODUCTION

The word technology comes from the Greek word *techne* (skill) and *logia* (science) and essentially refers to the tools, materials and methods of their application. The whole socio-economic development was characterized by a certain type of technology. For example, thanks to the gradual development of technology before World War II in every country the largest unique group consisted of farmers, during the fifties it became production workers and from the nineties to gradually become "technicians", or people that use hands and theoretical knowledge in their work.[1]

According to Alvin Toffler[2], there are three waves of social changes - the development of agricultural production and the abandonment of foraging economy, the industrial revolution and information age. Although it takes a different approach in the development stages, Drucker identifies the transformation of society according to the technological advances, and the invention of the press, improvement of the steam engine and the appearance of computers[3]. So, although there are some differences, there is theoretical agreement that the new tools, materials and methods of their application produced social and economic transformation in the qualitative and quantitative terms. Also, all economists agree that the era in which we live is characterized by information and telecommunication technologies.

Current technological changes, especially information and communication, as well as biotechnology and nanotechnology, gradually transforming the economy and society, creating new ways of working and new types of jobs. They make it possible to provide solutions to key sociological challenges such as health care, environment, security, mobility and employment. However, besides creating new ways of managing old and new risks, new technologies create new risks and thus the opportunities and challenges for insurance companies.

❖ RISK MANAGEMENT IN INSURANCE COMPANIES

Insurance companies are rather conservative due to the specifics of their business. Adoption of new technologies in this sector is generally slower than in other sectors. However, since it does not operate in isolation, external trends in the field of technological development are forcing insurance companies to innovate in order to recognize opportunities on time, ie to combine business agility with profitable growth. Bearing in mind that in the contemporary conditions understanding of the

[1] Draker, P.: *My view of management: ideas that improved the management*, Adižes, Novi Sad, 2003, pp 186-188
[2] Toffler, A.: *The Third Wave*, Bantam Books, New York, 1984
[3] Draker, P..: *Postcapitalistic society*, Business system „Grmeč" – „Privredni pregled", Beograd, 1995

technological changes is an issue of development and survival of insurance companies, we are pointing out the opportunities and risks in the insurance sector that new technologies carry with them. Information technology is important from the aspect of their use and object of insurance too, as well as nanotechnology whose development can launch a new socio-economic transformation.

In the management of insurance companies and other companies the key requirements that are imposed include ensuring customer satisfaction and competitive advantage based on costs and improved service quality, adequate pricing of products and services, compliance with regulatory requirements, ensuring the return to shareholders and in the case of insurance companies, adequate establishment of insurance reserves and promoting process of risk acceptance. Faced with the number of risks, risk managers have to make many decisions, including decisions on retention or transfer of risk, choosing techniques of risks retention or transfer, type of insurance cover, whether or not to invest in projects of reducing the frequency and size of damage in terms of economic profitability of such projects. All decisions are based on the relationship between costs and benefits in order to select the best financial effect, or alternatives that would financially have the most positive final result. In making such decisions many variables and factors that affect risks should be considered. In this sense, the application of modern information technology has become a necessity. For example, the company Marsh (broker in insurance and reinsurance) was in the project[4] of assessing instruments of financial risk management in renewable energy projects funded by the United Nations. They used sophisticated computer supported modeling applications, including the assessment of value at risk (VaR)[5], Monte Carlo simulation[6] and stress testing[7] and made the financial projections with various security programs of projects (including standard insurance with and without the insurance of downtime, derivatives, futures contracts, options and loan warranties). They identified the best structure within a given financial context and the result of a study is that standard insurance coverage provides the highest level of protection for these projects.

When calculating the number of parameters that enable risk management, such as probability, standard deviation, value at risk (VaR), present value[8], or the time value of money, net present value[9], risk-adjusted return on capital[10] and the other, depending on the type of risk and specific situations, different tools supported by information technology solutions are applied. Some of them are information systems for risk management support, intranet and the Web sites for risk management and risk map[11].

❖ INFORMATION TECHNOLOGIES AS A RISK MANAGEMENT SUPPORT

Information systems for decision support risk management are computer supported software database that enables risk managers to keep and analyze relevant data and that based on that data predict future realization of insured events and lower the level of damage. They make decisions on risk management on the base of reliable and accessible information. These databases for risk management may contain different data in different domains (the domains are taken into account the different areas of risk exposure, such as for example asset, liability and life). For example, if we consider the

[4] Assessment of financial risk management instruments for renewable energy projects, UNEP Working Group 1 Study Report, Paris, http://www.unep.fr/energy/projects/frm/doc/UNEP%20WorkingGroup1Report2007.pdf

[5] Value at risk (VaR) is a measure that is used in risk management and can be defined as the maximum possible damage that can be expected in a given period (eg one day or 100 years) with a certain confidence level (for example 95% or 99%) .

[6] Monte Carlo simulation is a stochastic process that involves generating a series of random numbers in order to obtain the possible outcomes. These outcomes are derived from a number of fixed and dynamic parameters and the process is repeated several times, typically several thousand times in order to derive the distribution of probable financial outcomes.

[7] Stress tests are used to explore the possible effects of specific catastrophic scenarios on the financial performance of the project or company. In Switzerland, for example, stress tests used to assess the solvency of insurance companies.

[8] The present value of future cash flow as a measure is used to assess alternatives in terms of discounting future values to current. Calculated using the formula: $Pv = \frac{C}{(1+i)^n}$ where is Pv – present value, C – future cash flow, ie future value, i – interest rate used in discounting n – period number (mostly in yearsIf investments are considered, for example, the higher the present value means a more favorable option. The opposite is the case, the size of the damage, the higher the present value, the risk is higher.

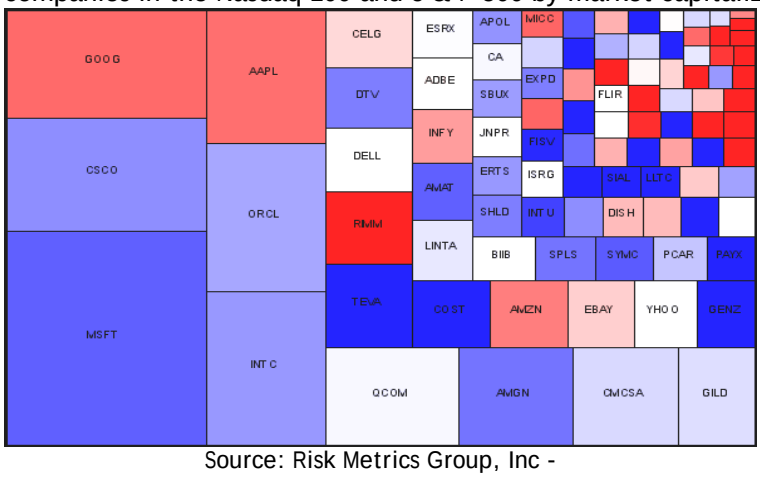
[9] Net present value is used mostly by assessing the viability of investment in risk reduction, and is calculated using the formula: $NPV = \frac{C}{(1+i)^n} - I$ ie $NPV = Pv - I$ where is: I – initial investment. Positive net present value (NPV) indicates viability of investment.

[10] Risk adjusted return on capital (RAROC) is especially important measure that connected risk and return. RAROC enables estimation of required size of capital needed in every branch of business, product or client, and shows how these requirements contribute to the achievement of total return on capital . Also, RAROC provides an economic basis for consistent measurement of all relevant types of risks and contributes to promoting a consistent, fair and rational measure of performance taking into account the risks thereby improving managerial decision in terms of relationships between return and risk. Application of RAROC began in the nineties of the twentieth century in order to allocate capital efficiently on the ex-ante basis and was made possible thanks to the development of information technology. RAROC essentially represents the difference between the net return and risk premium (eg, by insurance companies).

[11] Rejda, George E.: Principles of Risk Management and Insurance, Pearson Education, Inc., 2005, p. 75

domain of management of risk that threaten property, this database may contain information about the characteristics of the property elements (such as, for example, data on the characteristics of the materials in built structures, how old are machines, the level of provided fire protection measures, the presence of security cameras, etc.). Then information about the existence or non-existence of an insurance policy for certain elements with information on the characteristics of coverage - the duration and extent of insurance coverage, the amount of insurance premium to be paid, details of the damage in the previous period and so on. This information is important for decision making and analysis of results in order to undertake additional corrective measures. Also, this information is important because the insurance companies require historical data on the damages, which can be used in order to get bonuses in insurance premiums (if the database information indicates that the damages were small).

Companies create web sites as risk management support that enable the publication of information that becomes publicly available in order to improve the reputation of companies regarding the reliability of risk management, which is especially useful to investors, as well as to companies in terms of obtaining additional capital. Except the information publishing, intranet application can support risk management on the base of internal information by using web technology, which through an internal Web site become available to all levels of management. It is especially important in terms of availability of information on procedures, a necessary undertaking of certain measures in some situations, clarification of certain terms, frequently asked questions and problems related to specific situations, thereby improving risk management at each level of organization. Also, in recent time thanks to the application of information technology in the field of risk management sophisticated risk maps are developed. They are networks that specify the potential probability of risk realization and intensity of damage consequences that every organization is faced to. Risk maps could relate not only to internal risks but also credit and market risks, insurable risks and other risks. Risk maps are used for setting risk priority, ie for determining which of the identified risks should be first treated as an important element of risk management. Prioritization of risk management is based on their individual impact as well as probability of risk realization and risk maps help in graphically presentation of some events from the aspect of financial impact and probability. By designing these maps analysis of each individual risk must be taken into account and the use of maps vary from simple display of risk exposure to the possibility of generating risk exposure scenarios based on these maps. Figure 1 shows a map of market risk created by the company Risk Matrics Group and based on the classification of companies in the Nasdaq 100 and S & P 500 by market capitalization and risk [12].



Source: Risk Metrics Group, Inc - http://www.riskgrades.com/retail/treemap/treemap.cgi

Figure 1: Market risks map of companies in NASDAQ 100 index

On the Figure 1 the risk is represented by colors: red color means a greater risk of market instrument of some company in relation to the blue color, while market capitalization is represented by the size of the rectangle. For example, Google (GOOG) has a higher degree of risk and lower market capitalization than Microsoft (MSFT).

For a long time the application of information technology by risk managers in insurance companies and companies from other sectors meant keeping, monitoring and analysis of data on actual damages. In such conditions the key information were about damages, no matter in which part of business they incurred, ie whether it is human, property or damage based on responsibility and so on. Such information enabled risk management based on a reduction of damages and deciding on the scope of insurance coverage, as well as deciding on the transfer of risk in general. These systems are also used for are keeping data on property and how to prevent damages, for statistical analysis of realized damages in the past and forecasts of possible future loss events. For example, in the U.S. in order to generate this information, the two database of claims in the past are formed. The first one is CLUE (Comprehensive Loss Underwriting Exchange) and the second one is A-PLUS (Automated Property Loss Underwriting System), serving insurance companies to check the owner's risk and risk of the residential building. In this way it is currently possible to obtain information about the historical trends of claims, necessary in making decisions about the acceptance of risk and setting premiums, which leads to savings in time and money. It is essential that

[12] Market capitalisation is the product of the value of one share and the total number of shares of company.

information systems are tailored to the needs of specific companies in order to enable the achievement of maximum effectiveness and efficiency in the implementation. Having in mind that each company has specific exposure to risks such as property, liability risks, the risks of variability of asset positions, it would not be useful to implement standard solutions. It would be much better to apply systems designed to the specific problems of the company. Implementation of risk management support information systems has been greatly improved risk management practices that were traditionally performed without the use of modern computer technology and some of its advantages - speed and level of integrity. Actually, application of modern information systems allows timely, accurate and comprehensive analysis and information that enables precision, reliable and effective decision by risk managers.

Gradually the role of information systems began to expand to other areas of interest of risk managers. For example, in the field of identification and risk assessment examples of improvements include geographic information systems began to develop after Hurricane Katrina and the application of GPS devices for vehicle insurance. 21st Century company[13] applies GPS technology to allow parents to determine the exact location of the car and ride characteristics of their children, teenagers[14]. Also, with "Pay As You Drive" model, based on the use of GPS tracking device that measures the driving mileage and driving time, Siemens has allowed insurance companies to offer insurance premiums that reflect the individual driving characteristics of their clients and to resolve claims more reliably.

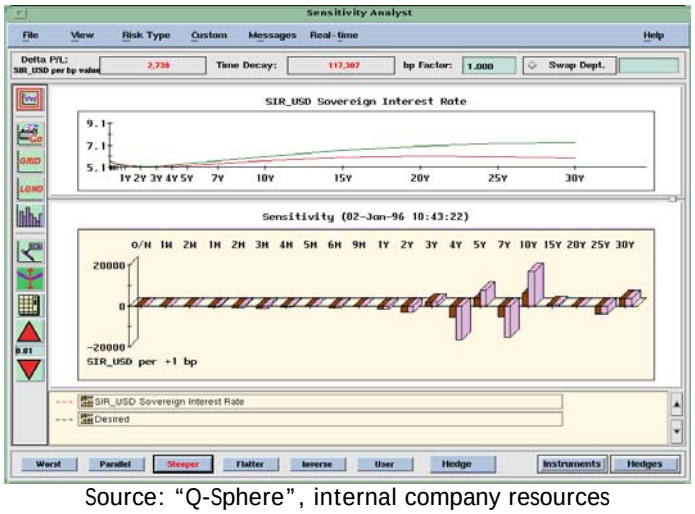
❖ NEW APPROACHES TO THE APPLICATION OF INFORMATION TECHNOLOGIES IN INSURANCE COMPANIES

In recent years are highlighted the need for holistic risk management and possibilities of using information systems to support this new approach to risk management. Holistic approach to risk management aims to quantify the total exposure to all risks and their interdependencies, which providing a basis for determining the amount of capital needed to cover the total exposure to risk in order to ensure continuous business.[15] So-called computerized composite models based on the parallel implementation of a number of different software packages are applied. It enables the use of different software vendors as well as the parallel use of different applications (application of historical analysis, Monte Carlo analysis, assessment experts, event-driven simulation) for the simultaneous analysis of different risk categories (market, credit, operational and insurance risk). This is particularly important because the variety of software solutions is a common problem for the insurance and reinsurance companies. Historically speaking, software solutions are often set as mutually exclusive and oriented to certain risks, which is crucial in terms of increasing orientation toward holistic risk management. Composite model allows full exposure of the system in the form of web services but with the improved overall security and authentication, real time system response to risk parameters changes with possibility to get context-adapted responses, which means that users at different levels of organization can get different answers to identical questions.

Simplified example, in terms of users - risk managers, the model works by the manager:

1. selects a sufficiently large portfolio,
2. selects the group of risk parameters in the curve on the chart above,
3. selects a scenario,
4. makes query for the sensitivity evaluation (risk tolerance) and they become visible on the graph below (Figure 2 - red bar chart represent the actual value),
5. if the risk manager is not satisfied, he specifies tolerance (Figure 2 - pink bar chart represent a desirable value),
6. selects a list of possible actions and send to the server and
7. server send to the user the selected subset of possible actions (minimizing the number) and quantifying them.

The goal is not the absolute elimination of risk, but the selection of risks that have the greatest potential impact on business. After identifying and selection of



Source: "Q-Sphere", internal company resources
Figure 2: Composite model of risk management

[13] 21st Century is a new name for AIG Auto Insurance.
[14] If a teenager has exceeded a predefined speed driving, the parent can be notified by e-mail or SMS about that. Source: 21st Century Teen Driver Program - http://www.aigteengps.com
[15] Njegomir, V.: *Risk management by applying the composite model,* Proceedings of the 7th International Symposium on Information and Communications Technology and Insurance, Plitvice, 2006

risks, manager should ensure their minimization, taking into account the risk interdependences (the impact on the individual risk can be reflected positive or negative on other risks).

Application of information technology to support risk management started back in the seventies with introducing VaR (value at risk) model by the first IBM desktop computers. From the eighties of the twentieth century, the application of information technology was even more important. Integrated risk management, which includes consideration of aggregate risk exposure, is particularly stressed as necessary in the period of global financial crisis in year 2008. This holistic approach to risk management requires sophisticated information technology because of increasing volume of data needed to be stored and processed as soon as possible in the real-time. For example, leading world banks and insurance companies in modern business conditions have risk exposure measured in millions, which requires processing a hundreds of millions of data. It is especially important in making decisions by trading on financial markets, where timeliness is crucial. As a result, companies are increasingly investing in information technology both in the field of hardware and software.

Despite the fact that information technologies allow easier risk management, they are not the solution to all problems. Reliance of banks on the modeling, statistical and mathematical calculations supported by information technology is considered as one of the indirect causes of the credit crisis. Thanks to the Basel II framework for regulating the solvency of the banking sector, banks have become too burdened by modeling and application of information technology in reducing individual risk. The absence of common-sense approach and evaluations as well as the absence of holistic perception of risk exposure caused credit crisis. Although the application of information technology is crucial in quantitative risk management, real risk management is unthinkable without the human factor, or managers who effectively minimize risk by interpreting the data generated by information systems.

Application of information technology is extremely important for insurance companies that use the information systems in almost all areas of business: calculating premiums and risk acceptance, insurance risk management, investment risk management, claims management, distribution channels, improving customer relations and administration. One research studies[16] was conducted in the organization of Investor Market Research Group and funded by the company "Accenture", which included 100 leading analyst of shares of life insurance and non-life insurance companies. The study pointed out that organic growth in key markets, cautious operations in emerging markets, improvement of operational efficiency and investments in information technology are crucial to insurance companies if they want to achieve above-average growth in the coming years that will be still affected by the consequences of the credit crisis and the current downward phase of the insurance premiums cycle. Also, outdated information technology infrastructure is considered one of the key problems of insurance companies after climate change, in the case of non-life insurance companies, and risk in investment portfolios of life insurance companies. From the aspect of this work, the most important application of information systems in insurance and reinsurance companies is their use in modeling the risk, especially catastrophic nature, which will be discussed in future presentations.

Risk management in insurance companies is based on the use of computer supported modeling. However, changes towards the implementation of integrated risk management and more dynamic business environment that is changing the paradigm in terms of risk management, require running of models of assessing the sufficiency and allocation of capital more than once a year, as it was practiced. There is increasing need for more sophisticated analytical information that can facilitate decision making on all components of a integrated risk management. Regulatory authorities and rating agencies define the use of economic capital models used to analyze risk on a holistic basis and to calculate solvency. For example, in Europe solvency regulation framework *Solvency II*, which should be implemented in EU member states by October 2012, request from the insurance and reinsurance companies use of risk management models with the possibility to choose the standard or internally developed models. Bearing in mind that the application of internally developed models involves determining the level of required capital to ensure solvency, which is based on the specific characteristics of the risks set forth in particular insurance and reinsurance companies, *Solvency II* Directive provides a framework that will enable the support of the application of internal models by means of determination of lower capital requirements. The application of internally developed computer-supported models of risk management is in the interest of themselves insurers and reinsurers because of a better way, or more accurately reflect the true picture of risk and a holistic approach will allow the creation of competitive advantage through more effective risk management and capital. However, to make this possible it is necessary to have sophisticated models that will allow frequent getting fast, accurate, reliable and detailed projections on how to manage risks more effectively, how to use available capital more efficiently, how to accurately determine the insurance premiums that reflect risk but also to be competitive. Old computer systems cannot provide, especially in the case of multinational insurance companies that offer many different types of insurance coverage. Because of

[16] Best's Review, A.M. Best Company, Inc., Oldwick, NJ, June, 2008, p. 70

that is more planned the use of high-performance computers that has the ability to provide timely analysis necessary for a holistic approach to risk management and capital. Waiting a few days longer is not acceptable solution for insurers and reinsurers any more and the assumption that the development of internal models, driven by *Solvency II* Directive will contribute to greater demand for more powerful computers. One solution is the network data processing that enables the distribution of complex stochastic models to smaller operations that can be run simultaneously, using great number of computers. Network processing is useful because it allows utilization of available hardware of a company. Finally, one of the solutions is the so-called cloud computing, or use the Internet in processing complex operations, where the cloud is a metaphor for the Internet. It should be stressed that the cloud computing is not a new idea but insurance and reinsurance companies recently began to use it. For example, Google, Amazon and Microsoft offer solutions for the use of "clouds" in the processing of complex computer operations in order to increase immediately processing power of computers by users of their services. Implementation of some of the options that allow increasing processing power of computers will enable the development and application of complex modeling that will enable a significant improvement in managing of risk and capital and consequently it will improve competitive advantages.

Three groups of solutions in supporting risk management are available on the market. They are software for claims management, holistic risk management and risk analytics. Selection of specific software and its supplier is a delicate issue that requires significant time considering that it is not only the price in question, but it is necessary to pre-determine the requirements that a software solution must meet, or characteristics that are considered crucial to the organization. By selecting software solutions specialized consultants can provide assistance. They are usually familiar with a wide range of available solutions and have experience. It can enable learning from others' mistakes and application of best practice. Despite the use of consultancy assistance is necessary to hire people from certain sectors of the company and people from the IT department. They are crucial in the software solution implementation, but also may help in choosing the most appropriate solutions, that correspond to other internal software solutions and specific information of a company. Although the marketing presentation of some software solutions are significant, the greatest benefit in the selection of appropriate solutions that meet the needs of companies, can offer trial versions that allow the use of actual data, specific to a particular company.

❖ CONCLUSION

Software solutions on the market are varied but the needs of individual sectors and companies as a whole may also vary. Thus, the need for software solutions of different insurance companies can be completely different. In this sense it is necessary to provide software solutions that customize to the company, which means the capability of software solutions to be configured and adapted to the needs of specific companies. In addition, software solutions must be robust but not too complicated, reliable with the ability to change, which involves flexibility and innovation. Software should also be visually accessible with the possibility of graphical presentation of results, as well as intuitive so that users can easily learn their use. It is significant availability of software solution for risk management support at any time and that can be enabled if the application is a web-based, or mobile version is enabled by devices like iPhone or BlackBerry. Finally, in choosing a software solution and provider an important role play secondary services such as access to software developers and sales staff and in particular the existence of employee training as an integral part of the complete service. The importance of selection of appropriate software solution and service provider is based on the fact that the solution can create value for the company in the form of improved risk and capital management, as well as creating competitive advantage of a company.

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