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CONTENTS

(MARCH 2017)

(pages 1-5)

**THE VIEW OF INVESTOR'S ON POTENTIAL OF MARKETING TOOLS
FOR IMPLEMENTATION OF MODERN METHODS OF CONSTRUCTION
IN SLOVAKIA**

Tomáš Mandičák, Annamária Behúnová, Jana Smetanková, Gabriela Hanečáková

(pages 7-10)

FEATURES OF ENTERPRISE RISK MANAGEMENT

Michal Balog, Alina Kovalenko

(pages 11-14)

**MEDICINE AND ENGINEERING – CONNECTION BIOLOGY,
TECHNOLOGY AND INFORMATICS**

Marianna Trebuňová, Viktória Mezencevová, Jozef Živčák

THE VIEW OF INVESTOR'S ON POTENTIAL OF MARKETING TOOLS FOR IMPLEMENTATION OF MODERN METHODS OF CONSTRUCTION IN SLOVAKIA

Tomáš Mandičák; Annamária Behúnová; Jana Smetanková; Gabriela Hanečáková

*Received: 07 Feb. 2017**Accepted: 02 Mar. 2017***THE VIEW OF INVESTOR'S ON POTENTIAL OF MARKETING TOOLS FOR IMPLEMENTATION OF MODERN METHODS OF CONSTRUCTION IN SLOVAKIA****Tomáš Mandičák**

Technical University of Košice, Faculty of Civil Engineering, Department of Construction Technology and Management, Vysokoškolsk 4, 042 00 Košice, Slovakia, tomas.mandicak@tuke.sk

Annamária Behúnová

Technical University of Košice, Faculty of Manufacturing Technologies with a seat in Prešov, Bayerova 1, 080 01 Prešov, Slovakia, annamaria.behunova@tuke.sk

Jana Smetanková

Technical University of Košice, Faculty of Civil Engineering, Department of Construction Technology and Management, Vysokoškolsk 4, 042 00 Košice, Slovakia, jana.smetankova@tuke.sk

Gabriela Hanečáková

Technical University of Košice, Faculty of Civil Engineering, Department of Construction Technology and Management, Vysokoškolsk 4, 042 00 Košice, Slovakia, gabriela.hanecakova@tuke.sk

Keywords: marketing tools, modern methods of construction, investor's view**Abstract:** This paper focuses on the marketing tools of enterprise, operating in the field of modern methods of construction. One of the way to get enough information about its formation is marketing research. In this case, it was used and focused on one area of this vast complex of decisions, namely on the marketing communication of the company. It is necessary to explain the basic concepts, divisions and methods on the input part. These are then transferred to the general, where the above-mentioned marketing research is conducted using fixed procedure steps. The main aim of research is analysing of marketing tool and set model of marketing tool from a point of potential investors in this field. Modern methods of construction present new trends in civil engineering industry and its exploitation is denending on good marketing strategy and communication tools. Results obtained through its in-depth analysis are aimed at designing new recommendations for companies in the field and their communication with the public as well as selecting appropriate promotional advertising tools. Tha main aim of the research is set to model of effective marketing and communication tols for implemenatation of modern methods of construction in civivl engineering industry in Slovakia.**1 Introduction**

The success of enterprise is largely related with the status and perception of enterprise in society. At present, marketing is one of the most important tasks that serves to attract and retain customers. Keeping and getting customers is only possible if the needs and wishes of customers are known and the requirements are met better than the competition. Every enterprise has set goals that it wants to achieve. They must face negative impacts and threats to achieve the desired goals. The way to reach the set goals of the business and to be able to meet the needs of customers, that is to say, the reconciliation of all these areas, solves the marketing strategy. Building a suitable strategy is accompanied by a range of activities and decisions that deal with business environment issues, products, pricing, distribution channels, communications, and many other parameters. On the basis of these facts, it provides an insight into marketing communication that analyzes and suggests communications between the public and company.

2 Theoretical background and problem statement

The concept of marketing has a number of definitions. Individual authors define marketing as follows. The American Marketing Association (AMA) defines marketing as an activity, set of instructions and processes for creating, communicating, delivering and exchanging offers that have value for customers, clients, partners, and society in generally [1]. According to Philip Kotler and Kevin Lane Keller, marketing is a social process through which individuals and groups acquire what they need and want through the creation, supply and free exchange of products and services with others [2].

Other authors, for example Kaňovská defined marketing as a thought process that puts the winner in first place [3]. It is completed by the organization of the enterprises and the activities it performs, in such a way that the needs of customers are identified and satisfied effectively.

THE VIEW OF INVESTOR'S ON POTENTIAL OF MARKETING TOOLS FOR IMPLEMENTATION OF MODERN METHODS OF CONSTRUCTION IN SLOVAKIA

Tomáš Mandičák; Annamária Behúnová; Jana Smetanková; Gabriela Hanečáková

A marketing mix is a well-known set of marketing tools that serve to achieve the specified marketing goals of an enterprise on the selected market. Frequently used for the sake of brevity is also the term "4.P". E. Jerome McCarthy, designed the marketing mix tools as follows [4]:

- product,
- price,
- place and
- promotion.

It is possible to see in this context also the addition of other tools, which together with the above create "5.P" - 4.P and people, or even "7.P" - 5.P and physical evidence and processes. For the purposes of analysis in the article we are based on the basic division into 4P [4], [5].

The product needs to focus primarily on the quality of the product or service, its strengths or weaknesses. In the market research it is necessary to ascertain whether there is interest in products or services and whether there are potential customers. If there is a lot of competition on the market, it is necessary to distinguish it from it. Marketing is important to know the market perfectly, so a thorough analysis is needed [6].

The price is an important factor in the market. The goal is to analyze the potential of the customer and set the price as expected. An important factor influencing sales is also the point of sale itself and time. On a right-handed occasion, it is possible to increase sales several times [6].

The last part of the 4P basic division is promotion. Properly selected product or service presentation can target potential customers and rapidly increase product sales, services. According to the target group, it is necessary to choose the right communication, sales promotion, advertising, public opinion and personal sales. The main selling tools are television, newspapers, magazines, videos, exhibitions, fairs, flyers, city public transport, apps, blogs, promotional materials, promoters, billboards, posters, radio, internet, social networks and mailboxes [6].

Modern methods of construction are applied in the construction industry as a type of innovative constructional methods that are preferred over traditional constructional methods. They offer a number of advantages such as cost, time, error, better life cycle prognosis and lower environmental impacts [7].

Therefore, modern methods of construction can be divided into [8], [9]:

a) off-site techniques

- o volumetric (bulk) constructions,
- o panel construction systems,
- o hybrid constructions,
- o subassemblies and components

b) on-site techniques

- o wooden frames,
- o isolated lost formwork,
- o thin masonry bond,

- o lamellar frame constructions,
- o tunnel forms,

- o filigree structures.

All of these methods must be supported by effective marketing strategy and tools, for example social medias, printing materials and all others. Question of this field is follow: What marketing tools are effective for implementation of Modern Methods of Construction (MMC).

3 Methodology**3.1 Research methods and data collection**

The establishment of research in construction industry was carried out in a logical sequence. Based on a thorough analysis of theoretical approaches it has been set basic research problem of research in construction industry and fundamental research questions raised. Subsequently it was Formulated main aim of the research, which is supported by partial objectives. The methodology of the work and methods of research, we define the research methodology of processing. We have identified a sample clarify the methods of data collection and data processing method.

In research in construction industry were exploited empirical research methods research. In the empirical methods have been used on a larger scale observation, questionnaire surveys, interviews and representatives of enterprises. From theoretical methods it was most used method of abstraction, analysis, synthesis methods of induction to deduction. It was extensively along with application and even the method of comparison.

Data collection was conducted by the questionnaire. Questionnaire was designed and distributed in electronic and print form. Questionnaire was produced by online platform FORMEES in electronic form and print form. The research sample was approached by e-mail and personal with the request to participate in the research. Total were interviewed 413 of respondents.

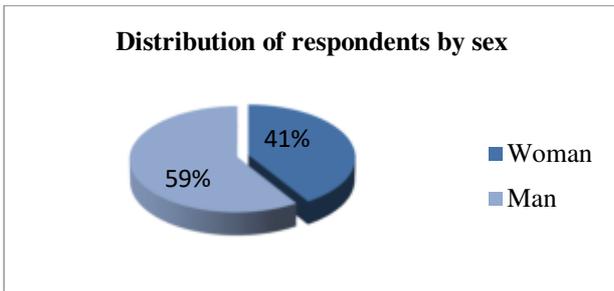
3.2 Research sample

Breakdown of research sample is very important in terms of correlation between the studied variables. Due to the content page of research was defined basic specification of the statistical of research sample.

The survey was attended by 413 respondents with a percentage of 41% of women and 59% of men (Graph 1).

THE VIEW OF INVESTOR'S ON POTENTIAL OF MARKETING TOOLS FOR IMPLEMENTATION OF MODERN METHODS OF CONSTRUCTION IN SLOVAKIA

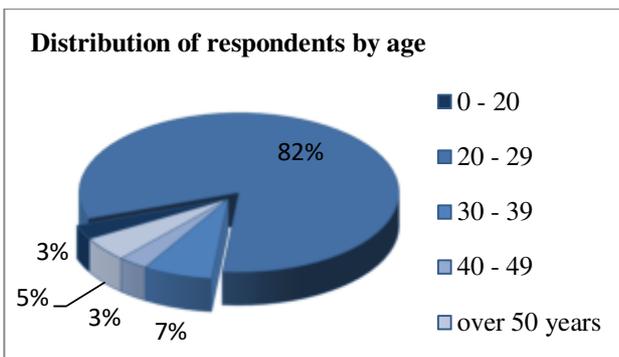
Tomáš Mandičák; Annamária Behúnová; Jana Smetanková; Gabriela Hanečáková



Graph 1 Distribution of respondents by sex

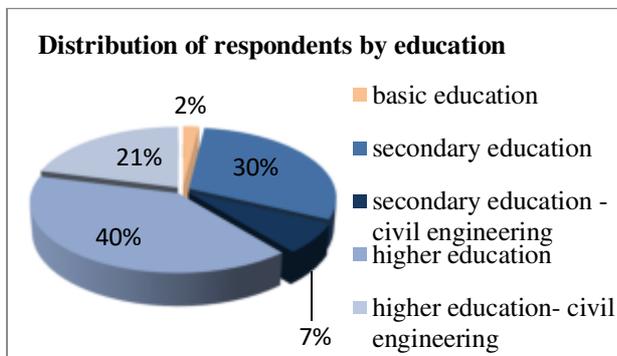
The aim of the research was to address respondents of different age groups. Of the interviewed respondents, the largest number of interviewed age groups was 20-29, namely 82% of the respondents. Other age categories were represented by the following percentages (Graph 2):

- in age 20-29 years – 3%,
- in age 30-39 years – 7%,
- in age 40-49 years – 3 %,
- and in age over 50 years – 5 %.



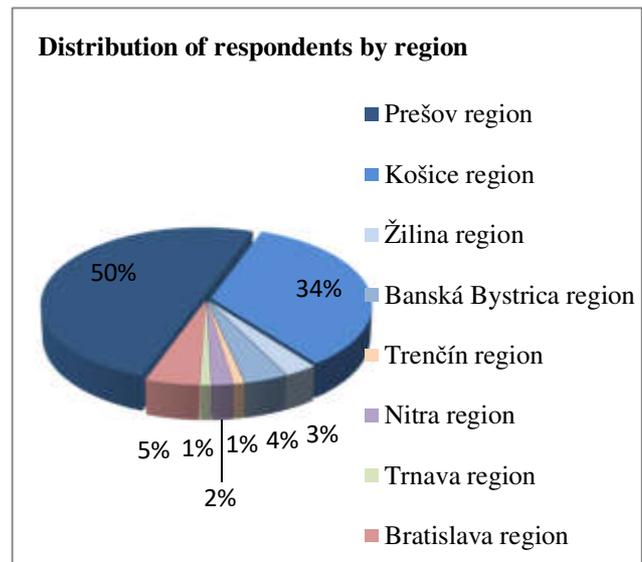
Graph 2 Distribution of respondents by age

Respondents addressed reached above all university education (up to 41%) and higher education in the field of construction 21% of respondents surveyed. Respondents with basic education (2%), secondary education (30%) and secondary education in construction (7%) participated in the survey, see Graph 3.



Graph 3 Distribution of respondents by education

From Graph 4 it can be seen that all the territorial categories of the Slovak Republic were represented on individual questions. Of the total number of respondents, the largest share (50%) of Prešov region was followed by Košice region (34%), Bratislava region (5%), Banská Bystrica region (4%), Žilina region (3%) And Trenčín and Trnava after (1%).



Graph 4 Distribution of respondents by region

4 Research results

The marketing department of the enterprise determines the marketing strategy, that is the form and amount of advertising it wants to raise awareness of the target group and thus minimize its costs to maximize profits. The result of the survey has shown that media perceptions and their ability to engage with different groups vary considerably depending on the age group of respondents. Based on these facts, it is necessary for an enterprise to define a target group and then choose appropriate promotional media. Age is an important input as a group of people at a certain age range manifests itself in most of the same social features, interests, and specific requirements. When choosing an ad, you need to take these facts into consideration and choose the appropriate way to advertise. Individual age categories favor the following promotional tools. From Figure 1, the most effective ways of promoting in different age categories are:

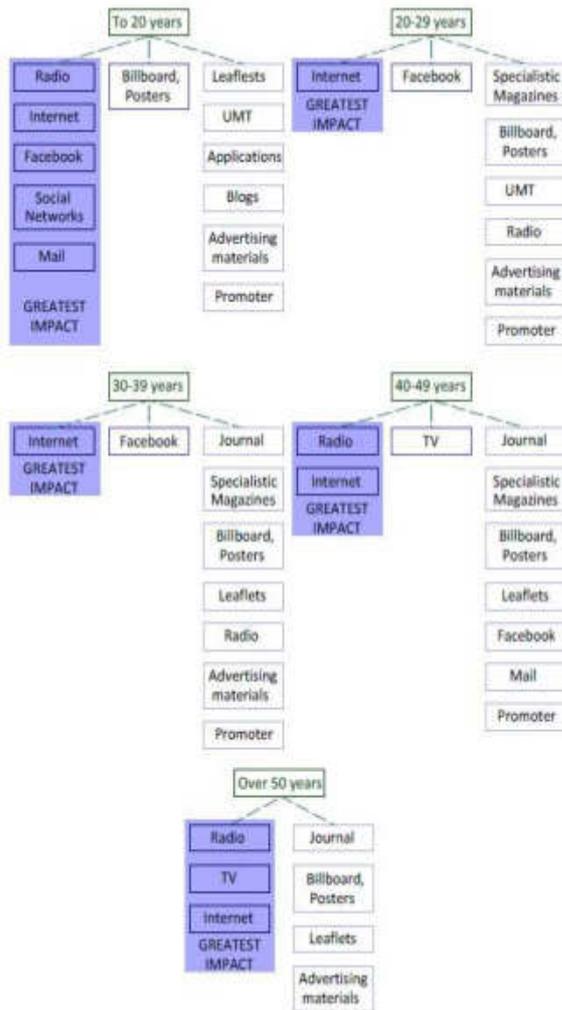
- at the age of 20, *radio, internet, facebook, social networks* and *mail* are the most accessible media,
- at the age of 20-29 and 30-39, the *internet* is the most accessible medium,
- aged 40-49 are the most popular *radio* and *internet media*

THE VIEW OF INVESTOR'S ON POTENTIAL OF MARKETING TOOLS FOR IMPLEMENTATION OF MODERN METHODS OF CONSTRUCTION IN SLOVAKIA

Tomáš Mandičák; Annamária Behúnová; Jana Smetanková; Gabriela Hanečáková

- and over the age of 50 are the optimal tool for promoting radio, tv and the internet.

Table 1 Ranking of marketing tools in selected research groups (age group 20 -29 years)



*UMT- Urban Mass Transportation

Figure 1 Scheme of effective marketing tools broken down by age group

Based on the research, the so-called “Model of marketing tools”. The model is broken down by individual target groups, specifically by age. The model details the tools that have a greater impact on the target audience. This view is according potential investors.

Due to the fact that interest groups are 20-29 and 30-39 years of age for the companies concerned, the following Tables 1 and 2 point to preferred marketing tools by these target groups. Selection of these group is not random. According previously researches, these groups of people are the most probably for buy or achieving of houses. There are really potancial groups.

REPLY	MEDIA SORTED ACCORDING TO THE APPLICABLE USABILITY
1	Tabloid magazine, videos
2	Newspaper, specialistic magazines, leaflets, TV, social networks, applications, blogs, mailboxes, exhibitions/fairs
3	Specialistic magazines, billboards/posters, UMT, radio, advertising materials, promoter
4	Facebook
5	Internet

UMT- Urban Mass Transportation

Table 1 shows that respondents aged 20-29 have the largest influence tabloid magazine and videos. Based on results from this research is necessary use these tools for better implementation fo modern methods of construction.

Table 2 Ranking of marketing tools in selected research groups (age group 30 -39 years)

REPLY	MEDIA SORTED ACCORDING TO THE APPLICABLE USABILITY
1	Applications, videos
2	Tabloid Magazine, UMT, TV, social networks, blogs, mailboxes, exhibitions/fairs
3	Newspaper, specialistic magazines, billboards/posters, leaflets, radio, advertising materials, promoter
4	Facebook
5	Internet

UMT- Urban Mass Transportation

From Table 2 shows that respondents aged 30-39 have the greatest impact on applications and videos. It is interesting knowledge achieved by research. Research shown, this group of respondents are finding a lot of information and they want to see some documentary and relevant resources.

Conclusion

The basic philosophy of the company is customer satisfaction. Each enterprise has certain goals that it wants to achieve by doing business, linking and aligning the spectrum of successive decisions and activities that we call the marketing strategy in a comprehensive way.

THE VIEW OF INVESTOR'S ON POTENTIAL OF MARKETING TOOLS FOR IMPLEMENTATION OF MODERN METHODS OF CONSTRUCTION IN SLOVAKIA

Tomáš Mandičák; Annamária Behúnová; Jana Smetanková; Gabriela Hanečáková

The marketing strategy decides on issues related to market or internal market, products, pricing, distribution, or marketing communications, and others.

The conducted marketing research brought a picture of public opinion, modern findings and recommendations on modern methods of construction and on the tools of their promotion and advertising. The proposed model further defines the marketing tools that are key and relevant to the promotion of products in the given area from the point of view of customers, that is to say potential investors, and pointed to the low-efficient promotional tools.

Final model of effective marketing tools for better implementation of modern methods of construction is possible use in conditions of Slovak civil engineering industry. It must be said, it's a general model based on selected research sample. Construction market has a lot of specific conditions and factors. Probably, these are interesting marketing tools according this group of respondents. Construction companies should be thing about other factors, that impact on better implementation a offer of modern methods of construction.

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FEATURES OF ENTERPRISE RISK MANAGEMENT

Michal Balog

Technical University of Kosice, Faculty of Manufacturing Technologies with a seat in Presov, Department of Manufacturing Management, Bayerova 1,080 01 Presov, Slovakia, michal.balog@tuke.sk

Alina Kovalenko

Technical university of Kosice, Faculty of manufacturing Technologies with a seat in Presov, Department of manufacturing management, Bayerova 1,080 01 Presov, Slovakia, a.kovalenko_92@ukr.net

Keywords: risk, characteristic of risk, methods of assessment

Abstract: Learned the characteristic of the risk in a company; the causes of occurrence of risk situations are revealed, methods for assessing risk situations and identified ways to eliminate the risk in the enterprise. Situation of risk in the company it is a main opportunity of company development. It is mean that in different cases company may manage of this risk and forward there to best way for the whole company.

Introduction

Situation of risk in the company it is a main opportunity of company development. It is mean that in different cases company may manage of this risk and forward there to best way for the whole company.

Risk - activities related to overcoming the inevitable uncertainty in a situation of choice, in which it is possible to quantitatively and qualitatively assess the likelihood of achieving the intended result, for example, disorders deviation from target [0].

1 Risk classification

Risk can come from both internal and external sources. The external risks are those that are not in direct control of the management. These include political issues, exchange rates, interest rates, and so on. Internal risks, on the other hand, include non-compliance or information breaches, among several others [0].

Thus, risks are divided into:

- Internal – planning, decision making, labour organization, human resources, technology, financial politic, labour discipline.
- External – politic, social-economic, crime and law, technical, climate, demographic, ecology [0].

Hazard identification is a process controlled by management. It is important to remember that a worker may perceive something as a hazard, when in fact it may not be a true hazard; the risk may not match the ranking that the worker places on it. After all basic steps of the operation of a piece of equipment or job procedure have been listed, we need to examine each to identify hazards associated with it. Some hazards are more likely to occur than others, and some are more likely to produce serious injuries than others.

The question to ask oneself is “Can any of these accident types or hazards inflict injury to a worker?” There are 11 basic types of accident [0]:

- Struck-against – Can the worker strike against anything while doing the job step? Identify not only what

the worker can strike against, but how the contact can come about.

- Struck-by – Can the worker be struck by anything while doing the job step? This means that something moves and strikes the worker abruptly with force.

- Contact-with and Contacted-by – Can the worker be contacted by anything while doing the job step? The contacted-by accident is one in which the worker could be contacted by some objects or agent. Can the worker come in contact with some agent that will injure without forceful contact? Any type of work that involves materials or equipment that may be harmful without forceful contact is a source of contact-with accident.

- Caught-in and Caught-on – Can the person be caught in, caught on. Or caught between objects? A caught-in accident I one in which the person. Or some part of his or her body, is caught in an enclosure opening of some kind. Can the worker be caught on anything while doing the job step? Most aught-on accidents involve worker’s clothing being caught on some projection of a moving object.

- Caught-between – Can worker be caught between any objects while doing the job step?

- Fall-Same-Level and Fall-to-Bellow – Can the worker fall while doing a job step? Two hazards account for most fall-to-same level accidents: slipping hazards and tripping hazards. The fall-to-below accidents occur in situations where employees work above ground or above floor level, and the results are usually more severe.

- Overexertion and Exposure – Can the worker be injured by overexertion; that is, can he or she be injured while lifting, pulling, or pushing? Finally, can exposure to the work environment cause injury to the worker?

These risks primarily concern the work of managers with human resources.

Before considering some of the specific techniques available for organizations to identify risks, several important factors should be noted about this process [0]:

- The end result of the process should be a risk language specific to the company or the unit, function, activity, or process (whatever is the focal point).

FEATURES OF ENTERPRISE RISK MANAGEMENT

Michal Balog; Alina Kovalenko

- Using a combination of techniques may produce a more comprehensive list of risks than would reliance on a single method.

- The techniques used should encourage open and frank discussion, and individuals should not fear reprisal for expressing their concerns about potential events that would give rise to risks resulting in major loss to the company.

- The process should involve a cross-functional and diverse team both for the perspectives that such a group provides and to build commitment to ERM.

- Finally, the process will probably generate a lengthy list of risks, and the key is to focus on the “vital few” rather than the “trivial many”.

Some risks are dynamic and require continual ongoing monitoring and assessment, such as certain market and production risks. Other risks are more static and require reassessment on a periodic basis with ongoing monitoring triggering [0].

2 Risk analysis methods

The quality of the analysis depends on the accuracy and completeness of the numerical values and the validity of the models used. An alert to reassess sooner should circumstances change. Both qualitative and quantitative techniques have advantages and disadvantages. Most enterprises begin with qualitative assessments and develop quantitative capabilities over time as their decision-making needs dictate (Table 1) [0].

Table 1 Measurement Techniques Comparison

Technique	Advantages	Disadvantages
Qualitative	<ul style="list-style-type: none"> • Is relatively quick and easy • Provides rich information beyond financial impact and likelihood such as vulnerability, speed of onset, and non-financial impacts such as health and safety and reputation • Is easily understood by a large number of employees who may not be trained in sophisticated quantification techniques 	<ul style="list-style-type: none"> • Gives limited differentiation between levels of risk (i.e. very high, high, medium, and low) • Is imprecise – risk events that plot within the same risk level can represent substantially different amounts of risk • Cannot numerically aggregate or address risk interactions and correlations • Provides limited ability to perform cost-benefit analysis

Quantitative	<ul style="list-style-type: none"> • Allows numerical aggregation taking into account risk interactions when using an “at risk” measure such as Cash Flow at Risk • Permits cost-benefit analysis of risk response options • Enables risk-based capital allocation to business activities with optimal risk-return • Helps compute capital requirements to maintain solvency under extreme conditions 	<ul style="list-style-type: none"> • Can be time-consuming and costly, especially at first during model development • Must choose units of measure such as dollars and annual frequency which may result in qualitative impacts being overlooked • Use of numbers may imply greater precision than the uncertainty of inputs warrants • Assumptions may not be apparent
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Knowing the characteristics of a particular type and characteristics of risk exposure to the company, the business unit that exists in the company, able to develop some ways to overcome the negative effects of a plan or minimize risks. Risk analysis is through the arsenal methods and techniques available to the manager in its activities. Risk assessment is able to send this risk in favour of the company. In this case, actions concerning risk management to be relevant and do not affect the general principle in the company.

2.1 Methods of risk assessment

When we are talking about learning of the risk situation in the company we must first of all identifying this risk. After this risk-manager may identify tools which can help to forward situation to development all organisation.

Some techniques for identifying risk are [0]:

- *Brainstorming.* This method combines all possible proposals in the team about eliminating the risk situation. The method helps to find the best options for working with risk, to find less costly solutions to the problem with a higher efficiency coefficient

- *Event inventories and loss event data.* In a brainstorming session or facilitated workshop (discussed later), the goal is to reduce the event inventory to those relevant to the company and define each risk specific to the company. The risk identification process can also be

FEATURES OF ENTERPRISE RISK MANAGEMENT

Michal Balog; Alina Kovalenko

seeded by available loss-event data. A database on relevant loss events for a specific industry can stimulate a “fact-based discussion.”

- *Interviews and self-assessment.* This technique combines two different processes. First, each individual of the organizational or operating unit is given a template with instructions to list the key strategies and/or objectives within his or her area of responsibility and the risks that could impede the achievement of the objectives. Each unit is also asked to assess its risk management capability using practical framework categories

- *Facilitated workshops.* After the information is completed and collected, a cross-functional management team from the unit or several units might participate in a facilitated workshop to discuss it.

- *SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis.* The strengths and weaknesses are internal to the company and include the company’s culture, structure, and financial and human resources. The opportunities and threats consist of variables outside the company and typically are not under the control of senior management in the short run, such as the broad spectrum of political, societal, environmental, and industry risks.

- *Risk questionnaires and surveys.* A risk questionnaire that includes a series of questions on both internal and external events can also be used effectively to identify risks. For the external area, questions might be directed at political and social risk, regulatory risks, industry risk, economic risk, environmental risk, competition risk, and so forth. Questions on the internal perspective might address risks relating to customers, creditors/investors, suppliers, operations, products, production processes, facilities, information systems, and so on.

- *Scenario analysis.* Scenario analysis is a particularly useful technique in identifying strategic risks where the situation is less defined and “what-if” questions should be explored. Essentially, this technique is one way to uncover risks where the event is high impact/low probability.

- *Using technology.* Modern technologies can greatly help in dealing with the situation in the river. For example, the creation of a working group, where employees of existing units can communicate with each other and suggest options for influencing the risk situation.

- *Other techniques.* Other possible approaches for identifying risks include value chain analysis, system design review, process analysis, and benchmarking with other similar as well as dissimilar organizations.

3 Enterprise risk management

Classic risk management as seen in Enterprise-wide Risk Management acknowledges 4 ways of dealing with risk: Avoid, Reduce, Transfer, Retain or Accept. These four strategies can be illustrated using a risk matrix, where the impact of a certain event stemming from an exposure to a certain risk, is plotted against the probability of that event actually happening (Figure 1) [0].

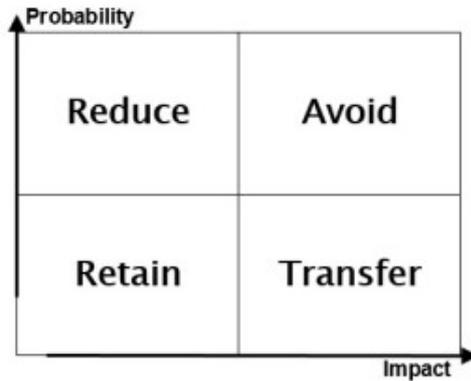
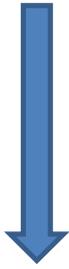


Figure 1 Risk matrix

Companies that succeed in turning risk into results will create competitive advantage through more efficient deployment of scarce resources, better decision-making and reduced exposure to negative events. Now is the time for senior business executives to begin applying a broad “risk lens” to the business (Table 2) [7].

Table 2 Enable risk management, communicate risk coverage

Audit committee and management expectations		The RISK Agenda	Results lens
		<i>Strengthen risk governance and oversight</i> Define risk strategy and oversight with accountability for risk management at the board and executive levels	Value: differentially invest in the risks that matter to generally development; improve controls around key business processes
	Applying a broad “risk lens” to the business	<i>Integrate risk and performance management</i> Embed an enterprise approach to risk assessment and monitoring into business planning and performance management	Cost: reduce overall cost of control spend by 30%; leverage automated controls more effectively

FEATURES OF ENTERPRISE RISK MANAGEMENT

Michal Balog; Alina Kovalenko

		<p>Coordinate multiple risk functions Improve leverage across multiple risk functions to expand coverage, reduce cost and enhance value to the business</p>	<p>Risk: align risks to corporate strategy; embed risk culture across the enterprise and reduce risk overlap through improved coordination</p>
	<p>Company goals, strategies and business initiatives</p>	<p>Enhance business-level performance Enable the organization to differentially manage key risks with optimized processes and controls at the business level</p>	

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Conclusions

Knowing the characteristics of a particular type and characteristics of risk exposure to the company, the business unit that exists in the company, able to develop some ways to overcome the negative effects of a plan or minimize risks. Risk analysis is through the arsenal methods and techniques available to the manager in its activities. Risk assessment is able to send this risk in favor of the company. In this case, actions concerning risk management to be relevant and do not affect the general principle in the company.

By creating a separate department of risk management, managers should give the head of the department certain powers, fill skilled workers, documented fix the limits and scope of responsibility assigned to managers and employees. Thus, a clear division of labor and organized work unit helps minimize costs that may arise in the process of overcoming the risk situation and professional staff able to direct risk for the further development of the company.

Risk is now becoming the fourth dimension of business. People were the first dimension. Process became the second dimension during the height of the manufacturing era. Evolving technology formed the third dimension. Embedding risk as the fourth dimension of business has the potential to fundamentally transform how organizations connect risk to reward.

MEDICINE AND ENGINEERING – CONNECTION BIOLOGY, TECHNOLOGY AND INFORMATICS

Marianna Trebuňová

Technical University of Košice, Faculty of Mechanical Engineering, Department of Biomedical Engineering and Measurement, Letná 9, 042 00 Košice, Slovakia, marianna.trebunova@tuke.sk

Viktória Mezencevová

Technical University of Košice, Faculty of Mechanical Engineering, Department of Biomedical Engineering and Measurement, Letná 9, 042 00 Košice, Slovakia, viktoria.mezencevova@student.tuke.sk

Jozef Živčák

Technical University of Košice, Faculty of Mechanical Engineering, Department of Biomedical Engineering and Measurement, Letná 9, 042 00 Košice, Slovakia, jozef.zivcak@tuke.sk

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Abstract: Biomedical engineering is a broad field that covers a wide range of medical disciplines. Increasingly, nature is linked to engineering and technology. There is a breakthrough in chemical engineering and nanotechnology. Current progressive information, sensors and wireless technologies opens new means of monitoring patients and interpreting patient health data. In this review article, we focus on the field of biomimetics and inform about new possibilities of using wearable implantable systems.

1 Biomimetics

Engineers, scientists, and business people are increasingly turning toward nature for design inspiration. The field of biomimetics, the application of methods and systems, found in nature, to engineering and technology, has spawned a number of innovations far superior to what the human mind alone could have devised [1-2]. The reason is simple. Nature, through billions of years of trial and error, has produced effective solutions to innumerable complex real-world problems. The rigorous competition of natural selection means waste and efficiency are not tolerated in natural systems, unlike many of the technologies devised by humans. For example, gas-powered cars are only about 20 percent efficient, that is, only 20 percent of the thermal-energy content of the gasoline is converted into mechanical work.

Biomimetics, also known as Bionics (a term coined by an American air force officer in 1958), Biognosis, and Biomimicry, has been applied to a number of fields from political science to car design to computer science (cybernetics, swarm intelligence, artificial neurons and artificial neural networks are all derived from biomimetic principles). Generally there are three areas in biology after which technological solutions can be modeled [2]: 1.) Replicating natural manufacturing methods as in the production of chemical compounds by plants and animals. 2.) Mimicking mechanisms found in nature such as Velcro and “Gecko tape” (Figure 1) [3]. 3.) Imitating organizational principles from social behavior of organisms like ants, bees and microorganisms.

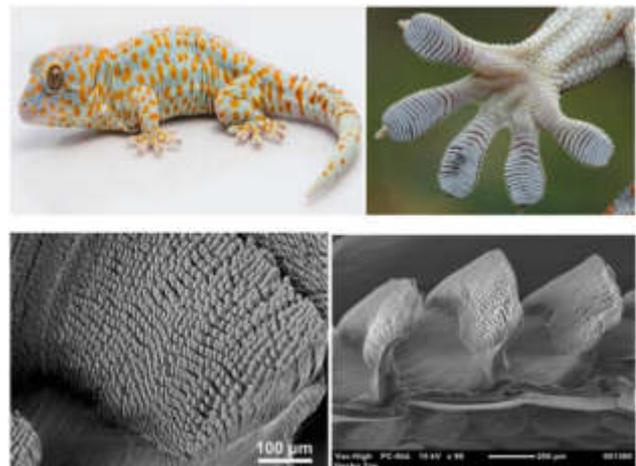


Figure 1 Geckskin™ is a new super-adhesive based on the mechanics of gecko feet [3]

To capitalize on the wealth of designs and processes found in nature, Dr. Julian Vincent, the director of the Centre for Biomimetic and Natural Technologies at the University of Bath in England, and his colleagues have devised a “biological patents” database that will enable engineers to directly tap into nature’s ingenuity bypassing the need to consult with biologists that they have come to rely upon for insight into nature’s workings. According to the June 9th, 2005 issue of *The Economist*, “The idea is that this database will let anyone search through a wide range of biological mechanisms and properties to find natural solutions to technological problems.” Currently, Dr. Vincent estimates that “at present there is only a 10% overlap between biology and technology in terms of the

mechanisms used” so there is a great deal of potential in this area.

The biological patents database takes a different approach to providing examples of natural biological technologies which fulfill the requirements of a particular engineering problem. As explained in *The Economist*, instead of searching by a plant or animal’s name, an engineer would query the database with a keyword like “propulsion” to get “a range of propulsion mechanisms used by jellyfish, frogs and crustaceans.” There are other ways to use the database as well, including characterizing “an engineering problem in the form of a list of desirable features that the solution ought to have, and another list of undesirable features that it ought to avoid.... So, for example, searching for a means of defying gravity might produce a number of possible solutions taken from different flying creatures but described in engineering terms. ‘If you want flight, you don’t copy a bird, but you do copy the use of wings and aerofoils,’ says Dr Vincent.” While the system only contains about 2,500 “patents” at present, Dr. Vincent aims to significantly expand the collection to help engineers identify natural systems and behaviors that might be useful in their engineering challenges. There is great hope that biomimetics will help mankind develop technologies that both reduce our impact on the environment around us and improve our quality of life [4-6].

2 Loadable and Implantable Technologies

Current technological advances and trends support an increasing interest in finding new solutions and forms of healthcare provision. Innovative portable and wearable systems (Smart Wearable Systems) offer solutions for affordable and personalized services in good quality. The systems are used to monitor patients 24 hours a day, in their own home and surroundings, according to pre-established medical protocols.

For health monitoring, SWS can provide a wide range of wearable and implantable devices, including sensors, actuators, intelligent textiles, power supplies, wireless communications networks, processing units, multimedia devices, user interfaces, capture, data processing and support software and algorithms decision-making. These systems are capable of measuring life functions such as body and skin temperature, heart rate, arterial blood pressure, blood oxygen saturation, sensing surface tension, and generating an electrocardiogram, electroencephalogram and frequency of breathing. Measurements are transmitted through a wireless sensor network, either for a central hub, such as a Personal Digital Assistant (smartphone), or are sent directly to a health

center. The physician can then manage patient management based on transferred data [1, 7].

2.1 Monitoring Parkinson

Symptoms and progression of Parkinson's disease (Parkinson's Disease) vary widely from patient to patient. The severity of the symptoms in these patients may vary considerably between the doses of drugs during the day. Making a precise assessment of the patient's condition and adjusting treatment for his or her needs is of utmost importance to the doctor. Patients often confuse the tremor of Parkinson's disease with drug-induced dyskinesias, which causes autoreports to be unreliable [1]. Because of these diverse experiences, it is hard for scientists to capture a truly accurate picture of what it is like to live with a PD. Workable technology, including bioengineers, including intelligent phones and smart clocks, is a promising new approach that has the potential to see how and what kind of information is collected and shared from the patient to the researcher. Intel has developed a large data analysis platform using the Amazon Web Services (AWS) infrastructure to identify the data accessed by Parkinson's researchers across the globe.

In a research initiative that began in 2014, the Michael J. Fox Foundation (MJFF) has worked with Intel Corporation to collect, measure and evaluate Parkinson's disease symptoms using "smart" wearable PD technology. This open access model allows free access to data from people with PD directly to scientists, and can help analyze new traces and present a holistic picture of what it means to live with Parkinson's disease. The first set of data will be available to qualified researchers this summer [8]. Research data is on the AWS and is made available to Parkinson's physician and researcher worldwide, thanks to Intel's platform. Through analysis, the data can reveal new useful findings about life with Parkinson's disease [9].

Similar procedures could be used to detect 1) episodes by exacerbation’s COPD (chronic obstructive pulmonary disease), 2) changes of functional abilities in patients, which have got stroke and those who have undergone rehabilitation, 3) seizures in patients with epilepsy and other medical events in which the time is significant. The exact method of monitoring the patient and the type of data collected and transmitted would vary according to the disease concerned [1].

2.2 Smart tattoos

Bioengineers from the University of Illinois - who work with colleagues in Singapore - have found out how to insert flat, flexible, extensible electronic sensors into a temporary tattoo that can resist wrinkling, bending and

twisting of the skin (Figure 2) [10]. These microelectronics, which are thinner than human hair and water-resistant, could be used to monitor the electrical signals produced by heart, brain and muscle without irritation (Figure 3).



Figure 2 Smart tatoos [11]

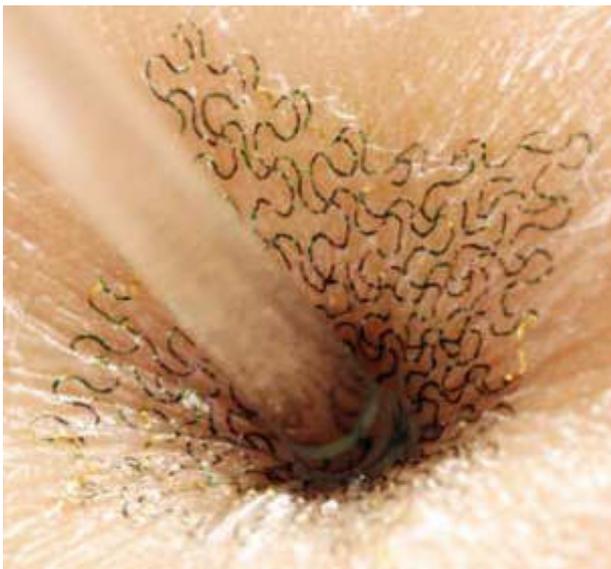


Figure 3 The circuits' filamentary serpentine shape allows them to bend, twist, scrunch and stretch while maintaining functionality [12]

Applications are extensive. Tattoos could be used to monitor heart arrhythmias, sleep disorders and cardiac activity in premature babies, stimulating muscles. Other detectors, transmitters and receivers could be attached to the tattoo. Currently, bioengineers are working on producing a small battery powered by solar cells or a wireless transmitter. They hope that one day they will be able to interpret chemical information from the skin [1, 13].

Conclusions

Advances in sensor technology and innovations in wearable technology have provided a number of new devices ready to support innovation in medical and professional applications, including diagnostics, surgery, and remote patient monitoring in indoor and outdoor areas. Wireless medical devices provide new dimensions for these applications. Biosensors, combined with wireless devices, can remotely monitor a person's health at home or patient in the operating room in an "intelligent device" [7].

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