13th INTERNATIONAL

WORKSHOP ON KNOWLEDGE MANAGEMENT

13th International
Workshop on Knowledge Management

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JOB FAIR

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Hella Slovakia Front-Lighting, s.r.o., *Poster presentation*
ON Semiconductor Slovakia, a. s, *Poster presentation*
TRW Automotive (Slovakia) s.r.o., *Poster presentation*

Photos

IWKM

JOB FAIR in Trenčín

Bratislava

Foreword

On 18 and 19 October 2019, the Bratislava campus of Vysoká škola manažmentu (School of Management) hosted the 13th International Workshop on Knowledge Management (IWKM). The scientific event was held under the auspices of prof. Ing. Edita Hekelová, PhD., the rector of VŠM. The workshop was accompanied by Job Fair, which ran simultaneously in both campuses: Bratislava and Trenčín. The key topic of the scientific part of the workshop was „*Knowledge: measurement, evaluation and interpretation*".

A reader can challenge this subtitle: The knowledge is in principle non-measurable. How can its measure, evaluation and interpretation become a conference topic? Isn't the subtitle an oxymoron? It is not. The visitors could learn it in the very beginning of the workshop – during its introductory seminar on **Data Mining Tools and Measurement Data Analysis** led by prof. Ing. Petr Berka, PhD. from VŠE in Prague. The contributions of Milan Hrdlík (VERI2, s.r.o.), Renata Janošcová (VŠM Trenčín), Branislav Bernadič (VŠM Trenčín) showed that there were many aspects worth investigation.

The panel discussion **Measuring Quality of Universities' Functions** presents the same problem from another angle: the necessity to measure not only the presence of knowledge but also its quality. Prof. Ing. Soňa Ferenčíková, PhD. (VŠM Trenčín) moderated three discussions with Jozef Hvorecký (VŠM Trenčín), Katarína Pišútová (Comenius University in Bratislava) and Barbora Záhradníková (Adient, Bratislava).

They underlined the importance of measuring all aspects of the university role: scientific, educational and social. Their opinion exchange met with the audience's expectations. They presented also calls for academic integrity and ethical behavior – the growing problems in the Slovak tertiary system.

The workshop included presentations of research results of participants from the Czech Republic, Finland, Germany, Saudi Arabia and Slovakia. In particular, the attendance from Slovak institutions exceeded the organizers' expectations. It indicates that after years of stagnation, the interest of academia and industry is growing. One can only regret that VŠM – the Slovakian pioneer in the field – recently cancelled its Knowledge Management study programs.

The variety of presented topics proves the size of Knowledge Management and its multi-spectral influence. Feel the taste:

- *Ilkka Mikkonen* (OAMK, Oulu): The Agile Transformation
- *Mária Olejárová, Mária Tajtáková* (VŠM, Trenčín): Knowledge Management within Culture-based Urban Regeneration Projects in Slovakia
- *Monika Šestáková* (VŠM, Trenčín): Redefining the "Permanent Establishment" Concept in order to Make Its Measurement More Relevant for Digital Economy
- *Eva Rakovská,* (University of Economics, Bratislava), *Alžbeta Kanáliková* (University of Žilina): LMS as a Tool of Knowledge Management
- *Erika Jurišová* (Comenius University, Bratislava): Language Education at the Faculty of Pharmacy of the Comenius University in the Newly Accredited Program UNIcert ®
- *Martin Nehéz, Marek Lelovský* (Slovak University of Technology, Bratislava): A Graph Mining Perspective on Graphlet-Based Network Similarity

- *Václav Zubr* (University Hradec Králové): Applications of the Dimensions of the Learning Organization – Questionnaire in the IT Sector in the Czech Republic

The Job Fair allowed the VŠM students to learn about the job opportunities in HELLA Slovakia Front-Lighting, s.r.o. Kočovce, ON Semiconductor Slovakia, a. s. Piešťany, TRW Automotive (Slovakia) s.r.o., Nové Mesto nad Váhom, and ADIENT Slovakia s.r.o. Bratislava. For students, the most attractive part of these company introductions was "interview training", in which their representatives simulated the real interviews with their job applicants. Among others, the students got the understanding of which soft skills belong to the highest valued ones.

Thank you to all the participants for their contribution to the quality of the 13th IWKM. We wish you pleasant reading.

Jozef Hvorecký

Renata Janošcová

Co-chairs of IWKM

Who are the Leaders in the Data Mining Industry?

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Abstract: Gartner Inc, a world's leading research and advisory company has developed a methodology how to identify leading companies in a particular market segment. The so called Magic Quadrant uses two complex criteria, "completeness of vision" and "ability to execute" to group possible vendors into four groups: leaders, visionaries, challengers and niche players. Based on the Gartner reports, the paper shows the leading companies in the data mining industry in the last five years. The corresponding data mining systems are briefly introduced as well.

Keywords: magic quadrant; data mining systems.

1 Introduction

The markets for various products and services develop in similar ways. At the beginning, when a market emerges, e.g. due to a new technology, a number of companies appear offering new partial products or solutions that still have a limited impact. In the next phase, high growth can be observed when new vendors enter the market as they are attracted by its potential. Then, a consolidation phase follows, when the growth of the market is not as high but still there is space for some new vendors entering it. When the market becomes mature, only a few key players remain in established positions.

To assess the position of vendors on the market during the high growth and consolidating phases of the market development, Gartner Inc., a leading consulting company, designed a method called Magic Quadrant. Based on two compound criteria, Magic Quadrant visualizes the vendors as divided into four groups: the Leaders, the Challengers, the Visionaries and the Niche Players.

The rest of the paper is organized as follows: Section 2 describes the Magic Quadrant in general, Section 3 discusses the Magic Quadrant for data science for the year 2018, Section 4 focuses on vendors identified as the leaders in 2018 and shows how their position has changed in the last five years. This section also presents data mining tools of the leaders on the market. Section 5 concludes the paper.

2 Gartner Magic Quadrant

Gartner Inc. is a world's leading research and advisory company in the areas of IT, Finance, HR, Customer Service and Support, Legal and Compliance, Marketing, Sales, and Supply Chain. Gartner provides their clients with insights and analyses of various aspects of business and industry. Among them, the Magic Quadrant is a popular and widely used method to compare vendors of some products or services.

Following the idiom "One image counts for thousand words", Magic Quadrant is a graphical representation of the position of the selected vendors on the market. The basics of the Magic Quadrant are two compound criteria: completeness of vision and ability to execute.

Completeness of vision is composed of market understanding, marketing strategy, sales strategy, offering product strategy, business model, industry strategy, innovation and geographic strategy components. Completeness of vision thus refers to the strategies of developing innovative products or services. Ability to execute is composed of products/services, overall viability, sales execution/pricing, market responsiveness, marketing execution, customer experience and operations components. Ability to execute thus refers to the practical issues related to sales and marketing [5]. So, the criteria summarize the potential of a vendor to develop and successfully deliver innovative products. Based on these criteria, the vendors are divided into four groups. Leaders are vendors that have high rating in both the completeness of vision and the ability of execute; they provide mature products and services that meet market demand, and they can affect its overall direction. Challengers are vendors that have high rating in the ability to execute but low rating in the completeness of vision; they typically have a significant size and resources but may lack a strong vision or innovation. Visionaries are vendors that have high rating in the completeness of vision but low rating in the ability to execute; they have a strong view of how the market will evolve but a lower capability to satisfy all possible customers. Niche players have low rating in both the completeness of vision and the ability to execute; they perform well only in a segment of the market because they typically focus on a particular functionality or geographic region. The categorization of the vendors may vary over time; vendors may move between leaders and challengers as the market may shift; visionaries may become leaders or challengers if they strengthen their ability to attract buyers and keep or lose their innovation potential.

Both criteria are numeric, so a vendor can be displayed as a point in a two-dimensional graph, where the x-axis corresponds to the completeness of vision criterion and the y-axis corresponds to the ability to execute criterion. Magic Quadrant visualizes the vendors divided into four groups (quadrants): the Leaders are positioned in the upper right quadrant, the Challengers are positioned in the upper left quadrant, the Visionaries are positioned in the lower right quadrant and the Niche Players are positioned in the lower left quadrant.

It is necessary to note that not every vendor on the market is included in the Magic Quadrant. Gartner makes some selection focusing only on vendors that are the most important or best suited for the buyers in the market. So, just “being included in the Magic Quadrant” is like “being nominated” for an award.

3 Magic Quadrant for Data Mining and Data Science

The market with tools and systems for data mining seems to fulfil the requirements to be analyzed by the Magic Quadrant technique. Although the area has been known for decades and the first data mining suites were made available in the 1990s, which can mean that the market is already mature (consider the pioneering system Clementine by ISL, Inc. that introduced as early as in 1994 a visual interface allowing to use statistical and DM algorithms in an intuitive way without programming), recently we could observe a new breakthrough in this area that has its expression in new terms like deep learning, big data or data science. And indeed, Gartner Inc. issues Magic Quadrants also for this area and reflects the new trends by changing the names for the reports. So, in 2014-2016, the Magic Quadrant was used for advanced analytics platforms [7], [2], [3], in 2017 for data science platforms [4] and in 2018 for data science and machine learning platforms [5].

Fig. 1 shows the Magic Quadrant for the year 2018, that is the Magic Quadrant for data science and machine leaning platforms [5]. While we can find about 90 commercial and about

25 open source data mining suites on the market (see e.g. http://www.kdnuggets.com), the Magic Quadrant contains only 16 vendors. Alteryx, SAS, RapidMiner, KNIME and H2o.ai are the leaders; MathWorks and TIBCO are the challengers; Dataiku, Domino, Microsoft, IBM and Databricks are the visionaries, and Teradata, Anaconda, SAP and Angoss are the niche players. We will focus only on the leader's quadrant in the next section.

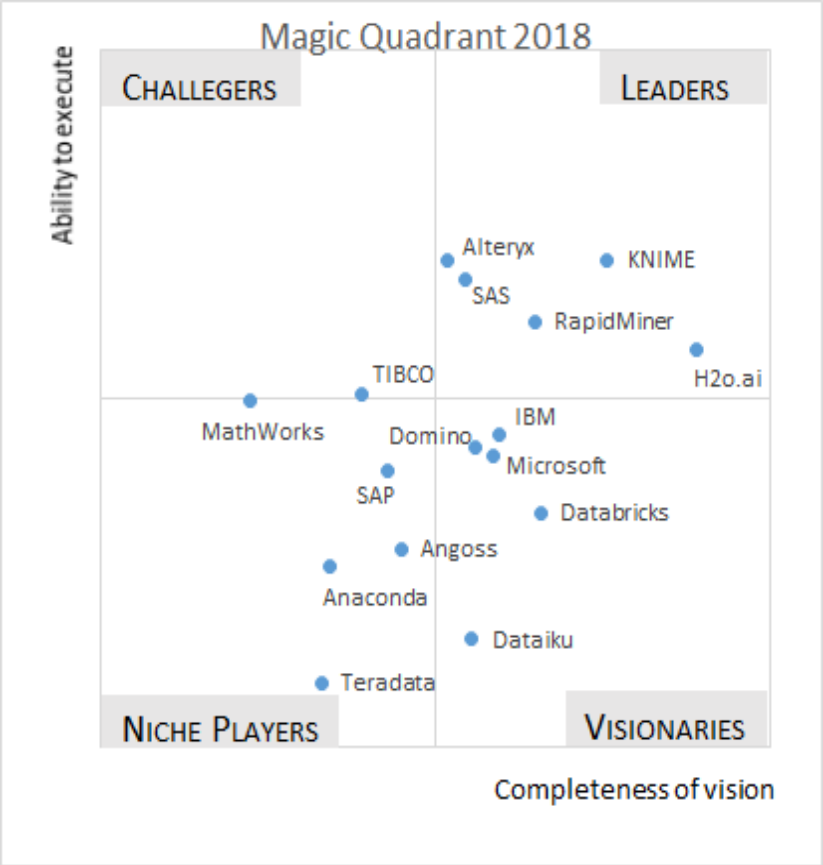

Fig. 1 *Magic Quadrant for data science for 2018 [5]*

4 Leaders in the Data Mining Industry

Gartner Inc. identified five vendors to be the leaders in data mining and data science for the year 2018: Alteryx, SAS, Rapid Miner, KNIME and H2O.ai (Fig. 1). Let's have a closer look at those vendors and their data mining and data analysis products and services.

Alteryx, Inc. (https://www.alteryx.com), founded in 1997, operates a self-service data analytics software platform. The main products/components are Alteryx Designer for data preparation and analytics; Alteryx Server, a secure and scalable server-based product for scheduling, sharing, and running analytic processes and applications in a Web-based environment; Alteryx Connect, a collaborative data exploration platform; Alteryx Promote, an analytics model management product for data scientists and analytics teams to build, manage, monitor, and deploy predictive models in production; and Alteryx Analytics Gallery, a cloud-based collaboration that allows users to share workflows in a centralized repository [1]. Fig. 2 shows a screenshot of the Alteryx Designer.

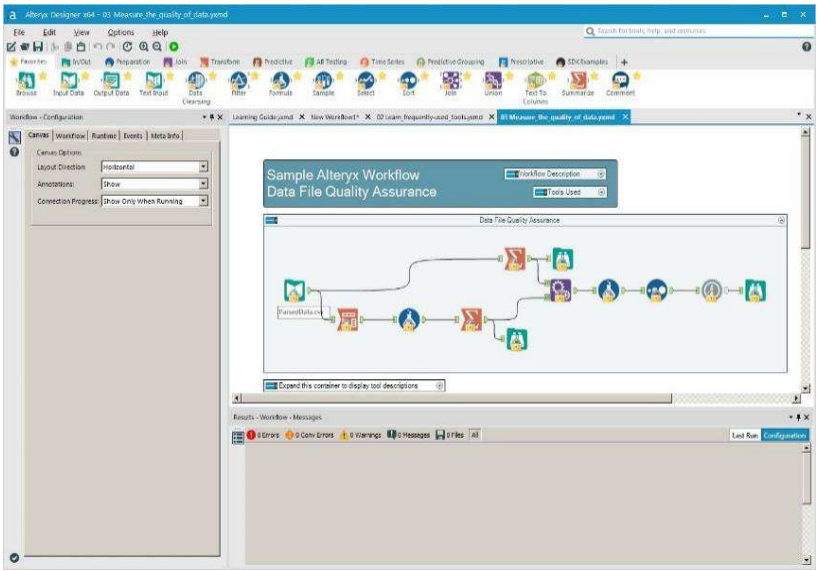

Fig. 2 *Alteryx*

SAS Institute (https://www.sas.com) provides analytics, business intelligence, and data management software and services.. SAS Institute started in late 1960th as a project at the North Carolina State University to create statistical analytics software (hence the name SAS). Since then, SAS Institute has become the largest privately owned software company in the world. The flagship product of the company is SAS, a huge system for advanced analytics, multivariate analyses, business intelligence, data management, and predictive analytics. SAS provides a graphical point-and-click user interface for non-technical users and more advanced options through the SAS language. Other products offered by SAS are JMP and Enterprise Miner. JMP is a suite of computer programs for statistical analysis developed by the JMP business unit of SAS Institute since 1989. SAS Enterprise Miner, as a stand-alone data mining tool, was released in 1999 (for a screenshot of Enterprise Miner version 7.1, see Fig. 3).

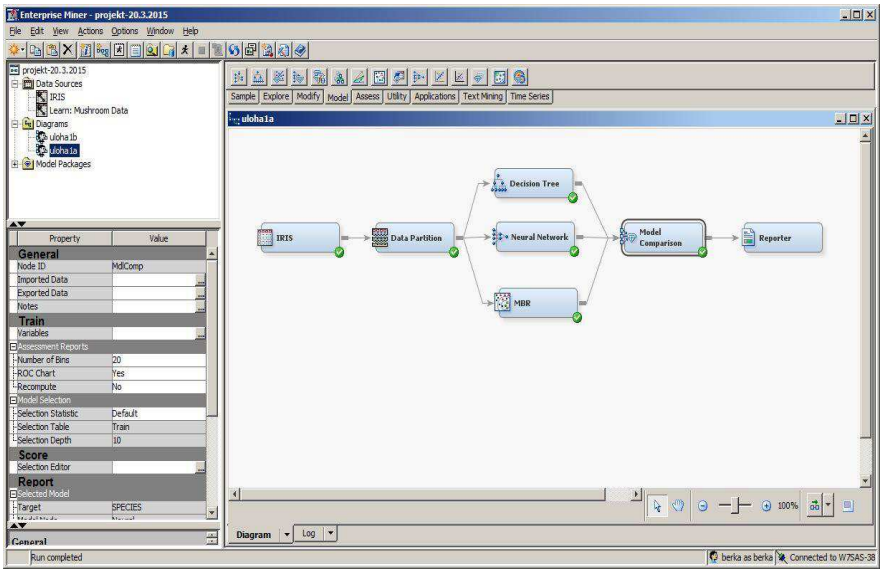

Fig. 3 *SAS Enterprise Miner*

RapidMiner, Inc. (https://rapidminer.com) develops an open source data science platform. The company focuses on the creation, delivery, and maintenance of predictive analytics. It offers RapidMiner Studio, a visual programming environment for predictive analytic workflows; RapidMiner Server that enables users to share, reuse, and operationalize the predictive models and results created in RapidMiner Studio; and RapidMiner Radoop that provides graphical environment for big data analytics using Hadoop and Spark.

The main data mining product is RapidMiner Studio, an integrated visual environment for data preparation, machine learning, deep learning, text mining, and predictive analytics (see Fig. 4. for a snapshot). RapidMiner Studio functionality can be further extended with additional plugins from the RapidMiner Marketplace in an easy way, similar to downloading applications into a mobile phone. The development of the system started in 2001 at the University of Dortmund, under the name YALE (Yet Another Learning System), so the company emerged as a spin-off at that university (the company is now based in Boston, USA). RapidMiner Inc. has a mixture business model. RapidMiner Studio is available both as a free system (the so-called community edition with the limit of 10 000 rows in the data table) and as a paid enterprise edition [1].

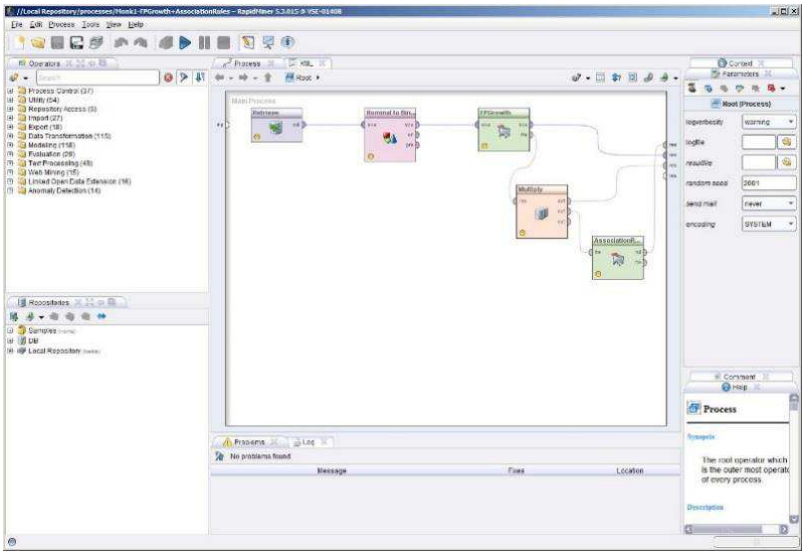

Fig. 4 *Rapid Miner Studio*

KNIME.com AG (https://www.knime.com), offering open-source enterprise solutions and services, is another vendor that started at a university - in this case, at the University of Konstanz, Germany, in 2004 (KNIME.com AG is now based in Zurich, Switzerland). The original system KNIME (KoNztanz Information MinEr) is a free and open-source data analytics, reporting and integration platform. Like RapidMiner, also KNIME offers various extensions to the system, now named KNIME Analytics Platform (see Fig. 5 for a snapshot). Beside this product, which runs as a desktop, KNIME.com AG also offers KNIME Server for remote and scheduled execution, automation, management, and deployment of data science workflows and tools for integrating KNIME Analytics Platform in large open source projects like Keras for deep learning, H2O for high performance machine learning, Apache Spark for big data processing, Python and R for scripting, and more.

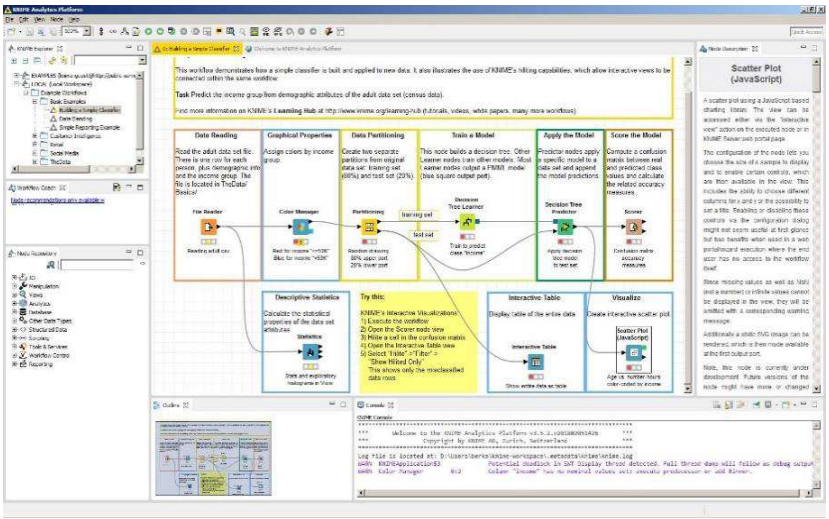

Fig. 5 *KNIME*

H2O.ai (https://www.h2o.ai), founded in 2011, is a relatively new vendor that appears in the Magic Quadrant in 2017 for the first time. H2O.ai develops a parallel processing prediction engine for machine learning and predictive analytics of big data. It offers H2O, an open source, distributed in-memory machine learning platform that supports the most widely used statistical and machine learning algorithms (see Fig. 6 for a screenshot) and H2O Driverless AI, an enterprise platform that employs the techniques of expert data scientists in an easy to use application, which empowers the users of the system to work on their projects faster using automation of different data mining steps. The company also provides marketing mix modeling, risk and fraud analysis, advertising technology, and customer intelligence solutions [1].

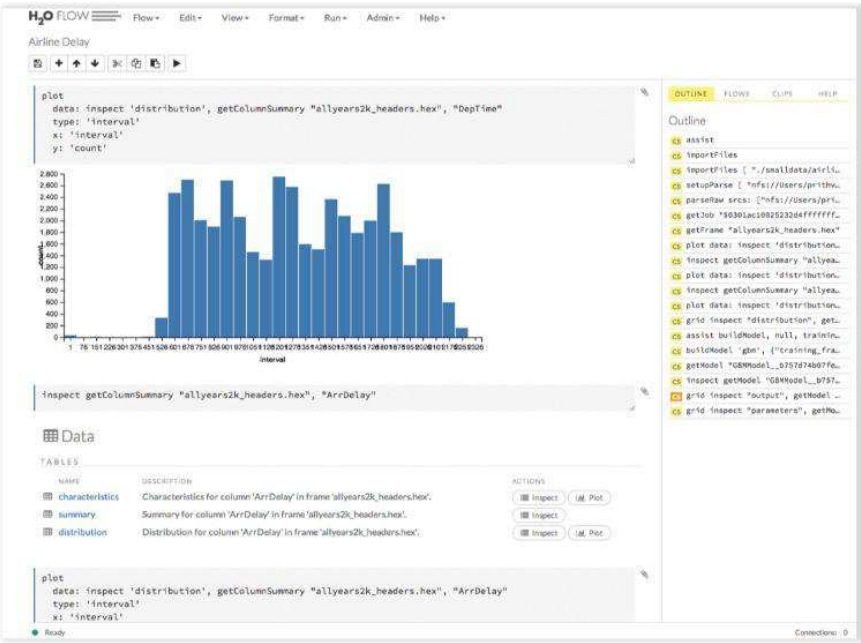

Fig. 6 *H2O.ai*

Not only the „snapshot“ of the vendors' position in the Magic Quadrant but also the changes over time are interesting. Fig. 7 and Fig. 8 show the current leaders' positions in the Magic Quadrant in the last five years (period 2014-2018). As we can see, all the leaders keep high completeness of vision during the whole period. Concerning the ability to execute, the established vendors also keep high ability to execute, while „newcomers“ improve this criterion. So we can conclude that the situation among the leaders is stable, as most of them keep their positions for several years.

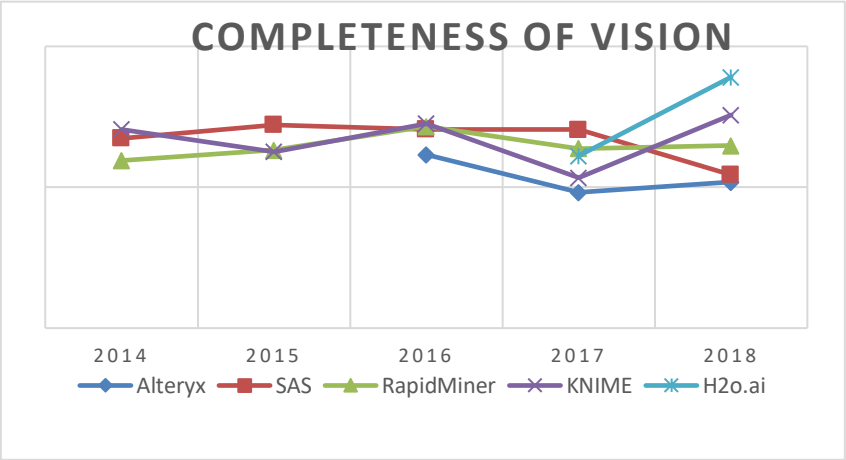

Fig. 7 *Completeness of vision of MQ 2018 leaders in the last five years*

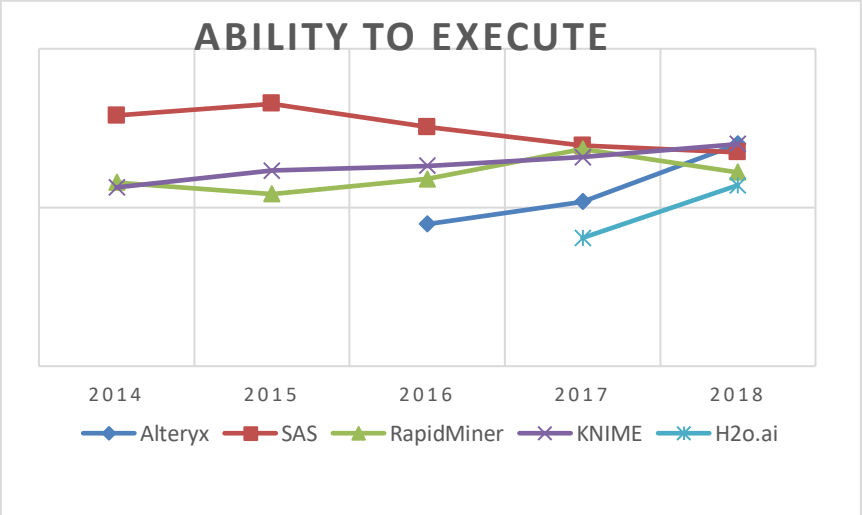

Fig. 8 *Ability to execute of MQ 2018 leaders in the last five years*

5 Conclusions

Magic Quadrant is a useful technique that allows to determine the strongest vendors on a particular market, for the purposes of this paper - on the market with tools suitable for data mining and data science. As the analysis of Gartner's Magic Quadrant report over the last five years shows, the situation among the leading vendors, as monitored by the Gartner, Inc., is stable. However, we must be aware that the Magic Quadrant focuses on commercial vendors. To get the full picture of the market with data mining and data science tools, we must consider also the open-source software community and, eventually, also the cloud solutions.

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Analyzing Phenomena as a Possibility to Break off the Limits of Measurement

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Abstract: The aim of this paper is to analyze the limits of measurement methods and the opportunities to capture phenomena that lead to important scientific knowledge. That is why we will present some short examples of such research from the past that still have big influence in science and the author's own current research.

Keywords: Phenomena. Limits of measurement. Qualitative research.

1 Introduction

Thanks to quantitative methods, a lot of scientific findings were elaborated, so that most research designs are based on these established methods. Important conditions for these methods are situations that fulfill three aspects: objectivity, reliability and validity.

The problem is that such settings have artificial characteristics like in laboratories. For that reason, a lot of daily situations aren´t taken into account by quantitative methods. In the last forty years, qualitative methods were developped, so that this problem has been solved. That means that situations like phenomena could be analyzed in a scientific way.

Because of the contrary logic of these two approaches (quantitative methods are mathematically testable - more objective, repeatable, the research groups are big and they have a long scientific tradition while qualitative methods are not mathematically testable - more subjective, not repeatable, research groups are small and these methods are new), most researchers are focused either on quantitative or qualitative methods. Therefore, there are barely researchers with much experience in both methods.

Based on these facts, we can assume that there are much more quantitative researchers than qualitative ones. Thus, this text represents a contribution to change so that more researchers can discover the interesting possibilities of qualitative methods and their high meaning for scientific discoveries.

2 Narrative interviews - an established method among qualitative researchers

A book by Sabina Misosch is an interesting source of information about qualitative interviews, especially narrative interviews. At the beginning of the book, she explains that she represents methods that produce verbal data. That means processes that obtain narration, or in which guides are used, or in which information is received through group work. According to Misosch, qualitative interviews are a central method in empirical social research. She points out that detailed information about individuals can be identified. Because of the strong similarity with everyday situations, this method is often underestimated in terms of its

requirements during the implementation. For this, her book clarifies the necessary competences and preparation of an interviewer for the appropriate interview execution. After a detailed presentation and discussion of the different methods, she gives the reader recommendations on the respective research objective [11]. In our discussion, we are concentrating on the chapter three of the book, dealing with narrative interviews. In addition to demonstrating her general presentation of this method, we use primary sources for further explanation. More important for our presentation is her opinion on the use of this method.

Under a narrative Misosch understands "the oral or written representation of a happening from the perspective of a subject." According to her, narrative interviews, which relate to the verbalization of experiences during an interview, are the most established method in biographical research, but they are also used as a "narrative method" renamed in action and organizational research [11]. Misosch represents the original context of this method.

The emergence of narrative interviews began with a project of Fritz Schütze, who analysed the interaction between doings of an individual (the micro level) and consequences for the society (the macro level) at the verbal level to determine crucial processes by means of interviews of local politicians during merging of several municipalities [12]. In her book, Küsters also provides a good overview of narrative interviews as a specific qualitative research method. Based on Küsters, the further development of the methodology of biographical research by Schütze led to an increasing meaning of biographical-narrative interviews in qualitative research [14]. Furthermore, Lamnek, as an experienced scientist in qualitative research methods, points out that qualitative procedures have a particular advantage in minority research against quantitative approaches. The advantages would lie in their openness and flexibility, so that a special approach to the specifics of the examined environment would be permitted. It would be about cultures that were explored a little bit and subjects exposed to rapid change. For this reason, an exploratory approach should be suggested. In the collection of research-relevant data, Lamnek points out the dominance of forms of qualitative interviews in the research of minorities [9]. A sociology professor Thomas Brüsemeister from the Justus-Liebig university in Gießen agrees with that [9]. According to the Institute for Media and Educational Research at the University of Augsburg, narrative interviews allow typological formation in the biography and life research.

2.1 Steps of narrative interviews

The narrative is the focus of a narrative interview. It´s a special form of narrative that is called “Stegreiferzählungen” (spontaneous interviews) [11]. So, Misosch points out that there is no preparation by the interviewee, and retrospective stories are presented in a face-to-face situation. Two elements are central: the narrator must be able to depict experiences that are temporarily comprehensible and to present his subjective feelings [11]. Consequently, a crucial challenge is to formulate a narrative impulse by an open question in relation to the life story so that a narrative is produced. By means of non-verbal or short approvals during the narrative, the narrative flow is to be maintained. After the narrator has formulated the end of his story, the possibility exists for the interviewer to ask questions [6,13]. According to Schütze, Misosch represents the different constraints that a narrator is exposed to by telling his story. Misosch refers to Schütze and speaks about “Zugzwänge des Erzählens” (constraints by telling a story) [9]. These constraints are:

- Shaping constraints: Important elements give us central aspects for the sake of traceability.

- Condensation constraints: The narrator wants the listener to follow the historical order of the events.
- Detail constraints: Important event points (causal, motivational) need to be detailed [1,13].

Apart from the questioning part, the researcher plays a passive role during most of the interview, immediately after setting the "narrative impulse". In this way, the interviewer has enough room to let his tales run free [1,8].

Then, according to Schütze, Misosch presents the decisive analysis steps of this interview method [1,13]:

- Analysis of the narrative segments (the researcher focuses only on the narrative parts of the interview. He ignores comments, explanation, …), then the overall narrative form under systematic inclusion of the research question.
- Pragmatic refraction of the theory. Knowledge of the narrator in the context of spreading of the theory. Activities and their functions (here comments and explanation of the narrator are analysed).
- Empirical context of the course of action. What self - theory, world theory and foreign theories can be identified by the narrator?
- Differentiation and consolidation of provisional categories and derivation of further cognitive questions.
- The contrasting comparison: First minimal comparison because of the search for similarities between the interviews, then maximum comparison as a result of the search for the biggest differences between the interviews-> then construction of a theoretical model through systematic classification of the categories among each other.

The theoretical model leads to a process model of specific types of lifeprocesses, their phases, conditions and problem areas if special people groups are investigated as for their life-historical opportunities and conditions.

2.2 Discussion of narrative methods

In the following points as critical aspects of narrative interviews, Misosch discusses:

- Life is not like a story. The latter distorts the event sequences for comprehensibility. Furthermore, the visibility of the other players is being blown out. To this point, Misosch points out that this circumstance is achieved by clean implementation of the method, which takes these aspects, inter alia, into account by considering the different narrative constraints [11].

- The personality of the interviewed person has a decisive effect on the quality of the interview about the information content. Here, Misosch argues that narrative interviews do not place such an expectation in the individual but leave it to his own narrative [11]. It is, therefore, up to the researcher whether he is using an interview or not. It would be quite conceivable that a research interest is related to the analysis of timid persons. In such a context, very elaborate interviews would be counterproductive because the target group would be missing.

- Due to the time difference, the current attitude of the interviewee might have changed. Based on Misosch, a researcher could react to this problem by using the narrative method by Rosenthal [11].

- Misosch criticizes that the interviewee could deliberately distort the information due to self-protection or other interests. It was not proven that other interview methods were less favourable regarding openness. It would depend not only on the survey method but also on the sensitivity to the information. The competencies of the researcher play a central role. Misosch emphasizes that this objection is applicable, except for the verifiability of historical events [11].

- The tension of the narrative would not always lead to the continuation of the narrative but to its completion. Reactivation of the narrative would be equivalent to a break in methods [11].

- Furthermore, Misosch notes that narrative interviews could lead to a high psychological strain on the narrator and corresponding emotional crises.

- A good interviewee could, nevertheless, succeed in generating the inner processing of life events by an individual person through narrative interviews. This is a great advantage for Misosch, as the inner world of experience of a person can be worked up with this method in a very detailed way. Consequently, connections of an individual's life to society processes could be developed through such a research method.

Irrespective of this, Prof. Detka points out that an individual approach and a not too rigid procedure with qualitative data should be respected [5].

In summary, Misosch has made a good presentation of the narrative interview method. The criticisms of this method in literature have also been well illustrated and commented on, and she has added her own critique points. In the end, however, she gave this method high appreciation regarding its important position within qualitative research. Misosch points out to the importance of the abilities, the preparation and the experience of the researcher regarding the level of discovery. Independently, narrative interviews are not suitable for every research question. The focus is on the analysis of phenomena, which are interpreted by individuals, with the focus on these corresponding interpretations in the analysis procedure. It is ideal if a research question with a similar topic was previously dealt with by quantitative methods and open questions, which cannot be answered quantitatively, remain. Thus, not every target group of research can participate in standardized procedures. Think of people with disabilities in the cognitive range or with further deficits, which complicate detailed and knowledge-generating communication. Frequently, as in the case of the detection of internal processes in persons with disabilities, minorities are involved. For such a target group with the systematic elaboration of the subjective experience, the narrative interview research is predestined.

2.3 Narrative interviews in international business and management

The presentation of narrative interviews shows that this method is suitable for researching a qualitatively neglected topic on the foundation of people with disabilities. Finally, research of this issue led to the conclusion that people with disabilities are more often founders of a livelihood than people without disabilities (see Pagán, 2009, for Europe; Jones, 2011, for the UK). It is astonishing that one can distinguish between the types of disabilities, and people with stronger deficits tend to be more likely to be founders than people with fewer deficits (see Boylan and Burchardt, 2002). The fact is that the educational level is also lower than in the rest of the society [10]. The question is whether the development of such assertiveness has been a secondary effect due to its handicap or whether other mechanisms (for example, support from

relatives, special legal regulations, etc.) have triggered such an effect. The analysis of the subjective world of experience is indispensable for the determination of these processes. Qualitative exploration of this minority is certainly open to decisive individual and social phenomena, which are important for other entrepreneurs, and thus can contribute to optimization of the promotion of business start-ups.

3 Qualitative research of a personal budget - an example

People with disabilities, especially those with a mental disability, have difficulties to determine their own life and to live satisfactorily because of their impairment. The provision of support by appropriate specialists and legal guardians as representatives of interests seems to be inadequate. The introduction of the Personal Budget could be interpreted as an indication of this. The UN Convention on Disability also points out that the implementation of the wishes of people with disabilities is problematic. In the first place, not all wishes of this group of people can be realized (for example, due to self- or foreign risk); secondly, there are professional duties which do not allow clients to fulfill their wishes (e.g. because of the risk of self-endangerment); as well as the institutions' own interests (capacity utilization, cost control, ...). There are other reasons that people with disabilities feel constrained by society. The Personal Budget is intended to provide a remedy.

The Personal Budget was introduced with the Ninth Book of the Social Code (SGB IX) as of 1 July, 2001. As a result, beneficiaries or recipients of benefits can choose a budget from the rehabilitation institutions instead of services or benefits for participation. This is how they pay the expenses required to meet their personal needs. This means that handicapped people can be self-employed and self-determined budget-takers, who are responsible for the "purchasing" of the services themselves; they become buyers, customers or employers. As experts in their own cases, they decide themselves which aid or service is best for them and which person should provide it at the time they want. This freedom of choice encourages the self-determination of disabled people. The Personal Budget resolves the previous triangle between the administration, the recipient of the service and the service provider [14].

The Federal Ministry of Labor and Social Affairs (BMAS) introduced a program for structural reinforcement and spreading of the Personal Budget for the years 2008-2010. In 30 different model projects, the aim is to research and publish how the new instrument can help improve the quality of lives of people with disabilities. According to the rehabilitation fund, a total of 6000 Personal Budgets was provided by June 2008. Due to incomplete feedback, the BMAS estimated the 10,000 Personal Budgets in the year 2008 [12].

As with any new instrument, the introduction of the Personal Budget presents many problems. These can be characterized into three main categories:

– The resource problem, in particular of financial nature: the government's motive to save money in the long term and the problematic handling of the Personal Budget by authorities due to scarce financial and human resources. As a result, the application of the Personal Budget for public institutions does not run smoothly and poses considerable difficulties for potential budget-takers.

– The problem of a missing provider market and corresponding comparability of service providers.

– Legal problems with the application of the Personal Budget by the legal guardian and the simultaneous assistance of the implementation of the measures by the latter. Also, the legal guardian can become a main decision taker of the Personal Budget at any time. However, this is at the expense of the autonomy of people with disabilities. At the same time, the question arises as for consultation and support of an application for the Personal Budget. Finally, there is no legal claim on qualified budget assistants, who could take over these functions for the budget taker.

For these reasons, as well as due to the novelty of the Personal Budget, precise consideration of the decision-making process for or against the application for a Personal Budget from the perspective of people with disabilities as addressees and their legal guardians is appropriate. It should be assumed that this is a dynamic process. It may be that a potential budgetary applicant with an elevated level of motivation asks for a Personal Budget and wishes to withdraw his application due to the difficulties that arise. It is also conceivable that, prior to the withdrawal of the application, he is motivated by his legal guardian to maintain the application procedure. Third parties (such as potential service providers, relatives, friends, etc.) could also play a decisive role in the decision-making process regarding the application.

3.1 Research design

60% of the budget takers are under legal guardianship [10]. By examining personal budget takers that receive a lot of support by legal guardians, we can find out which elements of support are conducive to independence of people with disabilities and which elements are counterproductive. These results can be used to examine the entrepreneurship of disadvantaged people, and advice can be given. Some of the most important elements of interaction are the administrative ones.

That´s why after presenting the methodology of the exploration, we will focus on the results of the administrative interactions. Thus, the operational question of the research design is: How is the decision-making process for or against applying for a personal budget considering the background of the individual life story? The answer to this question should be dealt with by using qualitative research methods because of the lack of information about people with disabilities in applying processes. It is important to stay open-minded while collecting the maximum of information that can be analyzed in the next step.

Overview of the Research Design

Design:

The design of the exploration contains 7 autobiographical-narrative, 7 case-historical-narrative as well as 3 professional biographical-narrative interviews with 4 different phases (decision-making process, decision, application, decision of the payee).

Survey:

– Autobiographical narrative interviews with 7 potential budget takers
– Case-historian-narrative interviews with adult guardians
– Professional biographical-narrative interviews

The audio data are transformed in a written form (Transcription)

The evaluation contains 4 steps:
Step 1: sequence analysis

Step 2: contrastive comparison
Step 3: theoretical sampling
Step 4: performing steps 1 and 2 until theoretical saturation by using interviews.

Results of the interview analysis:

Administrative deficits have important influence on the received service. In cases where institutions have deficits in administrative processes, a lot of unprofessional interactions happen (see the interactions listed in the table in the appendix). Problems in administrative processes are not only based on deficits but also have a political background and can be seen as barriers (look at the table "Results of the exploration" in the appendix, at the case ma4, position of the legal guardian, branch "grade of satisfaction"). However, complex administrative processes can be used by an established service provider to create dependencies of clients to control the market (see the remarks on the service provider in the case kp or A10).

Nevertheless, there are also positive examples, where administration runs without problems like in case R9. So, technological development is not interesting if established administrative procedures don´t run in an efficient way. This is important for cross-border mergers, for enterprises wanting to establish innovative products, for firms trying to reach a new market with already established competitors or wanting to invest in countries with strict political regulations protecting their own national companies, like Russia, and the tendencies that are happening in the USA.

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Appendix

Results of the Exploration

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
Applicant	Kp	X	Help adoption (active application supporting interaction (I1)), retreat (deficit-oriented interaction (I2)), persistence (help complicating interaction (I3)), lying (I3), bad communication (I3), working with information asymmetries (I3), Satisfaction (R1)	I1, I2, I3, R1	X	X	Expectations not realized (dissatisfaction with help, Z1)
Legal Guardian	Kp	No Problems (A0)	Adding further help (actions to improve situation after a rejection of a personal budget, S1), Change of application form from personal budget to classic service (L1), detailed analysis (S1)	S1, L1	Poor control of the service provider by adult guardian (control deficits, F0), - many involved specialists in the PB (complexity difficulty, F1), -	Change of provider when switching to classic service (H1), Change to inpatient service (change of measure, H2), adult advisor	Expectations not realized, no dissatisfaction but distancing, - distrust and recommendation to do so to colleagues dealing with PB, desire for external

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
					feeling of adult guardian to be obliged to bring evidence to clerks (danger of being exploited, F2), too little control (F0)	feels in distress (inconvenience adult guardian, H3), adult guardian as control supporter of administration (H3)	control, possibilities of performance fraud by service providers, desire: specified clerk, signaling the willingness to cooperate (dissatisfaction with help and application, Z2)
Provider	Kp	X	Working with dependencies (I3), working with information asymmetries (I3), cheating (I3), bad service quality (I3)	I3	X	X	X
Applicant	GR	Rejection wish for inpatient help (A2)	Conscious decision for livelihood (I1), observing application (I1), lying (I3), rejection of help as danger for livelihood	I1, I3	Change of personnel (F1), communication problems (F1), - Several applications (F1),	More communication, less alcohol consumption (outside PB) (Positive prior	Breaking of the PB coupled with competence problems in administration

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
			(I3), retreat (I3), mistrust (I3)		information misunderstanding in application (F1), mistrust caused by long processing times (Faulty application processing, F4), - Antipathies and feeling of neglect (not in PB) (negative prior experience F5)	experience outside PB, H4)	(dissatisfaction with the application, Z3)
Legal Guardian	GR	Application for inpatient help (A1), + switch of application in outpatient help, failure of application of personal budget (A4) and exchange to another administration	Use of psychological knowledge (I1), application of further assistance (I4), application to two authorities (I3), written communication with client (I1), fax sending (I1), reflection on work efficiency (I1), reduced frequency of	I1, I4, I3,	Assumption that legal advisors shy away from complicating and protracted application and approval (F1), low guardianship fee (F2),	X	Desire for clear responsibilities in application process, proposal application then application examination then clerk determination, positive experience with services from PB (dissatisfaction application,

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
		(A4.1), reminder on application because of health worsening (A5), exchange with clerk on phone (A6), application on further help services (A7), information asymmetries between legal guardian and clerk (A8), No definitive responsible clerk and disappearing of the application (A9)	visits (I1) - lack of cooperation on processing by clerk (I3), - no consideration of the specifics of client (I3), - time-delayed and inadequate processing of applications (I3), - fear of suicide attempts (I3), - complicated and difficult application (I3), - Ambivalent relationship with client (because of personal budget application coupled with mental illness) (I3), - Border crossing in the application process (I3), + good relationship between adult guardian and his client (I1), + personal information from adult				satisfaction service provision, Z4)

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
			guardian to his client (I1), + Transparency in the application procedure in favor of relationship adult guardian and his client (I1)				
Provider	GR	X	- too little empathy (not in the personal budget PB) (I3), - service provider has made application by himself (I5) in another case	I3, I5	X	X	X
Applicant	ka	Worsening position of clerk because of complaint by teamleader (A10), Rejection application personal budget (A4), Rejection	Adding further help (I1), persistence (I1), exhaustion of all offers (I1), ignored letters (I3), perform therapies (I1), doing application (PB application) (I1), rejection by administration (I3), unauthorized assignments	I1, I2, I3, R1	Long assessments (F4), no consideration of the specifics of the applicant (F4), - No local assessments (F4), no professional assistance with application (F1)	X	Z3

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
		opposition (A4.2), Legal action (A4.3)	(administration on Probation Authority) (I3), Conflicts between specialists (I3), Non-Reliable Unreliability (I2), client sees adult guardian as support (R1)				
Legal Guardian	Ka	Temporary delay in treatment of application without consequences for the relation betw. legal guardian and applicant (A11)	Risk of loss of life partner due to technical intervention (I3), assumption of duties by legal guardian beyond competences (I1), sympathy (I1)	I1, I3	X	X	Desire for clear responsibilities in application procedure, proposal application acceptance then application examination then case officer definition, bad experience with the application procedure for PB, item experience with service provision (Z4)

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
Applicant	P16	x	Admission of help (I1)	I1	X	X	X
Legal Guardian	P16	Application three months before (A12), extension of the admission (2,5 years) (A13), Growing of complexity in application (A14)	assumption of unpleasant tasks in help setting (I1), a lot of time and room for emotions (situation improvement with PB, S2), better understanding of role of big service provider compared to freelancers (I1)	I1, S2	rejection of PBs by adult guardian for reasons of remuneration and expenses (F1), previous knowledge in PB as opposed to colleagues (application-promoting factors legal guardian, F3), Empathic Social Welfare Office (other application-promoting factors, F6)	X	Refusal of PB by clients due to institutionalization, initially little evidence of quality, prevention of inpatient housing via PB, mentally disabled people as the only target group in PB, exclusion of difficult clients where professional help fails, and emotional access would be appropriate in case of danger creation of dependencies (Z3)
Applicant	A15	X	X	X	X	X	X

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
Legal Guardian	A15	X	Initiation of legal action (I1), empathy (I1), decision transfer (I1), pressure on administration for further payment (I1), support of the assistant with regard to recognition as a specialist (I1), no consideration of the peculiarities of the person being cared for (I3), official Interventions do not work (I3), rejection of responsibilities on the part of the authorities (I3), relocation to adult guardian (I3), conflict of interest in the suggestion for help setting (I3), - Excessive expectations from the administration (I3), +	I1, I3, S2	X	X	Wish of improvement (Z4)

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
			activation of the client (S2), pleasant living environment (I1)				
Applicant	BR	X	Conscious decision to secure a livelihood (I1), exclusion (I3), Exploitation of specialist (I3), sympathy (I1), unreliability due to lack of reflection (I3), Inability to absorb the consequences of manipulation (I3)	I1, I3	X	X	X
Legal Guardian	BR	Legal guardian has planned the helping aims by himself (A15), Growing of complexity of application (A14)	Involvement of a nursing service at its own expense (non-specialist personal interactions to improve the situation, I6), use of its own outpatient service (I6), provide clothing and food (I6), De-escalating	I6, I1, I3,	Expectation of target achievement as a prerequisite for PB grant (F2), - Exclusion of difficult clients from the service providers (F4), - Reduction of the	X	X

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
			measures (I1), inpatient accommodation (I1), Threat of abandonment (I1), PB as a way to find suitable service providers (I1), lack of cooperation in processing (I3), review of the adult guardian by consultation of the client (I3), - demarcation problems of the environment (I3), - unfavorable regional environment due to the lack of specialists and poor public transport (I3),		PB on payment of monthly cards, gym studio contributions and small extra supplementary service (F4)		
Applicant	R9	No problems (A0)	Conscious decision to make a livelihood (I1), cold withdrawal (I3), use of inpatient care (I1), share experience in lectures (S2),	I1, I3, S2,	No consciousness of the client about his position as client in PB (F1)	X	Situation deterioration without help (satisfaction with service provision, Z0)

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
			exaggerated expectations of administration (not in PB) (I3), improvement of situation with help of service (S2), low-level conversations (S2), professional interventions (S2), consent to the PB (I1) picked up application form of the legal guardian by the client (I1), outside activities (S2), no need to go to mailbox because of support by adult guardian (I1)				
Legal Guardian	R9	X	Initiate legal action (I1), transparency (I1), sympathy (I1, S2)	I1, S2	Successful opposition to sanctions of recruitment agency (F3)	X	Good experience with the services (Z4)

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
Applicant	ma4	X	Pressure on adult guardian (I3)	I3	X	X	X
Legal Guardian	ma4	Notification only on service provider (A8), No information about admitted time period for help (A9), exclusion of legal guardian (A9)	Transparency (I1), claim for perfectionism for liability reasons (I3), sympathy (I1)	I1, I3	Long processing times for further approval, which leads to the cessation of assistance (F4), mistrust development by long processing times (F1), refusal PB by caregivers for reasons of remuneration (F2), duration between application and approval usually leads to the maturity of the assistance and consequently inpatient accommodation (F4)	X	Cheating of large institutions in the application process, easier handling, politically desired displacement of small service provider to the detriment of the freedom of choice of budget taker, lack of competition between established providers, Detection, less psychiatric accommodation, desire for external control, recommendation, good experience with the service provider (Z4)

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
Applicant	AB	X	demarcation (I3), mistrust (I3), public interest in the budget recipient (I3), assistance from integration assistants (I1), due to the absence of adult guardian support of the client in administrative procedures (I1), due to conflicts in contact with administrative staff, handling of applications for processing (I1), Attorney for the purpose of promoting co-operation in application process (I1)	I1, I3	No adult guardian (F1)	X	Rejecting behaviour because of complicated personality (Z0)
Legal Guardian	A10	X	Talking about problems with client (I1), lies (I3), Lack of	I1, I3, S3	Professional interactions (F6)	Termination of the measure by the legal	Rejection PB due to quality defects,

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
			cooperation from clerk (I3), Conflicts between professionals (I3), mistrust (I3), Institutions and environment exert pressure on adult guardian (I3) involvement of an attorney in the application of an adult guardian (aggravating factors in the implementation in PB, S3), signaling of cooperation (I1)			guardian (termination of service by legal guardianship, H5), House ban for adult guardian by the client (H3), cessation of adult guardianship (H3)	desire for external control (Z1)
Provider	A10	X	Misuse of dependency relationships (I3), poor communication (I3), poor qualitative service (I3)	I3	X	Influencing of the budget taker against the adult guardian (H3)	X
Legal Guardian	PZ14	No notification about rejection (A17),	Time-delayed processing of applications (I3),	I1, I3	Addiction of the budget taker (F2), PB as a financial	The adult guardian as supporter of	Rejection of the PB by clients due to institutionalization,

Interviewee	Case	Course of application	Interactions/reactions	Type of intervention	Important elements for the application	Course of offered service	Grade of satisfaction
		Rejection of medical documents (A18), Legal guardian has planned the helping aims by himself (A15)	notification of rejection (I3), disagreement with the opinion of the expert (I1)		benefit to the federal state, adult guardians are encouraged to apply PBs (F7), Rejection of assignment statements (F1), - Lack of experience in PB as possible reason for refusal of adult guardians (F1), - Criticism of pure medical assessment (F4), need for closer examination of the suitability of possible budget takers (F4), Exclusion of addicts (F2)	control in the PB (H3)	adult guardians avoid PB, withdrawal of the PB application by adult guardians, PB as another form of billing modality with the same incumbent service providers, caring assistance as insignificant additional expenses, exclusion of certain persons (without guardianship and inability to manage own finances) (Z4)
Provider	PZ14	X	Bad service quality (S3)	S3	X	X	X

Notes:

X means no information

The abbreviations of the cases are used to distinguish each case (see under the branch „case“ of the table)

There are different items summarized under one main category. So, the items are listed and linked to the specific category as shown in the branch (interactions/reactions)

Under the category A9 (Poor treatment of application), more items are summarized because of their similarity. These are:

- no information about admitted time period

- exclusion of legal guardian

A Comprehensive Perspective of Knowledge Management Processes: Building An Octagon Framework

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Abstract: This study aimed to answer the following question: What are the processes required to utilize organizations' intellectual capital efficiently and effectively, in light of the knowledge management concept? This study is part of a series of studies aimed to build a comprehensive and resilient KM model. Content analysis was adopted as a methodology based on exploratory and in-depth readings as a basis for the techniques of disassembly and synthesis, as well as the comparison. Besides, the study adopted two intellectual premises, which are the knowledge notion perspectives and the ontological geographic chart of knowledge (OGCK). Many studies and models of knowledge management processes were reviewed. The study discussed and developed the seven-stage model by (Evans, Dalkir, and Bidian)[1], which is the upgraded version of the (KMC) model presented by (Heisig)[2]. The study produced an eight-step KM model that includes the following processes: identification, organization, storage, dissemination, application, development, learning, and generation of knowledge.

Keywords: Knowledge management; KM framework; KM processes.

1 Introduction

The dominant feature of this era is the pace of change and the legendary progress in the fields of knowledge and technology, which in turn have posed great challenges to a young and ambitious society, such as the Saudi society, which is facing challenges whithin an ambitious plan that includes many programs, including the transition of the Saudi society to the world of knowledge through comprehensive knowledge transformation in all fields, such as education, economy, health, etc. The most important of these challenges is the intellectual transformation into the world of knowledge. The importance of intellectual transformation comes through its pivotal role in establishing and developing theories, models, processes, methods and tools necessary to manage knowledge efficiently and effectively, commensurating with the society needs, capabilities, resources and prevailing culture in organizations, which contribute to transforming the society in all its sectors into a productive knowledge society.

This study is part of a series of studies that aims to build an integrated knowledge management framework to meet the needs of organizations in the Kingdom of Saudi Arabia and other similar countries with the same culture. This study aims to answer the following question: What are the required processes to benefit from the intellectual capital of organizations efficiently and effectively? In light of the knowledge management concept, the main approach was to develop and synthesize a framework for knowledge management processes. The study adopted the content analysis approach, in which the study gathered the analytical technique in the analysis of information and the previous models, and the elicitation technique, which provides a large space for creativity and initiation of new perspectives and issues which have not been presented before. Therefore, the study adopted two intellectual premises, which are the eknowledge notion perspectives and the ontological geographic chart of knowledge (OGCK). This study attempted to achieve its objective through studying and reviewing the KMC life cycle model produced by Evans, Dalkir, and Bidian [1], which was

an amendment of the original KMC life cycles presented by Heisig's. [2]. Accordingly, an octagon KM processes framework was developed, which comprises the following processes: identification, organization, storing, dissemination, applying, developing, as well as learning and generation of knowledge.

2 Methodology

Within the content analysis approach, the study combined analytical and constructive techniques that focus on innovative learning techniques in presenting new perceptions, issues and concepts.

Extensive and in-depth reading was performed to collect, summarize and analyze data and information from specialized intellectual production, which was found in books, academic research, universities' theses, blogs and websites, concentrating on the aspects of KM processes and KM frameworks.

The study adopted a process of comparison between some previous frameworks and the proposed one, highlighting its contribution.

Validating the proposed framework was done by means of proving that the framework is sufficiently accurate for the knowledge management processes. A semi-structured interview technique was selected to verify the proposed framework validity, as a systematic forecasting method that involves semi-structured interaction with four academic experts in knowledge management and three practitioners in business administration. Before the interviews, the proposed framework, together with sufficient required information was sent to the interviewees.

3 Results

This study reveals some significant results that follow:

3.1 Building a practical and comprehensive octagon framework for knowledge management processes

By studying and reviewing the KM life cycle model produced by Evans, Dalkir and Bidian, besides other models, a practical and comprehensive octagon framework for knowledge management processes was built, which is illustrated in Figure 1.

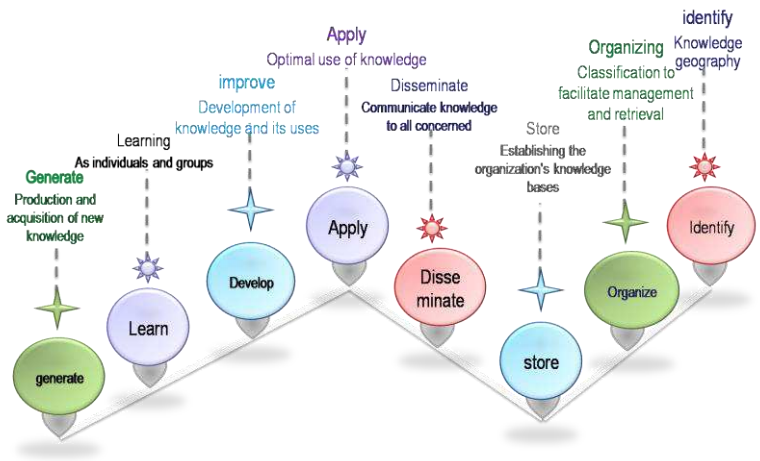

Fig. 1 *The Octagon framework for KM processes*

3.2 Subsequent Comparison Process

Table. 1 summarises the comparison between the proposed framework of this study, the (KM) life cycle model produced by Evans, Dalkir and Bidian in (2014), and the KMC model presented by Heisig in (2009), using the producing years as the reference.

Tab. 1 *Cross review of knowledge management processes*

Study	Framework processes								
2018	identify	organize	store	dissemnate	apply	develop	learn	generate	*
2014	identify	*	store	share	use	improve	learn	Creat	*
2009	identify	*	store	share	Use	*	*	Creat	acquire

3.3 Validity test: Interviews outcome

The interviewees determined that the framework proposed by this study, within its domain of applicability, is sufficiently accurate for knowledge management processes; therefore, the produced framework achieved a high degree of face validity.

4 Discussion

How can we benefit from intellectual capital within organizations in light of the knowledge management concept? What are the required processes? By using the knowledge management perspectives, this paper will improve the firms' perceptions of managing the organizational knowledge and highlight its importance. To ensure that the reader is on the same page, it is essential to articulate the intellectual premises which have been adopted as bases for the study and which also reveal the contribution of this study. These intellectual premises contain knowledge notion perspectives and the ontological geographic chart of knowledge (OGCK), which are explained as follows.

4.1 The knowledge perspectives

There were three perspectives of the knowledge concept taken into consideration while writing this paper.

a. First, the binary concept of knowledge, which divided it into two categories: The explicit knowledge, which is in printed or electronic formats, structured or unstructured. The implicit knowledge, which consists of cognitive capabilities, attitude and skills, which is partially corresponding with what Dalkir mentioned in 2011[3].
b. Second, the historical eras of the knowledge management, as presented by Nancy Dickson 2014, starting with the data and information management, to the experience management and the ideas management[4].
c. Third, the location of the knowledge resources related to the firm, whether they are outside or inside.

4.2 The ontological geographic chart of knowledge

At the start, the ontological Geographic Chart of Knowledge is an unforseen gathering of terms. "Ontology" indicates a group of notions and classifications in a subject field or domain that shows their properties and the relations between them [6]. "Geography" presents description of the Earth [5]. "Knowledge," on the other hand, implies the material and immaterial realm of ideas, experiences and human cognition, skills and attitudes [5]. Locating knowledge or tracking its transmigrations disturbs these common perceptions but indicates the substantial and social nature of knowledge.

The ontological geographic chart of knowledge is a descriptive map. The main point of this chart is to identify, gather, organize, locate, and relocate the knowledge, which can be easily communicated, disseminated, improved and learned.

4.3 The octagon framework for knowledge management processes

We reviewed a wide range of knowledge management models. The most interesting model was presented by Hisig under the title Knowledge Management Lifecycle (KMC). The strength and contribution of Hisig's comprehensive study is shown in three main points. First, he conducted a content analysis of 160 KM frameworks that had been proposed. Second, he concluded that KM activities were centered around six processes and the most frequently mentioned activities included: use, identification, creation, acquiring, sharing and storing. Third, he involved practitioners in the identification of KM frameworks and the required activities.

Moreover, we reviewed the work of Evans, Dalkir and Bidian, published in 2014 and developing an advanced KMC model that contains seven processes: identification, storing, sharing, using, learning, improving, and creating.

As a result of the content analysis, this study proposes an octagon KM processes framework, which consists of identification, organization, storing, dissemination, application, improvement, generation of knowledge and learning (Figure 1).

a) Identification

Generally, the identification phase depends on obtaining and maintaining a clear and updated knowledge geography. Analyzed and evaluated knowledge are major attributes of knowledge presented by this phase. The study suggested the ontological geographical chart of knowledge as the main method. It shows strong and weak points related to the knowledge carried within the organization. This phase has direct and strong relationships with some other phases, such as

organizing, storing, disseminating, improving and learning. It is the start point to provide the knowledge needed at all management levels, problem solving and improving the decision-making process. The identification phase of this framework is almost identical to the building process by Evans and Ali (2013) [14], the capturing process by Dalkir (2005) [7] and the identifying process by Wiig (1993) [8].

b) Organization

Due to the importance of organization, this study considers it as an independent phase. The advanced knowledge management tools and techniques play important roles in the organizing phase as a dependent phase besides quick and incredible improvement on the side of information technology. Suitable knowledge organizing presents different correlations between multiple aspects, which lead to generating new ideas and creating added value. The ontological geographical chart of knowledge expectedly presents a great value to the organizing phase. This phase is mostly impeded within the store phase in other studies.

c) Storing

This phase is mostly considered as the organizational memory, where each valuable piece of knowledge is planned to be in use at a proper time and for a specific length of a period. An updated ontological geographical chart of knowledge will help as a contemporary methodology storing all kinds of knowledge. The previous phase strengthens the storing phase, and it allows the stored knowledge to be efficiently and effectively manipulated, retrieved, and eventually shared. The storing process has multi-correlation with other phases, such as organization, dissemination, application, developing and generating.

d) Dissemination

Knowledge is retrieved out of the ontological geographical chart of the knowledge (organizational memory) for dissemination both internally and externally. The dissemination of knowledge is a significant process, where the problem is that most of the employees are not aware of knowledge presence, particularly when new knowledge is generated, obtained, developed and stored. Luckily, deploying the ontological geographic chart of knowledge will make the problem part of history. As per Meyer and Zack (1999), having an explicit, dynamic, and flexible network of expertise (e.g. community of practice) enhances collaboration and can greatly assist in disseminating of information, experience and ideas as an organizational intellectual capital [9]. Other knowledge management tactics and methods may encourage the disseminating of more tacit forms of knowledge, such as coaching, mentoring, and an on-job training as well as storytelling (Peroune, 2007) [10].

e) Application

It is important to remember that unless this phase is achieved successfully, “all of the knowledge management efforts have been in vain, for knowledge management can only succeed if the knowledge is used” (Dalkir, 2011)[11]. When the knowledge is applied (put to use), its value can be extracted throughout the organization, to make decisions, solve problems, enhance efficiency, or boost innovative thinking. According to Dalkir (2011), the involvement of the experts is required to apply the tacit knowledge correctly, effectively and efficiently [11]. The

application phase is also a key to internalizing implicit knowledge. Yuasa (1987: 25) called this 'learning with the body'[12] and Boisot (2002) 'learning-by-doing'[13].

f) Learning

Within the knowledge perspective, tacit knowledge was built according to Bloom's learning domains, which consist of (cognitive) knowledge, skills and attitude, which might help to create and enhance a learning culture in the organization. The disseminated and applied knowledge can also be improved or used as the basis for generating new knowledge and refining existing knowledge. A part of the learning phase, especially in the status where experts provide understandable context, assures that employees gain experience as they explicate the impact of the knowledge on their work environment (Evans and Ali, 2013) [14]. The repeated process of thinking of the value and applicability of knowledge comprises double-loop learning (McElroy, 2003) [15].

g) Improving

The previous learning phase leads to more improvement in the knowledge in use. A new value is either identified or generated from them and additions or updates are made to keep the knowledge current and applicable to the organization operations. On the other hand, a short lifecycle is the most common characteristic of products and services in the market nowaday; therefore, the improvement phase will work to lengthen the products and services lifecycles. This study is consistent with what M. Max Evans, Kimiz Dalkir and Catalin Bidian (2014) reported [1], that the improvement phase is a decision stage for knowledge to be retired, reorganized, stored, improved or transferred for further use.

h) Generating

Necessity is the mother of invention [16]. A need or problem promotes creative efforts to satisfy a need or solve a problem. This saying appears in the dialogue Republic, by the ancient Greek philosopher Plato. Generating and creative innovation are the attributes of the organization that leads its sector. Building an innovation culture based on a learning organization and system thinking is the road map for the organization to survive and achieve its planned goals. The ideas management is required the most in this phase.

4.4 The subsequent comparison process

This study headed towards discussing and development of the Evans, Dalkir and Bidian seven-stage model. It concludes with emphasis on the seven processes of the model and adding the stage of organizing, as in Figure 1, based on its great importance. This is explained by Zaim (2009): "Knowledge is meaningful when categorized, placed and stored in a specific and useful form, so it can only be used by the right person at the right time and in the right way" [17]. Based on the above, the study concludes with an octagon framework for knowledge management processes consisting of identification, organization, storing, dissemination, application, development, learning and generating.

- This study agrees with Hieseg's model in term of the following processes: identifying, storing, and generating. And differs in the title of the disseminating and applying processes,

- Heisig's study is unique in the acquisition process as a stand-alone process, while this study included the concept of acquisition in the generating process.
- This study differs from Heisig's study in its assurance on organizing and learning phases because of their pivotal role in promoting knowledge management.
- This study agrees with Evans, Dalkir and Bidian in the titles and contents of the processes identifying, storing, developing, generating and learning. They differ in the name but agree in the content, in the applying and disseminating processes.
- This study differs from the Evans, Dalkir and Biden model with organizing as an independent process, which is partially embedded in the store phase of their model.

4.5 Validity test: Interview outcomes

Seven semi-structured interviews were condected. Our interviewees included four academic experts in knowledge management and three practitioners in business administration. Before the interviews, the proposed framework, together with sufficient required information was sent to the interviewees to help them in preparation.

The conversation pivots were indicated in verifying the following points:

- the model assumptions
- the model technical structure
- validation of the model behaviour
- testing of business policies
- assuring that the results appear reasonable
- their point of view regarding the application of this framework if circumstances permit
- Besides, the model may be compared to the actual work environment to see how they correspond [18].

After all, the interviewees determined that the proposed octagon framework for knowledge management processes was sufficiently accurate for knowledge management processes; therefore, the produced framework achieved a high degree of face validity.

With our deepest appreciation of the participating group, it was agreed to implement a future study to determine the implementation mechanisms of the proposed framework to enhance knowledge management in organizations.

5 Conclusions

The key contribution of this study is that it is the third attempt at building and improving the knowledge management lifecycle, which started with Heisig's extensive analysis of 160 knowledge management frameworks presented in the original 6 stage model (KMC), followed by the expansion of the view of KMC process model performed by Evans, Dalkir and Bidian.

The study used two intellectual premises, including the emphasis on knowledge management perspectives based on the historical context (information, experiences and ideas), as well as the binary classification of knowledge, which adopted Bloom's domains of

learning as a basis for implicit knowledge. Moreover, the study presented the ontological geographic chart of knowledge (OGCK) as a new notion for organizing knowledge, in order to assure the importance of the organizing phase and its reliability to add value to the knowledge.

The study proposed a high rank validity octagon framework for the knowledge management processes and recommended further studies in the following subjects: in-depth illustration of the chart of knowledge management processes, arranging of recommended and useful tools and techniques to facilitate the framework process, and implementation mechanisms of the proposed framework.

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Language Education at the Faculty of Pharmacy of the Comenius University in the Newly Accredited Program UNIcert®

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Abstract: Knowledge measurement and evaluation is an important factor in learning foreign languages. Quality of university language education cannot be measured by any tests or an oral examination. The real language skills are determined by the ability to communicate in life situations and use the foreign language efficiently in the professional working environment. In 2017, the Faculty of Pharmacy of the Comenius University was accredited to offer language courses in the international certification system UNIcert®, which enables it to define complex conditions for obtaining an internationally recognised language certificate with a comparable proficiency language level at various universities focusing on general language study or a specific study field. The article deals with the study of languages at the Faculty of Pharmacy of the Comenius University and the new certification program UNIcert® *The English and German Language for Pharmacists,* and it identifies essential aims of the program.

Keywords: language education, certificate, UNIcert®

1 Introduction

Being able to speak a foreign language and use it actively in the professional communication empowers students in a variety of ways. It can support their studies and increase access to information sources while using the foreign language. It gives them a chance to study abroad and gain international experience in various mobility programmes. It extends their knowledge and professional skills and improves their employment opportunities.

A language taught in the higher education system is called a Language for Specific Purposes (LSP). LSP courses are aimed at a specific target language, and they are designed to prepare students for real-life situations. The methodology, the objectives and the teaching depends on the specialized needs. (Trace, Hudson, & Brown, 2015, pp. 3) Common examples are English for Aviation, Spanish for Pharmacists or German for Doctors.

Strevens (1988, pp. 1-2) describes the specific purpose instruction as teaching practices designed to meet the learner´s requirements aimed at the specified content (topic-based) related to occupations or a field of study. That means *Language for Specific Purposes* focuses not only on linguistics but also on the content area knowledge. To create an LSP course, it is important to define clear aims of the course and find out the needs of the learners. The curriculum is driven by students of the specialized field of study. Course development should be systematic and focus on students and their requirements.

When we speak about measurement of knowledge and its evaluation, we need to have a closer look at its definition. Hunt (2003) defines knowledge as a belief that is true and justified. Measurement can be also based on the correctness of answers. Correct and incorrect answers can clearly indicate if the person knows something. But as Hunt suggests, these methods have deficiencies, such as a level of certainty. We can add there is not a single test on quality and sufficiency of language knowledge. We have established a new program that is aimed at ensuring quality of language education in the university environment.

The main goal of our paper is to describe the terminology education at the Department of Languages at the Faculty of Pharmacy of the Comenius University, analyze the current foreign language teaching practice, introduce the certification and language teaching system UNIcert®, and define objectives of the new language curriculum, which can lead to an internationally recognised language certificate of English for Pharmacists or German for Pharmacists.

The first part will focus on depicting terminology education at the Department of Languages. The next part will deal with detailed description of Academic Language Preparation in the English and German languages. Then, the international certification and language teaching program UNIcert® will be introduced. The fifth part will concentrate on objectives of the new language programs *English for Pharmacists* and *German for Pharmacists*. After analyzing of language goals, further action will be suggested.

2 Terminology education at the Department of Languages

The Department of Languages at the Faculty of Pharmacy was established in the academic year 1993/94 and it still has the same organizational structure. (Ozábalová 2007, pp. 127) The essential task of the Department is the terminology education and its main goal is to provide students with terminological knowledge, enhance their communication skills and prepare them for professional life.

The language education at the Faculty of Pharmacy involves courses in Latin-Greek pharmaceutical and medical terminology for future pharmacists and students of the Bachelor Study Programme *Medical and Diagnostic Devices*, the Academic Language Preparation in the English and German languages and seminars in the Slovak language for international students.

Learning Latin and Greek terminology is essential and compulsory for the medical practice as well as for the study of pharmacy, which is also stated in the *Directive 2005/36/EC of the European Parliament and of the Council of 7 September 2005 on the recognition of professional qualifications.* Hamar (2017, pp. 19) concludes that Latin is "*an indispensable part of the training of future pharmacists*". Since 1990, there have been two compulsory courses of Latin-Greek terminology (*Latin Pharmaceutical Terminology I.* and *Latin Pharmaceutical Terminology II.*) for future Pharmacists taught, which offer the basic terminology and necessary vocabulary used in the subjects like anatomy, botany, pharmacognosy, and others. The Latin language is essential for scientific communication in the field of pharmaceutical sciences and as Hamar (2018, pp. 269) explains, this is the key reason why students start with learning the Latin language and essential Greek expressions immediately in the first year of study. The courses involve learning the basics of botanical nomenclature, the fundamental grammar with the morphological and syntactical structures used in the medical and pharmacological terminology, the pharmaceutical terminology, mainly related to medicine and drugs, the terminology of medical prescription as well as pharmaceutical Latin abbreviations (Hamar, 2018). Students can use the specialized dictionary *Trojjazyčný latinsko-slovenský slovník pre študentov farmácie a medicíny* by Ozábalová, Vallová and Hamar to enhance their vocabulary and find Latin and English translations. The dictionary consists of the professional terminology in the Latin, English and Slovak languages. The main goal of the dictionary is to help students of pharmacy and medicine work with textbooks and materials in the Slovak and English programmes. The dictionary is organized alphabetically and updated regularly. It provides the latest list of words and expressions used in pharmacology, complying with the latest publication the *European Pharmacopeia* for pharmacists. Students of the international programme have an opportunity to learn the Slovak language, which can help them to communicate and make themselves understood in the Slovak study environment. Kližanová (2018, pp. 45) concludes

that almost all international students of the Faculty are interested in learning the Slovak language in order to develop a good command of language for professional communication.

3 Academic English and German Language Preparation

Besides Latin and Greek terminology, students have an opportunity to learn the English and/or German language. There are 5 courses of Academic Language Preparation offered in the English language and 5 courses of Academic Language Preparation offered in the German language. The main target of the courses is to enhance students' proficiency level in the languages, deliver the specialist terminology and prepare students for professional communication in a foreign language in the field of pharmacy.

Academic English Language Preparation (1-3) is compulsory in the Bachelor Program *Medical and Diagnostic Devices* and is focused on preparing students for professional work in the medical and pharmaceutical environment. Students can continue with voluntary elective subjects Academic English Language Preparation 4 and 5 as they are necessary for the certification examination.

Academic English and German Language Preparation (1-5) in the Master Study Programme can be studied as obligatory elective courses since the second semester of the studies. They are carried out in the Slovak and English study programmes during five semesters. The contents of these specialized professional courses closely follow the contents of other professional courses taught in the relevant semesters.

Academic Language Preparation 1 in the English Language is designed for students of the first-year study who have the intermediate level of English. It involves topics such as Parts of the Body, Skeleton, Five Senses, Body Systems, Aches, Pains and Disorders, Pharmaceutical Practice and Laboratory. The course materials can be found in the textbook *English for Pharmacists 1* by Holá, Kližanová and Žufková, which has been recently published by teachers of the Department. It consists of authentic articles followed by reading comprehension exercises and videos with reading and listening comprehension exercises and vocabulary practice. The aim of the introductory course is to make students familiar with the essential professional vocabulary used in the pharmaceutical and medical sciences. Similarly, the course *Academic Language Preparation in the German language* provides students with the essential medical and pharmaceutical terminology and improves the students' German language skills.

Academic Language Preparation 2 in the English and German languages is designed to continue in acquiring professional vocabulary in the field of pharmacy and medicine. The main topics comprise Factors Influencing our Health, Health and Environment, Ozone Layer and Protection against the Sun, Drugs and Addiction, Bacteria and Viruses, Flu, AIDS and other Infectious Diseases, Disease Transmission and Disease Prevention. Students learn to describe symptoms, differences between viruses and bacteria and treatment of various illnesses and disorders. They can deal with common health issues, ask relevant questions about illnesses, analyse a specific health problem and suggest a suitable solution. A new textbook *English for Pharmacists 2* by Holá, Kližanová and Žufková has been published this year to help students learn topic-based terminology and enhance their communication skills. The textbook will be followed by *English for Pharmacists 3,* which is being prepared to be published in the following semester.

Academic Language Preparation 3 in the English and German languages focuses on Macronutrients, the Role of Vitamins and Minerals, Healthy Nutrition, Malnutrition and Eating Disorders, Cosmetics, and First Aid Guidelines. Students learn to offer advice about healthy

eating habits and speak about the risks of obesity and bad nutrition. They can provide patients with information on problems with vitamin deficiency and give instructions to administer the first aid in a foreign language.

Academic Language Preparation 4 in the English and German languages concentrates on Common Disorders and Their Treatment, the Home Medicine Cabinet, Comparison of Traditional and Alternative Medicine, and Medicinal Plants.

Academic Language Preparation 5 in the English and German languages deals with the Health System in Slovakia, Regular Check-up, Allergies and Immunity and Trends in the Pharmaceutical Industry. The course is also preparation for the certification examination and provides students with guidelines for presentation preparation and practice, listening comprehension training and written production of formal letters and abstracts.

4 Certification program UNIcert®

UNIcert® is an international certification and educational program in foreign languages, which is nowadays employed by 53 European universities. It is the only academic language learning program in Central Europe which guarantees a high standard of professional and academic oriented language skills training. UNIcert® represents a comprehensive and transparent language learning system unifying the different education systems in the university environment, including awarding certificates which are centrally managed and subject to strict rules. This means that it can ensure foreign language education with the same quality at diverse universities, which allows student mobility in Erasmus or other mobility programs based on the compatibility of language programs and the uniformity of certification exams. Students can study not only the academic language but also the language focused on their study field and improve in the area where they will work and gain experience (Hamar – Jurišová, 2017).

Since the inception of **UNIcert®** in 1992, more than 100,000 certificates have been issued in 29 languages. Unlike other certificates, **UNIcert®** is an open educational system targeted at university students of non-linguistic studies. Its main mission is to provide a comprehensive and transparent system of language training, and it considers specific university conditions, objectives and needs typical for students of diverse higher education institutions.

The level of **UNIcert®** certification is determined by the level of language proficiency:
B1 (UNIcert® I),
B2 (UNIcert® II),
C1 (UNIcert® III)
C2 (UNIcert® IV),

which is defined by **the Common European Framework of Reference for Languages.**

After successful completion of the program in the **UNIcert®** system, graduates obtain an internationally recognized certificate which can be issued only by universities that are accredited and authorized. In Slovakia, such authorization is granted by the Institute for Accreditation of Language Teaching at Universities in Central Europe called UnicertLUCE.

5 Objectives of the new language programs, the English and German language for Pharmacists

The primary objective of professional language education in the UNIcert® system at the Faculty of Pharmacy of the Comenius University in Bratislava is to build up language skills in

the target language in the field of pharmacy. Students will develop their ability to comprehend written texts and shorter lectures related to the field of their studies. They learn to understand media broadcasts on professional topics, create a longer text on a number of general and professional life topics ranging from 300 to 400 words, using common and specific phrases from the study area. They will be able to gather information in the professional field, establish and maintain working contacts and communicate in a domestic and foreign working environment.

5.1 The content of the courses

Language Academic Training focuses on systematic training of language skills, including acquisition of new language skills. In addition to specialist vocabulary, professional terminology, and grammatical-stylistic features, lessons will also involve practising communication in real-life situations and acquiring linguistic knowledge in the area of the target language of pharmacy. The language program also includes expert themes using popular scientific content. Students learn to distinguish between popular scientific and scientific language.

5.2 Language skills

The linguistic preparation concentrates on acquiring knowledge and skills in using lexical, grammatical, semantic, phonological, sociolinguistic and pragmatic competences. The biggest emphasis is put on practising vocabulary and grammar issues in diverse structural, substitutional, gap-filling and communication exercises. Professional language training deals with word formation and terminology acquisition needed in all the skills involved in issues related to the students' field of studies and to the area of their interest. Special attention is devoted to practicing receptive vocabulary (contextual analysis of word meanings), understanding of essential linguistic and sociolinguistic characteristics in the professional style, and productive training of linguistic structures in general and professional texts.

The language program will develop the following language skills:

5.2.1 Listening comprehension

Listening with understanding focuses on developing the ability to understand monological or dialogical speech in the target language on current general and expert topics of the study area. Students acquire the ability to select the essential information needed to understand a spoken text. While developing these skills, the emphasis is placed on the following strategies: the ability to identify the main idea, highlight the basic facts, answer questions provided by the teacher, select relevant information, understand the meaning of unknown words from the context and reproduce the text by making notes.

5.2.2 Speaking

The main goal of oral production is to enhance language speaking skills and abilities to discuss various professional topics spontaneously and continuously, argue about various issues, properly cite and interpret information from literature and available online resources, and logically connect ideas in larger entities. Students learn to get involved in dialogues or discussions and express themselves on the discussed subject9 as well as respond promptly to questions. They will be able to express, justify and defend their own opinions, make objections

and provide constructive criticism, comment on events and ask additional and clarifying questions. Conversations in specific situations and role plays will be also performed.

5.2.3 Reading

Students learn to select, compare and organize information in longer texts of medium difficulty, understand the context and take measures, look for logical relationships, capture detailed and specific information in common and professional articles and texts and distinguish explicitly and implicitly expressed thoughts. Developing these skills focuses on the following strategies: identifying the main idea, keywords and relevant information in the text, searching for predetermined information, deducing the meaning of unknown words from the context, excluding redundant information from the written text, and identifying true and false statements based on the written context.

5.2.4 Writing

Written production is focused on mastering writing of longer texts (300-400 words) on general and simple expert topics. Students learn to identify the formal and informal style and their appropriate features. They will acquire principles of various writing styles in social and professional communication using standard linguistic and stylistic means and become familiar with basic units of the formal written style, such as a resume, an application, a motivation letter, an e-mail, etc. They will also develop creative writing, text processing (transformation, expansion, reduction) and note-taking while listening to lectures, identifying significant information and its subsequent classification, writing a summary of articles and practising of writing on a chosen topic.

When writing a project, formal letters or an abstract, students deal with formal and content aspects of using proper language structures. They will learn how to use bibliography and refer to scientific resources. They will deal with ways of introducing quotations and standards for paraphrasing ideas listed in the bibliography.

5.3 Socio-cultural and intercultural skills

Professionally oriented language teaching focuses also on understanding the culture of target countries with the focus on intercultural differences, which are crucial in terms of students' own culture but also in terms of their field of study and future occupation. The language curriculum deals with culture-specific phenomena, supports the student's tolerant perceptions of other cultures, and develops empathy to be sensitive to cultural differences.

5.4 Study skills

Teaching practice of vocational language education is based on the principles of the communicative approach including all forms of social work (group work, plenary work, pair work, use of pictorial material, project work, etc.) and developing strategies of autonomous learning (conscious forms of learning, creating good habits in the learning process, working with keywords in the selection of topics). Special attention is given to designing of teaching units so that students' suggestions can be implemented in the classes. Individualization of the learning process focuses on unlocking students' personal and educational potential and considering their needs and individual learning styles.

5.5 Methods and Materials

Language teaching involves up-to-date and authentic materials, including the Internet sources and scientific journals, simulation of job interviews, and solving tasks similar to real-life situations as well as project work. The language training comprises also training of fluent and spontaneous pronunciation, the correct and confident use of the grammatical features of the target language, and acquisition of specific professional terminology. Equally important is promotion of creativity and development of research and study skills for independent study and independent performance of the profession and development of creative and critical thinking.

6 Conclusion

Learning languages in the university environment means many advantages for students as they usually want to learn a foreign language to improve their communication skills and increase professional vocabulary in their study field, and their intrinsic motivation becomes more intensive while preparing for a future occupation. The main aim of the newly accredited language programs *English for Pharmacists* and *German for Pharmacists* is to prepare students in all four language skills for understanding vocational issues in the authentic form concerning the pharmacy and health issues. They promote development of students' speech production and their ability to communicate in the English or German language without any problems in common situations as well as in the professional world of pharmacy. After defining the main objectives of the courses, it is necessary to focus on learners' needs and develop an efficient system of language education in order to achieve their goals. The next step is to revise the existing teaching materials, develop new materials for the courses *Academic Preparation 4 and 5* and design online materials for vocabulary, grammar and examination practice.

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The Agile Transformation

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Abstract: Within the past ten years, the ways of developing products and services have undergone significant changes. The software and service development environment has been transforming, as manifested in technologies, people and processes. As a result, organizations have been facing pressure to be highly adaptive to change. To study these changes, it is necessary to examine the development processes as well as human and business-related aspects. Recent studies of agile development have not seemed to focus on changes on the organizational level. Insights about agile transformation are significant as the environment is in a state that is continuously evolving, which will affect the methods and frameworks chosen to develop products and services. This paper tends to distinguish factors, which differentiate between a traditional and an agile organization.

Keywords: Agile; Scrum; project management; change management; knowledge management

1 Introduction

Today we are facing an environment which has become increasingly difficult to predict. Agile is a new concept aiming to respond to such uncertainty, and the methodology has been adopted as a preference to developing software. According to some studies, it has a long history, with earliest origins tracing back all the way to 1940's. The principles and values, which would provide a definition of Agile, referred to as "the Agile Manifesto", arose in 2001. At that time, the concept of Agile became widely known and the implementation of different frameworks began. Of those frameworks, Scrum has been the most widely used framework in the world [1]. As the methodology has since evolved, it has created other frameworks, such as Lean and Kanban.

One definition of the agile transformation describes it as "an act of transforming an organization's form or nature gradually to one that is able to embrace and thrive in a flexible, collaborative, self-organizing, fast changing environment." [2]. Upon reflecting the agile transformation, the matter is seen as something more than simply choosing a set of methods or practices to deliver in an agile environment. Rather, it also involves the issues of culture change and mindset, to be able to support a self-organized, collaborative environment inside an organization.

The purpose of this paper is to study the impacts of Agile not only in software development but also on an organizational level, to identify the differences between traditional and agile organizations and to examine the benefits and challenges of agile adaptation.

2 The Agile Transformation

The core idea of Agile may be included in many business environments, alongside but not limited to software development. This chapter will expand the ideology by identifying some

of the characteristics which are essential for an organization to call itself agile. The related concepts will include assessing the changing role and significance of management as well as introducing the Agile Performance Model framework (APM). Finally, in chapter 3, a case company example will aim to provide a practical example regarding agile transformation.

2.1 What makes an organization agile?

Before moving further with the concepts of agile change, it is interesting to consider what kind of agile definitions there exist. Agile refers to adaptability, flexibility and delivering solutions at speed. The Agile Manifesto defines the core values and supporting principles, which act as a guideline to introduce what agile is fundamentally about. This provides a good framework for assessing how agile an organization is. However, to study how the agile values and principles manifest themselves inside organizations, it is necessary to examine which other agile definitions there are.

Despite a software-development-related or a process-oriented perspective, Agile can be explored as a mindset – a way of thinking. Having an agile mindset involves absorbing agility into one's identity to the extent that becomes the new norm. While an organization may implement different tools, practices and support various agile principles and values, the agile mindset is seen as sitting on top of everything while wrapping everything together [3].

Consequently, for Agile to find success within an organization, it can often be a question of adopting the mindset. For example, when a new framework is introduced, individuals may begin to implement it; however, if they do not understand why it is being used, the temptation of gradually going back to old habits can be high. To look at the issue more practically, it is worthwhile to consider how the agile mindset compares with a "fixed" mindset, which refers to the non-Agile way of thinking.

Tab. 1 *Fixed and Agile mindset* [3]

	Fixed mindset	**Agile mindset**
Ability	Static, like height	Can grow, like muscle
Goal	To look good	To learn
Challenge	Avoid	Embrace
Failure	Defines identity	Provides information
Effort	For those with no talent	Path to mastery
Reaction to challenge	Helplessness	Resilience

The differences between the mindsets are evident from the examples mentioned in the table 1. The agile mindset is about evolving continuously rather than remaining at a certain level, welcoming and overcoming challenges instead of backing away from them and taking failure as a chance to learn. Where a fixed mindset sees threats, an agile mindset may see opportunities. The goal of continuous improvement lies at the heart of the agile ideology. Agile organizations do not tend to punish employees for their mistakes. This is due to

accepting the idea that to be constantly able to improve can involve things occasionally going wrong. This applies particularly to software design as no system is without flaw, but expectancy to having flaws will encourage putting in place necessary practices to monitor and respond to vulnerabilities. In terms of project management, agility allows to experiment and then analyze whether experiments are bringing value and abandon them if that is not the case.

"Business agility" is a term created to describe the adaptability of businesses to an ever-changing environment. Organizations that have the capability to act and adapt when facing changes operate under an agile mindset. These organizations welcome new ideas and support flexibility in their processes and systems. Openness and adaptability are also characteristics of their corporate culture. Simon Sinek [4] has argued that the values of the company lie at the very core of the agile business principle. According to his theory, organizations should have a clear idea about the reasoning behind their existence before focusing on the practicalities of their operations. This rationale, along with the values of the organizations, should thus be the driver for their decision-making and operations. Another argument by Sinek emphasizes the importance of delivering products and services which respond to customer needs. An agile organization should always place the customer in the center of what they do. Many organizations that have first adopted agile software development methods are now considering how to introduce agility into their business operations.

To discuss briefly agile business, a set of core business objectives which are the most relevant when discussing agile projects is identified. According to Jim Highsmith [5], agility stresses the following five as the most meaningful: continuous innovation, product adaptability, improved time-to-market (including return on investment), people and process adaptability and reliable results. An agile mindset may connect with innovations since the self-organizing nature of agile enables to set up an environment to innovate new ideas. Agile delivery of products requires adaptability as it strives for technical excellence, using customer value and adaptation as ways of measurement.

Agile software development involves prioritizing product features and delivering them in small, frequent increments. This will push the teams to consider the number of features which should be included in the releases and eliminating less valuable requirements. Concentrating on value-adding activities and including the necessary skills to complete a project would result in improving the time-to-market in agility. The people and processes need to adapt similarly to products, to create value for customers. Processes in agile is a topic which has been under discussion. Many organizations tend to include repeatable processes into their development. This may respond well to situations where expectancy to change is low. As agility expects changes to happen any given moment, it may prefer reliability of processes. Reliable processes operate under certain boundaries while aiming to meet deadlines and expecting changes to occur [5].

A very recent article by Aghina et al. has identified five trademarks, which an agile organization possesses in terms of strategy, structure, process, people and technology. Without going into too many details, organizations were discovered to have an overall purpose and ambition by which they navigate (The North Star) a network of empowered teams, supporting of rapid decisions and learning in their processes, having dynamic, passionate people including a cohesive community as well as highly advanced technology [6].

	Trademark		Organizational-agility practices[1]
Strategy	North Star embodied across the organization		• Shared purpose and vision • Sensing and seizing opportunities • Flexible resource allocation • Actionable strategic guidance
Structure	Network of empowered teams		• Clear, flat structure • Clear accountable roles • Hands-on governance • Robust communities of practice • Active partnerships and ecosystem • Open physical and virtual environment • Fit-for-purpose accountable cells
Process	Rapid decision and learning cycles		• Rapid iteration and experimentation • Standardized ways of working • Performance orientation • Information transparency • Continuous learning • Action-oriented decision making
People	Dynamic people model that ignites passion		• Cohesive community • Shared and servant leadership • Entrepreneurial drive • Role mobility
Technology	Next-generation enabling technology		• Evolving technology architecture, systems, and tools • Next-generation technology development and delivery practices

[1]The 5 trademarks include 23 practices for organizational agility; 18 are based on survey research. Five additional practices are included that have emerged from recent experiences with large global companies transforming into agile organizations.

Fig. 1 *Five trademarks of agile organization* [6]

2.2 Agile culture change

It can be said that an organization is defined and shaped by its culture, which can manifest itself in many aspects – work roles, processes, frameworks, tools, etc. While being visible in many day-to-day practices, ultimately, culture will always come down to people and interaction. Understanding what kind of a business culture dominates a business is seen as vital before implementing Agile, however it can be quite challenging to identify and visualize the subtle elements that affect how people interact [6].

There are many ways in which culture effects the operations of an organization. It can include the following basic characteristics: mission and direction, adaptability and flexibility, involving and engaging the people and creating consistency from core values. Culture is a complex entity, which includes internal factors, such as the core values and capabilities as well as external factors like strategy [7]. The issue of corporate culture may be difficult to define and describe despite of the fact that it is present everywhere in the workplace. That is

because corporate culture includes certain characteristics, which make it difficult for individuals to give precise descriptions of it.

According to Edgar H. Schein, titled as a "leadership guru", culture is deep in the sense that it is very challenging to manipulate it. It is also broad as instead of having people controlling culture, usually it is the case that culture ends up controlling the people. Culture tends to remain relatively stable due to people naturally tending to prefer predictability [8]. Furthermore, culture includes a large variety of influential environmental factors, for example the market situation, social change or political climate. It exists through having a context and that context is much wider than people usually realize.

2.3 Management and leadership in Agile

Management in Agile is a very broad subject, which involves the organizational culture, tools and frameworks, project and product management and leadership. This paper will merely consider a few, relevant concepts. As mentioned, inspection and adaption are some of the core agile principles. Moving away from top-to-down management and into empowering teams is characteristic of forming an agile style of managing projects and people. Motivating employees and providing them an environment built on support and trust is a fundamental part of the agile principles. Therefore, it is relevant to study the issue of motivation and attitude between management and workers.

The Human Side of Enterprise is a publication created in 1960 by Douglas McGregor, which was later revised in 2006 [9] and which introduces a model to study how managers interact with their employees. The model includes two different management perspectives, divided into Theory X and Theory Y. The Theory X is an example of a control oriented view. It involves a set of beliefs that assume employees needing strict supervision due to their lazy tendencies, lack of ambition and tendency to avoid responsibility unless encouraged by centralized incentives. It regards that employees should be controlled as their individual goals would not be meeting the needs of the organization. Quite on the contrary, Theory Y assumes that employees are able to motivate themselves, be responsible for their learning and have a positive reaction to allowing them the freedom to exercise their talents in the workplace. Employees would not need to operate in a "stick and carrot" manner like in Theory X as their goals would align with the organization through commitment [3].

Tab. 2 *Theory X and Theory Y* [9]

Theory X managers believe that employees...	Theory Y managers believe that, given the right conditions, employees...
Hate work	Like and need work
Seek money and security	Seek to be involved and realise their potential
Have to be forced to work	Drive themselves and work effectively
Prefer to be told what to do	Take initiative
Are rarely creative	Are naturally highly creative
Are selfish	Commit themselves to larger goals

The theory regards the attitude of the management as a key to how employees will act and deliver their work. It assumes that when the management has a predetermined attitude and imposes it in the workplace, the employees will end up acting exactly the way the managers presume. This means that in Theory X, the employees would expect to be told what to do, having a negative mindset and regarding the work as merely a source of income and not as a means to express their creative needs. This is due to the management having such a key role in setting the underlying cultures and atmosphere at the workplace. As such, the managers' input will typically be manifested in the workers' output. Organizations following a model closer to Theory Y are being more productive according to studies [3]. This would be particularly true for agile organizations, as already discussed in the previous section. The Theory Y aligns more conveniently with Agile, which values motivated individuals before processes and expects that teams consisting of individuals will be able to self-organize.

When discussing agile management, the teams and their level of collaboration are an essential part for consideration. The issue is thus the team dynamics. For teams to function well together, certain functions either help or prevent teams from achieving a high level of performance. Patrick Lencioni [10] has made such a list of characteristics, which includes the following: trust, conflict, commitment, accountability and attention to results. According to the theory, these can be both positive and negative. A team can be regarded dysfunctional if it has not invested in achieving results, avoids being accountable, is fearful about conflicts and lacks commitment and trust.

Accountability refers to owning responsibility so that other team members, as well as the management, can expect the individuals to complete their tasks without too much involvement. With attention to results, the teams can practice a form of shared accountability. When speaking of conflict, it is generally associated as a negative term. This is not always the case where teamwork is concerned. When members of a team wish to keep their opinions to themselves due to a fear of getting into a debate, it can result in the team operating from a very narrow point of view. It would be better to raise discussion even when having conflicting views to avoid falling into a trap of "group thinking", which may not create very innovative ideas, for example.

Openness towards failure and shortcomings is one relevant point when discussing the building of trust. As already acknowledged in this paper, agile leaders will allow employees to make mistakes without the need to punish or be very critical or harsh. They too, should acknowledge not being perfect and realize how much they need to develop personally, just like any other worker. It can be a good idea to communicate this to the teams as well. Leaders can learn a great deal by observing what is happening around them and in other organizations and communities. Where commitment goes, agile leadership will aim to define and effectively communicate with the team about goals, making sure that the team is heading towards them together.

Gathering the different functions into a form of a pyramid demonstrates a value structure with trust forming the base upon which everything else is constructed. When colleagues trust each other, they are more open to sharing ideas and opinions even when it may result in debate, which may have a very fruitful outcome. When a team is committed, it is more eager to take initiative and share accountability, which will keep the team focused on achieving results. The management's role then becomes more about enabling and encouraging all these fundamental aspects [10] [3].

Fig. 2 *A functional team according top principles by Lencioni* [10]

Going back to the core agile principles, a publication titled Agile Project Management, written by Jim Highsmith [5], offers a simple yet effective quote about the difference between how a traditional manager plans projects compared with an agile manager. It goes: "A traditional project manager focuses on following the plan with minimal changes, whereas an agile leader focuses on adapting successfully to inevitable changes". This stresses the issue that almost every project requires at least some amount of planning, but the differentiating issue lies in the perception of the plan and the expected outcome. Highsmith also points out three main values, which an agile leader should have: delivering value over constraints, leading the team over focusing on tasks and adapting to change over complying on plans. These values are familiar from The Agile Manifesto and are good indicators for examining how agile the style of leading is [5].

As emerging trends have been transforming and continue to transform the way organizations operate and act, the organizations of today are almost like "living organisms", in need of some stability while being able to function dynamically [6]. In an agile organization, which is marked by less bureaucracy than before and an effort to act in a quick and flexible manner, the leader is an enabler, with a clear long-term goal to lead the direction. The theory about organizations being living organisms is demonstrated in the illustration below.

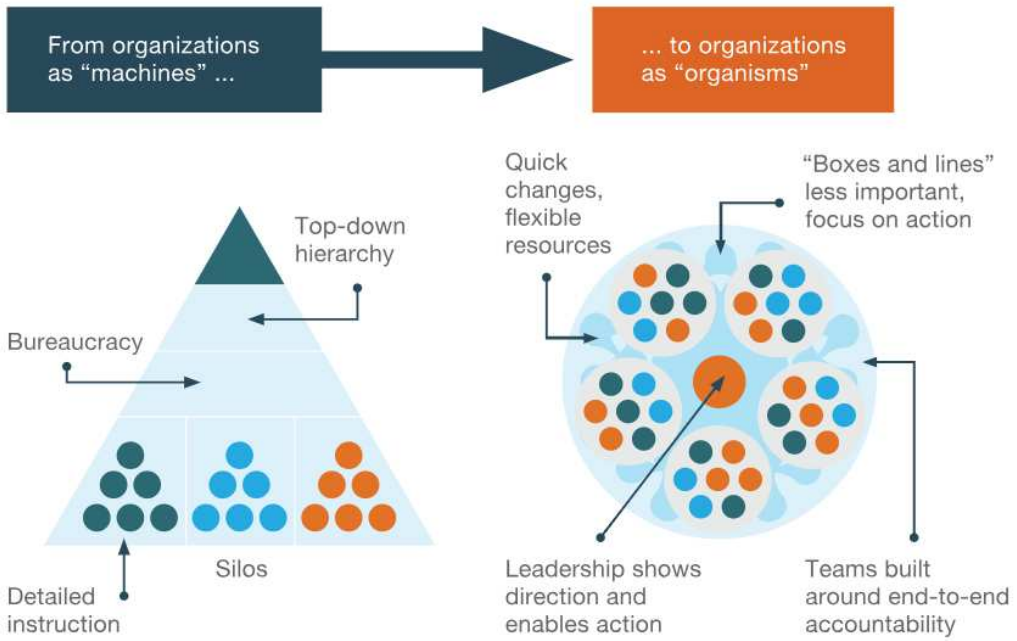

Fig. 3 *Agile organization as a living organism* [6]

2.4 Change management

During the latest few decades, organizations have been battling with a variety of significant changes, which touch on many different levels, such as economic, demographic, political, financial, collaborative as well as individual. The environment where products and services are developed has become increasingly competitive and the results may have taken a big toll on morale, for example through reducing staff due to outsourcing. Rapid advancements in technology have transformed the way organizations run their operations, aiming to produce feasible outcomes in an environment marked by a great deal of uncertainty. Many companies have failed to react to the changing requirements promptly enough and have died out as a result, while others have blossomed being able to grow even stronger with innovations, a focus and strategy, which support continuous improvement.

For an organization to stay competitive in times of extreme uncertainty, it needs to be able to adjust to a changing environment. Managing change includes many challenges; it requires short-term as well as long-term planning, and particularly in an agile environment, the objectives may include a great deal of inconsistency. This is because the future has become increasingly difficult to project, but projections are necessary to form a sense of direction.

Scrum, for example, prefers to develop iteratively in short-cycles, highlighting how important it is to be fast and innovative, which sometimes allows leaving decision-making at the last minute. However, even in Scrum projects and particularly dealing with complex issues in large organizations, long-term goals and broad guidelines are put to place, guiding the teams to aim towards a unified vision that is managed from above. Agile is not as chaotic as it is sometimes interpreted to be. Keeping in mind that Agile tends to rely on technical excellence, this means that a level of precision and risk management must be involved.

Obviously, organizations must always bind to certain laws, so there are always limitations to how they can operate and act.

Dr. Paul Evans (2000) has studied the paradoxical nature of the requirements for planning projects, extending on the ideology by creating the "The 11 Paradoxes of Leadership". It introduces the following traits, seen listed below, as suitable for change leaders and managers of today. It may act as a "checklist" for examining the considerations how an agile leader should behave, recognizing the conflicting nature of the values [3].

- To be able to build a close relationship with one's staff, and to keep a suitable distance.
- To be able to lead, and to hold oneself in the background.
- To trust one's staff, and to keep an eye on what is happening.
- To be tolerant, and to know how you want things to function.
- To keep the goals of one's department in mind, and at the same time to be loyal to the whole firm.
- To do a good job of planning your own time, and to be flexible with your schedule.
- To freely express your view, and to be diplomatic.
- To be visionary, and to keep one's feet on the ground.
- To try to win consensus, and to be able to cut through.
- To be dynamic, and to be reflective.
- To be sure of yourself, and to be humble.

Regarding change, the team and its leader can be imagined sailing in a boat with changing weather conditions surrounding them. Neither the team nor the leader can control the weather, but a boat typically has someone directing it, even when facing a storm or another unexpected event. It could be said that this is when the one in charge of directing the boat can become particularly focused and invested in the job, having to make decisions about how to approach a challenging situation. This describes the characteristics of change management. The more uncertainty there exists in the real world in terms of technological developments and trends, market fluctuations or growing demands, the more need it creates for managing change.

Change always involves culture. It is complex to manage because culture itself includes levels of complexity. Returning to the model of the four major aspects of culture: adaptability, mission, involvement and consistency, an organization would benefit from reflecting on how it is addressing these issues. A mission will typically be focused on the long term, setting the direction where the organization is headed to. To demonstrate the complexity of this theory, the following figure will highlight the issue [7].

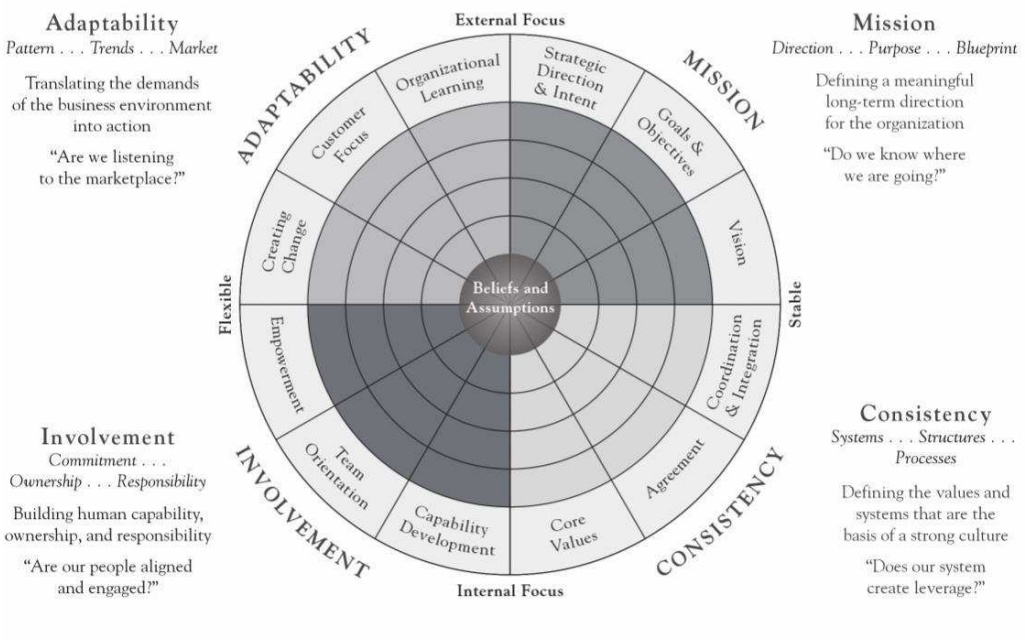

Fig. 4 *Organizational culture and business performance* [7]

Adaptability may refer to a variety of things, which relate to the environment where the organizations operate. Involvement refers to commitment and responsibility, which have already been discussed. It has been established that agile organizations require a level of consistency, despite of seeking high adaptation and being on stand-by for unexpected changes. For the agile leaders, it is relevant to study the aspects of how adaptable the organization is as regards the changing environment. This includes operating under a meaningful long-term mission, which is guided by vision and reflected in the goals and objectives of the organization. It would also be worth considering how engaged and capable the people are and if the systems and processes support the organization's culture. Agile will encourage organizations' awareness by constant reflection on these issues as that is how an organization can achieve continuous improvement. The agile leaders have an important and challenging role in practicing and sharing of awareness.

2.5 APM Framework and agile delivery

As we have mentioned in this paper, Agile has some constraints despite its flexible and adaptable nature. While planning of agile projects may often include having to deal with contrasting values, agile project planning includes some of the same objectives as traditional projects. Measuring agile performance is regarded as necessary to create a correlation between what the self-organizing teams are aiming to achieve and what the managers regard as a successful outcome. All projects tend to have some constraints; typical examples of these are: requirements, time and cost. To explore the issue of constraints in agile projects, something called "the Iron Triangle" is used to demonstrate the differences between agile and traditional projects. Technical quality has also been added as new addition to the figure [3].

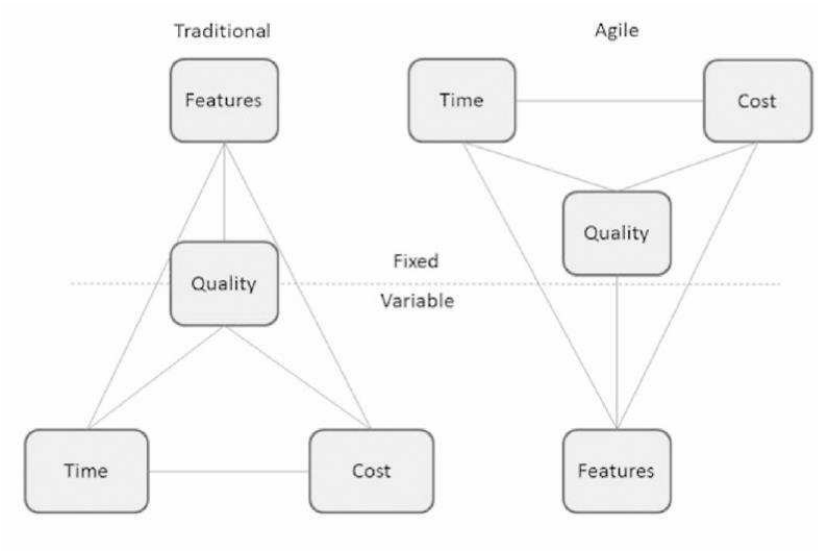

Fig. 5 *The Iron Triangle* [3]

The traditional model is consistent with the Waterfall method. Projects following the Waterfall approach include defining the features and the project in advance and assuming that the time and cost may change while the requirements stay the same. In the Agile model the pyramid has been turned upside down, having the expectancy that the requirements will change while cost and quality can be relatively fixed. The goal of managing the time constraints in short sprints is referred to as "time-boxing". Depending on the product and project, time-boxes can vary from days to weeks, and sometimes months while tending to prefer short cycles. Before a project begins, a high-level design or a prototype is introduced. Regarding the designs and prototypes, Agile prefers simplicity as requirements may change. For drawing estimations of the project constraints, Agile prefers that the team, together with customers and other stakeholders, collaborate and experiment with products to make effective decisions about requirements and choice of technologies [3].

The Agile Project Management (APM) Framework is a model, originally introduced by Jim Highsmith, in the publication "Agile Project Management – Creating Innovative Products" [5]. It describes the lifecycle of a project as consisting of the five following steps:

- Envision – determining the vision and objectives of the project
- Speculate – creating a capability or feature-based plan
- Explore – planning and delivering of tested stories
- Adapt – reviewing the results and team performance
- Close – concluding of the project

In the envision phase, the teams will figure out what will be delivered, who will be the people involved and how the teams plan to work together on achieving the vision. The success of the project relies greatly on this first stage. Highsmith regards the speculate phase as "to conjecture something based on incomplete facts or information", which is in fact how the dictionary defines the word speculate. This is to address the issue of having unknown factors involved, which replaces planning as more of gathering a collection of assumptions. The speculate phase will include having a wide set of product requirements, which are put in a

product backlog, having a release plan based on the requirements and estimating potential risks as well project costs [5].

The explore phase includes user or product stories. A user story is known from engineering but can typically be created by product managers in Agile projects. They can follow a structure of: as a <type of user>, I want <a goal> so that <a reason> [11]. The teams must decide how many stories are possible to deliver in the iterations or sprints for which they will seek reference from 1-5 earlier sprints. The term for this sort of retrospection is called "velocity" [3]. The explore phase also has the project leaders form a collaborative, self-organizing community. How the customers, product managers and stakeholders interact is also managed in this phase [5].

The issue of adapting has been discussed in many instances in this paper. It is mentioned in the Agile Manifesto that "responding to change is more important than following a plan". In the adapting phase, a plan can be revised according to feedback from customers, tech people or as a result of process performance evaluation. The project or iteration is then ended with a goal of learning from implementing the previous steps. The APM-framework is not expected to complete these steps continuously in this exact order; the loop of speculate – explore – adapt can be repeated until enough data are gathered to form a good view of the final product [5].

The APM Framework is a model for agile delivery. Large organizations or enterprises may have hundreds or more projects, which can use a mixture of agile and traditional practices. The transformation of a large enterprise may include using several methods and learn with time which ones work best. Highsmith has suggested an Agile Enterprise Framework, which operates on several different layers. They touch on governance, project management, iteration management and technical methodologies. Without going further into this theory, Highsmith has stated [5] that a framework should support and include the following:

- A culture of envisioning, exploring and adapting
- Self-organized, self-disciplined teams
- Reliability
- Flexibility and easy adoption
- Visibility
- Learning
- Practices for supporting each phase
- Management review

Another framework for examining aspects of agile delivery is the Cynefin framework (Snowden and Boone, 2007) [12], which separates environments into domains according to how simple or complex they are. A simple domain operates on a cause-and-effect basis, allowing to project the results with relative ease. The teams operating in a simple domain can draw a defined delivery plan up front. Such as situation would be an example of the Waterfall approach. A complicated domain is less predictable, but a defined plan can be used after spending some effort on analysis and accepting that some flaws may be included. This domain works for both Waterfall and Agile as well as Lean. The third domain is called a acomplex domain, where cause and effect no longer apply or can be accepted to change rapidly. Up-front planning is not suitable where so many complexities are involved, therefore the Waterfall method would not work well in this domain, while it would be ideal for Agile [3].

In the fourth domain, which is a chaotic domain, cause and effect have no place, which makes planning obsolete. Teams working in a chaotic domain will rather conduct experiments and try to get into another, more manageable domain. Kanban can be an option for a chaotic domain. It may also be an option for innovative brain storming sessions. The final domain is called disorder and it does not have a definition. This would mean that team members would use a working style that comes naturally for them but may not meet the needs of the project [3].

3 Case: Spotify's Agile Model

Spotify [13] is an established entertainment company which provides music, podcast and video streaming content. It operates on a freemium basis, offering basic features free of charge with advertisement while a subscription payment enables users to download and stream content with higher quality. [14] It is the world's biggest streaming company with 35 million songs uploaded to the service and having about 170 million monthly active users, of which 75 million were paying for its premium, ad-free subscription in 2018. Users can access Spotify using their computers, smartphones and tablets. Browsing or searching for content is enabled by using parameters such as artist, album, genre, playlist or record label. Spotify allows users to create, edit and share content on social media as well as make playlists with other users. Spotify has grown rapidly into a clear market leader in the music streaming sector. Some investors estimate the company to reach a value of 50 billion in a few years[15].

Spotify has an interesting history, having moved from a start-up to a global enterprise with users currently in 61 countries. The company hires 180 teams and 1800 people in the field of engineering and R&D. In total, the company employs 3500 people. Spotify adopted Agile in 2008 as they first started to implement Scrum. With the company growing rapidly, the Scrum teams were soon multiplied. It was discovered at the time that Scrum practices, such as sprint planning meetings and breaking down tasks, were no longer working efficiently. This resulted in a change of culture, where it was encouraged to break rules when needed as agile values would matter more than Scrum itself. Upon reinventing itself, the company changed the role of a Scrum master to act as an Agile Coach, which was a trend at the time Agile emerged. The new role of a manager was regarded more as being "a servant leader rather than a process master" [16].

Instead of having Scrum teams, the company organized development teams into autonomous "squads". These squads were small, cross-functional, self-organizing teams of less than 8 people. The teams would conduct end-to-end development, being in charge of designing, committing, building, deploying and maintaining operations. Autonomy meant that the squad would decide what to build and how, as well as learn how to work together while doing it. However, the teams would have some boundaries, such as strategy and short-term goals to be negotiated every quarter. Each squad would also have a long-term mission. The physical office space at Spotify was optimized for collaboration, with members working closely together, having walls acting as whiteboards and including a common area for retrospect sessions. Autonomy was regarded as an important value as it would keep team members motivated and allow them faster decision-making. In accordance with agile values, Spotify wanted to minimize hand-offs and unnecessary waiting for purposes of efficient scaling. The different squads would be tightly aligned by product strategy, company priorities and focusing on the overall mission over individual squads. As a quote from Spotify says: "Be autonomous but do not sub-optimize". [16]

Spotify regards itself as an organization where high alignment would mix with high autonomy. This includes a culture where the management figures out which problems to solve but lets the team members do the actual solving, a practice which is very much in accordance with agile principles. As far as development methods go, some may implement Scrums and sprints while others use Kanban. The methods are not standardized, but as certain tools are increasingly adopted, they may spread between teams and become a standard. A balance of delivering consistently while remaining flexible is the main goal at Spotify.

Spotify has over 100 separate systems, which are coded and deployed independently. While interacting with each other, one system focuses on one specific need, for example play list management and search or monitoring. The systems are small and de-coupled with clear interfaces and protocols. Each system is owned by one squad while most squads own several systems. Spotify supports an internal open source model, promoting a culture of sharing. If a squad needs help with coding from another squad, they can edit the code themselves while another squad may review it. This is regarded, firstly, as saving time since anyone can edit any code, and secondly, providing a culture of peer code review to result in better quality and a focus on knowledge sharing [16].

Since Spotify would soon have over 50 squads spreading across different cities, there was a need to develop more structure. As a result, the squads were grouped into tribes. The squads are focused on product delivery and quality while the tribes share knowledge on specific areas of expertise, for example web development or management, etc. This enforces an idea of having communities rather than hierarchical structures. As it is believed at Spotify, a strong enough community would be able to operate in a way that is less formal [16].

The teams deliver small but frequent product releases. There used to be bigger investments, having only a few coders, but as Spotify grew, it became a problem as dozens of squads had to synchronize with each other for each release and it would take months to get a stable version. To solve the issue, software architecture was changed in such a way that it would enable decoupled releases. This meant that each client platform would form a client app and would be assigned to a specific client app squad. This would allow easy product releases on one specific client platform (desktop, iOs, Android). The squads were also divided into feature squads, which would focus on one feature area, for example a search-feature. Infrastructure squads were formed to make other squads more effective by providing tools and routines, such as continuous delivery, monitoring and testing [16].

For product release and testing, Spotify implements release trains and feature toggles. The release trains mean that each client app has a release on a regular schedule (every week or every 3 weeks depending on the client). When the releases are kept frequent and regular, it means that less up-front planning is needed. The feature toggle is something that is used to hide an unfinished code in the case that it is not completed for release at the same time with the others. This is regarded as a good practice for integration testing, since feature toggles allow to hide or show features for testing and production purposes. This enables to gradually roll out the features as they are finished [16].

With assigning different types of squads working on different aspects, Spotify is aiming for a self-service model, where handoffs can be avoided by squads rather establishing a system based on enabling and providing of support. Spotify has invested in creating a liberal culture, which is based on strong mutual respect and motivation. It is tremendously focused on gaining very high worker satisfaction. This reflects on the way Spotify deals with surveys about worker satisfaction. According to a survey conducted at Spotify, worker satisfaction

gained a high result, with 91% stating to be satisfied; however, the first response by Spotify was to raise concern about a 4 % stating to be unhappy according to the survey. From this strong investment in satisfied employees, Spotify has gained a good reputation as a workplace [17].

The Spotify Agile Model is a very intriguing one. The company provides open information about the agile journey it is taking, with adjusting the process along the way and not being afraid to ditch things that do not seem to work well. Many could presumably want to imitate the model. By continuing to experiment to gain the best results, Spotify seems committed to embracing agile values in its operations, development methods and corporate culture. It can be stated that the experimental nature of Spotify may not be suitable for every organization. It is also worthwhile to recognize that despite having a staggering amount of monthly active users, Spotify has not yet managed to become profitable.

4 Conclusions

To study agile transformation, it has been necessary to study the technology aspect as well as the definitions of what agile can refer to. Defining agile may depend on which aspect is being under a microscope while it seems that the agile mindset and culture are the underlying principles, which affect how the practices, frameworks and tools are chosen to support organizational culture and values.

The difference between traditional and agile organizations is an issue, which involves the style of management, the ability to adapt to change and to continuously reflect on what could be improved. It includes adding a level of flexibility, which will allow the organization to respond quickly when things, such as product requirements or the service environment, change. Top-to-down management is not supported in Agile as this may reflect negatively on the motivation and attitude of the employees.

The question of whether organizations are truly agile or not will once again return to the Agile Manifesto and its core principles: individual and interactions over processes and tools, working software rather than clear documentation, customer collaboration over negotiating contracts and responding to change over following a plan. The research highlights the importance of an organization being invested in its employees. This includes having flexible processes, encouraging collaboration with teams and customers and being able to adapt to change through various ways, such as having a shared mission.

Managers and leaders in Agile have a demanding task since they are battling between factors which may argue with each other. In a fast changing, adaptive and flexible environment, they are required to provide an element of consistency and constraint. Change management is and will likely continue to be a key issue in how projects and people are managed today. As team sizes increase, Agile seems to become a question of re-organizing and scaling. The experimental nature of organizations will vary, which will result in the agile methods and frameworks varying accordingly.

Regarding agile frameworks and tools, it would be difficult to define how an organization should make the selection of which ones to implement. Agile will not give a direct respond to that question but it will encourage organizations to practice awareness, define their long-term goals clearly, align the short-term goals to match them and examine the internal and external factors involved. This is a healthy advice for any organization that wants to avoid being stuck

on the same level and, instead, wants to continuously improve and reflect on how it is performing.

The issue of mindset and culture, while relevant, is also very challenging to measure or provide a definite meaning to. Culture is something that surrounds people everywhere; perhaps that is why the effects of it are not always recognized although they surely exist and affect how people behave at work. Managers and leaders have an important role when it comes to organizational culture. By acting and managing others according to a certain prejudice, they can create a culture marked by negativity and control or, vice versa, a blossoming, creative and motivated self-organized individuals and teams.

Agile transformation is a very broad topic, which can be viewed from many different perspectives, whether it is the business, people, products, technologies or project management. Further research will be needed to examine the agile transformation and the characteristics of agile organizations. Business agility is also an area where further research could be done.

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The Necessity of Business Intelligence Solutions for the Sales Controlling in a Company

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Abstract: Data are becoming bigger and bigger, and their sources are diverse. Business Intelligence solutions are becoming more and more important for controlling of a company. A good technical set up is the basis for all analytical activities. A controlling tool for the end-user needs needs to meet the expectations of different hierarchy levels, and it needs to be intuitive. The paper shows a concept for the integrated sales controlling of a company, using Business Intelligence solutions.

Keywords: Business Intelligence, Data Warehouse, OLAP, Data Mining, Scorecard Model

1 Introduction

With rapid advances in information technology and increasing pace of globalization, comparability of products is increasing, leading to decreasing customer loyalty and shortening product lifecycles. Challenges for sales are increasing, and so they do for the company's success. Whereas in the past the increase in productivity was mainly limited to the production sector, it is now considered at least as important to optimize sales as a primary element of market and customer communication. In addition to reducing distribution costs, more efficient use and increase in the success rate of sales plays an important role. Sales activities and the number of customer relationships are becoming the focus of attention. Greater alignment of the entire company and sales as the first point of contact with the market and the customer will be indispensable in the future. As changes in customer requirements and needs are constantly expanding, the tasks of sales are leading to growing importance of the sales organization [1]. Especially in competitive markets with high product transparency and high reaction speed on the market, consulting as a product-accompanying service often provides an advantage in favor of a supplier [2]. Sales and optimal customer service, as well as continuation and expansion of long-term customer relationships, therefore, play a key role in the economic success of the entire company [3].

However, an area-wide sales controlling system, as a means of sales management, has not yet prevailed in most companies. Companies continue to focus increasingly on sales, products and product groups. This is particularly critical because the customer should be more in the focus of the sales activities as a central point of the company's success than he has been until now [4]. The main problem is in the lack of future-oriented reporting and in the absence of the necessary consistent data and information supply. Most users use disjoint, complicated and incomplete source systems [5]. According to a study by the market research institute Vanson Bourne, each employee uses an average of 67 minutes a day to collect information [6]. The resulting annual costs are already in the range of millions in small and medium sized organizations. More than two-thirds of companies surveyed believe the problem could be solved by providing a cross-company solution with access to all the information. It is all the

more astonishing that only a few companies have developed a corresponding business intelligence solution.

2 Sales Controlling

Controllers design and accompany the management process of target determination, planning and control and thus bear joint responsibility for achieving their goals. Increasing cost pressure also increases efficiency requirements within the sales controlling and high data quality. Also, the acceptance and confidence of the decision makers in the gained information is of elementary importance [7]. In addition to ensuring day-to-day business, it is important for sales controlling to generate input of information and to identify future requirements for action at an early stage [3]. Due to the growing complexity and dynamics of the corporate world, sales as an interface between the company and the customer play a significant role in the economic success of the company. The fact that this success increasingly depends on efficient sales activities requires results-oriented planning and control of sales. The integration of controlling activities into sales, via sales controlling, takes this challenge into account. Sales controlling is thus far from merely checking what is happening [8]. Rather, the area has a central coordinating function and support function. The individual segments of a company can be prioritized. The feedback for planning is a constant target / actual comparison. In case of deviations, this allows the company to detect weaknesses directly. A failure to achieve the goals is thus indicated early and appropriate countermeasures can be initiated [9].

In general, sales controlling purposes can be summarized for as follows:

1. Intelligence gathering
2. Coordination and distribution
3. Control and decision support

The information strategy is at the beginning of the task chain of modern sales controlling and forms the working basis. It is important to certify, evaluate and make available the information obtained by the management. The information strategy is the basis and thus decisive for the success or failure of the entire functional area. The information requirement is determined inductively and deductively. In the inductive procedure, the sales person selects the information himself. So, employee needs are at the center of the analysis. In the case of deductive investigation, the sales process takes the center stage. The problem with this method can be found in acceptance if the determined requirements from the employee's point of view do not correspond with the actual requirements. In general, data can be differentiated according to actual and planning data, as well as master and additional data. Future-oriented planning data offer the possibility for the future to develop scenarios and to calculate the probabilities of occurrence of these scenarios. Master data are normally static data [10]. Of particular importance is the local and temporal availability [11]. It is, therefore, necessary for the information evaluation and processing to be flexible and individual. It must be compressed and tailored to the individual information request information representation guaranteed, because usually there is a gap between the information request and the availability of information [12]. This leads to a reduction of the sales productivity with high information costs. In addition, insufficient information reduces the graduation rate and, consequently, the company’s turnover. Based on the information requirement and the supply, the sales controlling has the goal to better control endogenous factors and to better anticipate

exogenous factors. Efficient sales controlling supports the decision-making process in sales through higher information quality and better utilization of information [10].

An important factor for complete consideration of the sales controlling area is presentation of the operational as well as the strategic view. Especially in terms of objectives, the two components differ significantly.

3 Business Intelligence (BI)

In times of internationalization and globalization, almost all companies, regardless of the size and industry, are exposed to increasing global competition [13]. A well-functioning BI solution is an essential resource in this context for creating a strategic competitive advantage. To enable successful, strategic action, it is mandatory that those responsible have an in-depth understanding of the company's performance. The link to the corporate strategy is fundamental. The best BI solution is useless if it does not result in improved business decisions that support the business strategy. Successful BI solutions should, therefore, include measurable business goals, KPIs and actions based on business results. Implementation of a BI system offers the company the opportunity to question the strategic goals and uncover inefficiencies in the organization's decision-making process. A very important factor of success of such a system is the acceptance by potential users. Accordingly, from the beginning, it must be considered which employees should have access to the system and which goals should be linked to the use of the system [14].

The BI approach consists of four main components. These components are referred to as Data Warehouse, Data Marts based on it as analysis tools and for the user to run as a user interface. For a holistic view of the BI approach in a broader sense, the work below deals with the components used directly or indirectly for the decision support in more detail. The delineation of the individual BI subareas makes sense, since some concepts are used synonymously in practice, which are all components of BI, but based on completely different concepts. Overall, the BI approach can be seen as a value chain in which information is extracted from data at different stages, which information is captured by the users in the form of knowledge and ultimately leads to an action that improves the situation. The goal is more efficient management of resources and external and internal customer-supplier relationships [2].

3.1 Data sources

The first step is to identify the information needs of users and decision makers. It is thus necessary to clarify which data are required to obtain the relevant information. It needs to be evaluated if the data can be found internally or if additional sources of procurement need to be found for data that are not yet available [10]. The problem with obtaining data is a lack of consistency, a lack of up-to-dateness, a missing time reference, version problems and missing semantics. All this leads to performance losses and cost increases [7]. If possible, this step should be automated as much as possible; qualified employees should be more concerned about analysis than about preparation of the data and the data collection [15]. After determining the internal and external data requirement, automatism must first be created in the data acquisition and data transmission necessary for the operation of the system [16].

3.2 Data Warehouse (DWH)

Information is the fourth factor of production and also a decisive competitive factor in a company. The DWH meets the challenge of this task. It serves to create an information offer and forms the basis for the management of the production factor [2]. The goal is to develop a comprehensive database with the DWH to enable the analysis of complicated issues [17]. The idea for this is originally from the year 1990 and was conceived by INMON [18]. The term is used to describe a database isolated from operational data processing systems, which serves as a company-wide, consistent database of current and historical data as a management support system [19]. The difference between operational systems and the DWH is the following: in operational systems, the current data are stored. This can be changed by updates at any time. A DWH, on the other hand, contains a whole history of data. The time horizon of a DWH is about five to ten years, while that of the operational systems only 60 to 90 days. For the reason of space alone, the DWH should only contain data that are relevant to users [20].

First of all, the content of the DWH is modeled. It is recommended to do a data transmission procedure. This can be done top-down, by deriving operational metrics from the business concept and critical success factors, or bottom-up, by identifying the metrics needed to control and assess quality, performance, and competitiveness from the operational metrics. An orientation framework for the data content of DWH is the so-called triangular model [2].

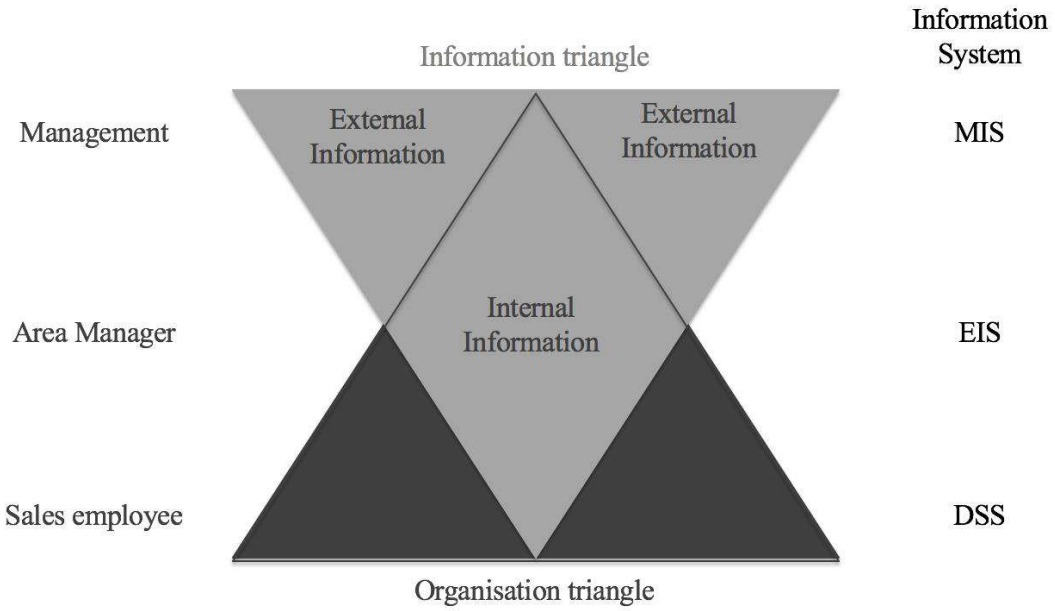

Fig. 1 *Triangular information model*

The organizational triangle symbolizes the company's internal information and its aggregation with increasing organizational height. In the case of distribution, this is mainly a result of the relationship with the markets [21]. The vertical stripes represent the area and function area related knowledge. With increasing height, this knowledge is becoming more and more integrated. The intersection of the organization and information triangle symbolizes the extent of information which flows in the company. Information used outside the organization triangle illustrates the external information that is often needed to make a decision, but often in a condensed form. Therefore, preparation and integration of these data

into the company's own database structuree play a decisive role. This often causes significant problems [2]. In essence, they can be grouped into three main fields of heterogeneity, distribution and autonomy. An almost always occurring question is the one of heterogeneity. The semantics are already different for different internal data sources, but if external sources are added, then the probability increases again. After obtaining and collecting the required data, the most important task is the syntactic and semantic consolidation and the correction of erroneous data sets [22]. An efficient DWH only supports sales controlling if it ensures the provision of higher data quality through a consistent, harmonized and historicized database [10].

However, it is necessary to consider the construction of subsets for individual functional areas and the use of analysis tools when designing the DWH. Nevertheless, conceptual separation of the structure of the DWH on one side and the use of analysis tools on the other side are advantageous since a change in the analysis in the front-end [23], which occurs due to the constantly advancing technology at regular intervals, only causes one conceptual revision of user access, but not the entire data structure. In addition, the different tools cause totally different demands of the data structure. Defining the DWH according to the requirements of all tools is, therefore, not easy. However, if a complete decoupling is achieved, even with emerging tool changes, it will be a one-time process that provides flexibility for development and change [24]. Setting up DWHs improves the internal and external reporting of a company significantly in terms of consistency and availability of data as well as flexibility of the department in the information retrieval. High standardization in development based on a DWH specific process model also reduces both development time and costs, as well as subsequent maintenance costs [22]. The DWH contains the finest data granularity. All derivations, aggregations, and domain related relationships are referred to as data marts. The advantage is that the DWH creates a common information base. Data marts can individually access DWH data and external data. All data are collected centrally in the DWH. From this consistent database, called hub, function-related data marts are created. The problematic of the heterogeneous data foundations described above influences not only the technical standardization but also the technical structure of the DWH [23].

3.3 Analysis tools

Nowadays, business is done in a confusing world of data. Data overflow and a lack of information are not contradictory. Internal data originate from the operative business; external data can be procured by third parties. The challenge is to prepare the relevant data out of large data volumes in such a way that they can be further processed by using suitable tools. The first big hurdle is taken with construction of the architecture and regular updating of the database. However, the data alone are not an added value [2]. Therefore, the extensive data stored in the DWHs and Data Marts must be analyzed. This only makes sense if they are brought into a context, resulting in valuable information. The problem is thus to process the large amounts of data with suitable tools to obtain relevant information [24]. For this, it is necessary to know if and if so, which relationships exist between the data and how they can be evaluated. Within BI, there are numerous approaches to analyzing the data. In the following text, three possible tools are presented: data mining, online analytical processing (OLAP) and reporting, which essentially provide the basis for all systems used in practice. Their use is essential to implement customer orientation [26]. In all kinds of businesses, Microsoft Excel is a popular tool for processing information. Although it can not generally be defined as a BI instrument, it does represent a data source and a proven assisting tool [14].

a) Data Mining

The data mining process helps to identify and uncover new, previously unknown relationships and hidden patterns in large volumes of data before any concrete need for information or analysis exists [24]. The information gained serves as the basis for sales controlling and thus for strategic customer management. The basic techniques of data mining are multivariate statistical methods, such as regression, factor and cluster analysis or induction, neural networks and data visualization. In this way, algorithms and associations are found which help to discover classifications and to make corresponding groupings. With the help of the association rule, correlations between different products purchased by the customer can be demonstrated. In addition, it is possible to analyze the purchasing decisions of a customer over time to represent development of the buyer's habits. In combination with demographic data, a more specific customer profile can be created. Based on this, it is possible to adjust the sales process accordingly because the most effective way of sales is to provide the customer with a tailored selection of products. Especially in fund business, early detection of niches can generate significant market shares. In addition, knowledge about the customer always creates a competitive advantage [26]. In summary, the fields of application of data mining are often found in the areas of customer segmentation, detection of up- and cross-selling potentials and early detection of emigrants. Data Mining is, therefore, used to strategically manage sales as early as possible to align the long-term focus of the company with decision support [10].

Examples are known in which the use of data mining achieved a positive return on investment within just a few months and the sales quota increased significantly [26]. Nevertheless, only 18% of all deployed BI solutions currently have such an analysis tool. The early recognition of opposing developments is a measure that is of enormous importance for all users [23]. Data Mining is the precursor to OLAP analysis, identifying patterns and dependencies within the dimensions which are worth investigating.

b) Online Analytical Processing (OLAP)

Another tool for analytical data evaluation is the OLAP concept. This is a hypothesis-based analysis method. Either the multidimensional structures revealed by data mining or manually generated queries are checked. The established hypothesis is then confirmed or rejected by the analysis result [23]. It is important to present the knowledge gained in the system in such a way that the provider can simply process it further. Thus, the alignment of the data to the needs of the management takes place. Specific views on multi-dimensional but hierarchically condensed data are typical. The analysis allows the user to break down the data into layers and cubes to get an overview of the data from different perspectives, such as segments or regions. The target values are logically connected with each other via four dimensions: time, value, quantity and product. Access is thus suitable not only for the entire DWH but also for the area-related data marts. This, in turn, supports the ability to perform ad hoc queries in addition to predefined queries as faster responses are delivered through shorter re-times. OLAP is particularly suitable for analysis of data in time dependencies and for filtering out deviations and outliers [10]. Furthermore, it is possible to change the level of detail within a perspective and change to another record on one perspective, for example to compare different regions or different funds [27].

OLAP is a top-down analysis of data. Due to its ex-post nature, the area of application of the OLAP is in operational sales controlling [10]. Thus, in any company, the opportunity to increase productivity is to minimize the inconvenience of doing business. With the help of the

OLAP method, knowledge about the right target group can be supplied by the data aggregate of the DWH. Based on this, the sales employee can then derive his sales campaign and the right actions. An example of direct sales of insurance proves a 2.5-fold increase in productivity through the use of OLAP [26].

c) Reporting

The fast pace and complexity of the markets has an impact on the planning and controlling processes. They are increasingly in need of optimized reports that allow rapid adjustment of sales activities. Furthermore, there is an increased need for well-founded information on the income and risk situations of institutions as the basis for decisions. In the past, this led to even more diverse, partially redundant and not user-friendly reports, which were very complex and, therefore, difficult to understand. The areas in which reports are generated can be divided into internal and external. Internal reporting includes the view on profitability, sales performance, risk, organization and processes. The external reporting system can be subdivided into supervisory law and accounting [27].

Reporting should increase the quality of information for users. Therefore, the reports must be easily accessible and must contain information for the purpose of the user [29]. It is very important to pay attention to the level of detail [10]. While sales and management only need an overall view of the sales activities, the reports for sales representatives must include both global information, such as target percentage achievement, and detailed job and activity status information [3].

The individual reports must be linked together in the sense of a logical and technical top-down link in order to identify causes for market and process changes and to be able to derive and implement countermeasures faster [10]. The difficulty can be seen in the abundance of past-related data and the future-oriented strategy of deducing targeted actions. Furthermore, organizations, and especially sales, must be future oriented, this is why the importance of qualitative factors increases.

4 Sales Controlling Setup

How could the theoretical concept of sales controlling and BI end up in an overall sales controlling setup including both sides? The concrete interest in the findings of the sales controlling is on the side of the sales organization of a company. The benefit can be found in the creation of a competitive advantage over the competition. The idea is to combine the different theories in a so-called Sales Scorecard.

4.1 Sales Scorecard

The parameters and KPIs of the scorecard should be determined in such a way that they remain meaningful in the long run and can be used to compare performance and comparability with the performance of other business units. The concept claims to put the focus of the review on strategic success factors. This applies to criteria of efficiency as well as effectiveness. Importantly, the created metrics will meet these requirements and allow a company the relative comparability both internally and across the industry. Due to this complex task, the functionality and operation of the Sales Scorecard, which should combine these factors in the future, will be presented below [30].

The principle of the Sales Scorecard is based on the Balanced Score Card from KAPLAN AND NORTON from 1992, which has become a recognized tool for controlling corporate and business area strategies. A groundbreaking factor was the inclusion of four perspectives in the sense of a multi-criteria measurement system, beyond the consideration and overvaluation of financial results, to determine the strategic and operational success of the company's focus and strategy [8]. Originally, employees, processes, customers and finances were selected as perspectives, which, in the form of cause-and-effect relationships, also depend on each other in this order and ultimately all have a direct or indirect impact on the financial perspective [31]. There are special success drivers for each level. In order to achieve this, critical factors, the respective actual value, the critical limit for success, as well as the target values and measures for achieving the target, must be worked out with the responsible person. It is important that monetary and non-monetary metrics balance each other [32]. Only with the help of qualified and motivated employees is it possible to carry out the processes in such a way that they lead to a benefit for the customer and his satisfaction. This in turn has a direct impact on the success of the company [33].

Within the scope of the Sales Scorecard, the peculiarities of the fund business and the focus on sales performance, as well as the development of various products, will be met by modifying the four perspectives. The goals of the measurement of the operative sales performance and the achievement of the long-term strategic corporate success are defined in five perspectives. In addition to the four original perspectives of the BSC, a product view will be introduced because product development plays a major role in comparison of the general market development and the development of competing products on the market. The financial perspective reflects purely monetary success of distribution. The target can be the sales target from annual planning of the management. The process perspective provides information about the sales processes. The employee perspective enables individual performance tracking. On one hand, individual achievement of objectives of an employee can be measured; on the other hand, qualification measures, which are largely responsible for the success of the sales department, are also derived from this perspective. The customer perspective measures development of the customer relationship over the entire lifetime and puts a stronger focus on the gross profit per customer than on the pure sales development [30].

In order not to jeopardize the introduction of the Sales Scorecard, it is incontrovertible that both the management and the users are directly involved in its implementation within a company [31]. Implementation makes sense only if a clear strategy exists. Like the BSC, the Sales Scorecard should not contain more than 15-25 metrics that reflect goals as closely as possible [30]. The objectives must be defined and formulated as specifically as possible and, if achieved, lead to a sustainable competitive advantage. It is important that the goals are feasible and achievable in the available framework conditions [31].

When implementing the Sales Scorecard, it must be ensured that only the critical success factors are mapped when identifying the goals. At best, these are already known internally. They must be formulated precisely, like that different opinions are not possible with regard to the strategic orientation [34]. As with the development of the BSC, in the case of the Sales Scorecard, it is also necessary to link the goals of the strategic success factors via interdependent cause-and-effect relationships, bottom-up, towards the financial perspective. In order to avoid confusing and complex presentation, it is important to show only the most important relationships. Following this, the actual value must be determined for the respective goals [30].

After that, the critical limits have to be determined. This is mathematically possible by quantifying the previously determined qualitatively recorded cause-effect relationships [33]. The alternative is the in-house coordination and the use of benchmarks, such as industry-wide average values. A shortfall of the values is then a warning signal to pay special attention to this area in the subsequent period. To clarify the situation, it is advisable to use a traffic light system to identify reactive or proactive measures for the areas at risk, depending on the indicator. Finally, in addition to the critical limits, the target values have to be determined. It is important to ensure a balance between credibility, accessibility, motivation and ambition. It is recommendable to check and adjust the values on a yearly basis. In the course of the identification of dangers, a distinction can be made between the indicators of early and late detection with medium to long-term lead times for the target values [30]. To enable initiation of the appropriate countermeasures, it is important that the sources of the deviations are displayed and that the development of the indices over time is monitored, since only then can trends be foreseen at an early stage [35].

The Sales Scorecard is a tool with which the central success factors of the sales activity on different levels are monitored. This requires a link with the corporate strategy as this also has a direct impact on the direction of the sales department. However, it is not a tool for holistic corporate management [36]. In order to ensure acceptance and success of the mission, it is, nonetheless, of crucial importance to integrate all stakeholders directly in the development. Especially vertical conflicts can be prevented by optimizing the content. For example, company-wide sales targets can be broken down to sales units, sales channels or even to individual customers. In order to increase acceptance on the level of the users, it is important to involve the works council early in the conception. In order to ensure the acceptance and the success not to endanger and on the other hand the coworkers themselves must be integrated with development of the characteristic numbers, since they work with the tool on a daily basis and can determine important parameters in the best way. In addition, it becomes clear that it is primarily about further optimizing of the sales performance and thus the success of each individual rather than controlling of the activity [34].

The expectation of the sales controlling system ranges from long-term customer orientation in line with the current market changes, to operational implementation and strategic control, including the definition of applicable control variables, the development of early warning indicators and a deviation analysis [10].

4.2 Back End

The DWH architecture is created according to the requirements of the implementing company. It is based on the key figures or the data needed to calculate them. The structure is important for future evaluations and relevant to the smooth migration of historical, current and future data. When building the solution, it makes sense to integrate as many components as possible into the back end from the technical side as changes in the structure are easier to implement there than at the front end [24].

It does make sense to outsource the Back End to a DWH server, which is hosted by an external provider. This leads to cost reduction through improved use of the hardware. Another advantage usually is increase in performance as the server structure of professional providers usually allows access to a variety of data sources. For the files of most different formats, there are extensive possibilities of transformation. The metadata are centrally managed and used throughout the company. This allows all users to access the same information without

requiring synchronization. There is a high reuse in the platform based on user permissions and data descriptions. The data must, therefore, be kept relational and multidimensional so that a parallel read in different aggregations is possible. The centralization of the metadata thus has an impact on all areas of the concept. Subsequently, the historical data must be migrated into the new DWH structure [23].

4.3 Dashboard as Front End

For optimal communication with the internal and external customer, visualization of the information must be done with web-based dashboards [2]. This can maximize the benefits of a BI system and minimize or, at best, eliminate the risks, including time and cost issues. Regardless of the structure of sales, employees in a store, on-site, at the customer‘s home, or on-the-go, according to their roles and rights, can view all the information they need at any time as long as they have an Internet connection. Applications for laptops and smartphones also enhance this service. In addition, DWH data are always up-to-date as changes and entries in the system lead to an immediate update. These framework conditions are the basis for the realization of targeted and cause-appropriate decisions. In a web-based BI system, all the BI functionalities that are required are contained in the form of a total solution. This includes reporting, dashboarding, analytics, self-service, process integration, and upstream data integration. The service starts from a historical perspective and allows you to query historical events and results. Furthermore, the visualization as well as forecasts and developments for the future can be derived from the current business process. Root cause analysis minimizes risk by greatly reducing the time it takes to find irregularities and abnormalities. Each user has an individual dashboard, which in turn consists of predefined elements according to his roles and rights. For the tools, it is important to have a common, consistent operating philosophy that makes the job easier for the user. This creates a high level of acceptance at all hierarchy levels [10].

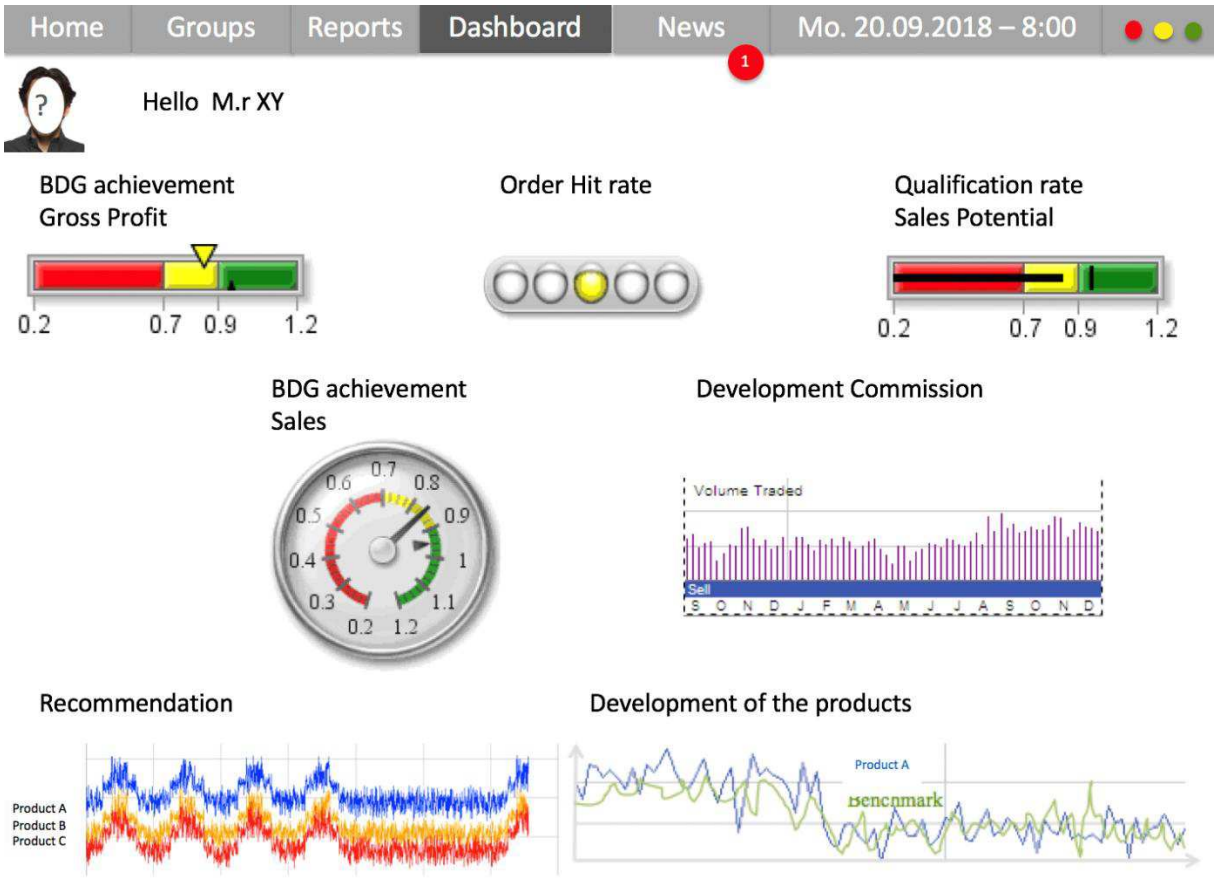

Fig. 2 *Strucutre of the Dashboard*

The data provided will be of benefit to the company only if they are also utilized by the use of tools [37]. In addition to the predefined key figures per level, it is possible to make individual adjustments. The output is in the context of result tables and graphics. They tell you what value each of these metrics currently has, how far away they are from the next critical value, and what size would be the optimal value. They illustrate the current situation. On the central entry page, the individually defined, top strategic targets are presented graphically. The number of parameters should be limited to about five. The user can access the underlying detailed information via a drill-down function from the highest hierarchical level of the various control and business areas. For example, if misconduct of a key figure becomes clear when opening the entry page, the decision maker can go directly to the next lower level by selecting the key figure and receive more detailed information there [38]. Presenting the most important data not only in the tabular form but also graphically provides the opportunity to give a quick overview of the degree of achievement of the tasks to be fulfilled. This results in a high degree of acceptance among the respective process owners as they are supported in their task fulfillment and direct activities can even be initiated from a predefined set of measures [10].

The following is a list of the main advantages of the Dashboard:

Tab. 1 *Added Value through Dashboard*

Performance increase
Constant self-reflection and self-control leads to significant performance improvements and ultimately to a competitive advantage over the competition. Recognition of correlation and situations as well as their connection.
Mobile access
Access anywhere, anytime via laptop and smartphone.
Time saving
Drill-Down-Function, No more explicit use of spreadsheets required.

The front-end of the sales controlling system should be designed in such a way that the individually predefined reports appear on the first menu level and access to ad hoc analysis tools is possible after a few menu levels as far as possible. At the forefront is the information about the product as well as the presentation and reporting of the sales success [39].

5 Conclusions

The markets are more and more saturated. The acquisition of new customers is mostly possible in the context of cut competition. Existing customer relationships must be maintained and expanded through individual service. Products must be tailored to the individual needs of each customer, which requires a target group-specific approach. New trends can be detected and included in the product range. Unprofitable customer relationships are not maintained or even deliberately terminated, while profitable contract contacts are promoted and expanded. Offers or refusals of offers by companies are based on specific life situations. By an even more targeted approach and thanks to comprehensive data analysis, the extent of the data load can be reduced. On the way from the product provider to the solution provider, the implementation of a sales controlling system is only the first step [40].

Especially in case of groups that are able to offer their customers all-in-one solutions, a customer-oriented and effective sales organization leads only through professional CRM systems to process all relevant information. This creates a possibility of customer transfer from one product to another. Both the customer data and the product data are stored centrally in the DWH and employees from different sales departments have access to it, which enables an improved customer approach by co-working across the different product lines [35].

In addition, more and more innovative approaches, such as microgeography, can be integrated. Qualification of home addresses, living environment data, socio-demographic data, lifestyle data and regional and communication data for the definition of retail valuations, post-purchase affinity and consumer focus are delightful approaches towards making more effective use of distribution resources. The task of the IT is integrating the data into the DWH, and building more meaningful analysis results represents a huge challenge for the future. It is important to keep an eye on these issues as the quality of the results given by the analysis tools increases many times as the amount of available information increases [35].

The course of customer discussions can be better controlled by a high degree of up-to-date customer, product and market information. Furthermore, customer satisfaction is enhanced by the increasing quality of advice. Thanks to the improved customer approach, it is possible to significantly reduce process throughput times and reduce process costs. In addition, up- and cross-selling activities will be improved and customer churn will be reduced. The introduced sales controlling system ensures a competitive advantage in the market through its consistency as the entire sales area is geared towards the customer. The software is thus a dynamic uni-que-selling proposition of the company [20]. Through data processing that reflects reality, not only proactive sales management but also early risk identification is possible. This is important because risks in the market are not always and inevitably associated with opportunities. A sales controlling system, therefore, also offers the option of integrating a risk management system [35].

The half-life in IT is relatively low compared to other technologies. What still represents the state of the art today may not be up-to-date tomorrow. In addition, not everything that is technically feasible also makes economic sense. But there is no doubt that the BI approach offers companies a great opportunity to use their resources and potential more effectively and to increase their efficiency. However, individual distinguishing features are in the service from the customer's point of view. It is, therefore, advisable to carry out such a project with a partner who, in addition to the business administration knowledge, has the necessary IT know-how. It is important to understand that support can make a difference to successful implementation of such a project. Industries in which industrialization has already progressed have been aware of this fact for some time. The focus is, therefore, increasingly on product development, customer satisfaction and improved quality in the processes. In order to gain the trust of potential customers, it only helps to face them transparently, to explain them the problem but also to deal with their problems in a very special way. Only then can a solution in the desired quality and to the satisfaction of all be available [8].

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A Graph Mining Perspective on Graphlet-Based Network Similarity

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Abstract: Analysis of networks has emerged in recent years as an important knowledge management tool. Specifically, the social network analysis can positively influence customer behavior prediction, identification of proper groups of shoppers/clients or efficiency of viral advertising. In particular, mining of graphlets (i.e. small induced subgraphs) has become a prominent research topic. Although it originally comes from bioinformatics, it finds considerable applications in social networks, as well. In this paper, we focus on the network similarity problem and related graphlet-based algorithms and corresponding data management processes, respectively. We describe known solutions, draft their possible alternatives and pose several open problems.

Keywords: networks; protein-protein interactions; graphlets; similarity measures.

1 Introduction

The basis of the network science was grounded by A. L. Barabási and his research team approximately 20 years ago. It is a field which primarily deals with a structure and dynamics of real-world networks and its research methods are taken over from statistical physics, combinatorics, computer science and probability theory. The most remarkable applications of the network science were found in electrical engineering, informatics, operations research (e.g. transportation), social science, bioinformatics, security and cyberwarfare. Overlapping of the network science and knowledge management is growing in significance more and more. As an example, one can mention results regarding customer behavior predictability in social networks [13], community detection [14, 19], studying the dynamics of viral marketing [11], etc. Another challenging subject is the graphlets mining problem, which originated in bioinformatics [16]. Therefore, there is a close relationship among the network science, bioinformatics and the knowledge management. Details are discussed in the monograph by I. Jurišica and D. Wigle [10]. A typical example represents an analysis of protein-protein interactions.

In organisms on a subcellular level, major biological processes are provided by biochemical or functional interactions among macromolecules, such as proteins. Specifically, many of the key biological activities (e.g. metabolism, gene expression, immunity, signaling) are mediated through protein interactions [18]. For instance, there are nearly half a million protein interactions in a human body but so far, only a part of them has been investigated in detail [18]. In order to extract valuable knowledge concerning these processes, a network-based abstraction is employed. Corresponding networks are called protein-protein interaction networks, shortly PPI networks. Studying them is currently one of the prominent topics in bioinformatics.

Examination of similarities among PPI networks of the same type or, on the contrary, finding anomalies among them is an appealing task, which has found applications in biomedicine. A

famous algorithmic method for this purpose was invented by N. Pržulj [16, 17]. It is based on frequency analysis of small patterns (called graphlets) occurring in networks. During 15 years of practical usage of Pržulj's method, it proved its efficiency, but several weaknesses were observed, as well. In this paper, we address two early emerged limitations, which are probably the most significant ones. Although there was a lot of effort dedicated to eliminating them, the discussion on this theme is still going on.

- The first limitation comes from the fact that for real-world PPI networks with thousands of nodes, algorithmic counting of graphlet frequencies requires high demand on computational resources. Fortunately, due to recent highly nontrivial graph-theoretical results (see e.g. [7]), graphlets counting algorithms were improved considerably. Known software programs are e.g. FANMOD, GraphCrunch, RAGE (surveyed in [7]). Currently, the most powerful one seems to be ORCA – the Orbit Counting Algorithm, which was developed by T. Hočevar [7]. Although the ORCA performs very well using even low-cost hardware, research and development of other new methods and software programmes is permanently in progress [3].
- The second limitation regards the statistical methods measuring networks similarity. The original idea considered visual comparison of two graphlet frequency distributions (each for a different network) but was enriched by the usage of so called *relative graphlet frequency distance* [16]. Unfortunately, it seems that the relative graphlet frequency distance is very context-sensitive. Moreover, T. Hočevar said [8]: "*So far I haven't seen a fixed threshold used for deciding whether two networks are similar or not*". A new systematic measure was defined in [17], which is *graphlet degree distribution agreement*, shortly GDD agreement. Such a measure is used frequently and seems to be better suited for measuring the networks similarity than the former one. Nevertheless, there exists space for further research in this area.

In this paper, we turn our attention towards the network similarity comparison process using the ORCA software. Moreover, in Section 3, we introduce two quantities which are originated in statistical divergence theory. They are the total variation distance and the Hellinger distance, respectively. These quantities are used as network similarity measures in our experimental study (Section 4). In order to conduct experimental simulations, we describe the ORCA-based workflow, which is utilized in the dataset processing. In Section 4, we argue why the usage of the new measures is reasonable. We discuss their advantages and weaknesses and suggest the directions for future research.

2 PPI Networks and Graphlets in Bioinfomatics

2.1 Graph Theory

Roughly speaking, a network is a collection of nodes with connections among them. Formally, a *graph* (i.e. an equivalent notion to the network) is a pair G=(V, E), where the set V represents a collection of *vertices* and the set E comprises *edges*. In reality, vertices represent nodes of a given network and links (or connetions) are modelled by edges. We assume that each edge connects exactly two vertices as its endpoints. Moreover, links (edges) are without directions and they do not form "self-loops". Between ech pair of vetices are no multiple edges. These assumptions match all types of networks which we are dealing with in this paper. Given a graph G=(V, E), a *subgraph* of G is a graph H=(W, F) such that $W \subseteq V$ and $F \subseteq E$, i.e. both W

and F are subsets of V and E, respectively. Induced subgraphs are instances of subgraphs which are often used in bioinformatics. Thier definition is as follows. Let G=(V, E) be a graph and let $W \subseteq V$. An *induced subgraph* of G with respect to W is the graph whose vertex set is W and whose edge set consits of all such edges of E that have both endpoints in W. A *connected graph* is a graph in which all pairs of distinct vertices are connected by a path, i.e. each vertex is reachable from another one. An equivalence relation between two graphs is defined via isomorphis. Two graphs $G_1=(V_1, E_1)$, $G_2=(V_2, E_2)$ are said to be *equivalent* if there is a one-to-one mapping $\sigma: V_1 \rightarrow V_2$, called *isomorphism*, such that for all pairs $u, v \in V_1$ it holds $\{u, v\} \in E_1$ if and only if $\{\sigma(u), \sigma(v)\} \in E_2$. An isomorphism of a graph G onto itself (i.e. $\sigma: G \rightarrow G$) is said to be *automorphism*. Given a graph G, let Aut(G) denote a group of all automorphisms $\sigma: G \rightarrow G$. Let $v \in V(G)$ be a vertex, an *orbit* of v is a set of all images $u=\sigma(v)$ for all automorphisms $\sigma \in Aut(G)$. Examples of orbits are described at the end of this subsection.

Let G = (V,E) be a graph, a *graphlet* is a connected induced subgraph of G with at most *5* vetices. Two graphlets are the same if there exists an isomorphism such that it maps one graphlet to the other one. (Two different occurrences of the same graphlet are usually referred to as its copies.) Graphlets play a seminal role in bioinformatics [10, 16, 17]. There are totally *30* graphlets with *2*, *3*, *4* and *5* vertices. Ordering and labeling of graphlets with at most *4* vetices is shown in **Fig. 1**. All graphlets are denoted by $g_1, g_2, ..., g_{30}$. Note that e.g. g_7 has three different orbits (two vertices with degree *2* belong to the same orbit, the central vertex forms another single-element orbit and the single vertex with degree *1* represents the third orbit) and all vertices of g_3 belong to the same *3*-element orbit (similarly, g_6 has the only one *4*-element orbit). Moreover, g_2, g_4, g_5 and g_8 have equally two orbits.

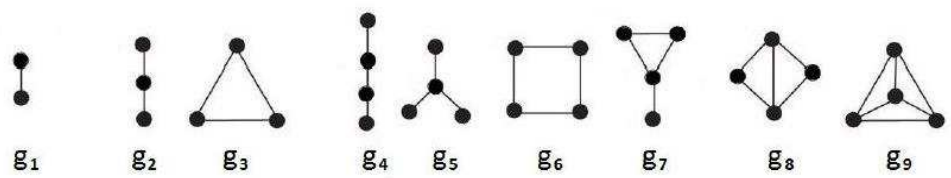

Fig. 1 *All graphlets with at most 4 vertices.*

2.2 Proteomics and Networks

Proteins are macromolecules of aminoacids which are essential components in all organisms. They do not act in isolation but they interact among each other [6]. Protein-protein interactions (PPI) are neither static nor stable;; instead, they are dynamic. Some of them are quick but others are slow. Clearly, in PPI networks, vertices represent proteins and edges interactions. From a general point of view, PPI networks represent a type of biological networks which are commonly called interactome networks [9]. Their structure and behavior is very complex, e.g. PPI networks of mammals have approximately ten thousand proteins and hundreds of thousands interactions. An example of the PPI network Caenorhabditis Elegans is shown in **Fig. 2**. It consists of *2903* proteins and *4631* interactions.

Detection of protein-protein interactions is also highly nontrivial and it encompasses various methods (indirect, in vivo, in vitro, etc.) [6]. PPI networks share some common properties. Specifically, empirical evidence that the structure of PPI networks is close to geometric random graphs was published in [16]. To obtain this result, the graphlet-based similarity method was

adopted. This and further knowledge concerning structure of PPI networks provides a basis which may be essentially helpful in drug design or in related biomedical applications [1, 5, 6].

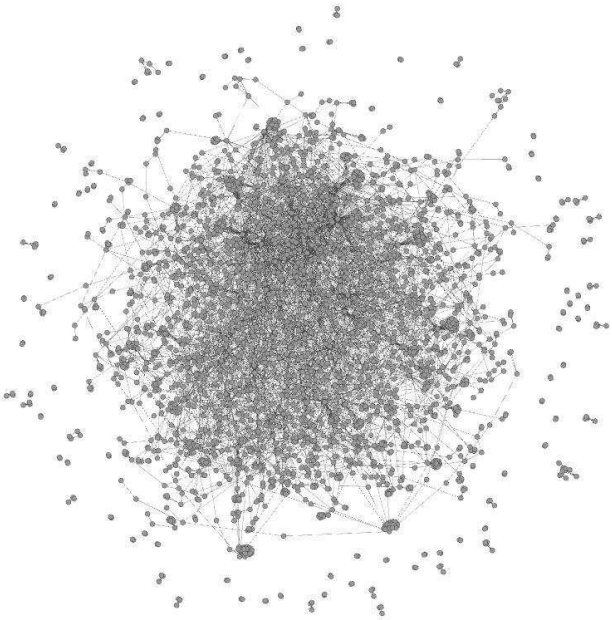

Fig. 2 *PPI network of the roundworm Caenorhabditis Elegans (2903 proteins and 4631 interactions) drawn by the freeware Gephi [2]. The dataset was downloaded from [15].*

3 Networks Similarity Measures

There is a wide variety of approaches to comparing networks or graphs. These approaches range from exact and very strict (graph isomorphism) through various kinds of equivalences (automorphic, regular, etc.) to statistical comparison methods. The latter ones are based on the so-called structural similarity, i.e. an approach in which graphlets occurrence[1] in both compared networks is evaluated by various statistical measures [16, 17]. A selection of these measures (or quantities) is listed in the following subsections.

3.1 Relative Graphlet Frequency Distance

Let G=(V, E) be a graph. For i=1,…, 30, let $N_i(G)$ denote the number of graphlets g_i in a graph G. Let T(G) denote the total number of graphlets in G, i.e.

$$T(G) = \sum_{i=1}^{30} N_i(G) \tag{1}$$

and let the *negative logarithmic relative frequency* of a graphlet g_i be as follows

[1] Or alternatively, subgraphs occurrence

$$F_i(G) = -\log\left(\frac{N_i(G)}{T(G)}\right). \tag{2}$$

Given two graphs G and H, the *relative graphlet frequency distance* (or *distance for brevity*) is defined as follows.

$$D(G,H) = \sum_{i=1}^{30} |F_i(G) - F_i(H)|\,. \tag{3}$$

Recall that the graphlet g_1 (i.e. a single edge) is a trivial case. Therefore, it occasionally suffices to set i=2 in all lower bounds of summations in the above formulas.

Two major limitations of the relative graphlet frequency distance are as follows.

1. If $N_i(G)$ is zero then the corresponding value $F_i(G)$ is undefined in equation (2). It causes that all undefined values of both $F_i(G)$ and $F_i(H)$ had to be omitted in equation (3). Such a fact may influence negatively the accuracy of the relative graphlet frequency distance *D(G, H)*.
2. It is difficult to determine bounds on *D(G, H)* generally. It follows that for a computed value of *D(G, H)*, it is questionable whether graphs in the question are "very similar", "slightly similar" or "not similar". In other words, there is no widely accepted threshold on relative graphlet frequency distance which could be used for deciding whether graphs G and H are similar or not.

The relative graphlet frequency distance was introduced in [16]; however, due to the above reasons, other similarity measures were defined in later works of N. Pržulj at al. They are e.g. graphlet degree distribution agreement (shortly GDD agreement), graphlet degree vectors and signature similarity (see [17] for the details). Due to the space limitations, these quantities are not mentioned in this paper. Instead, we suggest two quantities which are described bellow. Their origin comes from the theory of statistical divergence.

3.2 Total Variation Distance

According to the previous results, the problem of similarity between two networks can be formulated, in essence, as a problem of comparison for two statistical distributions. Such a problem is usually solvable by the statistical methods, namely by statistical divergence. Only the discrete case is useful for our purpose. For two discrete distributions $P = (p_i)_{i=1}^n$ and $Q = (q_i)_{i=1}^n$, the statistical divergence is a "cumulative" quantity which is proportional to the sum of distances between all pairs (p_i, q_i) for i=1, ..., n. In this paper, we use two discrete cases of such a quantity: the total variation distance and Hellinger distance. In order to measure the graph similarity, both are modified accordingly.

Let G, H be two graphs. Recall that $N_i(G)$ and $N_i(H)$ are the numbers of graphlets g_i in a graph G (or in H, respectively) for i=1, …., 30. Recall also that T(G), i.e. the total number of graphlets in G, is expressed by eq. (1) and the same expression holds for T(H) as well. The *total variation distance of graphs* G and H is defined as follows

$$\delta(G,H) = \frac{1}{2}\sum_{i=1}^{30}\left|\frac{N_i(G)}{T(G)} - \frac{N_i(H)}{T(H)}\right|. \quad (4)$$

3.3 Hellinger Distance

Although it is based on the same idea, such a measure is more complex than the previous one. All symbols have the same meaning as above. The *Hellinger distance of graphs* G and H is defined as follows:

$$HD(G,H) = \left[\frac{1}{2}\sum_{i=1}^{30}\left(\sqrt{N_i(G)/T(G)} - \sqrt{N_i(H)/T(H)}\right)^2\right]^{1/2}. \quad (1)$$

It is easy to see that if two graphs are similar, then the value of HD is close to zero (and nonnegative); otherwise it is approaching to one. Therefore, such a measure provides a sufficient tool whenever one needs to distinguish "degree of similarity" between two graphs. Moreover, a deeper insight can confirm that both major limitations of the relative graphlet frequency distance are eliminated in the Hellinger distance.

Within the rest of this paper, the relative graphlet frequency distance, the total variation distance and Hellinger distance are commonly called as *distances*.

4 A Case Study

In this section, we demonstrate the graphlet-based network comparison method using the ORCA software tool [7]. However, the decision regarding the ORCA utilization caused some specific problems which had to be solved. Namely, due to the fact that ORCA requires a strict format of input data (and additionally, the output is a large matrix of integers), it was necessary to design a new workflow (i.e. the knowledge dicovery process) suitable for our purpose. The details are explained below.

4.1 Workflow and Datasets under Study

Our workflow is derived from the generally accepted knowledge discovery process described in [10], pp. 3-6. It represents the transformation of data to knowledge and it is suitable for various domains, including biological knowledge discovery applications, as well. It usually involves 5 steps: selection, preprocessing, transformation, data mining and interpretation. Our workflow is its modification and consists of the following steps.

1. Data preprocessing. The input format of files processed by ORCA should satisfy two necessary requirements: there are no multiple edge occurrences, and labels of all vertices are ordered consecutively, using values from 0 to n-1. To do so, we use two short programs (in Matlab and Python, respectively) which were designed in [12]. These programs are able to do the transformation of input data as it is desirable.
2. The graphlet frequency counting using ORCA. This part represents the first step of the knowledge discovery process. The ORCA was downloaded from URL: http://www.biolab.si/supp/orca/, section "*Download*"; the user's manual can be found on the same web page and the implementation details were published in [7]. For a given graph with n vertices, the output from ORCA is the file which contains

a matrix of n×73 integers. Its value $a_{i,j}$ is the frequency of *i*th vertex in the *j*th orbit, where i=0, …, n-1 and j=0, …, 72 (see [7] for details).

3. Statistical analysis. We used the MS Excel for this purpose. The output file was imported to MS Excel (in "csv"-format) and analyzed according to the measures described in Sect. 3.
4. Interpretation. Four different criteria of similarity comparison were used (see Sect. 3). Such an approach enables to compare their abilities (or weaknesses) and provides a basis for new findings, as well.

The above steps were used to evaluate the similarity of three sample networks which were generated artificially. Datasets were downloaded from http://www.biolab.si/supp/orca/, section "*Download*". They represent three different networks, whose elementary properties are listed in **Tab. 1**. The last column of the table (The Model) refers to the graph model which was used to generate the corresponding network. Visual representation of the networks was drawn by the freeware Gephi [2], see **Fig. 3**.

Tab. 1 *Properties of 3 sample networks.*

Denotation	Number of vertices	Number of edges	The Model
ba_1k_2k.in	1000	1996	Barabási-Albert
ba_1k_4k.in	1000	3984	Barabási-Albert
geo_1k_4k.in	1000	4000	Geometric random graphs

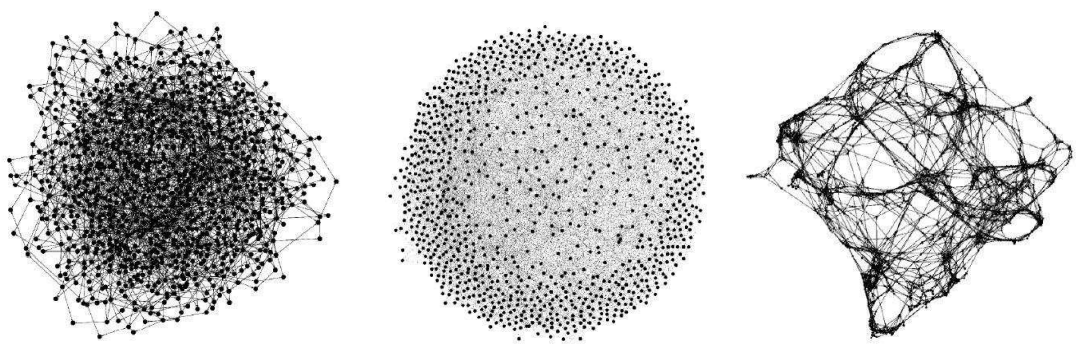

Fig. 3 *The networks ba_1k_2k, ba_1k_4k and geo_1k_4k (from the left to right) drawn by the freeware Gephi [2].*

4.2 Results and Intrepretation

The similarity of above networks was evaluated by four different ways. The first one is based on a visual comparison of graphlet frequencies, three others are based on similarity measures introduced in Sec. 3, i.e. distances.

Recall that each output generated by ORCA comprises of a n×73 matrix ($a_{i,j}$) with vertex-orbit frequencies. In order to compute $N_i(G)$, i.e. the number of graphlets g_i (for i=1,…, 30) in a given graph G, we summed elements of the matrix ($a_{i,j}$) in its *j*th column iff the *j*th orbit corresponds to the graphlet g_i. Such a sum, divided by the number of occurrences of *j*th orbit in g_i, equals to $N_i(G)$. For each nonzero value $N_i(G)$, the negative logarithmic relative frequency

of a graphlet g_i (i.e. $F_i(G)$) was computed according to equation (2). If $N_i(G)=0$ then $F_i(G)$ is undefined. The frequency graphs of values $F_i(G)$ for all three networks are shown in **Fig. 4**. The values in all cases when $N_i(G)=0$, are omitted. One can see that frequencies of the pair *ba_1k_2k* and *ba_1k_4k* are more resembling than of other pairs.

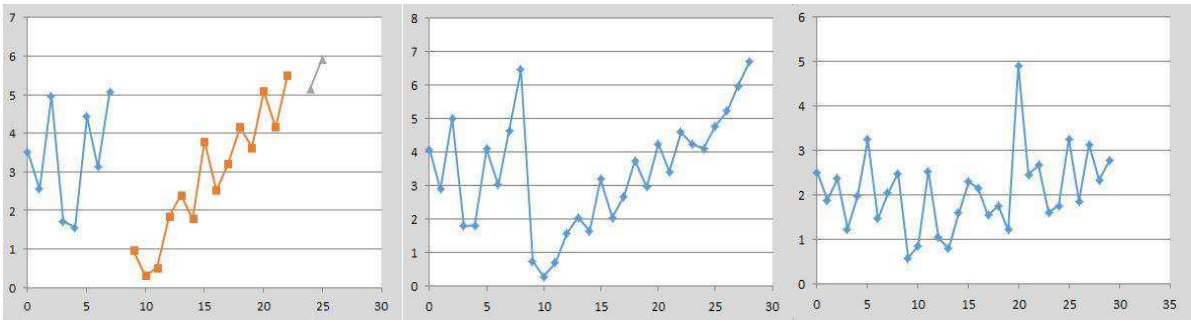

Fig. 4 *Frequencies of $F_i(G)$ for three networks (ba_1k_2k on the left, ba_1k_4k in the middle and geo_1k_4k on the right). Numbers of graphlets (1,..., 30) are in x-axis, values of $F_i(G)$ are in y-axis.*

According to equation (3), the relative graphlet frequency distance *D* was computed for each pair of networks. In corresponding summations, all indices i, for which $|F_i(G)-F_i(H)|$ are undefined, are omitted. The computed values of the relative graphlet frequency distance are listed in the second column of **Tab. 2**. The numbers of all defined values which contributed to the resulting sum (see eq. (3)) are in parentheses in the same column. Their numbers are: 24, 24 and 29, respectively. (Undefined values of $|F_i(G)-F_i(H)|$ are not included.) Values of the total variation distance δ and the Hellinger distance *DH* were computed by equations (4) and (5), respectively. The number of contributed summands were always 30 in both of these distances. The resulting values are listed in the 3rd and the 4th column of **Tab. 2**, respectively.

Tab. 2 *Values of three similarity measures for all pairs of compared networks. Numbers of summands are in parentheses for the relative graphlet frequency distance. (As regards the other two measures, the numbers of summands are always 30.)*

Compared networks	**Relative graphlet freq. distance** ***D***	**Total variation distance** $\boldsymbol{\delta}$	**Hellinger distance** ***HD***
ba_1k_2k *vs.* ba_1k_4k	10.67 (24)	0.1265	0.1211
ba_1k_2k *vs.* geo_1k_4k	35.69 (24)	0.6777	0.6166
ba_1k_4k *vs.* geo_1k_4k	45.87 (29)	0.5814	0.5444

The visual comparison of networks's frequency distributions (**Fig. 4**) is only an auxiliary criterion. More significant knowledge can be obtained by the usage of distances (see **Tab. 2**). In general, if a distance is smaller, then the similarity of compared networks is more expressive (and vice versa). As it is shown in **Tab. 2**, the networks *ba_1k_2k*, *ba_1k_4k* are the most similar out of all pairs. On the other hand, the distances of pairs in which the *geo_1k_4k* is occurred are essentially greater. Note that values of both distances δ and *HD* are the greatest for the pair (*ba_1k_2k*, *geo_1k_4k*), which does not correspond to the value of the distance *D*.

Therefore, the accurate judgment can not be formulated. It is only possible to say that the similarity of all pairs of networks in which *geo_1k_4k* occurs is not significant.

4.3 Discussion

Despite the small number of samples in our dataset, the obtained results are beneficial. Both major weaknesses of the relative graphlet frequency distance have been confirmed in our study. These weaknesses, however, do not occur in the total variation distance and the Hellinger distance.

The similarity of the above networks was evaluated in four different ways. Although they always lead to a similar conclusion, we suggest to prefer the total variation distance and the Hellinger distance, respectively. The total variation distance is, in a sense, a modification of the relative graphlet frequency distance but the Hellinger distance represents a more sophisticated quantity. The authors believe that due to its suitable properties, the Hellinger distance could represent a reference similarity measure. However, such an argument needs to be verified in further experimental work.

5 Conclusions

The paper is focused on selected aspects of the graphlet-based similarity analysis of networks. We address the problem of an appropriate networks similarity measure, which has been already discussed in [17]. Our contribution is based on computer simulations. In order to conduct them, the ORCA-based workflow was described and used. Comparing three network similarity measures leads to the observation that we recommend the Hellinger distance as the most suitable one.

In order to verify our findings, it would be desirable to enlarge samples dataset. However, additional experimental studies require an improvement of the ORCA-based workflow. Due to this reason, the authors are currently working on a new software which would perform the processing of statistical analysis more efficiently. Another future research could be aimed at new network similarity measures design.

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Knowledge Management within Culture-Based Urban Regeneration Projects in Slovakia

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Abstract: The paper deals with the implementation of knowledge management within culture-based urban regeneration projects in Slovakia. Studies have shown that places with high concentration of cultural organizations and/or access to arts activities are more likely to undergo economic revitalization. The concept of culture-based urban regeneration describes a schema where culture is purposely employed as a vehicle for economic growth, cultural tourism development, local community enhancement and social inclusion leading to an overall urban and social revitalization. The aim of the study is to demonstrate how a creative and innovative approach enables overcoming barriers and obstacles in the revitalization of urban industrial and cultural heritage based on "bottom-up" initiatives and knowledge sharing.

Keywords: Knowledge management, culture, urban regeneration, case study

JEL Classification: R1, Z1

1 Introduction

Knowledge is considered to be the main source of economic and social progress in a nowadays society. It generates innovation, which enhances the creation of new socio-economic values and further development (Tajtáková, 2012). According to Besley (2010), the knowledge is now the dominant feature of the social transformations associated with globalization as the world-wide integration of economic activity. The key components of the knowledge economy include greater reliance on intellectual capabilities than on physical inputs or natural resources (Powell and Snellman, 2004).

However, since there is a strong primary focus on technologies within the knowledge economy, we may question the role of humanities in general, and the role of culture in particular, in the knowledge era. On one hand, there is criticism of the techno-economic orientation of the current knowledge society neglecting many humanities and creative art disciplines (Bullen et al., 2004, p. 4). On the other hand, Florida (2002) advocates knowledge networks and highly skilled labor forces in creative industries as key factors driving economic and urban growth and highlights the birth of a new parallel socio-economic phenomenon – the "creative economy".

The creative economy is based on creative industries, such as media, culture, arts, design, fashion, architecture, IT, marketing and research. It recognizes the creative labor as a vital force for the future development. Kloudová (2010, p. 117-118) highlights the creative economy as a new trend arising from the platform of completed industrialization, high technologies, advanced schooling and information gains in well-developed economies. According to Florida (2002), the sector of creative economy generates increasingly higher

revenue, involves a higher number of employees, leading to the emergence of a new labor class, a so-called creative class.

Yet, there is one thing in common for both knowledge and creative economy – the crucial role attributed to the innovation in economic and social development. In the first case, the innovation is understood as the transformative mode of knowledge transmission that could equally well be experienced in, or exemplified by, any field (Edelstein, 2010, p. 17). In the second case, Nivin and Plettner (2009, p. 33) argue that a creative environment drives innovation, which drives economic development. In addition, according to Stam et al. (2008, p. 119), creativity may also be particularly useful in knowledge-based economies, where creativity is required to convert scientific and technological knowledge into market value.

This paper presents findings based on five case studies analyzing culture-based urban regeneration projects in Slovakia. Our aim is to demonstrate how a creative and innovative approach enables overcoming barriers and obstacles in the revitalization of urban industrial and cultural heritage based on "bottom-up" initiatives and the knowledge creating-sharing cycle.

2 Culture-based Urban Regeneration and Knowledge Management

Studies have shown that places with high concentration of cultural organizations and/or access to arts activities are more likely to undergo economic revitalization and to overcome barriers relating to a class and ethnicity (Stern, 2000). It has been argued that the more concerns on culture/creative industry and cultural tourism, the more concrete interactions between culture, economy and development occur (Shang-Ying Chen, 2007).

The concept of *culture-based urban regeneration* or *culture-led urban regeneration* describes a schema where culture is deliberately employed as a vehicle for economic growth, cultural tourism development, local community enhancement and social inclusion, leading to overall urban and social revitalization. The perception of culture-based urban regeneration is basically twofold: On one hand, it is regarded as a means of improving the quality of life for local residents (e.g. Turok 1992; Jayne, 2004; Evans, 2005; Sagan and Grabkowska, 2012). On the other hand, it is seen as a way of enhancing the economic status and competitive position of cities (e.g. Florida, 2004; Temelova 2007; Pratt, 2008). However, Miles and Paddison (2005) argue that achieving social cohesion and economic competitiveness have been increasingly considered as parallel and interrelated goals.

Numerous successful stories of culture-based urban regeneration projects – including cities like Glasgow, Liverpool, Manchester, Bilbao, Rotterdam, Dusseldorf, Cleveland, Pittsburgh, etc. – demonstrate positive synergic effects between culture and economics within urban development. However, as pointed out by Pastak and Kährik (2016, p. 967), while in Western countries urban renewal has been on the political agenda for many decades, in Central and Eastern Europe, revitalization projects have been emerging only since the 2000s.

Nevertheless, the experience from Western Europe suggests that well-designed cultural projects may turn the image of grey post-industrial places with nothing to offer into new cultural venues attracting tourists and private investors and encouraging young people and entrepreneurs to stay or to return to create their own businesses. In addition, Pastak and Kährik (2016, p. 965) highlight a substantial effect of the culture-based urban regeneration on improving the physical quality of public spaces by creating arenas for social interaction and educational activities.

Borg and Russo (2005, p. 28-29) identified three main "impact areas" of culture on urban development, which they further integrated into the *Culture-Oriented Economic Development* (COED) model for the city (Figure 1). The model includes:

- Direct economic impact of employment and value generation in the cultural industries and indirect expenditure effects related to cultural professions.
- Induced effects of cultural activities on the quality of a place encompassing the tourist attractiveness, which leverages additional visitor expenditure, but also the location amenities for companies.
- "Creative inputs" accruing to the local networks of production (both to products and to processes of production or organizational models). These are "cultivated" in a lively and stimulating cultural environment, where a creative class develops, attracted by tolerance, openness, educational and social opportunities.

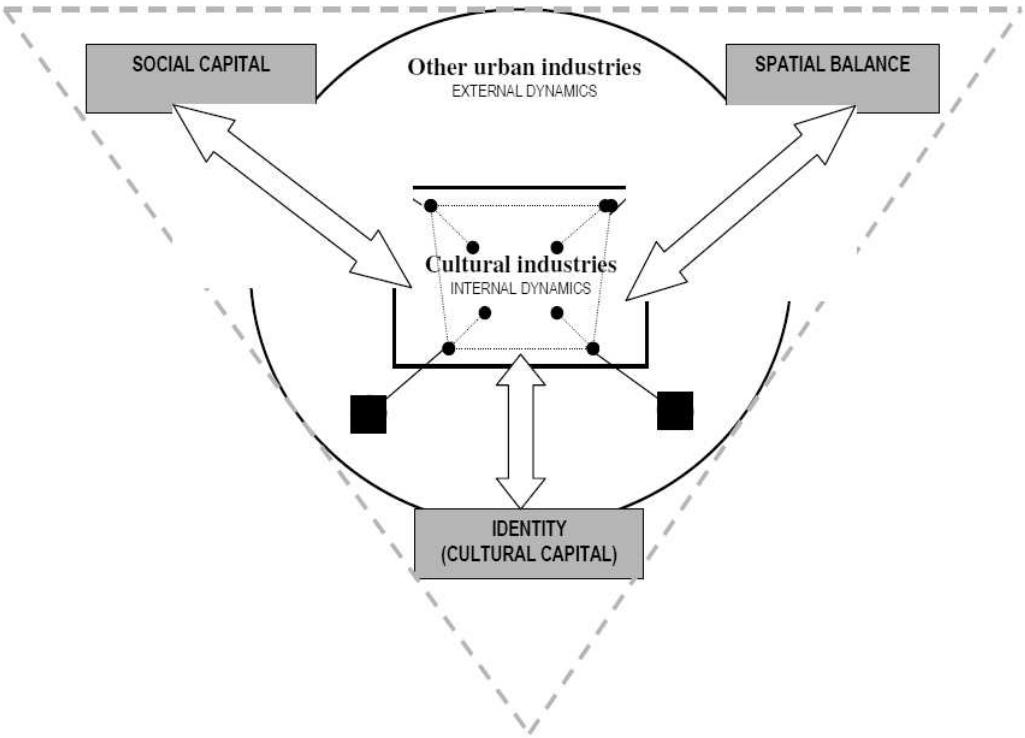

Fig. 1 *Culture-Oriented Economic Development (COED) model for the city*
Source: Borg and Russo, 2005, p. 32

The authors suggest to utilize the COED model as a reference framework to evaluate the role and effects of culture on the economic development of cities considering the "economic strength" of the cultural cluster, the "fertilization" of the local economic milieu by culture and creativity, and the "sustainability" of the process of economic growth determined by inclusive cultural activities and projects, their accessibility and spatial distribution in the urban area (Borg and Russo, 2005, p. 32-33).

We assume that the crucial factor determining the success of COED model within the context of culture-based urban development and the factor connecting all three areas is the effective knowledge management. Yet, only limited attention (e.g. Porumb and Ivanova,

2014; Olejárová, 2014, 2017) has been paid to the implementation of knowledge management into culture-based urban regeneration projects. The authors believe that the expected economic effects, community inclusion and cultural sustainability within urban development can only be achieved in the repeated cycles of knowledge creation, externalization, sharing, and critical assessment.

3 Methodology

3.1 In-depth Interviews

The focus of our study was on a qualitative research method, mainly on personal interviews carried out with the leading personalities of selected non-profit organizations. In order to search for similarities and/or differences identifying successful projects, it was crucial to use a set of identical questions with observed categories. Our intention was to analyze, compare and thus to identify successful practice based on knowledge tools and experience sharing. Moreover, the purpose of the used method was to obtain opinions of creative and innovative actors, recognize their know-how and collect sufficient amount of data for creating a learning model. Our interest was also concentrated on indicating internal and external factors, opportunities and barriers. The existence of creative and innovative elements distinguishing the observed leaders and their teams from the others and contributing to obvious success was a part of our research as well.

3.2 The Studied Sample

The studied subjects were selected projects the revitalization of which either has been accomplished or is still in a creative process.

Tab. 1 *The Studied Sample*

	Subject	**City**	**Original vs. Present Purpose**	**Reconstruction date**
1.	KC Dunaj	Bratislava	Department Store Independent Cultural Center	summer 2010
2.	Stará tržnica	Bratislava	Market Hall Cultural Center, Market Hall	fall 2013-2015, ongoing
3.	Stanica Záriečie	Žilina	Local Train Station Independent Cultural Center	spring 2003, ongoing
4.	Synagóga	Žilina	Jewish Synagogue Cultural & Community Centre	spring 2011, ongoing
5.	IC Culture Train	Košice	Suburb Community Centre Independent Cultural Centre	2005-2008
6.	Tabačka Kulturfabrik	Košice	Tobacco Factory Independent Cultural Centre & Creative Incubator	2009, ongoing

Source: Own processing

The observed subjects are located in three different regions of Slovakia: Kultúrne centrum (Center of Culture) Dunaj - Bratislava, Stará tržnica (Market City Hall) – Bratislava, Stanica (Local Train Station) Žilina-Záriečie – Žilina, Synagóga (New Synagogue) – Žilina,

IC Culture Train – Vyšné Opátske and Tabačka (Tobacco Factory) Kulturfabrik – Košice. The objects of our research were also three selected leading managers - founders/co-founders of civic organizations focusing on regeneration urban processes, who are creative and innovative knowledge workers representing so called "bottom-up" activities.

3.3 Case Studies

Using and evaluating significant amounts of data from different resources required systematic processing. Therefore, in the context of the case studies, it was necessary to define identical categories for all six studied subjects. The data we used in our research came from available printed and electronic resources, notes and audio-visual records from the events we visited as well as audio records from personal interviews with the observed leaders in the studied venues, while respecting all ethical principles.

Tab. 2 *The Structure of Case Studies*

	Studied categories	**Focus of Study**
1.	Actors & Activities	Presentation of the founders – leaders, their teams and realized activities
2.	History &Revitalization of the building	Identification of the original purpose of the buildings, their location and revitalization processes
3.	Purpose of the Venue	Transformation of the building purpose and its future usage after reconstruction
4.	Program Offer	Observation of the composition and frequency of the offered events in the revitalized venues
5.	Target Group(s)	Identification of the target group(s) in accordance with a program offer
6.	Responsible Team	Public presentation of the studied organizations, their leaders and team members (names, responsibilities)
7.	Financing Structure of the Project	Identification of the used financial and other resources with the focus on the multi-financing model
8.	Input of Stakeholders	Evaluation of opinions and reactions of different groups of stakeholders to the existence of revitalized urban venues

Source: Own processing

As mentioned before, a part of our research was focused on case studies, the selection of which was carefully carried out and specific conditions were taken into consideration. Our six case studies observed urban regenerations in three main Slovak regions and their capital cities under the leaders and teams of non-profit organizations. A large amount of information and demanding conversion processes required a complex and systematic approach in data selection, comparison and analysis of observed phenomena. Only the integrated framework and unified criteria could lead to designing the intended knowledge management model as an effective learning tool.

The outcomes were analyzed by using descriptions and comparisons of existing approaches and preferences of the research phenomena, including the internal and external environment of non-profit cultural organizations. Moreover, the SWOT analysis of innovative and creative approaches focusing on observed revitalization urban processes

enabled us to highlight effective tools and methods in order to formulate criteria and conclusions.

4 Results

The purpose of the analysis of the studied categories was the identification of similar and/or different characteristics which dominate particular subjects of our studied sample. The observed organizations in a frame of the selected categories show almost identical characteristics, the reason of which was prior effort to create centers of independent culture satisfying various communities. Moreover, such centers are not only expected to provide the visitors with multi-genres events and offer additional gastro services but also preserve the historical value of the regenerated buildings.

Another common sign of the studied organizations and the way they manage their venues is a transparent financing system guaranteed and supported by several resources, which enables sustainability of the projects. The permanent effort to monitor visitors feedback, together with open effective communication, productive cooperation with municipalities and the business sector, and following ethical and moral principles help fulfill the original visions of revitalization. Last but not least, it is necessary to mention the fact that the studied organizations are active members of several local and foreign platforms to share knowledge and experience related to similar regeneration urban projects, e.g. ANTENA, T.E.H., etc.

It is necessary to emphasize that out of eight studied categories in our case studies, we have selected those which contain knowledge attributes. The following Table 3 represents the summary of the outputs gained after the comparison of urban regeneration of the observed subjects.

Tab. 3 *Comparison and Summary of the Studied Categories*

	Studied categories	**Comparison and Summary**
1.	Actors & activities	In all the studied projects, there are creative and innovative leaders possessing former experience in the non-profit cultural sector. Together with the team members, they share knowledge in organizing and managing reconstruction, financing, dramaturgy and communication.
2.	History & building revitalization	A common sign of all buildings is their originally different purpose and historical value. After the reconstruction and conversion, they serve as cultural community centers.
3.	Building scope	Within the research project, there is a similarity in building conversion towards community cultural centers, independent culture, social events, markets, and creative industries as hubs or labs.
4.	Program scope	All objects possess multi-genre dramaturgy, regular markets, creative and innovative workshops, charity events, various services as shops, bars, and cafés.
5.	Target group(s)	Broad age and interest spectrum, social categories, locals and visitors, representatives of all sectors.
6.	Team	Creative, innovative and interdisciplinary individuals, educated professionals with experience and skills. They work in organizations with strong culture and vision and use conceptual and system thinking, leading to effectiveness and sustainability.
7.	Project financing	Multi-source financing focusing on sustainability and

		transparency.
8.	Stakeholders' reaction	Declared continual support, long-term interest, best practice status, awards for development, local and international network membership, effective communication, transparency and sustainability.

Source: Own processing

In spite of the fact that the revitalized venues are located in different cities and regions of Slovakia (considering possible demographic and economic deviations), the summarized outcomes indicate prevailing compliance visible in all the studied subjects. The period of a detailed analysis of the selected categories was followed by the phase of identification of the characteristics typical for our studied subjects - centers of independent urban culture. Through the comparison and the consecutive summary of the gained outcomes, it was possible to define the level of similarities and/or differences within our studied subjects.

The presented regenerated urban projects in the Table 3 are a part of a complex and conceptual framework, which indicates creative and innovative management. The observed leaders with their teams demonstrated the ability to learn and share valuable knowledge and experience coming not only from their previous projects but also from exploiting the skills of their Slovak or foreign peers. Both the reconstruction itself and the entire management of the revitalized buildings, including tailored program offers, effective communication and collaboration with stakeholders and transparent financing, deserve to be defined as a "success story". As emphasized by Olejárová (2017), such an outstanding effort of presented urban transformations including effective learning processes and management of knowledge caught the attention of the public and experts and resulted in receiving several Slovak and foreign awards.

The phase of collecting data was followed by the further stage of analyzing and comparing the studied categories in the context of selected subjects, while similar and different characteristics were identified. The elaborated set of case studies provided us with valuable outputs, which led us to the conclusion that the studied organizations indicated almost identical characteristics in the observed categories. Their intention was to convert dilapidated buildings into vibrant centers of culture offering a rich program suitable for various communities: not only for the young but also for families and seniors, creative artists and students, as well as for tourists. Olejárová (2017) highlights that such elements as open communication with stakeholders and demanding the feedback, insisting on transparent financing methods and sustainability were common procedures of innovative and creative management.

5 Knowledge Management Model

The base for our proposed knowledge management model is the SECI model. Our intention was to create a scheme which comprises the most decisive factors for an effective knowledge management cycle encompassing the knowledge creation, externalization, sharing, and critical assessment. It was also vital that it emphasizes the need of assessing all consecutive stages of knowledge conversion in order to achieve the desired goal: the efficient and effective knowledge management and communication among the team leaders, their teams and stakeholders. In other words, the purpose was to demonstrate how to learn and benefit from best practices and how to coordinate participative management of culture-based urban regeneration projects based on common effort coming from the non-for-profit sector, government, businesses, media, target groups and volunteers.

5.1 Characteristics of the Model Elements

In the following part of the paper we intend to briefly mention the particular elements of our suggested model, in which *a revitalized object,* together with *a knowledge database,* represent two poles of the model, which interfere with presented elements of the model, specifically within repeated knowledge transfers as well as identification of internal and external factors, challenges and barriers, the aim of which is to gain effectivity and sustainability of the regenerated subjects. Additional values of the observed activities are the implementation of the innovative and creative elements in the management of urban cultural centers, together with the interaction and inclusion of all involved stakeholders.

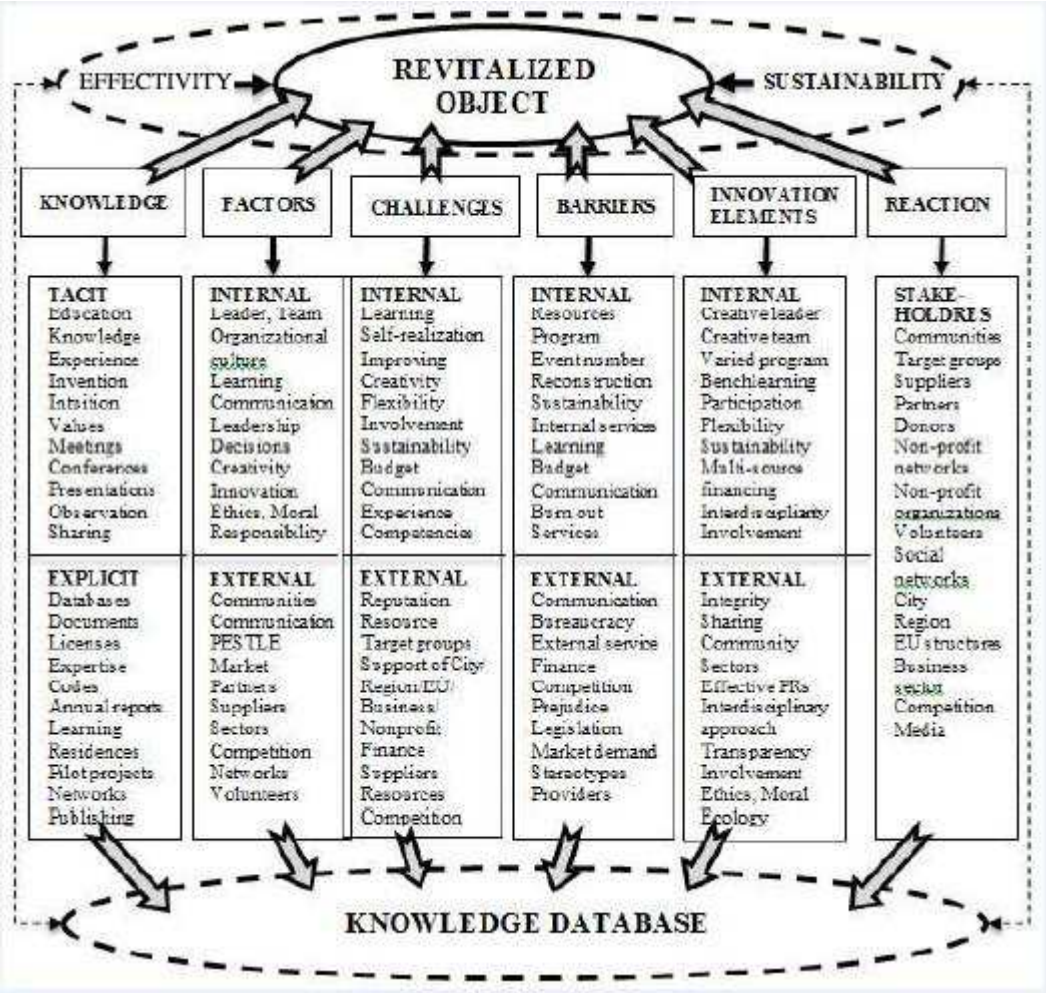

Fig. 2 *Knowledge Management Model for Urban Revitalization*
Source: Own processing based on the SECI model

5.2 Revitalized Object

All the studied subjects are buildings the original purpose of which was different from the present one, with a partial exception of Stará tržnica (City Market Hall) in Bratislava and Žilina-Záriečie (Local Train Station) in Žilina. All of them possess their historical value and belong either to the municipality, regional, state or church property. The submitted agreements describing their future purposes, utilization and conditions resulted in signing the

contracts among their owners and future users - representatives of the observed civic organizations. Creative and innovative knowledge managers, together with their teams and other stakeholders, undergo the processes of gradual reconstruction and regeneration and actively anticipate their modification into living cultural urban centers.

5.3 Knowledge Database

The database of knowledge represents a generator of human knowledge from different disciplines and areas. It is a bank of data, contacts, procedures, proposals, processes and solutions related to cases and issues that were necessary to deal with and to solve in the past. It is an effective tool, the advantage of which is visible especially when the leaders are not present or do not work for an organization anymore, while needed knowledge is available to the other team members. However, an essential condition is permanent gaining and storing of such data and the ability of all the involved to share, correctly identify and implement them when needed.

6 Conclusions

Our suggested model of knowledge management resulted from analyzed, compared and summed up findings, and its intention is to serve as a platform for shared knowledge, suitable learning models and a set of recommendations for appropriate coordination processes leading to effective, multicultural and sustainable urban cultural centers. In the frame of the presented model, it is necessary to concentrate significant and permanent attention to the knowledge database which serves as a base of human knowledge, procedures, data and solutions from various disciplines and fields. We are convinced that due to permanent creation, contribution, fulfillment and sharing of both the motivated creative knowledge workers and other involved participants, it can become a very effective tool.

The presented tailored knowledge management model reflects observed and studied results of the regeneration processes of inappropriately used urban buildings and their conversion into vibrant cultural centers. It also advises and recommends usage of appropriate knowledge management tools for either new or existing organizations willing to learn. Considering the fact that knowledge management contains multidisciplinary character, we believe in the need of a complex and holistic approach towards our research. The authors suppose that the potential of creative, innovative and interdisciplinary approaches and bottom-up activities focused on the multifunctional exploitation of historical urban buildings contribute to strengthening of their “genius loci”.

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Learning Management System as a Tool of Knowledge Management

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Abstract: The term Knowledge Management is often misinterpreted in various ways in the practice. Small and midsized enterprises often have the problem to understand and to involve the concept of Knowledge Management in daily life. This paper introduces the connection between the Learning Management System tools and the tools of Knowledge Management. It shows how to use them in practice as support for creation of the Knowledge life cycle within an enterprise and how to develop the Knowledge management system by using the Learning Management System. Finally, the paper reminds us that education within an enterprise needs deeper IT knowledge in the 21st century.

Keywords: Learning management system; Knowledge management system; Tacit knowledge; Business improvement; Learning net

JEL Classification: O32

1 Introduction

Although the term Knowledge Management has been well-known more than twenty years, there are still some enterprises, mostly small and mid-sized enterprises, without any information about it. Some of them have no idea how to use Knowledge Management or how to create a Knowledge Management system and establish it in daily practice. Managers of companies and enterprises often misinterpret what the Knowledge Management is and they interpret it as sustainable employee education by using e-learning [10]. Many of them do not like e-learning and the education supported by the computer.

But the era of Smart Cities brings new opportunities to join the small and mid-sized enterprises and companies into smart processes and to be in connection with customers and all employees everywhere they are. So, it is necessary to use appropriate IT tools for managing intangible assets, which is often the core of a successful business. There are many ways how to start introducing the Knowledge System into the business processes. Cloud solutions and IT outsourcing seem to be the best solution, but still, there are many questions (which IT functionality is the best to outsource; which cloud solution is appropriate for my enterprise; the financial aspect - decreasing the costs; does it really support the business processes? etc.). The IT outsourcing and using cloud solutions is often a part of business processes, so the transformation of IT has also impact on the business processes and on people. People do not like a change, especially, a radical change. Therefore, to make the transformation of people's thinking is necessary. It is the main role of the Knowledge Management in practice.

The article focuses on the possibility to involve the information technology supporting the knowledge management processes step by step, in an easy way, by using the Learning

Management System. The LMS Moodle is used as a good example for small enterprises, where the costs are minimal.

2 Knowledge management processes

The Knowledge Management definition has changed over the past few years. The boundaries between technocratic and managerial access are wiped out because the information technologies are involved in the business processes as their organic parts. But the knowledge management processes stay the same and if we take into consideration the following description of Knowledge Management from [3]: "Knowledge Management is the systematic management of an organization's knowledge assets for the purpose of creating value and meeting tactical & strategic requirements; it consists of the initiatives, processes, strategies, and systems that sustain and enhance the storage, assessment, sharing, refinement, and creation of knowledge", we have to see that the processes covering the knowledge life cycle [1] have an impact on corporate or enterprise strategy, functional organization of business processes and induction of changes in people's actions.

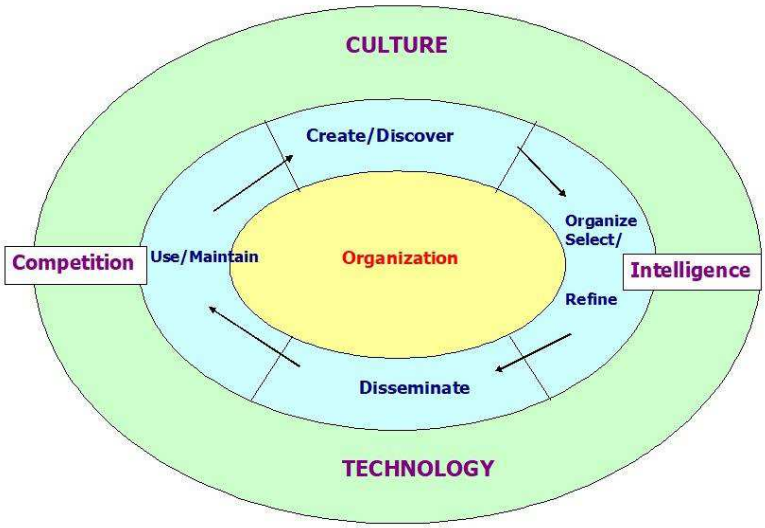

Fig. 1 *Knowledge life cycle within an organization* [1]

The knowledge within an organization is an intangible asset; it is human property (Who is the knowledge owner?) and it has sense only in the practice (What to do with the knowledge? Is the knowledge a driving force in the business process?). Finally, knowledge is not easy to gain and gather because it comes not only from learning but also from experience, observation and intuition. So, it is necessary to find a way how to store and reuse the knowledge and involve it in practice in a new way by using IT (How to handle the knowledge? How to use appropriate technologies?). [2] The three main questions „Who? What? How?" are very important in the case when the management are going decide to choose appropriate IT as knowledge management support.

Fig.1 describes the Knowledge Life Cycle within an organization (enterprise). Each phase of the life cycle has some specification and it is necessary to say that most of the phases concern explicit knowledge (to store and organize, to select and refine, to disseminate, to share and to maintain). Only creation, discovery and usage can be bound by tacit knowledge. The process

of knowledge creation often comes from discovering and observation of the tacit knowledge [4] hidden in actions, activities and business processes. There are many various techniques and methods of externalization of the tacit knowledge (surveys, interviews, brain storming, Delphi method, etc.), which are often supported by IT. Another possibility of how to discover and create the new knowledge is to analyse and model the existing knowledge-base containing the knowledge trapped inside organizational routines, processes, products, customers, etc. This kind of knowledge is called embedded knowledge [4].

The source of knowledge comes not only from within the organization but also from the external sources, such as customers, suppliers, cooperating partners and competitive environment of the market. Each source brings different knowledge, which can be included in joint projects, operational data, product feedback, market trends, developments, etc. It is not easy to coordinate the knowledge acquisition from various sources and to externalize the tacit knowledge for further purposes. Information technologies can be very useful and they allow management of all knowledge processes in a smart way.

3 Tacit knowledge and the Learning Management System

Although there are many various IT technologies for supporting all phases of the knowledge life cycle, such as groupware systems, the intranet and the extranet, data warehousing, data mining, Decision Support Systems, CMS, DMS, Artificial Intelligence tools, simulation tools, semantic networks, etc., it is sometimes too expensive and complicated to introduce these ITs in the practice of small enterprises. Many times, such ITs are not understandable for employees. The Learning Management System offers an easy way how to create embedded knowledge, how to store tacit and explicit knowledge, how to share and disseminate it, and it allows organizing it. Learning is an organic part of the knowledge life cycle, so LMS has similar functionalities as knowledge technologies [5].

As we mentioned before, the tacit knowledge is knowledge that is personalized and that is difficult to formalize and communicate but deeply rooted within an individual. The main question “How to capture or offer tacit knowledge through the learning management system?” seems like a challenge for IT professionals and for managers. Learning management systems have the primary role to manage the learning activities as courses, users and roles, but modern LMS have included the tools for supporting information and knowledge management.

The well-known SECI model [9] describes the four processes ongoing within an organization in daily routine (socialization, externalization, communication, internalization). Implementation of the SECI model in the eLearning is mentioned in [9].

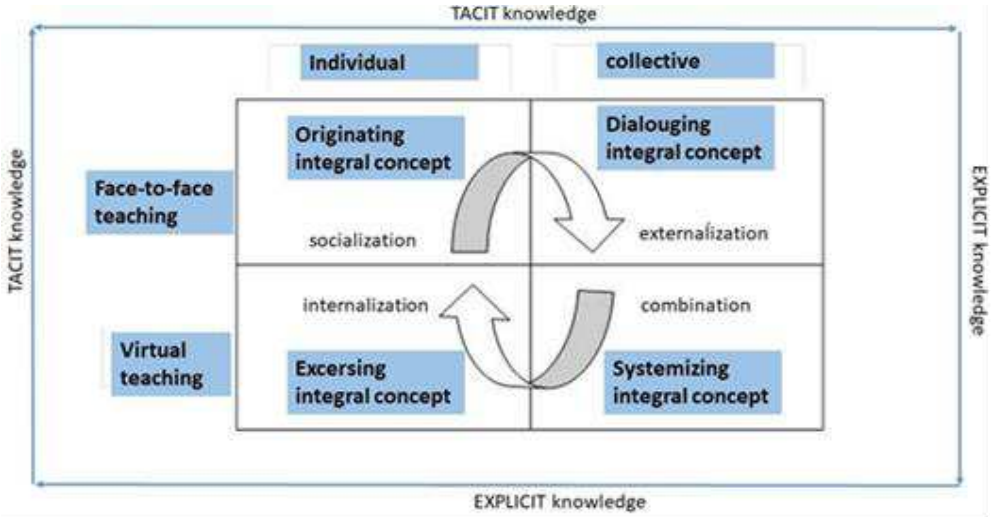

Fig. 2 *Implementation of SECI model in the e-learning course [2]*

Fig.2 describes how to implement the SECI model in learning, and the bottom part of the scheme concerns virtual teaching, where we traditionally use explicit knowledge as a source of teaching. So, when we speak about knowledge combination (explicit to explicit knowledge) in the context of e-learning, we speak about knowledge systemizing (for collective learning). In a similar way, we speak about knowledge exercising by internalization of explicit knowledge.

There is a big challenge how to deal with tacit knowledge in the context of using LMS as a tool for Knowledge Management. The two main points of this challenge are below:

1. The first challenge is how to convert the tacit knowledge into explicit knowledge. Explicit knowledge is information that can be electronically captured and stored so it can be managed and shared with others. Tacit knowledge should be converted into explicit knowledge and offered to learners in such a form that they could combine shared explicit knowledge with their own experience and proceedings. This kind of conversion creates a spiral effect that illustrates social learning [5]. One of the means of capturing tacit knowledge is a video. For example: someone captures a video of an assembly line worker installing a part of a newly built car. Tacit knowledge has been recorded and uploaded on LMS. Then, a subject matter expert (a line manager or a trainer, for example) can validate the video content, comment on it, categorize the content and align it with specific competencies. This is the way of storing and sharing the tacit knowledge within an enterprise. Another way is to use various scenarios, where the student can influence the content. A similar case is using of games.
2. The second challenge is how to publish explicit knowledge that encourages participants to create their own tacit knowledge. For example, we will publish theoretical knowledge and encouragement to complete an assignment - write an essay. Or, we will create an interactive test using the Scorm format that leads to gradual learning of skills. Also, a video is a powerful tool for handling tacit knowledge when we combine it with Artificial Intelligence. In this way, we can also learn how to exercise some procedures, which implement the tacit knowledge. Modern Learning Management Systems have plenty of features (SCORM, notification, gamification, videoconferencing, assessment engine, surveys engine, files repository, rich communication tools, eCommerce, single-sign on, etc.); they are often available on clouds and the users have mobile access to them.

4 LMS functionality that supports knowledge management

Traditionally, the LMS system records mainly explicit knowledge. Each LMS contains more functions - support system solutions, security, management and formal course development, services of knowledge (functions of the LMS system that are dedicated to knowledge and knowledge content), services of knowledge sharing, knowledge creation and knowledge mapping.

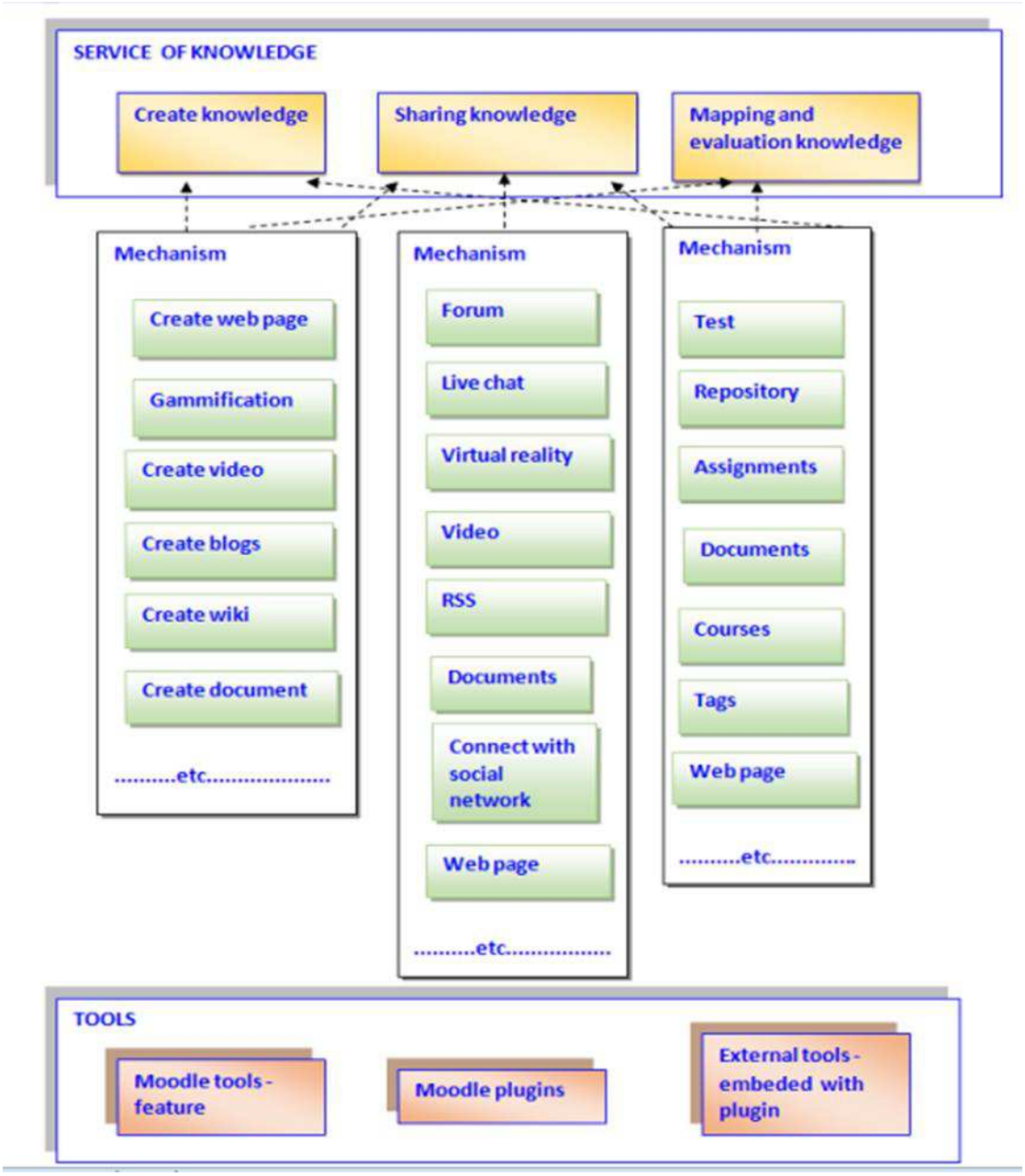

Fig. 3 *Knowledge services and their support by LMS tools (mechanisms)*

There are a lot of mechanisms that provide knowledge services and create new ones all the time. These mechanisms allow the conversion of explicit knowledge into tacit knowledge. The mechanisms are implemented through LMS tools or via plug-ins or external tools that are embedded or linked to the LMS. Fig.3 shows special knowledge functions of LMS - the

knowledge services are provided by mechanisms and are created with tools of the LMS system or external tools. Fig. 3 shows the mechanisms that are being used today and support the creation of tacit knowledge. In fact, other mechanisms can be added. Many mechanisms allow or offer two or three knowledge services. For example, we create a web page or a video, and we can share knowledge, so this is the service of sharing of knowledge. The same web site can map the knowledge and possibly evaluate the knowledge.

Here are a few examples of supporting of the knowledge life cycle by LMS. LMS systems are regularly upgraded and so the number of features that are focused on knowledge is going to increase regularly [5,6]:

- LMS Moodle has had a connection to Google tools since 2017, especially to Google glass - it is a tool that is associated with virtual reality [6];
- LMS Moodle has a connection to Office 365, too [6];
- The service of gamification has LMS Docebo directly in the system and LMS Moodle through plug-ins. Gamification is game-based learning; you can leverage your competitive nature while increasing learning engagement and, therefore, knowledge retention [5];
- LMS Docebo has the ability to create a website quickly with widgets [5];
- Almost every LMS system allows inserting a video and some LMS systems have a direct connection to mobile devices;
- LMS connectivity with the social network;
- Connectivity of LMS with Artificial Intelligence methods is represented in the example: LMS Moodle LOGs and Intelligent Agent Rules Moodle have the ability of tracking the learner's activities - learned activities, subjects, courses, frequently asked questions, connection with yellow pages which have data repositories in which personal information is collected, as well as areas of knowledge and interest of each person. In an educational environment, specifically, in Moodle, the users can find and contact other users based on knowledge - "know who knows". It means cooperating and sharing with people that use the same specialized knowledge [7];
- Another example in [8] is on how to use Artificial Intelligence, e.g. agent implementation by IBM Watson chatbot.

There are plenty of websites which offer a Learning Management System and do marketing for "the best solution" for your company, enterprise or school. The information technologies have gone "a long distance" in the last five years and there is a variety of combinations of the tools supporting all the phases of the knowledge life cycle in practice.

5 Conclusions

The terms Learning Organization and Knowledge Organization are often presented as "miraculous concepts" and they have brought a lot of theoretical articles, instructions and best practices on how to proceed when introducing the Knowledge Management in practice. We know plenty of methods and it is not easy to choose the best one. Sometimes the best solution is the simplest one, especially when we speak about small enterprises. The success of

introducing new IT in the company depends on the organizational culture, the company`s mood and the good relations between employees and managers.

It is easy to start with the open source Learning Management System and try to teach people how to improve their daily action by using „the right knowledge in the right way and in the right place“ and then upgrade the LMS tool and invest the money in further improvement. There are plenty of LMSs available (Litmos, Moodle, Learnis, Talent LMS, Adobe LMS, Lessonly, Bugle, etc.), so it is necessary to make the first successful step in the environment of the knowledge space.

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A Method of Measuring the Added Value of Facility Management as a Competitive Advantage and a Knowledge Generating Tool

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Abstract: This paper shows a method of measuring the added value of facility management as a knowledge generating tool. It shows ideas, the latest research insights based on intensive desk research, and also implemented innovations with specific cases and best practice solutions. The purpose of this reasearch is to describe how the measurement of the added value of facility management can be transfered into operational practice. The methodology used in this paper is the embedded case study method focusing on the market leader in the German shopping center industry.

Keywords: Facility Management (FM), VUCA, added value (AV), value creation (VC), Measurement, customer satisfaction

1 Introduction

1.1 The VUCA world

The VUCA world, short for volatility, uncertainty, complexity, and ambiguity, forces companies to take pride in facing challenges of the market and to make use of new solutions. [1] The increasing digitization, increasing sustainability requirements, changes on the tenant market, and the increasing competition for talented employees – these are numerous challenges. In this environment, especially innovations have become a crucial success factor. The current challenge in retail as well as the shopping center industry in Europe is: everything is changing. There are manifold reasons for this issue, among others:

- New technologies and digitization
- Mobile technology
- Big data
- e-commerce and m-commerce

1.2 VUCA and its effects on the German shopping center industry

The management of the German market leader in the shopping center industry, ECE Projektmanagement G.m.b.H & Co. KG (ECE), based in Hamburg, was interviewed regarding the market changes, the impact on various stakeholders, as well as the VUCA implications on the shopping center operators [2].

The VUCA world affects the business model of shopping center operators massively. The following table shows the different effects:

Tab. 1 *Cause-Effect-Overview*

Cause	**Effect**
Digitization	Product (Shopping center)
Speed of changes	Planning process (Shopping centers are long term investments)
Networks	Communication (Speed of communication)
Transparency	Working systems (Reporting and benchmarking)
Customer centricity	Strategy (Added value for customers due to competition)
Complexity	Processes and procedures (Many involved parties)

As expressed by ECE, the investors required transparency, flexibility, innovative capability and customer centricity from the center operators. The tenants (retail partners) want professional advice, benchmarking, marketing, as well as a variety of center events. For the visitors, it is important to find an attractive industry mix and nice gastronomy, create emotions and obtain convenience. [3]

To meet the customers' needs, it is important to have a "comprehensive management approach that encompasses the leasing, marketing, operational center and facility management as well as the commercial management of the assets. Operational excellence and optimum interaction in these core services ensure long-term sustainability in the operation of shopping centers and ensure that they will also remain an attractive venue for many generations in the future." [2]

Due to the different changes in the market and the impact on the involved parties, the facility management will become a strategic tool in the future. It is a management discipline that touches all the stakeholders and constitutes the interconnection in the value chain of real estates. In the following subchapter, the problems resulting from the market changes are derived from the facility management perspective.

1.3 VUCA and the increasing importance of the facility management

Customer satisfaction can have big influence on productivity measurement in FM. "Measuring customer satisfaction amongst customers allows a service provider to make strategic decisions in respect to resource allocation (i.e. which complaints to resolve) and customer relationship management." [4].

2 Added value of facility management

2.1 Definition of facility management

The facility management (FM) is the "integration of processes within one organization for the provision and development of the agreed services, which help to support and improve the effectiveness of main activities of the organization." [5]

Effectiveness means the ratio of the achieved result (output) and the means used (input). If the output is bigger than the input, FM has created benefits to the company. But how can this added value be measured exactly? And what exactly is meant by an added value in FM? How can it be operationalized?

The nature of the benefits of a FM department is widely described in the literature and has become increasingly important in the recent years. The reason for this is that FM has so far been regarded only as a "Cost Collector". However, the management discipline can make a significant contribution to the core business and to the entrepreneurial competitive position by controlling secondary processes. This contribution by FM is currently not being used by many managing directors and companies. It is, therefore, important to prove this benefit both qualitatively and quantitatively.

The main problem is that it is not clear how to measure this benefit, which is sometimes called added value. The measurement of the benefits of a FM department has not yet been operationalized and has been mostly conceptual in nature.

2.2 Definition of the added value in facility management

The added value was initially defined as follows: "Added value is understood as positive impact, which brings benefits to organizations and relevant stakeholders." [6]

As part of the literature analysis, it has been found that there are many models on the subject of "added value", but not all models for the research-related issues are useful or helpful. There is no standard definition of added value in the current literature, neither within the different sectors considered in the literature analysis (sustainability, hospitals, logistics, etc.), nor in FM. So, if the added value is interpreted as a pure advantage, then every goal achievement of a company can be an added value. This definition means that many models focus on pure goal fulfillment and not over-fulfillment, which was considered the actual definition of added value during the literature review. Furthermore, some causal relationships between goals and measures are disregarded and the reality is greatly reduced.

This view does not do justice to the complexity of the FM. Many models turned out to be very conceptual during the analysis, making it difficult to assess whether there is any potential to develop these models further. If no key figures are mentioned or there is no space in the models for key perfomance indicators (KPIs), benchmarks, etc., then the measurability of the added value is not given. This problem was common to many models, which meant that they could not be used for the research question. One aspect that was very interesting during the literature review was the fact that added value had already been successfully measured in many industries. The best example would be the medical industry. Here, the effects of different types of treatment on the recovery time of patients have been measured for years, which means it can be determined which type of treatment leads to earlier recovery and discharge of the patient by treating two patients with a similar health picture differently. Unfortunately, such experiences are very difficult to apply to the FM because of their industry

specifics, as real estate is often not focused in combination with the users and this is the actual focus of facility management. The last point that was problematic in the literature analysis was the very theoretical nature of the models. Many models are not practical or have not been used in practice. These were very conceptual in nature and sometimes hardly mature. The listed problems ultimately led to a total of five models fulfilling all defined requirements and being able to be used as the basis for the creation of an added-value model of this dissertation project. In summary, there are a variety of models in contemporary literature dealing with added value. Basically, there are usually only missing data sets with which the models would have to be supplied, in order to be able to deduce their practical suitability and optimization potential. Only when these data sets are determined and applied within the framework of a scientific work or general project work, can an ideal model for measuring the added value be generated.

2.3 Measuring the added value of facility management – The Track Record Model

The goal of embedded case study was to make the added value of FM measurable. The procedure followed the following structure:

- Literature research
- Process selection / embedded case study
- Interviews
- Derivation of the KPIs

The research-guiding question of this case study was: "How can the measurement of the added value be done in practice?" The challenge here is that the added value is currently treated conceptually, and no scientifically sound sources are available. In the case study, the choice fell on an embedded case study. The case study is a holistic research methodology that comprehensively studies cases of interest in a holistic way, taking into account their context and using different data sources and survey methods. [7] [8] It is capable of comprehensively examining cases of interest (such as a person, an event, an organization, etc.) that are of interest in a holistic way and in-their context. For this procedure, interviews with proven ECE experts were prepared and then carried out. From the evaluation of the interviews, understanding of the organizational structure as well as the added value in relation to ECE's core business activities was gained. Furthermore, the interviews revealed derivation of potential, specific measurement indicators. On the basis of these indicators, modeling was started based on the Bernhold model and the TdB. The interdependencies of the numerous KPIs in the shopping center portfolio, which were mentioned within the interviews and suspected by the project participants, turned out to be particularly complex. In order to be able to identify the influence of the individual KPIs, the track record must be determined. The Bernhold model is the first conception of a measurement model that covers the relations between the different stakeholder groups, the outcome as well as the taken measures. This model is based on the consideration that the added value is primarily reflected in the return. Using the model, it should be possible to measure how much one factor affects the other and what impact this has on returns - for example, how customer satisfaction contributes to the level of return through other factors. The weighting should make it possible to measure the share that FM contributes to the return. The main content of the model presented below is the content of the interviews conducted, the definition of the added value developed on the basis of the literature analysis and own ideas, as well as aspects of the TdB, which were used as the first approaches for calculation options. The primary goal was to develop a model that was as

practical as possible. This should take into account the requirements and the explicit circumstances of the ECE.

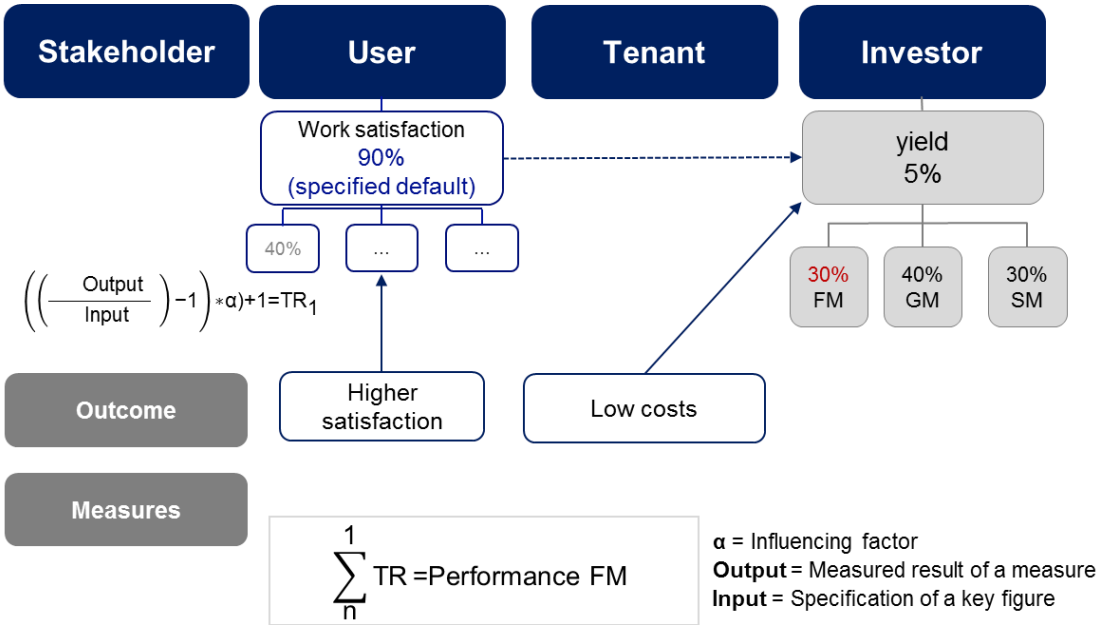

Fig. 1 *The Bernold´s model*

The Tableau de Bord (TdB) is a “decision support and control tool” [9], which also incorporates the perspective of the "intangible assets" (non-financial success factors). It pays attention to linking horizontal and vertical management units by showing a cause and effect relationship by creating an understanding of the objectives and actions of different levels of management. [9]

The TbB is relevant for the model development consisting of:

- Creating of a complete overview
- Creating a cause-and-effect understanding
- Deriving a company vision and strategy objectives at operational level
- Creating a rough overview instead of disproportionate depth of detail with the aim of rapid control

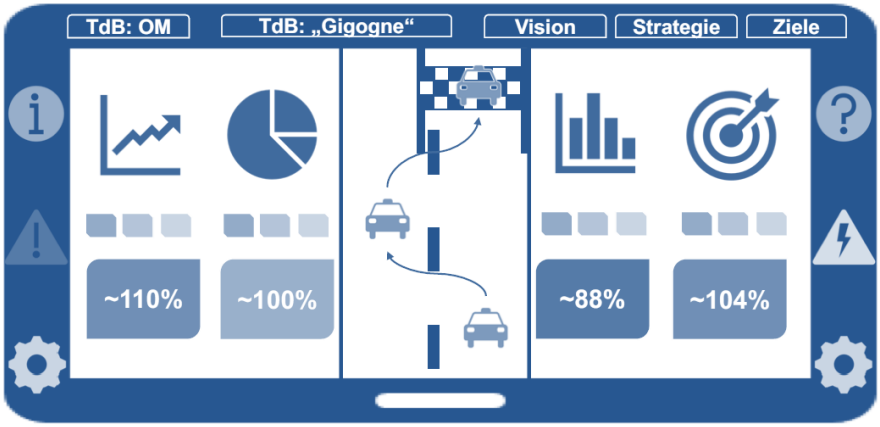

Fig. 2 *The Tableau de Bord model*

These two models mentioned above were combined with the value creation (VC) model of FM based on Schlicht. This model has three dimensions. The first one is the corporate dimension. This pillar is divided into the corporate strategy, the business model and the benefit as well as the added value that is created for a specific stakeholder group. The second one is the stakeholder or customer dimension, and the third one is the value dimension consisting of reward and risk. This represents the interconnection, where FM can create added value. Based on the corporate dimension, FM can foster the innovative component, for example in making a shopping center smarter. It can help to lift the product “shopping center” in the next lifecycle phase and, therefore, increase the resistance of the real estate in a highly competitive environment. The added value for the different stakeholder groups can be of quantitative or qualitative nature. Quantitative added value can be savings in a monetary, temporal or consumption-orientated way. Other quantitative benefits of the FM can be created yields or other sources of income. The qualitative component of the added value of FM can be divided into the risk and the quality cluster. The VC model shows that the AV of FM can be derived from the core business, the involved stakeholders as well as the business environment of the corporation.

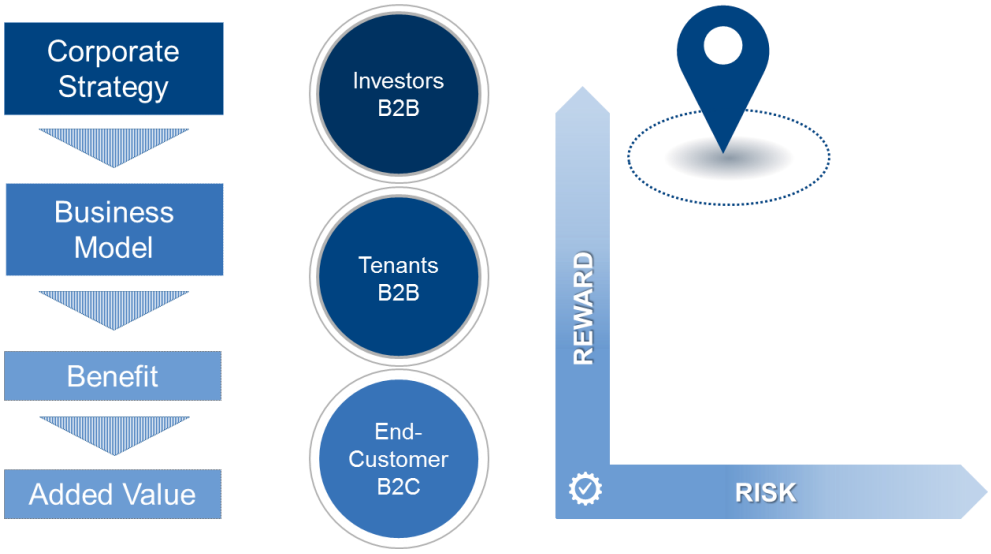

Fig. 3 *The model of value creation in FM based on Schlicht*

Out of these three models, the track record model for measuring the added value of facility management was developed in the case study with ECE. [10] It focuses on the facility management goals that were derived directly from the corporate strategy and goals as shown in the following figure.

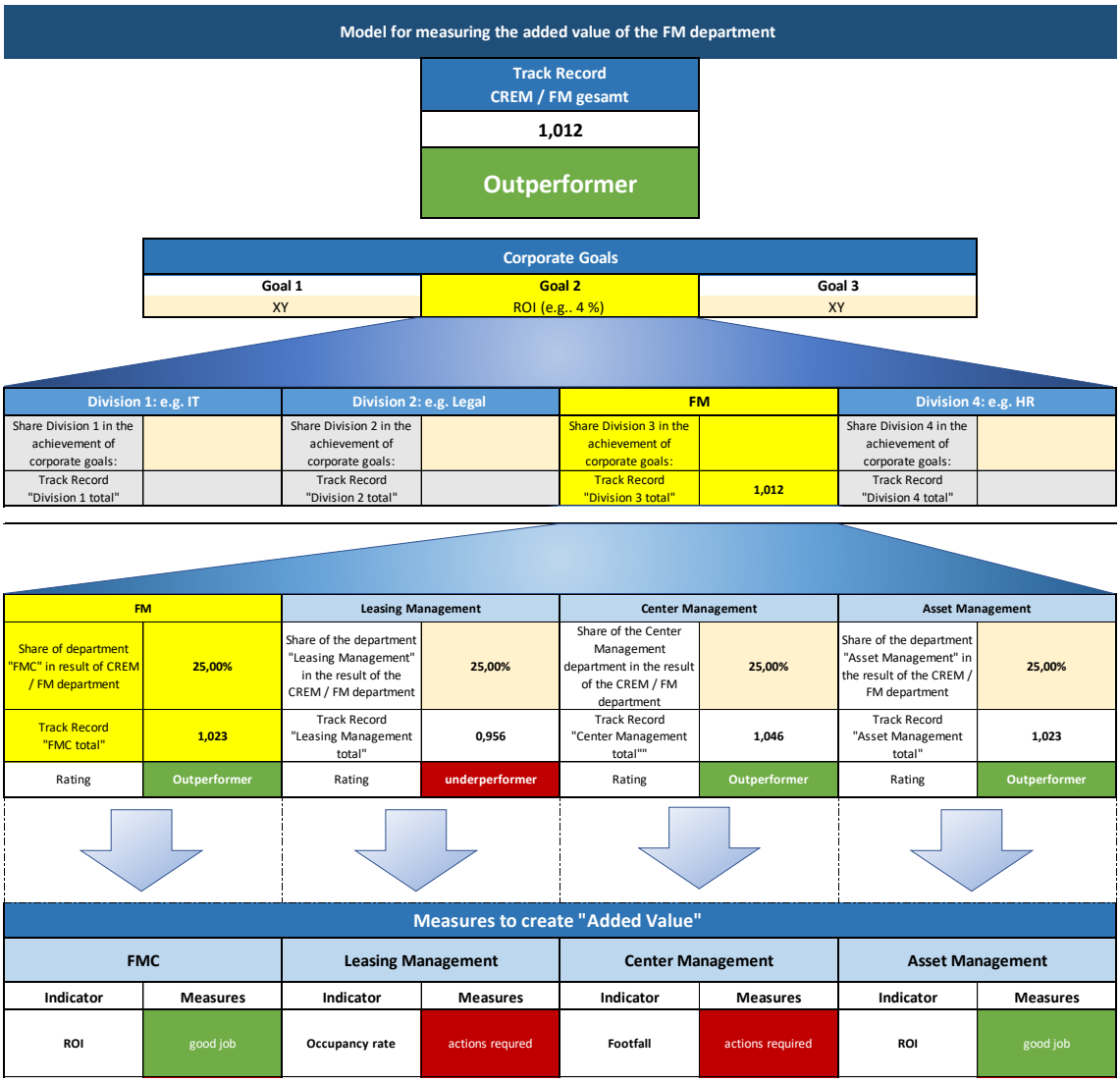

Fig. 4 *Example of the track record model for measuring the added value of FM*

In addition to the FM department, other departments influence the company's target achievement. Targets related to the KPIs can be adjusted by the company in the tool. From the interaction of input, output and weighting factors of the KPIs, the track record for each department and the associated targets can then be calculated. Adding the track records from Center, Asset and Leasing Management as well as Facility Management results in the entire track record of the FM department that can be calculated.

The track record can be used to uncover weaknesses and generate optimization potential. Food for thought for possible improvement measures is mentioned in the tool. External influencing factors, such as general economy, urban development or development of online

shopping are not considered in the model. If necessary, the calculation can be transferred to another department (e.g., Human Resources) so that all business units can ultimately be measured against their KPIs and their performance can be considered in relation to the common business objective.

The developed model covers the following logic:

- The key figures and services must be made measurable. (Interviews with the employees delivered the respective KPI)
- Transfer of the business units to the model. (Asset, Leasing and Center Management as well as the FM department)
- Each business unit is responsible for specific metrics.
- The model metrics were developed based on the interviews with ECE departments: FM, Asset, Leasing and Center Management.
- The business units have a different impact on business goals.
- The model measures the performance of the departments against their respective targets and calculates / measures the track record for each goal.
- The company has goals to achieve within a given time frame.
- All departments of the company work to achieve the company's goals and influence them to a certain extent.
- However, the share is currently unknown and, therefore, all four departments, each with 25% of the achievement of objectives, are equally involved in achieving the company's goals.
- Each department (for example, FM) is measured against specific targets, which in turn have a certain impact on the target achievement of each department. The weighting is the responsibility of the ECE and is individually adaptable.

Track record calculation

The track record is calculated by using the following formula:

$$\left(\left(\frac{\text{Output}}{\text{Input}}\right) - 1\right) * \alpha) + 1 = \text{TR}_1 \tag{1}$$

In the developed model, the ratio of the target achievement to the target for a given indicator / KPI is multiplied by a corresponding weighting of the indicator / KPI, thereby calculating a weighted track record for each indicator / KPI. The sum of the weighted track records for each indicator / KPI in a department gives the overall track record for a department and the sum of the department's weighted track records gives the track record for the FM department. According to the defined definition of the added value, the track record can be used to calculate the “overcrowding of goals set by the company” and to set the appropriate weighting of the goals in order to achieve a result that is as “business-oriented” as possible. The results of the calculation can be classified into three different categories according to the following description: If the calculation of the track record for a target results

in a value <1, the target for the corresponding indicator has not been reached, and thus the department is classified as "underperformer" with regard to this indicator. If the result is exactly 1, then the respective target was reached exactly. Thus, the result is classified in the category "goal achieved". As soon as the result is > 1, the result has to be classified in the category "outperformer". This classification is customizable by the ECE.

For example, the model may be adapted to achieve the category "outperformer" starting at a value of 1.2 as it may do more justice to the idea of over-achieving the goals than the computational solution of 1.0. The department has achieved more than what has been specified with regard to an indicator of the department and has thus achieved added value for the company.

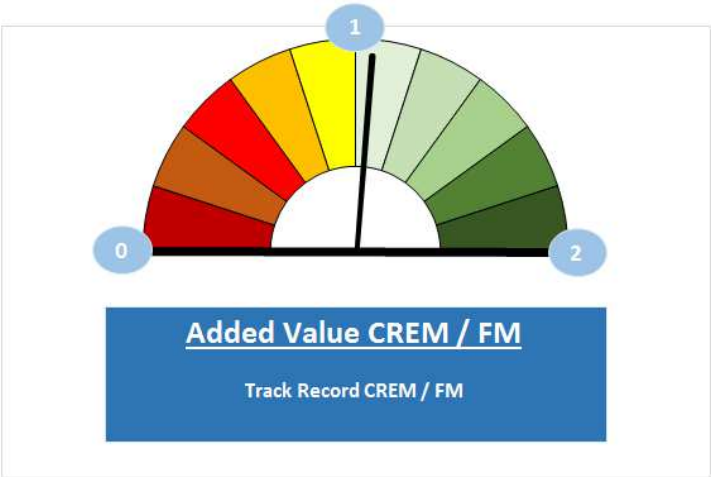

Fig. 5 *Cockpit of the track record model*

As part of the case study, the model was not only conceptually developed but also operationalized for the company ECE Projektmanagement GmbH & Co. KG (ECE) in the form of a comprehensive Excel application. This Excel application is structured in such a way that it can initially be filled out by the ECE headquarters in Hamburg, but it can also be extended accordingly in the form of data from the 200 centers of ECE. Furthermore, a calculation for each center, each region, and each jurisdiction is possible. This Excel application calculates the added value for a single indicator and indicators of an entire department as well as for the whole company. The results of the added value measurement are visualized for each department according to a tachometer diagram.

3 Conclusions

The VUCA world affects the business model of shopping center operators massively. The investors require the center operators' transparency, flexibility, innovative capability and customer focus. The tenants (retail partners) want professional advice, benchmarking, and marketing as well as wide variety of center events to be satisfied. For the visitors, it is important to find an attractive industry mix and nice gastronomy, to create emotions and to obtain convenience. To meet the customers' needs, it is important to have a comprehensive management approach that encompasses the leasing, marketing, operational center and facility management as well as the commercial management of the assets. Operational excellence and optimum interaction in these core services ensure long-term sustainability in

the operation of shopping centers and ensure that they will also remain an attractive venue for many generations in the future [2]. The facility management (FM) is a cross-divisional service function. It has many touch points with all customer groups, such as tenants (retail partners), investors and end-customers (visitors) of shopping centers. Thus, there is a lot of potential to create added value. Without FM, it would be impossible to operate a shopping center. Currently, FM is also in the transition phase. Out of the outcomes of this dissertation project, the definition of FM [5] mentioned in chapter 2.1. needs to be changed. According to the ISO 41011, Facility Management will fit better with the definition (April 2018) below:

"Facility Management is the organizational function which integrates people, place and process within the built environment with the purpose of improving the quality of life of people and the productivity of the core business." [11].

This definition illustrates the effect of FM very well. Therefore, the FM has big impact on the quality of stay (convenience) and satisfaction of the customers. Digitalization can facilitate this development, especially in the FM of a shopping center. With the help of 3D-Scanning, a "digital twin" of the property allows innovative indoor heat maps and traffic analytics in shopping malls (via customer tracking). FM can influence and deliver important data and key performance indicators, such as footfall, dwell time, visitor insights, shopping paths, returning customers, store analysis and many more.

By using a skillful combination of these data, the shopping center operator can manage the FM services in a more demand-oriented way. This leads to better productivity in terms of cost and quality. Therefore, further research has to focus on productivity measurements in FM, which still have not been studied in any real depth. With real time information regarding foot-fall and frequency, it is possible to operate the building technology and the whole shopping center much more efficiently. For these reasons, FM can make big contribution to creating a lasting competitive advantage in this volatile market environment. The FM department of ECE is pursuing the "smart center approach", which means that a building can be operated in response to demand, for example by switching off the air condition if the footfall is low.

This paper creates the basis for further scientific investigation. Within the literature analysis, it was found out that many models were not practical or had not been used in practice. These were very conceptual in nature and sometimes hardly mature. That was also shown in the change of the definition of the added value of FM during the project. The embedded case study showed that the added value approach with the use of the track record model could be operationalized in the real life.

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Redefining the "Permanent Establishment" Concept to Make Its Measurement more Relevant for a Digital Economy

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Abstract: The paper is from the field of the philosophy of measurement and it is based on the assumption that before applying exact and sophisticated methods to measure some phenomena, it is important to define the features of the object to be measured and redefine them if the traditional definition does not correspond to changes in reality. The concept of permanent establishment can be a typical example of the mentioned situation. The term PE basically describes the conditions under which foreign business presence in a country is taxable in that (host) country. That´s why it is intensively discussed in taxation theory and practice. The basic objective of the paper is to show why the traditional definition of the concept becomes irrelevant for the business model of a digital company, to analyze some alternative solutions and, in the conclusion, to show that an international consensus in defining the concept (although difficult to achieve) is badly needed.

Keywords: digital economy and taxation; permanent establishment concept; significant economic presence; knowledge workers in a digital economy; relevance of the PE concept for Slovakia

1 Introduction

The recent years have been a period of intensive debates among political institutions, international organizations and theorists (especially in economics and law|) about the principles of international taxation under conditions of a digitalized economy. Although very differing views have been presented, the consensus has been achieved in two important results: 1) The so called digital economy can't be separated (ring-fenced) from the traditional "physical" economy because new models digitize also the cycles of traditional products and services; 2) The different business models have different repercussions on value creation in different countries and changes in the taxing power of individual states are needed. Of special importance is the fact that multinational enterprises may create value (and taxable income) in countries where they are not physically present. The traditional definition of PE concept deprives host countries of a (sometimes significant) part of their taxing power in the value created within their territory but without physical presence of foreign companies.

The structure of the paper is as follows: The first part briefly summarizes the traditional philosophy of the PE concept and its basic features. The traditional definition has been codified in legal documents and is still a basis for international tax treaties. However, some measurement problems appeared also under the old philosophy. The second – the most important part – of the paper describes why the traditional definition of PE is not appropriate under conditions of a digital economy. The third part analyses the main alternatives to the PE concept suggested so far – especially the concept of "significant economic presence" designed by OECD. In this part, some practical policy measures to apply the alternative concepts will be mentioned.

In conclusion, it will be shown that any generally accepted modification (or reconstruction) of the PE concept requires international consensus. However, even before achieving such a consensus (which will be very difficult), the theoretical contribution of the discussions on the

PE concept is valuable. It can contribute to creating new knowledge (about the recent strategy of global business players) and to better understanding of some topics connected with the knowledge management (the role of knowledge workers in the digital economy, their extreme mobility and flexibility, the importance of intangible assets and intellectual capital, etc.).

2 Traditional philosophy of the PE concept

Although it is difficult to find some stabile (relatively long-term valid) norms in international taxation, certain basic, generally accepted features can be found. (OECD Convention 2014)

Primarily, a PE requires a fixed place of business within the geographical boundaries of the country of sales. The fixed place may include administrative offices, a factory, or a workshop, but not necessarily sales offices or storage facilities. Under most double taxation treaties, the income of a firm is taxed in the country where it has permanent establishment only if it carries out a business of a continuing and lasting kind there. It is usually assumed that a foreign organization operates from a fixed place, an employee's job title or description indicates that he or she performs activities related to revenue generation or sales of the organization, an employee operates in the host country for a prolonged period, sales are made to customers based in the host county and local contracts are negotiated by a locally-based employee or dependent agent.

On the other hand, a permanent establishment does not include (OECD Convention, 2014):

- the use of facilities solely for the purpose of storage, display or delivery of goods or merchandise belonging to the enterprise;
- the maintenance of a fixed place of business solely for the purpose of purchasing goods or merchandise or of collecting information for the enterprise

Another problem is how to interpret time of "permanency" or how long the organization should perform business activities in the country and when (in the case of building a new enterprise) the taxing right of the host country authority can be applied. There are different views regarding this issue. Many treaties provide specific rules with respect to construction sites. Under those treaties, a building site or a construction or installation project constitutes a PE only if it lasts more than a specified length of time (e.g. 2 years).

If the basic PE criteria are not satisfied, the enterprise will be taxed only in the state of its residency (home country). The traditional definition of the PE is of qualitative nature. It measures the qualities of economic presence against the agreed upon standards.

According to the traditional definition, a PE need not be a legal entity, but it is treated as an functionally separate and independent entity, an object important for the fiscal policy.

3 Why the traditional PE definition is not appropriate for a digitalized economy

As already mentioned, companies going digital may operate their business remotely and create value in foreign countries without physical presence in the country. From the "common sense" point of view, it seems that the most visible impact of globalization is the rapidly growing share of e-commerce (to final consumers, to other businesses), which distorts traditional working of the market mechanism. Cross-jurisdictional local sales without local physical presence of the supplier company existed even before; however, the scale of these transactions and their involvement in the economic life of the country leads to serious problems.

New rules regarding the destination principle for determining the place of taxation of cross-border supplies and effective collection mechanisms are to be found. This is basically the problem of indirect taxes, mainly VAT, which is not analyzed in our paper. A short-term solution for VAT will probably be easier to find than in the case of direct taxes. However, digitalization also makes the distinction between direct and indirect taxes less clear – as both types of tax optimization are involved in the new business model.

The core of our paper and the principal connection with the PE concept is in the field of corporate income taxes (CIT). How does the new business model of digitalized companies influence the value creation process in different countries? How to define criteria authorizing the local administration to tax profit achieved (or a part of profit)? A fixed place as the basic criterion of the PE concept can´t be used in many cases. The basic value creating factor in digital companies is *intangible assets (intellectual capital),* which are not clearly defined in accounting theory and practice and it is difficult to measure them. Even if measured in some way, it is difficult to connect their effect with a specific place. Digital business models enjoy high flexibility of business functions, assets, consumers and operations. The place that was actual for a specific function at the beginning of the fiscal year may be different at the end of the year. Rights to software and other intangibles can be easily transported to an associated enterprise in another jurisdiction. Which country has the right to tax the profit achieved?

Another factor often mentioned in connection with the digital business model is *reliance on data and user participation* (UiO, 2017, p. 8). Digital companies rely heavily on collection of data. The data are collected from users, suppliers and customers around the world. Some of the data are paid for; some are free. Data are used to improve products and services and to customize marketing. However, data are also sold to other organizations that combine and process them and use them for their profitability improvement. Is this process "value creation"? Has the local tax authority (in the country where the providers of data live) got a right to tax a profit derived from using these data?

OECD (2015) defines a positive externality, where two user groups meet and allow third parties to develop content for devices produced by themselves as the *multi-sided business* model (an example can be Facebook). At the beginning, a project requires a little or no capital. With acquiring new customers, the revenues grow. Who and where is creating value in such projects? These approaches can bring countless benefits to consumers and enterprises in many countries. However, some expenditures are not paid for (not covered in the monetary form). These platforms are often connected with monopoly power and some citizens or organizations are discriminated. These practices are more an issue of anti-monopoly policies. Ethical issues are also involved in multi-sided business platforms.

Multinational companies that are perfectly informed about the PE requirements try to avoid the PE status artificially. The areas discussed in this context include mainly conditions of commissionaire agreements (role of agents), including auxiliary activities into the value creation chain and fragmentation of business activities.

Even if there is "no fixed place of business", the PE will exist – according to OECD, MTC 2014, Article 5 – if the agent "habitually exercises" a right to conclude contracts on behalf of the foreign company. It means that the foreign producer (supplier) can sell products and services in another country using intermediaries to solicit sales and persuade customers to enter into contractual relations with the foreign company. This is a step forward (in the sense of widening the scope of PE) but the discussion goes on how to define the term "habitually".

Another widely discussed problem is the role of *preparatory and auxiliary activities* exempted from the traditional PE definition. It is well known that nowadays these activities play a very important role in the value creating process and can significantly contribute to profitability. According to some suggestions, it would be fair to include all these activities into the costs of the product or service and then to define a formula how to divide the resulting proceeds between the involved countries. However, achieving of consensus in this area will be extremely difficult.

Moreover, preparatory and auxiliary activities controlled by the same company can be located in different places within the same country and between countries. This fragmentation is a further problem for tax authorities. A multinational company can split the functions of cohesive business operations between different legal entities with physical presence in different states, and the tax liability is not clear.

Attempts on altering the original PE concept by different partial modifications are very frequent and contribute to making the concept more suitable for the modern economic era. However, usually they are dealing with separate, partial issues and do not provide a coherent alternative.

4 Some alternatives to the PE concept

Important modifications of the PE concept were suggested after publishing the OECD BEPS (base erosion and profit shifting) Action Plan of 2015. Let us mention mainly the suggestion that no activities of the preparatory or auxiliary character should be automatically exempted from the definition of the PE status. In the digital business model, such activities may, in fact, present a core business function. For an online retailer, for example, local storage activities should be regarded as core activities. The same can be said about gathering of information, which is an important value-driver for digital enterprises.

Probably the most discussed (especially in Europe) alternative to the PE concept is the concept of **significant economic presence** (sometimes called significant digital presence) or a **virtual permanent establishment**. This option was set out by the European Commission in a communication published in September 2017. In defining the significant economic presence three groups of factors are to be considered: digital factors, revenue-based factors and user-based factors. (EU, 2017)

Regarding digital factors, the proposed concept describes the virtual permanent establishment as the situation "when a non-resident taxpayer provides access to or offers a *digital platform,* such as an electronic application, database, online market place, storage room, or offers search engine or advertising services on a website or in an electronic application". Other potential digital factors are a local domain name or local payment options.

While the first type of criteria - types of digital transactions to be included in the definition - can be of qualitative character, user-based and revenue-based criteria require a quantitatively defined threshold from which the activity becomes "significant". Such a threshold can be expressed as the minimum number of users of some platforms, the value of cross-border e-sales, the proportion of total revenues obtained from the supply of digital services to customers in the host country, the number of business contracts for the supply of digital services, etc.

Let us mention at least some important thresholds suggested by the European Commission to consider a company as having significant digital presence in a Member State (EU, 2018):

- It exceeds a threshold of €7 million in annual revenues from digital services in a Member State.
- It has more than 100,000 users who access its digital services in a Member State in a taxable year.
- Over 3000 business contracts for digital services are created between the company and business users in a taxable year.

These criteria are regarded just as recommendations to member states, and states, as independent fiscal entities, can define the threshold themselves. Finally, the rules should be approved by national parliaments.

One of the most discussed weaknesses of the EU proposal of a significant digital presence is subjective character of defining the thresholds and the possibility that the accepted definitions will be in conflict with the existing bilateral tax treaties. This can mainly happen in the case of tax treaties with non-EU member states. That´s why the EU Commission regards this proposal as a short-term, interim solution. In the long-run, the digitalization of economies will intensify; the quantitative criteria defined today will become obsolete, and a consensus between states to modify the thresholds will be needed. The EU Commission, in our opinion, is right in suggesting that in the long-run, criteria of the degree of digitalization should be included into the tax basis harmonization process and a common definition of the corporate income tax base will be important.

The topical issue in discussions on taxing the profits from digital activities is not only defining criteria of foreign companies being tax-obliged in other countries even if they are not physically present in the country (which is directly connected with the PE concept) but also the *distribution of profits* between countries. One (sometimes neglected) factor is the role of customers as (unconscious) data providers. A combination of the direct involvement of customers as data providers and up-to-day technologies that make possible to receive and process a limitless amount of data has completely changed the way of marketing strategy and tactics (Brauner and Pascale, 2018) and significantly contributes to profits of big digitalized players. Which country is authorized to tax this increase in profits?

While EU proposal seems to be a “common” approach, at least of EU Member states, some countries try to find a unilateral solution of the problem. In practical policy, several models of **equalization levy** (Šestáková, 2018) have been introduced. The basic idea is to equalize market conditions for domestic and foreign enterprises. An equalization levy on a digital business model could mean taxing every transaction between a domestic customer and a foreign supplier if it is performed online or through electronic means. An example of such an approach can be India, where the equalization levy was introduced in 2016. Foreign enterprises providing online advertising to Indian business customers have to pay a 6% tax on the value of such transactions. In the case of India, it is not clear whether the levy is a form of direct (income) tax or an indirect tax. (Brookings India, 2007)

Another example of a short-term solution is the **withholding tax on digital transactions** mentioned also by the EU, which can be applied on all or certain cross-border transactions connected with e-commerce. This is a form of an indirect tax that could be imposed regardless of whether the foreign supplier has a PE in the country or not.

The common weakness of the mentioned unilateral approaches is that they assume separation (ring-fencing) of digital transactions from the traditional types of transactions, which is actually impossible or very short-sighted. Practical implementation would be very difficult for tax authorities and companies as well. Banks, for example, that are performing financial

transactions, should distinguish which payment is for a digital and which for a non-digital transaction, and receiving this information would be very expensive.

Probably, the most radical unilateral approach is the **diverted profit tax,** which was implemented by the United Kingdom in April 2015. The objective of this measure has been to achieve "a behavioral change" so that large companies will "divert" their profits from foreign taxation or reinvesting abroad and declare higher proportion of their profits for taxation in the UK. (The HMRC, 2017.)

The diverted profits tax (DPT) is charged at 25% on profits that are considered to be artificially diverted from the UK. The draft legislation outlines a number of tests and thresholds to assess whether DPT will apply to any transaction or business activity. The rules are very complicated, but the following applications (which are connected with the topics of our paper) can be mentioned (Šestáková, 2018):

- a non-UK company that sells goods or services to UK customers, even if only digital products delivered via the internet;
- a non-UK company that has a UK-based entity providing services (e.g. sales, marketing or head office);
- a non-UK company with employees that perform activities in the UK; or
- a UK-based company with operations offshore.

The scope of the law is very broad, and it seems to be effective. Additional amounts of Corporation Tax (CT) collected from businesses which have changed their behavior because of the introduction of DPT, grew from £31m in the year 2015/2016 to £281 million in the fiscal year 2016/2017 (HMRC, 2017).

In principle, the diverted profit tax is more an anti-avoidance measure than a concept of what the international taxation system should look like in the digitalization era.

5 Is the discussion on the PE concept relevant also for Slovakia?

The traditional PE concept has been internationally accepted for many years and included in bilateral tax treaties, which is true also for treaties concluded by Slovakia. The Slovak Republic is a small country with an important role of foreign investors. Tax revenue from taxing their profits (corporate income taxes) achieved by activities in the Slovak territory forms an important source of funds for the government fiscal policy. Taxation is a topical issue, and international competition, which is reflecting also the impact of digitalization, makes adjustment of the tax system to the modern era an imperative also for Slovak authorities.

However, the sectoral structure of FDI in Slovakia (an important role of manufacturing and energy supply) leads to a situation when majority of foreign investors *have a physical presence in Slovakia* – as required by the traditional PE concepts. It may seem that the question of the irrelevance of the PE concept is just a hypothetical one for Slovakia and can be topical only in the future. Slovakia participated in the EU discussion on the impact of digitalization, including the impact on taxation, and principally agreed with the EU documents mentioned above. However, in the country, these questions are not publicly raised; no discussion occurs, and no radical changes in the taxation due to the digitalization process are suggested.

Even if foreign investors maintain their physical presence in Slovakia, they are adjusting their business processes in a similar way as anywhere in Europe, and the increasing digitalization plays a very important role in these adjustments. Many issues mentioned above –

e.g. the increasing role of auxiliary and supporting processes, multisided business platforms, fragmentation, etc. – are topical also in Slovakia. However, the question how to measure them and include them in the tax base of corporate income taxes is not raised. E-commerce is rapidly increasing also in Slovakia, but the development of prices in this commerce is not monitored and its repercussion in the VAT scheme is not discussed - which is quite understandable due to a lack of available data about the actual degree of digitalization in Slovakia.

Data provided by users (customers) and then processed and used in multinational companies´ strategy have their source also in Slovakia. However, due to the size of the country, they are not as important as the data collected in large countries. Nevertheless, some of those data are sold to other companies and used to increase their profitability (which can be a potential tax base somewhere).

A key role of intangible assets in the digitalized business processes is a common tendency in all developed countries, and Slovakia is not an exception. However, reporting on the structure of intangibles in accounting documents is very poor (Bernadič, 2016), and in Slovakia it is probably worse than in some other EU countries. In this area, there is a lot of problems to be (collectively) solved in connection with the potential CIT tax base harmonization.

Probably, the main reason why a discussion on macroeconomic impact of digitalization (in the field of fiscal policy, possible inflation behavior, etc.) is not developed in Slovakia is the lack of statistical data on the actual situation (Fabo, 2018). Sometimes this role is underestimated and sometimes overestimated by mechanical transfer of tendencies and proportions from large developed countries. A lot can be done in collecting the necessary statistical data.

6 Conclusions

The concept of permanent establishment is one of the key issues in international taxation, very important not only for the practical fiscal policy but also for the theory. Knowledge management is a discipline where the theoretical contribution of these discussions can be valuable. Although achieving an international consensus on the basic principles of taxation in the digitalized era can be a long-term process, some theoretical and "knowledge" lessons from these discussions can be learnt immediately. Perhaps the most important are *the knowledge increasing and knowledge sharing lessons*.

Taxation itself is a knowledge-based activity - both from the government taxing authorities' point of view and from the point of view of companies that are continuously looking for new ways of tax optimization. Sharing of this knowledge between governments is very important. Moreover, the discussion on the (ir)relevance of the PE concept itself provides a lot of information about the recent approaches of the global business players in the field of digitalization.

Another important theoretical lesson (actually of an interdisciplinary character) is *the role of human capital* - its skills, extreme mobility, new types of motivation, etc. It can be said that a *new type of a knowledge worker* is formed in digitalized business models (or digitalized organizations in general). Companies are making use of the new talent grown anywhere in the world and realize that it is important to adjust their HR policies and sometimes even organizational structure and organizational culture to new demands. However, knowledge workers of a new type do not appear automatically. They are to be educated by the formal education system, different forms of training courses in the companies, "learning by doing" and

practical experience. The role of governments in supporting the digitalization process within their countries means not only creating the digital infrastructure but also creating such an institutional and economic environment in the country that will motivate new types of knowledge workers to stay in their (home) country or come back after gaining some international experience.

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Association between Two Categorical Variables and Information Channels Effectiveness Assessment

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Abstract: The paper deals with the possibilities of association between two categorical variables analyses and the application of such analysis in the i3nformation channels effectiveness assessment in the case when the same information is provided by more different information channels to different groups of people in the framework of one time period. When the association is confirmed by a test, the use of adjusted standardized residuals enabling the pattern of the association among the contingency table cells recognition is appropriate and will be used in the analysis. The association strength measurement possibilities will be described and the odds ratios will be applied in the information channels effectiveness assessment.

Keywords: adjusted standardized residuals; odds ratio; information channels

1 Introduction

It happens frequently that the same information in the framework of one time period is provided by more different information channels. For example, a firm informs people about offered services by paper publicity materials, the internet and publicity in media. It is interested in the effectiveness of the information channels for potential clients from different regions. The council of a town informs the citizens about its activities by a network of billboards, its web page and communal media. It would like to know the effectiveness of the information channels for different age categories of citizens.

A natural first step of such an analysis is asking people through which information channel they usually obtain information, by conducting a statistical survey. The "information channels" and "groups of people" are generally categorical variables. The association between two categorical variables will be analyzed – categories of the first variable represent information channels, and categories of the second one represent different groups of people obtaining information through these information channels. The procedure of information channels effectiveness assessment for different groups of people will be suggested. The use of the proposed procedure of information channels effectiveness assessment will be illustrated by the problem of customer satisfaction and s study of their profiles in a firm.

2 Analyzing Association between Categorical Variables

Categorical variables take values (categories) enabling to identify an attribute of each element. When only identifying of an attribute is possible, the measurement scale of the variable is nominal. When the values of the variable exhibit properties of nominal data and the order or rank of the values is meaningful, the variable is called ordinal – it is measured by the ordinal scale.

When the results of one variable tend to change as the results of the other variable take different values, we conclude there exists an association between those variables. Data for categorical variables association analysis are summarized in contingency tables. The association between two nominal variables will be analyzed.

2.1 The Procedures of Association Analysis

Three common procedures of association analysis between two nominal variables are recommended in the literature. The first one consists of two steps – conducting of a statistical test revealing if an association between variables exists, and if that is the case, measuring of how strong the existing association is, with the aid of some summary measures of association, such as Cramer`s *V*, contingency coefficient or Goodman and Kruskal's lambda (for example, see [4, 7]). The second procedure includes testing of the association and using of adjusted standardized residuals enabling the study of the structure of association when the association has been confirmed (for example, see [8]). The adjusted standardized residuals serve for identification cells of a contingency table, which are "responsible" for the revealed association. The last procedure consists of association testing, using of adjusted standardized residuals in the case of confirmed association and measurement of the strength of association by odds ratios (for example, see [3]). For information on channels effectiveness assessment in the stated context, the last mentioned procedure will be useful.

2.1.1 Chi-squared Test of Homogeneity and Independence

We speak of homogeneity in statistics when statistical characteristics of one part of a data set are the same as characteristics of another part of that data set. We will look at the chi-squared test of homogeneity. Let *Y* is a response variable and *X* is explanatory variable. The categories of *X* define *r* different populations, for example different groups of people.

The random samples from *r* multinomial populations (Multinomial distribution, see for example in [5, 10]) with *c* different outcomes are sampled in that test.

Let n_{ij} be the observed frequency in the *i*-th row and *j*-th column, $n_{i.}$ be the sum of n_{ij} values in the *i*-th row, and $n_{.j}$ be the sum of n_{ij} values in the *j*-th column of a contingency table. The sum of all n_{ij} values is the sample size *n*. In a contingency table, the row totals $n_{i.}$ in the last column are fixed, the column totals $n_{.j}$ are influenced by randomness of sampling.

For a fixed category of *X*, variable *Y* has a probability distribution. Let $\pi_{j|i}$ denote the probability of classification of the element in column *j* of *Y*, given that the element is classified in row *i* of *X* (the probabilities $\{\pi_{1|i}, \pi_{2|i}, \ldots, \pi_{c|i}\}$ define the conditional probability distribution[1] of *Y* at category *i* of *X*). When a response variable is identified and the population conditional distributions are identical for all populations, they are said to be homogeneous ([3], p. 229).

We are testing the following:

[1] For more information about joint, conditional and marginal probability distribution, see [10], pp. 89 – 92.

H_0: The population conditional distributions are identical for all *r* populations, formally:

H_0: $\pi_{j|1} = \pi_{j|2} = \ldots = \pi_{j|r}$ for $j = 1, 2, \ldots, c$

meaning that random samples are from *r* populations with the same multinomial distribution versus an alternative

H_1: The population conditional distributions are not identical for all *r* populations, formally:

H_1: $\pi_{j|1}, \pi_{j|2}, \ldots, \pi_{j|r}$ are not all equal for at least one value of *j*.

Assuming H_0 is true, expected frequencies are calculated as follows:

$$o_{ij} = \frac{n_{i.} \cdot n_{.j}}{n}$$

The value of test statistics is calculated according to the following relationship:

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} \frac{(n_{ij} - o_{ij})^2}{o_{ij}}$$

The critical region at the level of significance α is $\chi^2 \geq \chi^2_{1-\alpha}((r-1)(c-1))$, where $\chi^2_{1-\alpha}((r-1)(c-1))$ is $(1 - \alpha)$ – quantile of chi-squared distribution with $(r-1)(c-1)$ degrees of freedom. Due to the considered test statistic following the chi-squared distribution only approximately, it is obviously recommended to use this test only in the cases when no expected frequencies values are lower than 5. If not, joining of corresponding columns is necessary.

Let both *X* and *Y* be response variables. Then, one sample from multinomial population with *rc* different outcomes is sampled. The statistical independence is tested and the test is called the test of independence.

We are testing the following:

H_0: The variables are statistically independent, formally:

H_0: $\pi_{ij} = \pi_{i.} \cdot \pi_{.j}$ for $i = 1, 2, \ldots r$ and $j = 1, 2, \ldots c$

versus an alternative:

H_1: The variables are statistically dependent, formally:

H_1: $\pi_{ij} \neq \pi_{i.} \cdot \pi_{.j}$ for at least one pair of values of *i* and *j*,

where $\pi_{i.}$ is the marginal probability in row *i*, $\pi_{.j}$ is the marginal probability in column *j*.

Two categorical variables are statistically independent if the population conditional distributions on one of them are identical at each category of the other. The variables are statistically dependent if the population conditional distributions are not identical (in [3], p. 223). Statistical independence is a symmetric property between two variables: If the conditional distributions within rows are identical, so are the conditional distributions within columns ([3], p. 224).

In the chi-squared test, the value of χ^2 test statistic does not depend on which one is the response variable and which one is the explanatory variable (if either). The steps of the test procedure and the results are identical either way ([3], p. 229). The testing procedure is the same as was mentioned above in the case of homogeneity, differences among more proportions (when the required value of proportion is not specified) or statistical independence testing **(**For more information on Pearson chi-square test of homogeneity and independence, see [2, 7]).

It is clear that the homogeneity of conditional distributions in a test of homogeneity implies statistical independence of corresponding variables. So, equivalent interpretations of a test of homogeneity results are possible. When we reject the null hypothesis in a test of homogeneity, we can conclude that we have obtained the evidence that the conditional distributions of response variable *Y* on *X* are not identical or that variables *X* and *Y* are statistically dependent9 or simply that *X* and *Y* are associated.

2.1.2 Residual Analysis

Cell-by-cell comparison of observed frequencies n_{ij} and expected frequencies o_{ij} reveals the nature of the evidence about association between variables. The difference $(n_{ij} - o_{ij})$ is called a residual. The adjusted standardized residuals for two nominal variables can be defined as (in [3], p. 230):

$$r_{ij} = \frac{n_{ij} - o_{ij}}{\sqrt{o_{ij}\left(1 - \frac{n_{i.}}{n}\right)\left(1 - \frac{n_{.j}}{n}\right)}} \qquad \text{for } i = 1,2...r;\ \ j = 1, 2, ...c \tag{1}$$

where $\frac{n_{i.}}{n}$ – an estimated marginal probability in row *i*,

$\frac{n_{.j}}{n}$ – an estimated marginal probability in column *j*.

The denominator in formula (1) is a standard error of random variable $(n_{ij} - o_{ij})$, when null hypothesis H_0 about statistical independence of variables[2] is true. Adjusted standardized

[2] Or identicality of conditional distributions.

residuals r_{ij} asymptotically follow the standard normal distribution. They can be used to describe the pattern of the association among the table cells. A too large value of an adjusted standardized residual (greater than 2 in the absolute value) indicates a deviation from homogeneity in the cell.

2.1.3 Measures of Association Strength for Nominal Variables

A measure of the association strength is a statistic or parameter that indicates the strength of an association between two variables (in [3], p. 233). There are more summary measures of association strength between two nominal variables. Two approaches to summarize the strength of the association between nominal variables are known:

- Coefficients based on the χ^2
- Coefficients based on proportional reduction of prediction error (PRE)

Association Coefficients based on the χ^2

The χ^2 statistic as such is not used to measure association between two variables, but it serves as the element in association coefficients construction. The following association coefficients based on χ^2 are suggested in the literature: Phi–square (φ^2), Cramer's V and contingency coefficient.

The Cramer`s V is most frequently used. It is defined as

$$V = \sqrt{\frac{\chi^2}{n \cdot h}},$$

where h is the minimum from (r – 1) and (c – 1). Cramér's V varies from 0 (corresponding to no association between the variables) to 1 (complete association) and can reach 1 only when the two variables are equal to each other.

Association Coefficients based on PRE

Goodman and Kruskal introduced the idea of proportional reduction in error of prediction. Two association coefficients based on this idea are known − the Goodman and Kruskal's lambda and Goodman and Kruskal's tau.

The Goodman and Kruskal's lambda (λ) measures the percentage improvement in predictability of the response variable (row variable or column variable), given the value of the other variable (column variable or row variable).

The value of λ_r for row response variable is

$$\lambda_r = \frac{\sum_i \max n_{ij} - \max(n_{.j})}{n - \max(n_{.j})}$$

The value of λ_c for column response variable is

$$\lambda_c = \frac{\sum_j \max n_{ij} - \max(n_{i.})}{n - \max(n_{i.})}$$

The symmetric (non-directional) lambda (λ) can be also calculated. It lies between the values of λ_r and λ_c. The symmetric lambda is defined as

$$\lambda = \frac{\sum_i \max n_{ij} + \sum_j \max n_{ij} - \max(n_{i.}) - \max(n_{.j})}{2n - \max(n_{i.}) - \max(n_{.j})}$$

Asymmetric and symmetric lambda take values from the interval [0, 1]. The information obtained by summary measures of association is interesting but not so useful for managing the information flows (for more details see [6]).

Other Measures of Association Strength

When 2 *x* 2 contingency table is analyzed, the difference of proportions can be used as measure of association (see in [3], p. 234 or in [10], p. 298 − 301).

Odds Ratio

The odds ratio is the measure of association that can be used in all contingency tables. We will use success to denote the outcome of interest and failure to denote the other outcome. For a response variable with two values, the odds for success is defined as:

$$\text{Odds} = \frac{\text{Probability of success}}{\text{Probability of failure}}$$

The estimated odds for a response variable with two values equals the number of successes divided by the number of failures. The odds ratio θ in 2 *x* 2 contingency table equals the ratio of the 1st row odds to the 2nd row odds. In *r x c* contingency tables, odds ratio can be calculated in any 2 *x* 2 sub-table. In the context of the stated problem, we will use the odds ratios as the measure of relative effectiveness of information channels.

2.2 Procedure of Information Channels Effectiveness Assessment

We will suggest a procedure of information channels effectiveness assessment. In general, the different information channels are expressed by the *c* values of the first categorical variable, while the *r* populations − groups of people obtaining information through these information channels - are represented by values of the second categorical variable. Then the answers of respondents sampled by simple random sampling from each of *r* populations in the case of homogeneity testing are obtained. Alternatively, one sample from multinomial population with *rc* different outcomes can be realized. Then the independence is tested. The

sampled respondents indicate the information channel they obtained information through in their answers.

Then, the Pearson chi-squared test of homogeneity or independence is applied depending on how the random sampling was conducted. When the null hypothesis is not rejected, we did not obtain the evidence that the effectiveness of information channels is different for different groups of people. When the null hypothesis is rejected we conclude that the effectiveness of information channels for different groups of people is not identic. Then the residual analysis is effectuated. This analysis determines the cells of contingency table "causing" association. In the context of information channels effectiveness assessment, the relative effectiveness of information channels for different groups of people can be determined by that analysis.

In the third step, information channels effectiveness assessment based on odds ratios is realized (more in details about third step see in [9]).

3 Using of the Procedure of Information Channels Effectiveness Assessment

The use of the just-mentioned procedure will be illustrated on a study of the problem of the information channels effectiveness assessment based on hypothetical data from a statistical survey of a firm.

Example. A firm carried out a statistical survey focused on customer satisfaction and their profiles study. The 400 customers were randomly selected and asked to fill in a questionnaire. One of the closed questions in the questionnaire was: "From which information source did you obtain the first information about the services provided by our firm?" The answer distribution is shown in Table 1 (in parentheses there are the expected frequencies).

Tab. 1 Distribution of Information Channels according to Permanent Residence of the Customer

Information Channels **Permanent residence of customer**	**1st Information Channel (paper publicity materials)**	**2nd Information Channel (internet)**	**3rd Information Channel (publicity in media or other sources)**	$n_{i.}$
Bratislava city	150 (134.375)	74 (74.375)	26 (41.250)	250
Region Bratislava (except Bratislava city)	20 (31.713)	21 (17.553)	18 (9.735)	59
Elsewhere	45 (48.913)	24 (27.073)	22 (15.015)	91
$n_{.j}$	215	119	66	400

Source: own

The Pearson chi-squared test of independence offered *p*-value = 0.000106. That means that H_0 can be rejected in favor of the alternative hypothesis. We can conclude that variables „information channels“ and „permanent residence of customer“ are associed. The effectiveness of the information channels about services provided by the firm differs by the permanent residence of a customer.

3.1 Residual Analysis and Information Channels Relative Effectiveness

The adjusted standardized residuals were calculated according to (1), to find the cells causing the association. The results are in Table 2.

Tab. 2 Information Channels and Adjusted Standardized Residuals for the Different Permanent Residence of the Customer

Information Channels / Permanent residence of customer	1st Information Channel (paper publicity materials)	2nd Information Channel (internet)	3rd Information Channel (publicity in media or other sources)
Bratislava city	3.24	− 0.08	− 4.24
Region Bratislava (except Bratislava city)	− 3.31	1.06	3.14
Elsewhere	− 0.94	− 0.80	2.24

Source: own

Based on results in Table 2, we can conclude that there are more customers from the city Bratislava and fewer customers from the region of Bratislava who obtained information through the first information channel than it is suggested by the independency hypothesis. There are more customers from the region of Bratislava and fewer customers from the city Bratislava who obtained information through the third information channel than it is suggested by the independency hypothesis. We can conclude that the first information channel is relatively more effective for customers from the city Bratislava than for customers from the region of Bratislava and the third information channel is relatively more effective for customers from the region of Bratislava than for customers from the city Bratislava.

3.2 Relative Effectiveness Assessment of Information Channels

The odds ratio analysis will be applied. The association strength measured by odds ratio will be understood and interpreted as a value of relative effectiveness. In general, an arbitrary 2 *x* 2 sub-table can be analyzed by the odds ratio. The only appropriate approach is to analyze the sub-tables for which the corresponding residuals are greater than 2 in the absolute value.

We will analyze the following sub-table (in Table 3).

Tab. 3 Sub-table of Tab. 1

Information Channels **Permanent residence of customer**	**1st Information Channel (paper publicity materials)**	**3rd Information Channel (publicity in media or other sources)**	**Total**
Bratislava city	150	26	176
Region Bratislava (except Bratislava city)	20	18	38

Source: own

The relative effectiveness assessment of the first information channel for the customers from the city Bratislava in comparison to the customers from the region of Bratislava will be realized. The first information channel (the second column) will represent a success and the third one (the third column) will represent a failure.

The estimated odds for customers from the city of Bratislava is

$$\frac{\frac{150}{176}}{\frac{26}{176}} = \frac{150}{26} \approx 5.7692$$

There are about 5.7692 of customers from the city of Bratislava who obtained information through the first information channel per 1 customer who obtained the information through the third information channel.

The estimated odds for customers from the region of Bratislava is

$$\frac{\frac{20}{38}}{\frac{18}{38}} = \frac{20}{18} \approx 1.1111$$

There are about 1.1111 of customers from the region of Bratislava who obtained information through the first information channel per 1 customer who obtained the information through the third one.

The odds ratio for customers from the city Bratislava and for customers from the region of Bratislava can be calculated as follows:

$$\theta = \frac{5.7692}{1.1111} \approx 5.1923$$

A customer from the city Bratislava has a 5.1923 times greater chance to obtain information through the first information channel than a customer from the region of Bratislava. The first information channel is relatively 5.1923 times more effective for customers from the city Bratislava than for customers from the region of Bratislava.

It can be proven that when the third information channel represents success and the first one failure, the same odds ratio for the customers from the region of Bratislava will be obtained. This relation concerning odds ratios in contingency sub-tables is generally valid.

4 Conclusions

It was shown how to use data from a statistical survey and some methods of analysis of association between two nominal variables in the information channels effectiveness assessment. The testing of association enables us to make a decision about whether there exists an association between variables, where one variable represents information channels and the other one represents different groups of people obtaining information through these information channels.

When the null hypothesis is not rejected, the evidence about an association between variables is not obtained and we cannot conclude that there is a difference in relative effectiveness of information channels for different groups of people. When the null hypothesis is rejected, we can conclude that there is an association between variables. Once an association between variables is established, the question which combinations of variable values cause the identified association is interesting. Using of residual analysis is recommended for that purpose. Identification of cells "responsible" for an association in a contingency table enables us to recognize the relative effectiveness of information channels for different groups of people. When there is a great positive value of the adjusted standardized residual in the cell, the corresponding information channel is more effective for the corresponding group of people. When there is a great negative value of the adjusted standardized residual in the cell, the corresponding information channel is less effective for the corresponding group of people.

The use of odds ratios is recommended for information channels relative effectiveness assessment. In the application of the proposed procedure in the above mentioned example, the results showing that the first information channel is relatively 5.19 times more effective for customers from the city of Bratislava than for customers from the region of Bratislava and that the third information channel is relatively 5.19 times more effective for customers from the region of Bratislava than for customers from the city of Bratislava were obtained. In general, such an analysis based on odds ratios can be carried out for all 2 *x* 2 sub-tables of the contingency table of two nominal variables.

The described procedure can be also used in a lot of other contexts (see in [9]). The procedure does not require any professional software. MS Office with Excel is sufficient.

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Application of the Dimensions of the Learning Organisation Questionnaire in the IT Sector in the Czech Republic

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Abstract: The learning organization concept brings many advantages to the organizations (e. g. improving the performance or maintaining the competitiveness). Implementation of the learning organization concept in the Czech Republic has not been dealt with yet. This study deals with application of the DLOQ in small and medium-sized enterprises in the IT sector in the Czech Republic. Based on the results of the study it can be said that there has been a shift in applied human resource development models towards a learning organization. Of the 7 dimensions of the learning organization, the highest score has dimension 1 and the lowest score has dimension 4. If we compare the results by gender, there is no significant difference between men and women. A significant difference has been found in people who do not learn and those who devote more than one hour a month to learning.

Keywords: learning organization; DLOQ; small and medium enterprises; IT.

Introduction

In the learning organization model, learning and training are sources of future success. In his book The Fifth Discipline, Senge defines a learning organization as: „*…an organization in which people constantly improve their abilities and achieve the results they truly desire, where they find support, new and dynamic models of thinking where collective thinking and inspiration are supported and where people are still learning how to learn together.*“ [9] Kandola and Fullerton add to the definition of the learning organization factors such as a shared vision, culture, motivated workers, motivation to education, structure with learning opportunities, or the trust of managers in teamwork and its positive results [7]. Learning in the learning organization becomes an integral part of the whole work process; work and learning are interconnected in the process of continual improvement. The learning organization does not rely on learning as a by-product of routine work, but the learning is actively supported, facilitated, and rewarded. Interaction between individuals is then a key aspect of organizational learning. Employees in the learning organization strive to achieve their potential, share the vision of the target with team colleagues, and their personal goals are in line with the mission of the organization. These employees see their work as a whole or a system in which there are interdependent processes [6]. The implementation of the learning organization concept will allow organizations, among other things, greater flexibility, competitiveness, performance improvement, achievement of goals and longer existence than their competitors [3].

According to the Czech Statistical Office, the importance of small and medium-sized enterprises is rather high in the Czech Republic. These enterprises employ more than 70% of employees in the private sector. The Czech Statistical Office defines the small and medium enterprises by 250 employees. In detail, small and medium enterprises can be divided into

micro-enterprises with 1 to 9 employees, small enterprises with 10 to 49 employees and medium enterprises with 50-250 employees. We can also see the small enterprises divided into groups with 10 to 19 employees and with 20 to 49 employees. We can also see dividing of the medium enterprises into groups with 50 to 99 employees and with 100 to 249 employees. Enterprises that employ more than 250 people are called large enterprises. Every year, the number of small and medium enterprises changes due to newly created and newly extinct enterprises. The number of newly created enterprises is usually larger and the turnover is around 10% [12, 13]. When we compare information obtained in 2010 and 2015, we can say that the number of enterprises with 0 to 249 employees is constantly increasing (for example, in 2015 the number of companies was 5280 more than in 2014) [14].

We can use a large number of tools to measure and diagnose learning organisations. The used tool depends on the different definitions of the learning organisation. The definition of the learning organisation by Marsick and Watkins [10] is also one of these tools.

Tab. 1 *Seven learning organisation dimensions*

No. of Dimension	Dimension
1	Create continuous learning opportunities
2	Promote inquiry and dialogue
3	Encourage collaboration and team learning
4	Create systems to capture and share learning
5	Empower people toward a collective vision
6	Connect the organisation to its environment
7	Provide strategic leadership for learning

Source: own processing of [1, 2]

According to Marsick and Watkins, there are seven dimensions that characterise the learning organisation culture. Individual dimensions then represent the efforts of organisations to create learning opportunities for all employees, the effort to create a platform supporting dialogues, reactions and experiments among members, team learning, vision sharing or strategic leadership [3].

All dimensions are interconnected, which can aggravate statistical evaluation of analyses [16]. When comparing organisations with dimensions, we can see a correlation between dimensions, knowledge and financial performance [2, 4].

Implementation of the learning organization concept in Czech companies has not yet been dealt with to a great extent and only basic references, assumptions and assertions can be found in the literature. This finding has opened up space for carrying out a study that, using the "Dimension of a Learning Organization" questionnaire, has evaluated the rate of introduction of the concept of learning organization in the surveyed companies.

Methods

To compare this study with published foreign studies [5], a cross-section questionnaire survey was conducted between December 2017 and February 2018. This survey was focused on small and medium-sized organizations in the IT sector in the Czech Republic. The respondents were sent a questionnaire via e-mail addresses obtained from the Albertina Business and Marketing Database [11]. The size of the organization and the sector of activity

were selected as a business selection criterion. The business sectors were entered by the CZ-NACE code, the predominant activity, specifically: [15]

J – Information and communication activities – 62.0 – Activities in the In-formation Technology field – 62.01 – Programming - 62.02 – Information Technology Consultancy - 62.03 – Computer Equipment Management – 62.09 – Other IT activities

For this survey, a Dimension of a Learning Organisation questionnaire was selected in a 21-issue questionnaire version focusing on the 7 dimensions of a learning organisation [2]. Thanks to its expansion, this questionnaire is easily comparable to foreign studies. This questionnaire also provides adequate measurement results with its focus on the seven dimensions of a learning organisation. To maintain the validity of the questionnaire, the questionnaire was translated by two independent translators from English into Czech and then back to English. At the same time, retaining the meaning of the questionnaire was considered. For each dimension, Cronbach confidence coefficient was calculated using IBM SPSS Statistics Version 24. The Alpha coefficient ranged from 0.683 to 0.860 for each dimension. Overall, the value of the coefficient was 0.933. The calculated values of the Cronbach coefficient appear to be satisfactory (the coefficient higher than 0.7 is "satisfactory") [8]. Individual dimensions were assessed by the respondents on the 6-point Likert scale.

In order to verify the clarity of the questionnaire, a pilot study was initially carried out. This pilot study was carried out with a total of 20 students from the combined study of the Master's degree program in Information Management. The final version of the questionnaire was created using "docs.google.com". In total, 2,884 respondents were addressed. Approximately 250 of the e-mail addresses no longer existed; 25 respondents are currently not in business.

The obtained data were analysed using Microsoft Excel 2016 and IBM SPSS Statistics version 24 using descriptive statistics, parametric and non-parametric tests at confidence levels $\alpha = 0.01$ and $\alpha = 0.05$.

Results

In order to verify the questionnaire,-a pilot study was carried out, involving 20 students from the combined study of the Master's degree program in Information Management at the Faculty of Informatics and Management in Hradec Králové. These respondents are employed in the following areas: software development, telecommunications, IT, electronics production, internet sale, sales, law, health, advertising, government, work with children, transport and logistics, sports, energy and heating. The data from the pilot study were evaluated using Microsoft Excel 2016 and the IBM SPSS Statistics version 24 statistical programme.

After evaluating the pilot survey, information on the organisation's size and the position in the organisation was added to the questionnaire.

Tab. 2 *Cronbach alpha for each dimension*

Dimension	Cronbach α
D1: Creating opportunities for systematic learning	0.721
D2: Support for polling and dialogue	0.860
D3: Encourage team learning and collaboration	0.761
D4: Creating systems for capturing and sharing learning	0.683
D5: Motivating people for a collective vision	0.796

Dimension	Cronbach α
D6: System interfaces	0.765
D7: Strategic guidance for learning	0.791

Source: own

Using the Cronbach alpha reliability indicator, the reliability of each dimension was determined. All dimensions, except dimension 4, met the required reliability value; total reliability is relatively high (α = 0.933). Although dimension 4 (Creating systems for capturing and sharing learning) didn't reach 0.7 value, it's significantly close to this value (0.017 difference), so this value can also be considered satisfactory.

A total of 2,884 respondents from small and medium-sized companies from the Czech Republic with a focus on information technology activities were addressed. The study involved a total of 201 respondents (return on questionnaires was 6.97%). Organisations employing up to 10 employees, up to 50 employees and 250 employees were represented in the study (Figure 1).

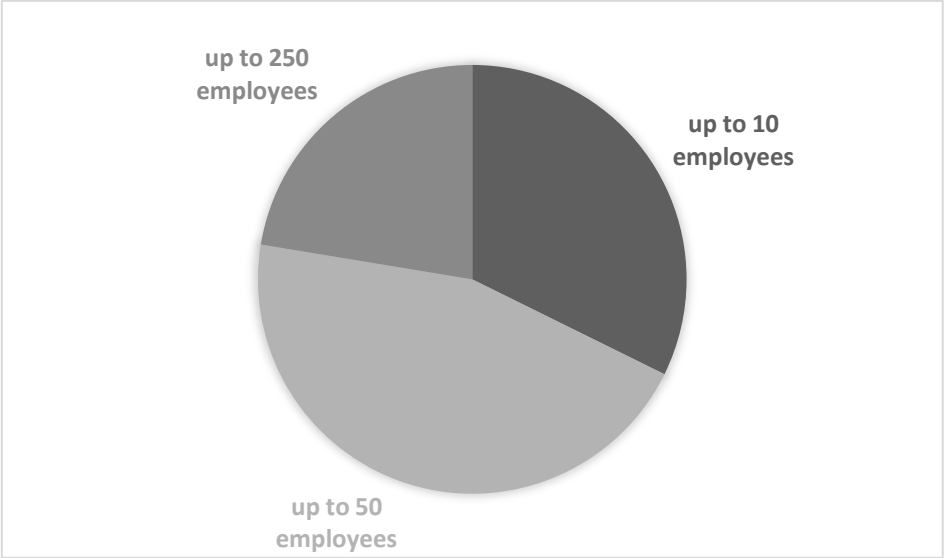

Fig. 1 *Percentage of enterprises in the study*

Most of the respondents were aged 31-50 years old. General staff accounted for 35.8% of the respondents and managers accounted for 64.2% of the respondents. The respondents reported employment time in the organisation up to five years, followed by 11 - 15 years.

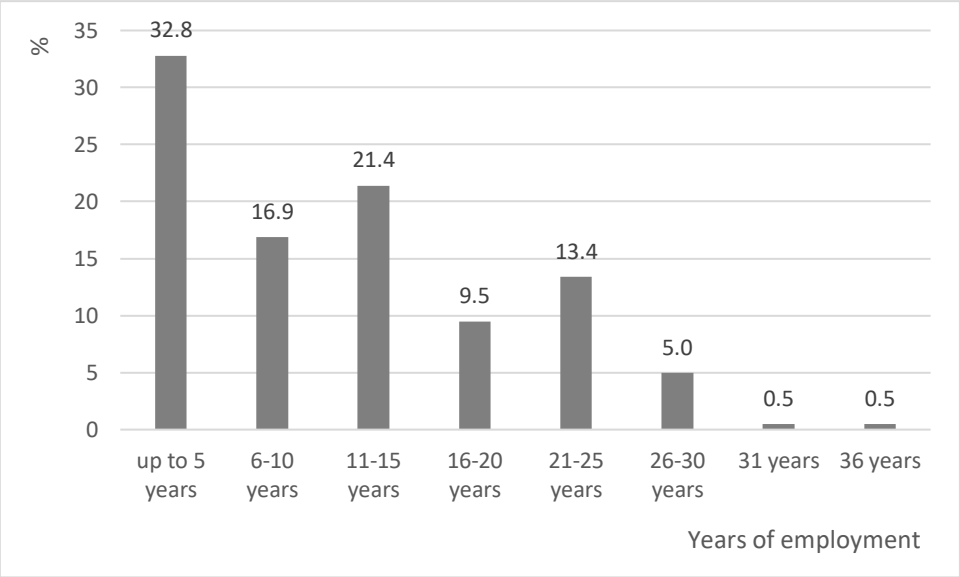

Fig. 2 *Time of employment in the company*

When comparing the evaluation of individual questions, one can say that none of the questions received less than half of the points. The respondents gave the worst rating in questions 10 and 11: "My organisation creates systems to measure the difference between actual and expected performance", with an average rating of 3.386, and "My organisation makes all evaluations available to all employees", with an average rating of 3.236. The greatest indecision throughout the evaluation by respondents was expressed in question 20: "In my organisation, managers look for opportunities for further education.", where they identified two values on the Likert scale from which the average was calculated.

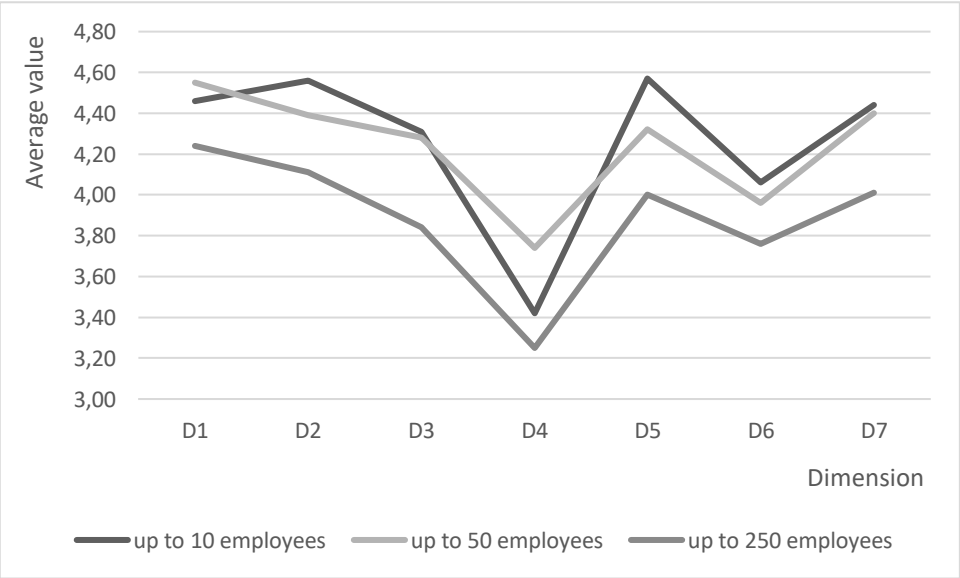

Fig. 3 *Comparison of results by company size*

Descriptive statistics show the highest assessment of dimension 1 - "Creating opportunities for systematic learning" and the lowest assessment of dimension 4 - "Creating systems for capturing and sharing learning". The assessment of most dimensions is fairly balanced; it can not be claimed that organizations in the Czech Republic do not contain any features of an educational organization (values close to four can be understood as consent with the claims in individual dimensions). If we compare t-test results of individual dimensions by gender, we find that there is no statistically significant difference ($p = 0.986$) between males and females at a significance level of $\alpha = 0.05$. The positive assessment of dimensions 3, 4 and 5 is growing with growing learning time (up to 35 hours per month); when people learn for more than 35 hours per month, the assessment decreases a little. The T-test reveals a statistically significant difference between people learning for "0 hours" per month and other groups of respondents engaged in learning ("1-10 hours" $p = 0.00028$; "11-20 hours" $p = 0 , 00025$, "21-35 hours" $p = 0.000092$, "more than 36 hours" $p = 0.00074$, $\alpha = 0.01$).

Discussion

Extension of the concept of the learning organization in the Czech Republic has not been described yet. This work is focused on evaluation of the concept of learning organization in information technology organizations registered in the Czech Republic.

A DLOQ questionnaire can be used to review the organization's up-to-date learning situation, which allows us to measure both changes in the organizational climate as well as changes in the culture, systems, and organization structures that affect individual learning [2].

If we compare the average results of each dimension, we will find out that all dimensions are highly correlated with each other, which is consistent with Watkins and O´Neil [5].

The following table shows an example of studies conducted abroad, along with an average rating score for each dimension. The total number of respondents in the comparative studies was N = 2854.

Tab. 3 *Comparison of DLOQ results with other studies*

Autor studies	**N**	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**
Watkins and Marsick	389	3.94	3.91	3.98	3.50	3.74	4.00	4.13
Selden	142	5.01	4.05	4.09	3.44	3.83	4.17	4.49
McHargue	264	4.16	4.15	4.33	3.78	4.20	4.35	4.73
Lien, Yang, Li	79	3.97	4.05	4.00	4.13	4.08	4.01	4.26
Hernandez	906	3.94	4.16	4.01	4.09	4.21	3.96	4.27
Maria	628	4.05	4.08	3.84	3.96	3.79	3.98	4.21
Ellinger	208	4.12	4.04	4.13	3.70	3.93	4.19	4.26
Milton, Watkins	37	4.26	4.35	4.32	3.13	4.15	3.99	4.42
Weighted average		**4.06**	**4.09**	**4.01**	**3.86**	**3.99**	**4.04**	**4.29**
Zubr	**201**	**4.45**	**4.39**	**4.19**	**3.52**	**4.33**	**3.94**	**4.33**

If we compare the results of this study with already conducted studies, we can say that the results obtained from organizations from the IT sector in the Czech Republic are satisfactory and in 5 out of 7 dimensions higher than the weighted average of the foreign studies conducted. By comparison with the weighted average of the results, it can be concluded that organizations in the IT sector in the Czech Republic meet most of the dimensions of the learning organization better than organizations in foreign studies. Higher assessment of organizations should give organizations a greater strategic advantage [5]. Only in two dimensions, organizations in the Czech Republic have a lower average score. Specifically, it is dimension 4 "Creating systems for capturing and sharing learning" and dimension 6 "System interfaces". If we compare the average value from the comparative studies with the completed study in the Czech Republic, there was no statistically significant difference between the individual dimensions of the learning organization concept ($p = 0.658$, $\alpha = 0.05$).

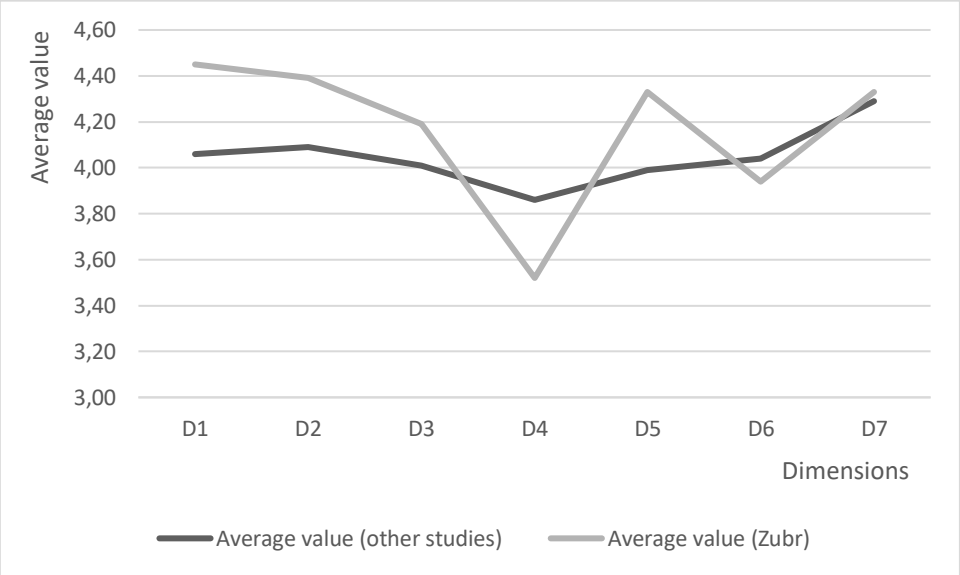

Fig. 4 *Comparison of the results with foreign studies*

Conclusions

Based on the results of the survey, it can be argued that there has been a shift in applied human resources development models in Czech IT organizations towards a learning organization. For the Czech organizations that participated in this study, it is especially recommended to focus on dimensions four and six (the lowest average rating).

Although the topic of the learning organization is supported by the European Union, there is still a lack of deeper studies in the Czech Republic that would be focused on learning organizations. The topic needs to be solved in the European context.

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Meranie kvality informačných systémov

Measuring Information Systems Quality

Ing. Renata Janošcová, PhD.
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IWKM

Vysoká škola manažmentu v Trenčíne

International Workshop on Knowledge Management
IWKM‘2018

October, 18 – 19

Bratislava 2018

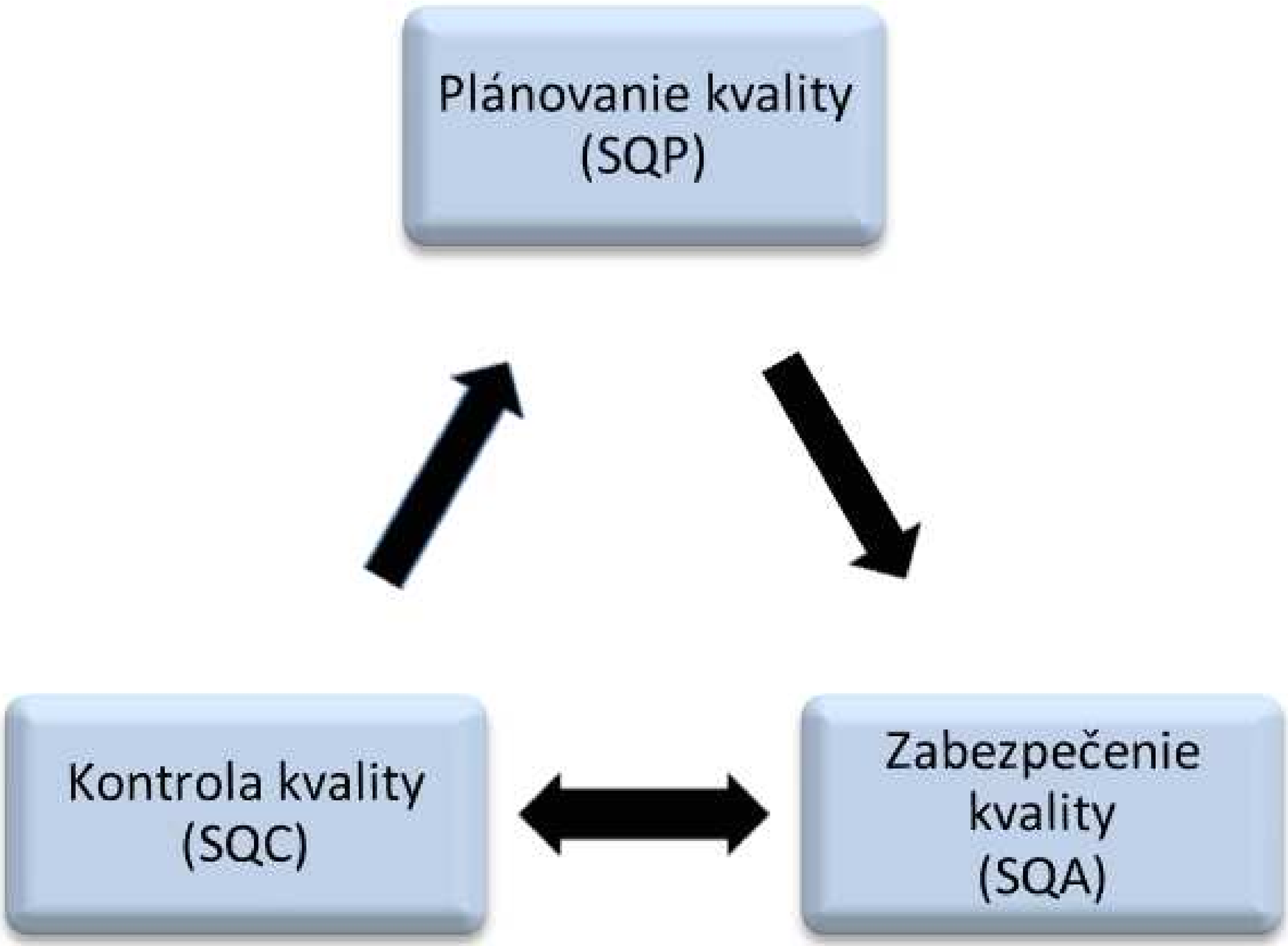
Kvalita SW

- **„SW“** – softvér / softvérový produkt / softvérový systém (informačný systém) / projekt tvorby SW/SP
- Dva základné pohľady na kvalitu SW
  - **Statický pohľad**
    - Snaží sa o statické chápanie kvality na základe **hodnotenia softvérového produktu (SW)** prostredníctvom súboru **charakteristík kvality**
  - **Dynamický pohľad**
    - Snaží sa o dynamické chápanie kvality softvérového produktu na základe **riadenia procesov jeho vývoja**, pretože **podstatné vlastnosti** softvéru ovplyvňujúce jeho výslednú kvalitu **vznikajú práve** v tejto fáze
  - **Manažérstvo kvality SW** *(SQM - Software Quality Management)*
    - Cieľom **SQM** je manažérstvo **kvality SW** a **procesu jeho vývoja**. Teda **zahŕňa obe koncepcie**, statické aj dynamické chápanie kvality SW

SQA ≠ Manažérstvo kvality SW

- Vrstva plánovania kvality SW (**SQP**)
  - **Identifikácia** noriem kvality, ktoré sa vzťahujú na **softvér**, **softvérový systém** alebo **projekt jeho tvorby**
- Vrstva zabezpečenia kvality SW (**SQA**)
  - **Implementovanie** vhodných štandardov a metód, ktoré zdokonalia proces vývoja SW a **zabránia vzniku chýb**
- Vrstva kontroly kvality SW (**SQC**)
  - **Sledovanie** výsledkov projektu tvorby SW, určenie **či vyhovujú** príslušným normám kvality a **identifikácia** spôsobov **eliminácie nevyhovujúcej kvality** SW

SQA ≠ Manažérstvo kvality SW

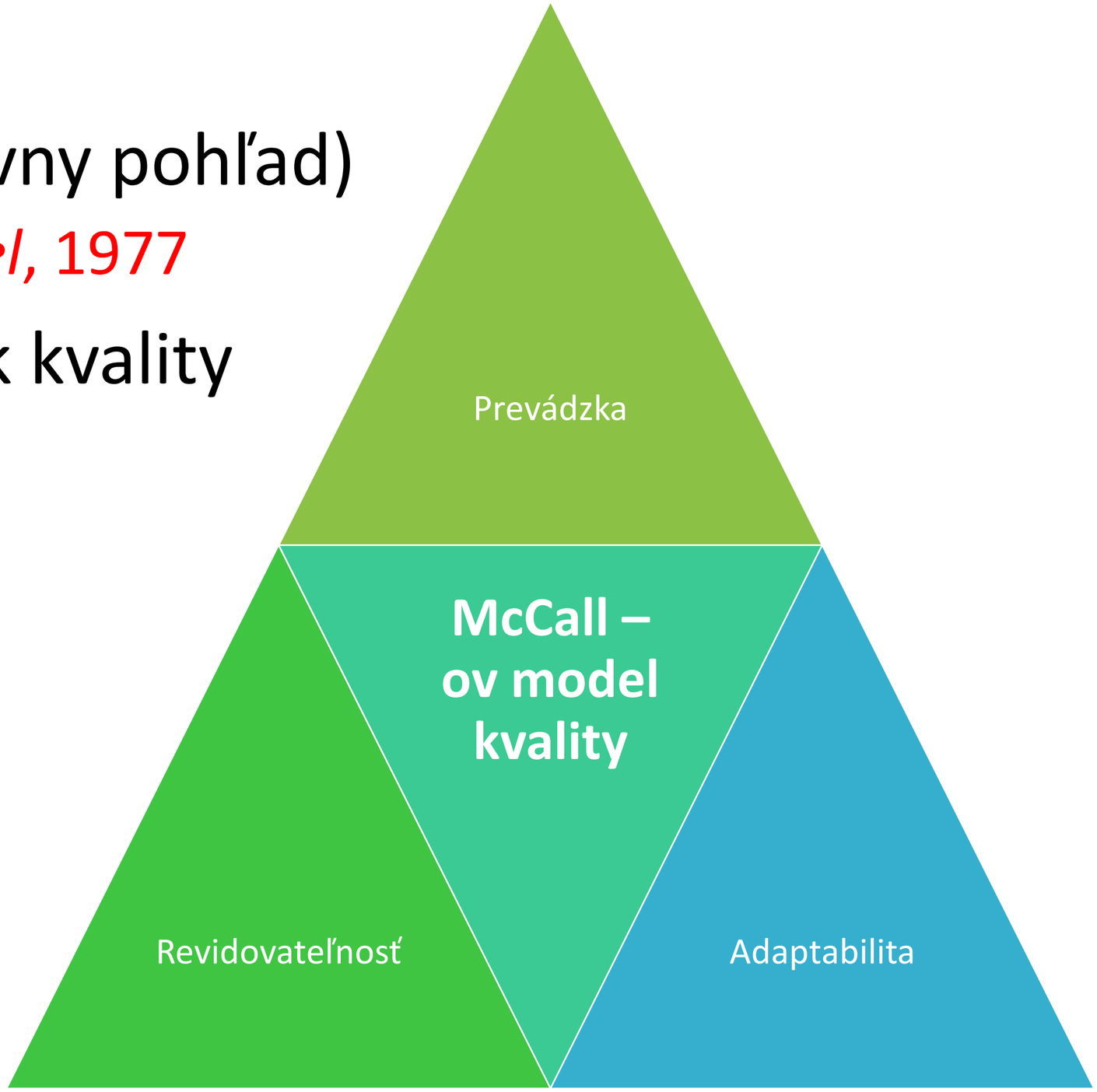


Modely kvality SW

- SQM má zabezpečiť, že **výrobok/produkt** alebo **služba** spĺňa **určené požiadavky**
  - Používame pritom **nástroje** a **metódy**, známe z oblasti **manažérstva kvality** produktov a služieb.
- Tieto nástroje a metódy sú rôzne a môžu zahŕňať **zaistenie zhody** s jedným alebo viacerými **štandardmi**
  - Predovšetkým s modelmi radu **ISO 9000**
- Modely kvality obsahujú **charakteristiky kvality**
  - Uplatnenie najmä pri použití **statickej koncepcie**, keď posudzujeme **kvalitu SW produktu** prostredníctvom **súboru charakteristík** kvality
    - Prvé všeobecne známe **modely kvality** sa objavujú v druhej polovici **osemdesiatych rokov**

McCall – ov model kvality SW

- **GE model** (kvantitatívny pohľad)
  - *General Electrics Model*, 1977
- McCall-ov trojuholník kvality
- **Faktory**
  - Použiteľnosť
  - Kompatibilita
  - Spoľahlivosť
  - ....



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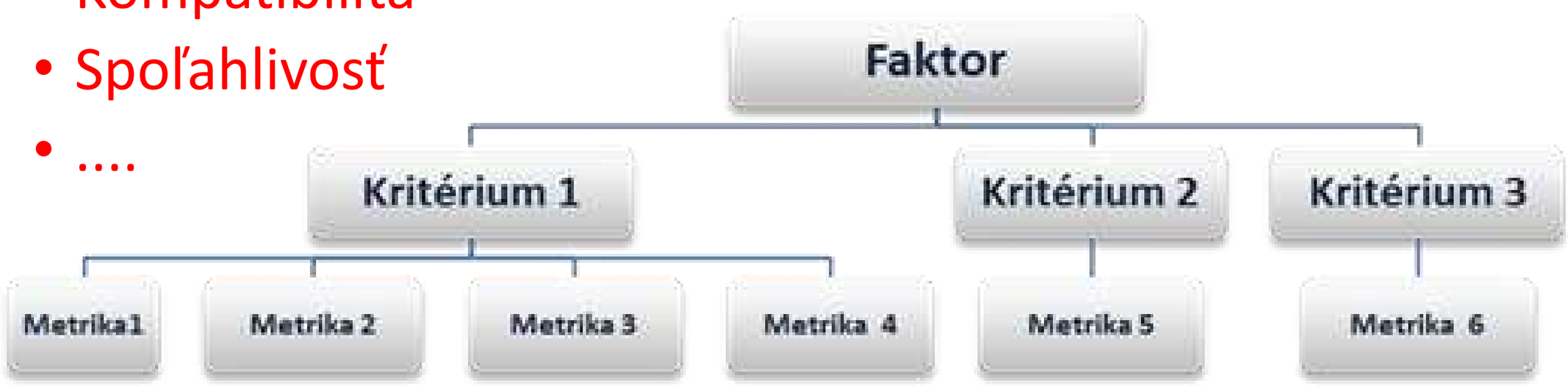


McCall – ov model kvality SW

$$F_q = c_1 m_1 + c_2 m_2 + \ldots + c_n m_n$$

- kde F_q predstavuje daný faktor kvality
- c_i – sú preddefinované koeficienty (môžu byť nimi napríklad váhy)
- m_i – hodnota merania kritéria
- Mnoho z ukazovateľov (kritérií) **možno merať len subjektívne**
  - Túto subjektivitu vo vzťahu vyjadruje člen $\boldsymbol{m_i}$, ktorý predstavuje **subjektívne meranie kritérií**, ktoré určujú daný faktor kvality, obyčajne v bodovom vyjadrení od 0 po 10 bodov

- **Boehm-ov model kvality SW (1978)** - merateľné kritériá sa sústreďujú na technické detaily (napr. testovateľnosť)
- **FURPS** a **FURPS+ (1987)**
  - delí charakteristiky SW produktu do dvoch kategórií:
    - **Funkčné požiadavky**
    - **Nefunkčné požiadavky** (v zmysle **nezaoberajúce sa funkčnosťou** SW)
      - Použiteľnosť, Spoľahlivosť, Výkon, Podpora, + implementačné obmedzenia, ...
- **Dromey-ov model (1995)**

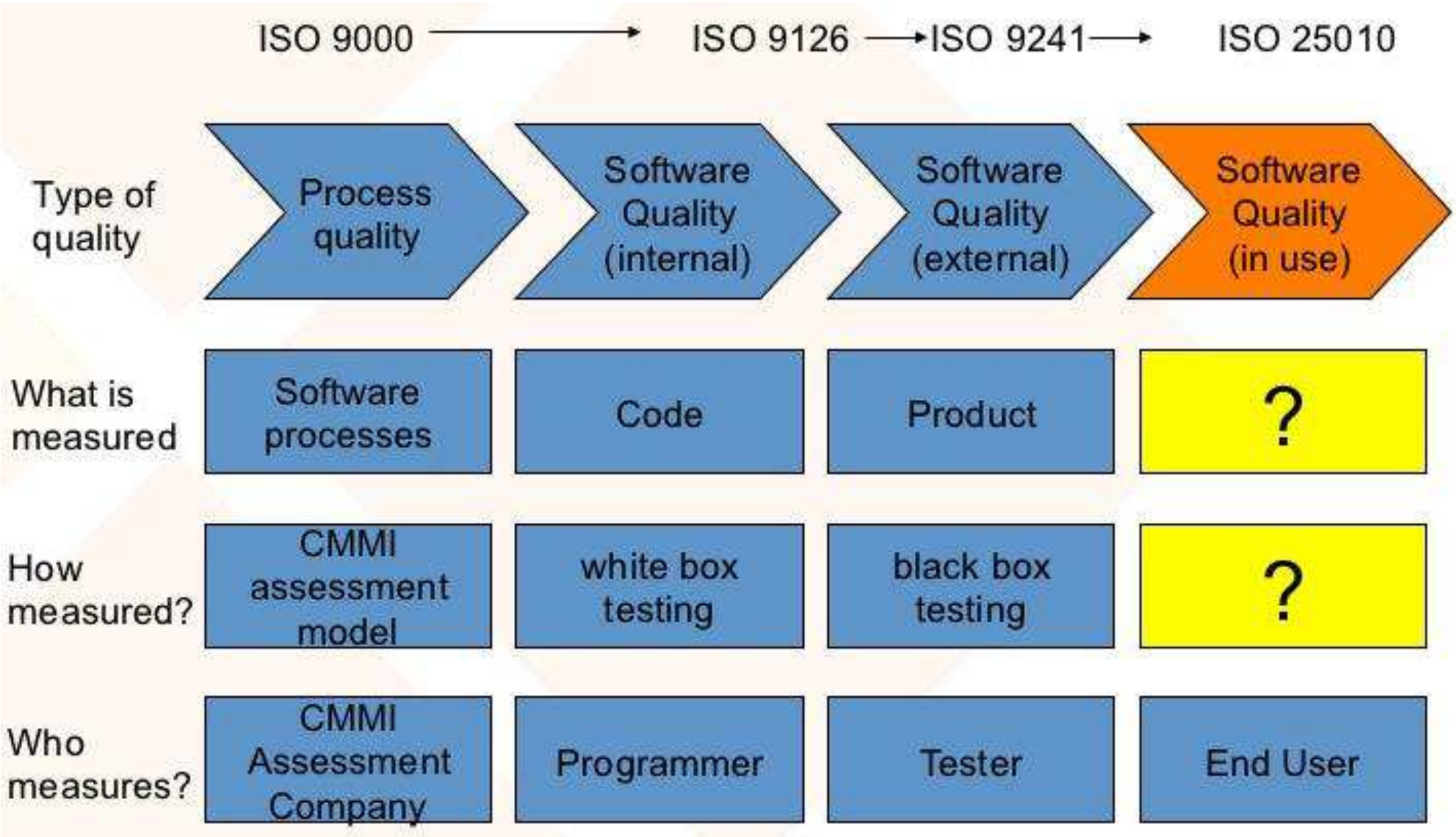
Ďalšie modely kvality SW

- Pri zabezpečovaní kvality SW môžeme použiť aj **vlastný model kvality**
  - Nevyhnutné **zvoliť**
    - **Vhodné atribúty** (charakteristiky) kvality
    - **Vyhovujúce merateľné veličiny**, aby bolo možné kvalitu SW **ohodnotiť**
    - Do tohoto procesu vstupuje **vývojár SW**, ale najmä **budúci užívateľ**
- Model GEQUAMO
- Firemné modely (MITRE's SQAE)

ISO modely kvality SW

- ISO/IEC 9126-1
  - Definuje kvalitu SW produktu ako **súbor charakteristík** SW produktu
  - inšpirovaný prácami McCall-a, Boehm-a
    - **Charakteristiky** (6) – **sub-charakteristiky** (27)
- Manažérstvo kvality (ISO/IEC 2500x)
- **Model kvality** (ISO/IEC 2501x)
- **Meranie kvality** (ISO/IEC 2502x)
- Požiadavky na kvalitu (ISO/IEC 2503x)
- Hodnotenie kvality (ISO/IEC 2504x)
- Rozšírenie SquaRE (ISO/IEC 25050 - ISO/IEC 25099)

Vývoj kvality SW



Ďakujem Vám za pozornosť

Data Mining Tools

Petr Berka
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University of Economics Prague

Seminar S1

Data Mining Tools and measurement data analysis

Vysoká škola manažmentu v Trenčíne
International Workshop on Knowledge Management
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Data Mining, Data Analytics, Data Science

- **Data mining** is the process of discovering patterns in large data sets involving methods at the intersection of machine learning, statistics, and database systems.
- **Data analytics** is the discovery, interpretation, and communication of meaningful patterns in data.
- **Data science** is an interdisciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from data in various forms, both structured and unstructured, similar to data mining.

(wikipedia)

Types of Data Mining Tools

- Data mining suites
- Programming tools
- Cloud solutions

Data Mining Suites

Stand-alone tools that implement a number of data mining and data pre-processing algorithms

- Commercial
- Free/Open Source

www.kdnuggets.com lists about 90 commercial and about 30 free tools

Data Mining Suites Features

Commercial

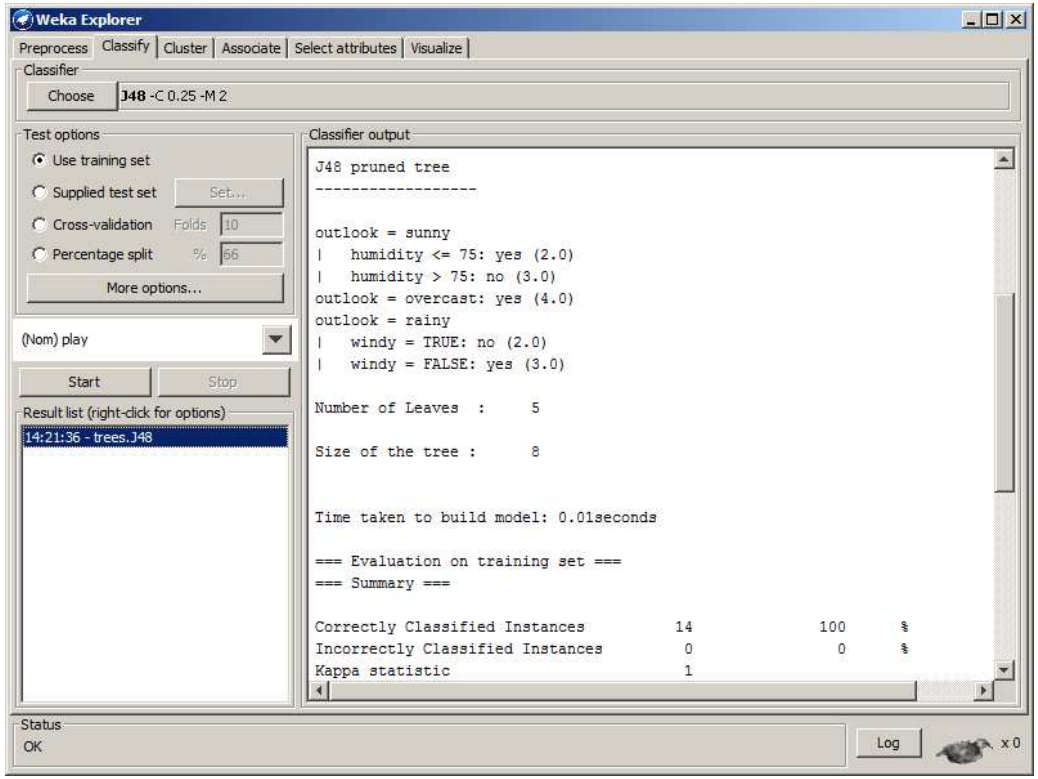
- No control of implementation
- Full control of installation
- Full control of data
- Full access to support

Free

- No/limited control of implementation
- Full control of installation
- Full control of data
- No/limited access to support

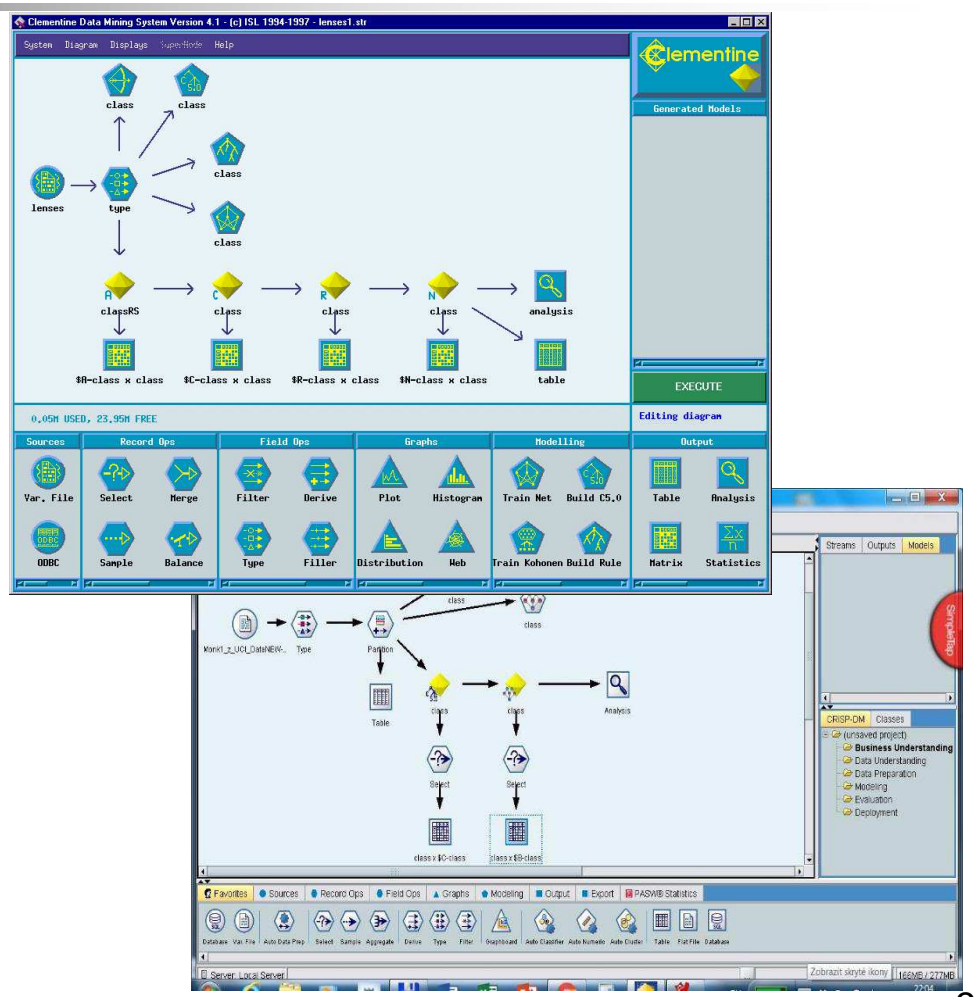
Weka (www.cs.waikato.ac.nz/ml/weka/)

- A collection of machine learning algorithms for data mining tasks from the University of Waikato, NZ. It contains tools for data preparation, classification, regression, clustering, association rules mining, and visualization.
- Development started in 1997.



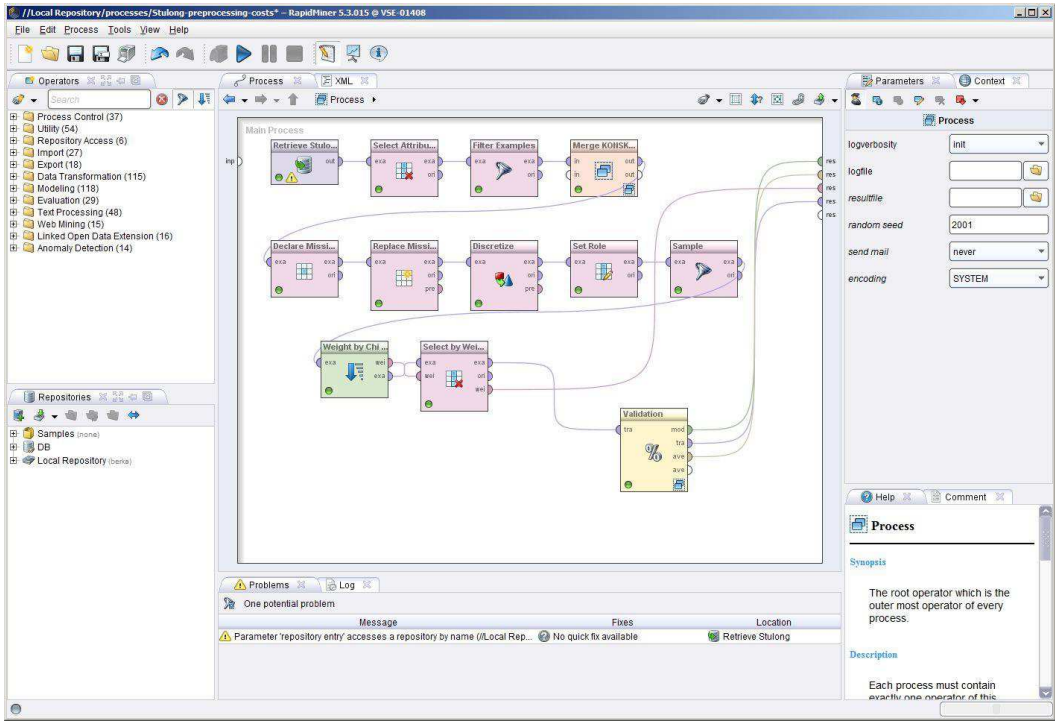
IBM SPSS Modeler (www.ibm.com)

- IBM SPSS Modeler, originally named Clementine (developed by ISL in collaboration with Sussex University in 1994), is a commercial DM system. Clementine introduces a visual interface that allows to use statistical and DM algorithms in an intuitive way without programming.



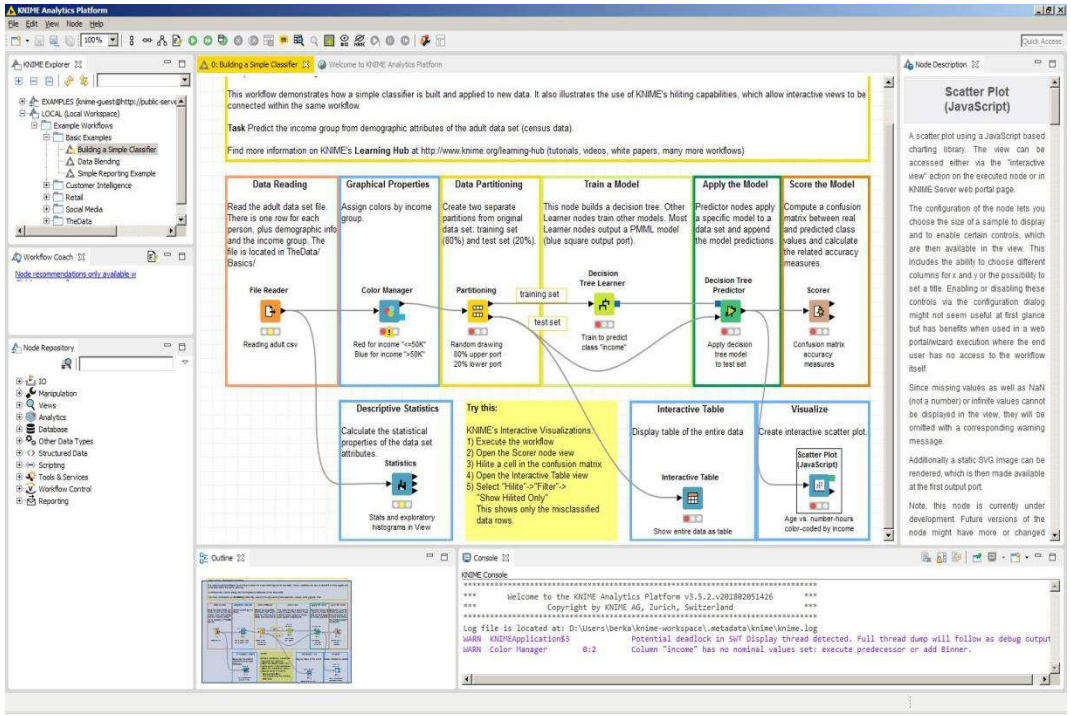
Rapid Miner (www.rapidminer.com)

- Data science software platform that provides an integrated environment for data preparation, machine learning, deep learning, text mining, and predictive analytics.
- Free version limited to 10 000 rows in data table.
- The development of the system started in 2001 at the University of Dortmund (under the name YALE).



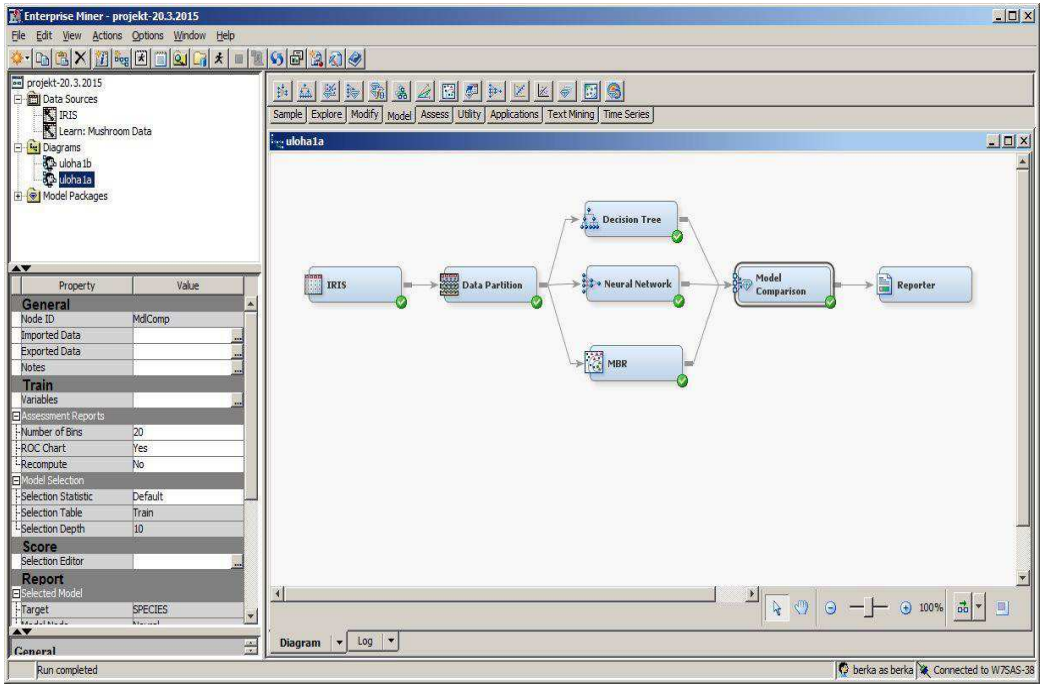
KNIME (www.knime.com)

- KNIME the Konstanz Information Miner, is a free and open-source data analytics, reporting and integration platform.
- The development of the system started in 2004 at University of Konstanz.



SAS Enterprise Miner (www.sas.com)

- SAS is a software suite that can mine, alter, manage and retrieve data from a variety of sources and perform statistical analysis of them.
- The original focus of SAS was on statistical data analysis (SAS Institute started as a project at North Carolina State University). SAS Enterprise Miner, as a stand-alone data mining tool, was released in 1999.



Gartner Magic Quadrant 2018

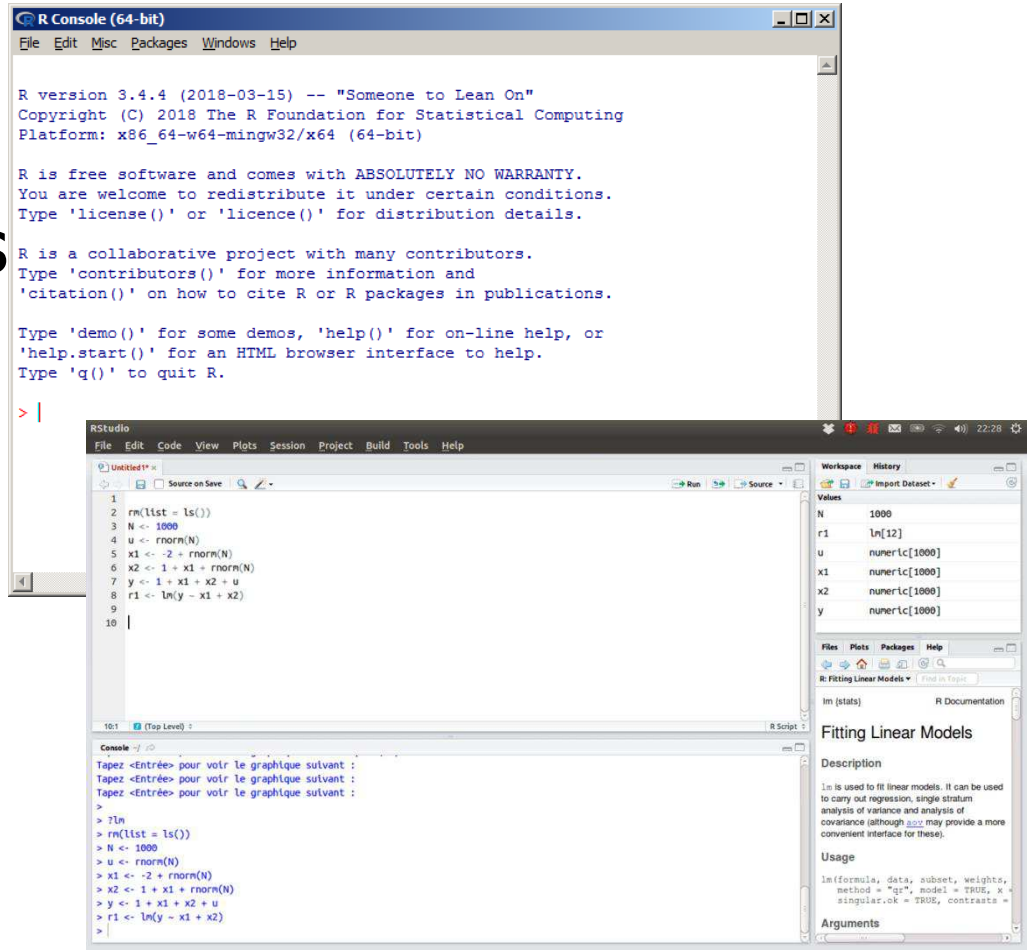
Programming Tools Features

Do it (almost) yourself solutions

- Full control of implementation
- Full control of installation
- Full control of data
- No/limited access to support

(www.r-project.org)

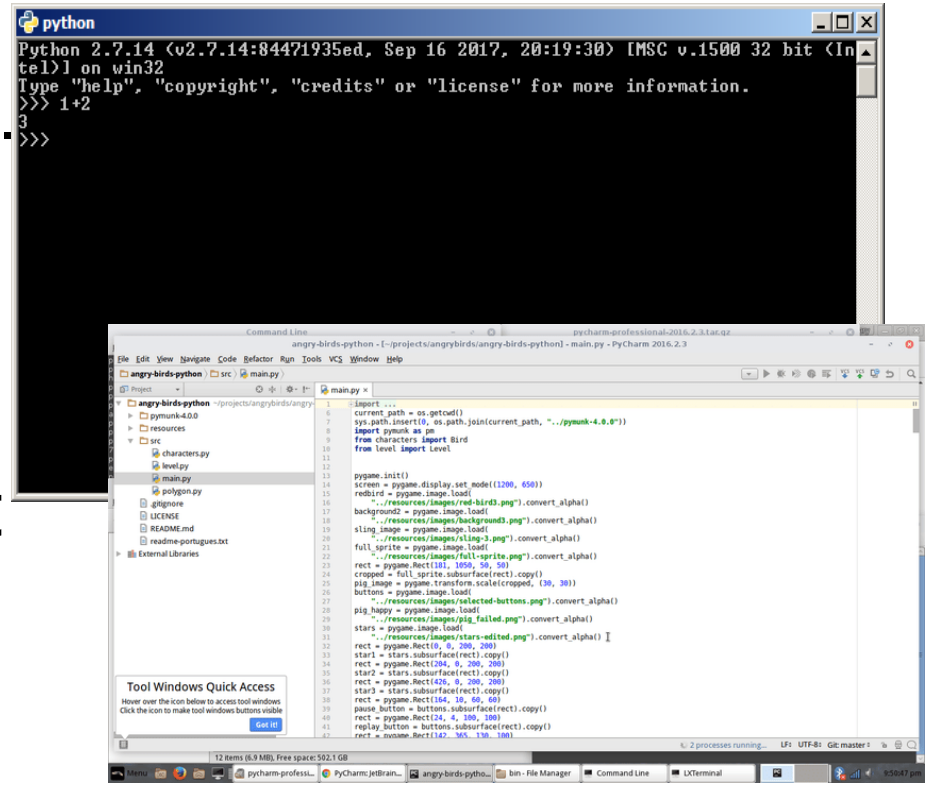
- R is a programming environment for data analysis and graphics (widely used for statistical data analysis).
- RStudio makes R easier to use. It includes a code editor, debugging and visualization tools.



Rstudio

python™ (www.python.org) …

- Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language.
- A number of IDE's (Integrated Development Environment) exist to support programming in Python.



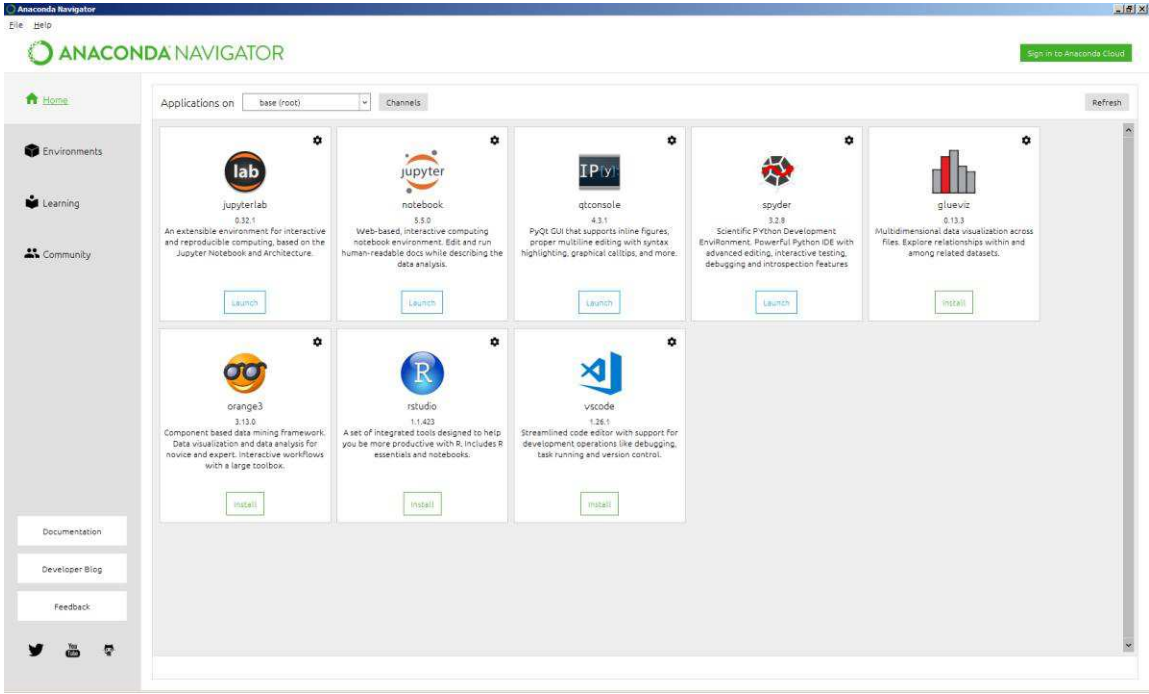
pycharm

… + libraries

- Scikit-learn (scikit-learn.org) is a free software machine learning library.
- TensorFlow (www.tensorflow.org) is an open source software library for high performance numerical computation including machine learning (neural networks).
- XGBoost (http://dmlc.cs.washington.edu/xgboost.html) is an open source software library which provides a gradient boosting framework.
- Keras (keras.io) is an open source neural network library.

ANACONDA (www.anaconda.com)

- A free and open source distribution of the Python and R programming languages for data science and machine learning related applications (industry standard for developing, testing and training on a single machine).



Anaconda Navigator

Cloud Solutions

Cloud computing refers to both the applications delivered as services over the Internet and the hardware and system software in the data centers that provide those services (Armbrust et al., 2009)

- PaaS – platform as a service
- IaaS – infrastructure as a service
- SaaS – software as a service
  - MLaaS – machine learning as a service

Cloud Solution Features

~ Systems

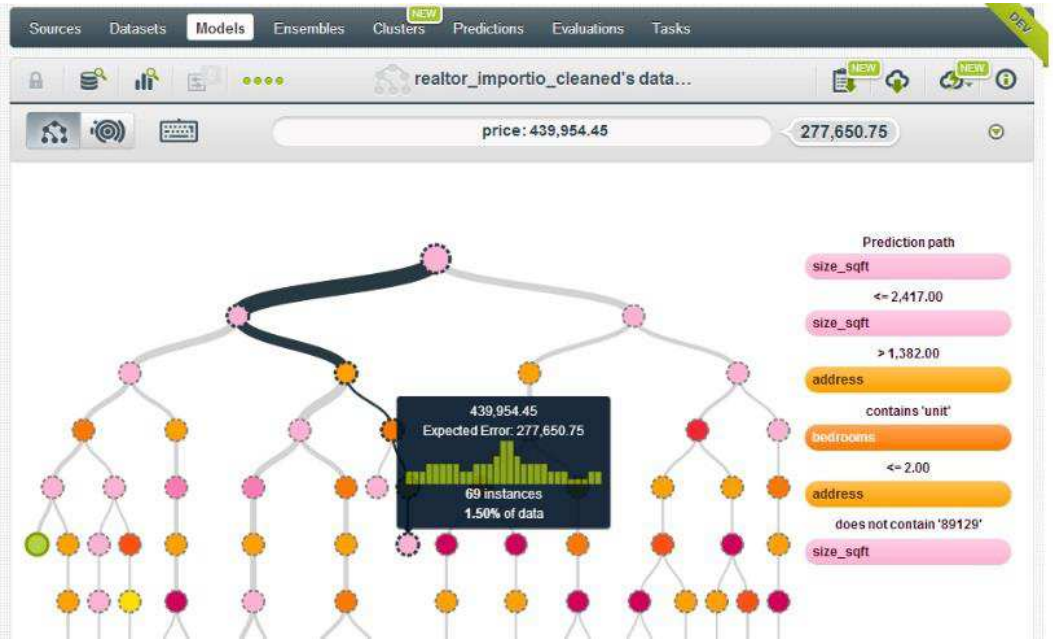
- No control of implementation
- No control of installation
- Limited control of data
- Limited access to support

~ Programming tools

- Full control of implementation
- No control of installation
- Limited control of data
- Limited access to support

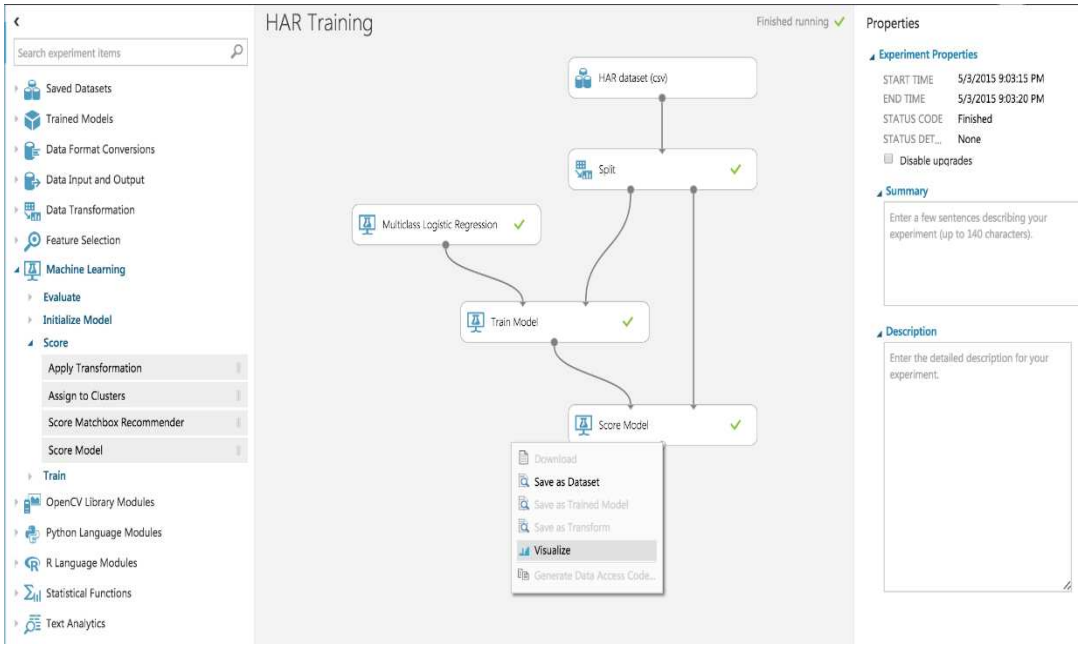
BigML (bigml.com)

- BigML is a Machine Learning service that offers an easy-to-use interface to import data and get predictions out of them.
- Implemented methods are decision trees and clustering.



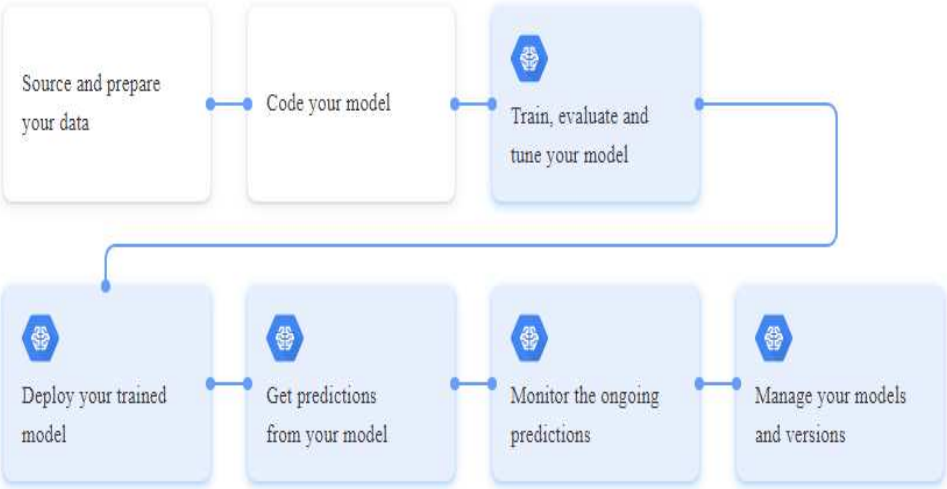
MS AzureML (studio.azureml.net)

- MS Azure is a cloud computing service created by Microsoft for building, testing, deploying, and managing applications.
- AzureML is a cloud-based predictive analytics service (decision trees, decision forrest, SVM, neural networks, logistic regression, clustering).



Google Cloud ML Engine
(https://cloud.google.com/ml-engine/)

- Google Cloud Machine Learning (ML) Engine is a managed service that enables developers and data scientists to build and bring machine learning models to production.
- Cloud ML Engine supports Scikit-learn, TensorFlow and XGBoost.

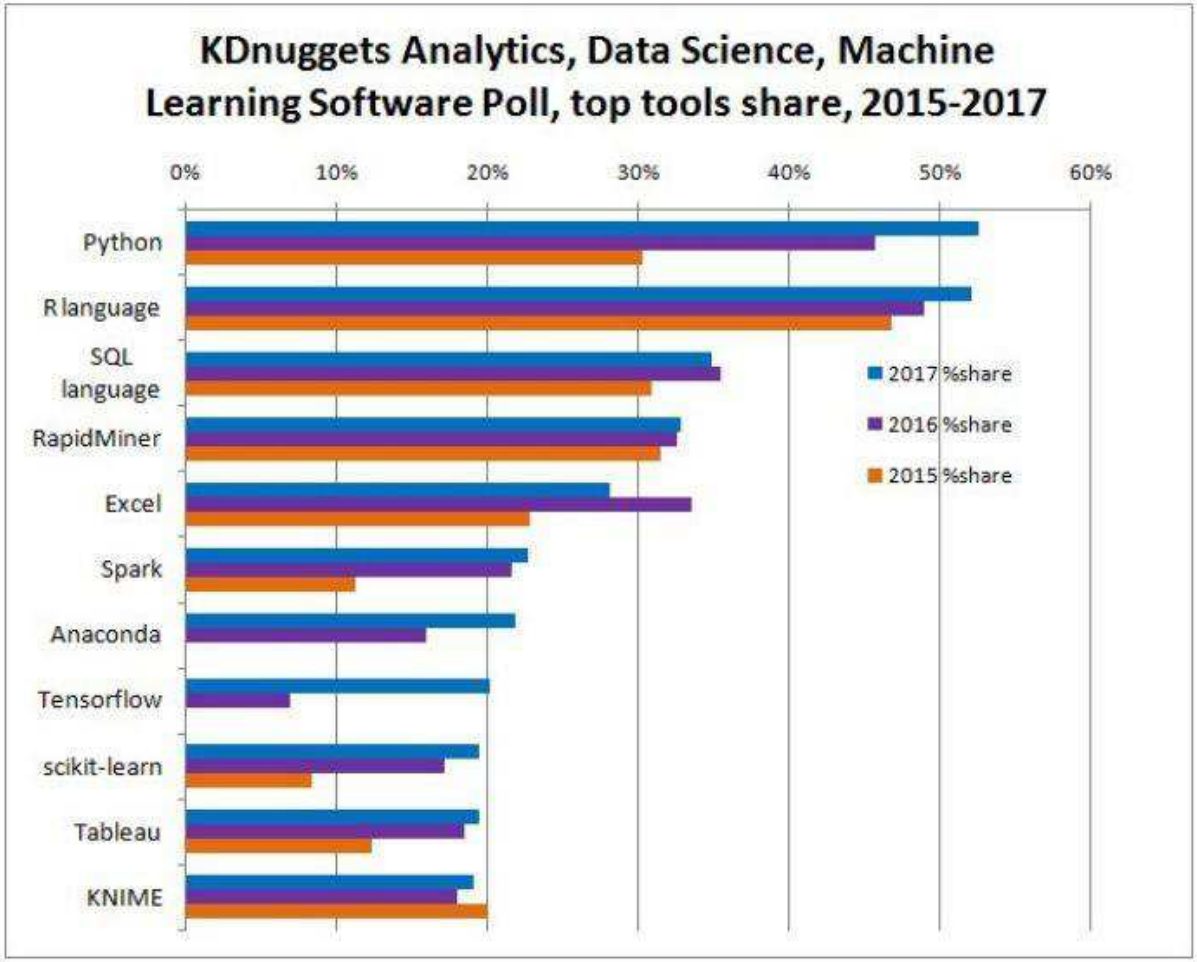


ML workflow

Suitability of tools

	Education in data mining	Research in data mining	Large apps	Small apps
Commercial suites	**Not much**	**No**	**Yes**	**Partially**
Free/open source suites	**Yes**	**Partially**	**Not much**	**Yes**
Cloud solutions	**Partially**	**No**	**Partially**	**Yes**
Programming tools	**Yes**	**Yes**	**Partially**	**Yes**

Popularity of tools



Conclusion

- There is a number of systems and programming tools for data mining suitable for different types of users
- The picture is even broader as I didn't discuss tools related to Big Data concept

Thank you

Perspectives in Measurement (State-of-the Art)

Branislav Bernadič, M.B.A., Ph.D.

Seminar S1
Data Mining Tools and measurement data analysis

Vysoká škola manažmentu v Trenčíne
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Content

- Motivation & Goals
- Definition & Fundaments
- Value (the concept of)
- Language
- Measurement as a methodological key-word
- Measurement practices
- Conclusion

Motivation & Goal

- A keynote of the 13th IWKM
- Potential for different disciplines informing each other (we're facing the same problem)

- Look at the problem from various perspectives
- Provide non-exhaustive brief description of some contemporary positions in the matter of measurement
- An invitation to a Post-Conference Monograph

Definition & Fundaments

Definitions

- Field specific
- No single one generally accepted
- Some agreement on: "…. *activity that involves interaction with a concrete system with the aim of representing aspects of that system in abstract terms*" (Tal, 2017)

Definition & Fundaments (cont.)

- what is measurable ?
- quantity & quantification
- which conditions make measurement possible?
- dealing with *quantifiable world*?
- when/how can *relations among numbers* map *relations among objects*?
- levels of an *acceptable error*
- operationalization (e.g. *fuzzy* → *quantity*)

Value (the concept of)

Value:

- Variable
- Number
- Axiological category

- whether math operations with the values make sense (Stark, 2018)
- mea. is theory loaded/contextual *(attribute)*
- *true value*: e.g. acc: value in a mathematical sense vs. value as a social concept
- problem of "*average household*"

Language

- the linguistic representations can be seen as *compression algorithms*, which economically condense vast amounts of information into a symbolic formula (Evers and Lakomski, 2000)
- mea. characterization also fits various kinds of perceptual and linguistic activities (Tal, 2017)

- mea. as *representation*
- mea. as *metaphor*

Mea. as a methodological key-word

- historically a demarcation lane between *natural* and *social* sciences (humanities)
- principles of *predictive science*

Issues:

- mea. vs. empirical information
- sources and representations of *variation* (inherent and induced)

e.g. in biological/social systems

Mea. as a methodological key-word (cont.)

- mea. where the entities under study have a *dubious ontological grounding*
- mea. outcomes reflect *facts* about nature or about human *tools* and *concepts*?
- level of *acceptable error*
- when measuring instruments *disagree*, is it always possible to ascertain which one is in *error*?

(Mitchell, Chang, Tal, 2015)

Mea. as a methodological key-word (cont.)

- validities (e.g. construct val.) and precision
- conditions under which relations among *numbers* can be used to express relations among *objects*
- numerical intervals do not always carry empirical information
- [if (a=b & b=c) then a=c]

empirical comparisons among physical magnitudes reveal only *approximate equality*, which is not a *transitive relation*

(Tal, 2017)

Mea. as a methodological key-word (cont.)

- understanding of mea. is key to:

→ interpretation of research results

→ validity of theory

→ acceptation/refusal of statements

→ correct comparison of measurements

.... *discrepancies between theory and accurate measurements led to the development of new theories. Such slight discrepancies would not even have been detected if we had been content with a merely qualitative explanation of the phenomena.* (Symon, 1964)

Mea. practices

- mea. standards accurate by virtue of fact or convention? (Mitchell, Chang, Tal, 2015)
- expected revision of the *International System of Units (SI)*
- *The General Conference on Weights and Measures* (13-16 November 2018)
- effective from 20 May 2019, SI is the system of units (s;m;kg;A; K; mol; cd) in which:

Mea. practices (cont.)

- the unperturbed ground state hyperfine transition frequency of the caesium 133 atom $\Delta\nu Cs$ is 9 192 631 770 Hz
- the speed of light in vacuum c is 299 792 458 m/s
- the Planck constant h is 6.626 070 15 × 10−34 J s
- the elementary charge e is 1.602 176 634 × 10−19 C
- the Boltzmann constant k is 1.380 649 × 10−23 J/K
- the Avogadro constant NA is 6.022 140 76 × 1023 mol−1
- the luminous efficacy of monochromatic radiation of frequency 540 × 1012 Hz, Kcd, is 683 lm/W

(CGPM,2018)

Conclusion

- Definition & Fundaments
- Value
- Language
- Mea. as a methodological key-word
- Mea. practices

- Cornerstone of Science
- What does it mean to measure something?

Resources

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Thank you!

- bbernadic@vsm.sk

Nástroje a možnosti analýzy údajov z otvorených zdrojov

Ing. Milan Hrdlík
Veri2 s.r.o.
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Seminar S1
Data Mining Tools and measurement data analysis

Vysoká škola manažmentu v Trenčíne

International Workshop on Knowledge Management

IWKM‘2018

October, 18 - 19
Bratislava 2018

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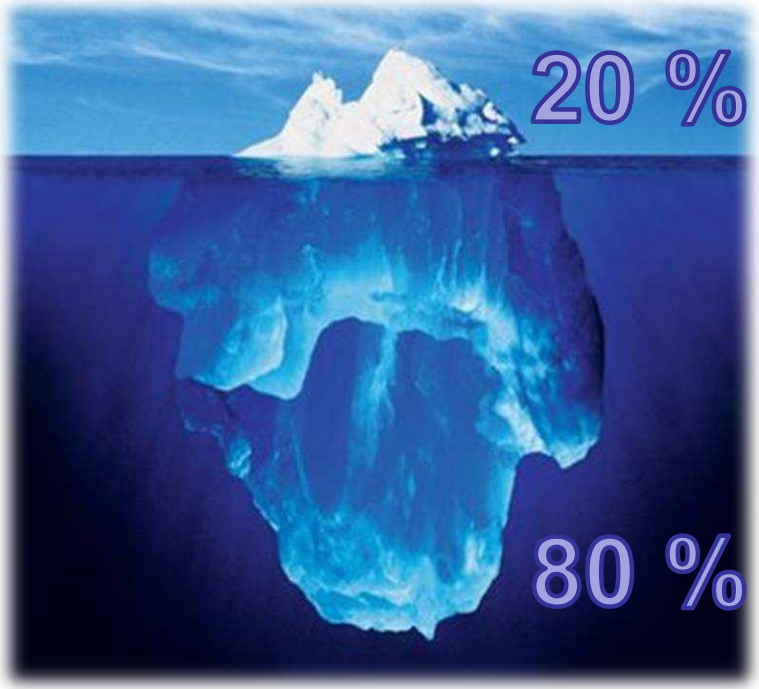

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- Dotaz **Huba**:
  - chápe, že ***Huba*** *môže* referovať k **osobe** alebo k **biológii**
  - nájde informácie o **hercovi** SND a nie o **mykológii**

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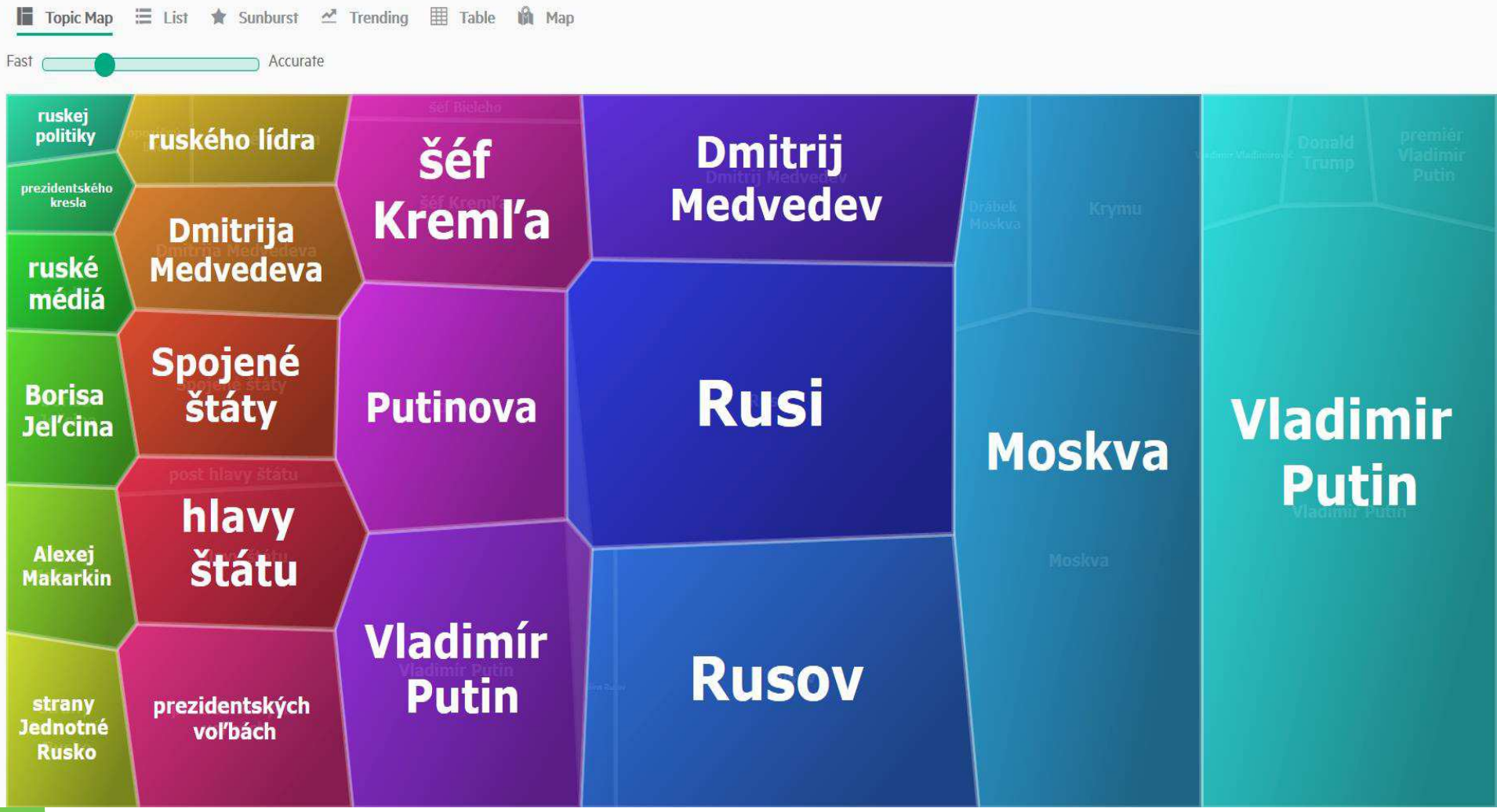
Term – „Putin“



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Západ sa zjednotil vďaka Putinovi

2 months ago

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chce zvaliť na následníka.“ * Od roku 2000 do roku 2004 ste boli „jeho“ premiérom. Bol to vtedy iný **Putin** ako dnes? „Bol to úplne iný **Putin**.“ * A čo sa stalo s tým pôvodným? „Začal som s **Putinom** pracovať, keď sa

Similar documents

Putin. Prečo si Rusi nevedia predstaviť iného

3 months ago

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stupňov pod nulou a dôchodkyňa Ľuba hodiny chytá ryby so svojím manželom bez rukavíc. „Je to v pohode, voda je teplejšia ako vzduch,“ upokojuje novinára, kým si namáča prst. „**Putin**, len **Putin**,“

Similar documents

Zaspievajme si ódu na Putina

6 months ago

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je onen hrdina, za ktorým ide celý národ. „**Putin**, ty si ten **Putin**, s ktorým chcem byť, po ktorom nemožno netúžiť, môj **Putin**, môj drahý **Putin**...“ Je to tak. Dielko je oslavným songom na hlavu ruského štátu

Similar documents

Dva české televízne večery s Putinom

a year ago

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než rok dá nájsť na internete. Či toto **Putin** vedel, či to vedeli ruskí dôstojníci, ktorí mu video podstrčili, či išlo o omyl, lajdáctvo, či zámer, sa zatiaľ nevie. Stone napovedá **Putinovi** 2. **Putin** tvrdí, že nie je bohatý a

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Západ sa zjednotil vďaka Putinovi SME

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Moskve, môžu si kúpiť trikrát taký veľký byt na bulharskom pobreží. To je naša tragédia - emigranti sú našimi voličmi. Ani na mladých ľudí sa nemôžeme spoliehať. Veľká časť 25- až 30-ročných je absolútne apolitická. To je generácia otrávená Putinovým režimom. Celý ich dospelý život je pri moci len **Putin**. Hlavné, čo pochopili, je, že najdôležitejšie zo všetkého sú peniaze. Zaujímavé je, že podľa prieskumov mnohí z týchto ľudí túžia pracovať v FSB alebo v daňovej polícii, pretože vedia, že tieto orgány predstavujú silu a moc nad ostatnými, a tým aj peniaze. Táto otrávená generácia je najväčším Putinovým zločinom.“

* Politické zmeny v Rusku sú teda v nedohľadne?

„Reálne príjmy klesajú veľmi rýchlo. Propagandistická schéma, že Rusko je obkľúčené nepriateľmi, že musíme zaľahnúť do zákopov a pripraviť zbraňe na paľbu, už dlho nebude zaberať. Ľudia sa začnú pýtať, prečo žijeme horšie a horšie. **Putin** to vie takisto. Myslím, že začne sám pripravovať odchod z najvyššej funkcie. Musí zvoliť taký spôsob, ktorý bude zároveň garanciou jeho bezpečnosti. Čo je však ešte dôležitejšie - on chce byť zapísaný v histórii ako vodca, ktorý pozdvihol Rusko z kolien, vyviedol ho z temnoty a donútil svet, aby ho rešpektoval. Všetko negatívne chce zvaliť na následníka.“

* Od roku 2000 do roku 2004 ste boli „jeho“ premiérom. Bol to vtedy iný **Putin** ako dnes? „Bol to úplne iný **Putin**.“

* A čo sa stalo s tým pôvodným?

„Začal som s Putinom pracovať, keď sa predchádzajúci prezident Boris Jeľcin rozhodol, že práve on bude jeho následníkom. Súhlasil som s tým výberom. Dnes viem, že sme sa obaja mýlili. Bol som presvedčený, že **Putin** je rovnaký ako my, ktorí sme prišli takpovediac zo Sovietskeho zväzu. Ale snažili sme sa porozumieť demokratickým hodnotám a myslím, že sme im porozumeli. Domnieval som sa, že **Putin** patrí do našej skupiny,prebudených‘. Spočiatku naozaj plnil všetky predpoklady aj moje podmienky, preto som aj súhlasil, že za jeho prezidentovania budem ruským premiérom.“

* Aké to boli podmienky?

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How understood what is important

<Dátum>
18.10.2011
19.10.2011

<Mená>
Lucia Žitňanská
Ján Gereg
Mikuláš Černák
Karol Mello

<Organizácie>
Najvyšší súd
Okresný súd

<Lokalita>
Slovensko
Bratislava
Most pri Bratislave

Mellov obhajca: Verdikt mi oznámil Mikuláš Černák

Zdroj: Plus JEDEN DEŇ/meg

18. október 2011 11:50 Aktualizované: 19. október 2011 00:00

Ministerka spravodlivosti Lucia Žitňanská chcela zvrátiť rozhodnutie sudcu Okresného súdu Bratislava I o prepustení najhľadanejšieho muža Slovenska Karola Mella (41). Nevyšlo jej to. Mellov obhajca Ján Gereg sa o rozhodnutí Najvyššieho súdu dozvedel od Mikuláša Černáka.

Zdroj: TASR

Karol Mello

Údajný boss hornonitrianskeho podsvetia Karol Mello sa pre chybu sudcu dostal z väzby na slobodu v máji. Jeho prepustenie spustilo vlnu kritiky na slovenské súdnictvo. **Ministerka spravodlivosti v polovici júna podala dovolanie na Najvyšší súd a dúfala, že sa prípad opäť vráti na Okresný súd Bratislava I, aby o Mellovej väzbe opätovne rozhodoval.**

Senát Najvyššieho súdu však včera Žitňanskej dovolanie zamietol. Zaskočený včera zostal Mellov obhajca Ján Gereg, nie však z rozhodnutia súdu, ale z toho, ako a kde sa informáciu dozvedel. ***„Bol som v ilavskej väznici za mojím klientom Mikulášom Černákom. Ten mi počas nášho sedenia pár minút popoludní oznámil verdikt v prípade Žitňanskej dovolania,"*** prezradil nám Gereg.

Päťčlenný senát o dovolaní ministerky pritom rozhodol pár minút predpoludním. **Karol Mello si slobodu užíva už piaty mesiac. Kde momentálne žije, polícia netuší.**

Na Slovensku je obžalovaný v prípade dvojnásobnej vraždy v Moste pri Bratislave. Momentálne je na Mella vydaný medzinárodný zatykač za inú vraždu, z ktorej je obvinený.

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EXTRACTION

- Rozpoznávanie
  - Osoby
  - Organizácie
  - Politické strany
  - Autor
  - Telefónnych čísiel
  - Čísiel bankových účtov
  - Emailových adries
  - Čísiel
  - Udalostí
  - Predmetov
  - ....

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EXTRAKCIA

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Bratislava - Správa štátnych hmotných rezerv spravila čudných obchodov viac. Nedávno predala v elektronickej aukcii 63tisíc gramov platinových sitiek s prímesou ródia za 667-tisíc eur, pričom trhová cena toho istého množstva platiny s ródiom dosahuje až 2,425 milióna eur. Platinové sitká kúpila firma Heneken. Osoba rovnakého mena ako jej 27-ročný majiteľ Michal Hudoba v roku 2006 kandidovala vo voľbách za SDKÚ-DS. V nedeľných Televíznych novinách o tom informovala televízia Markíza. Sitká obsahovali 92 percent platiny a osem percent ródia. Cena, ktorú kupujúci zaplatil za sitká, bola 10 eur a 60 centov za gram, pričom trhová cena zlatiny dosahovala 38 eur 50 centov za gram. Výkupná firma, ktorú kvôli platinu takmer za 30 eur za gram. Kr ncom elektronickej aukcie, napriek tor u, či je normálne, že má v relatív ych hmotných rezerv Eva Hrink uláš Dzurinda, reakciu neposkyt ojich najväčších káuz. Kvôli uzat seda Ján Odzgan odstúpiť zo , boli nominantmi strán SOP a


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    <entity3>Milan Bališ</entity3>
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    <entity1>Palkovičová</entity1>
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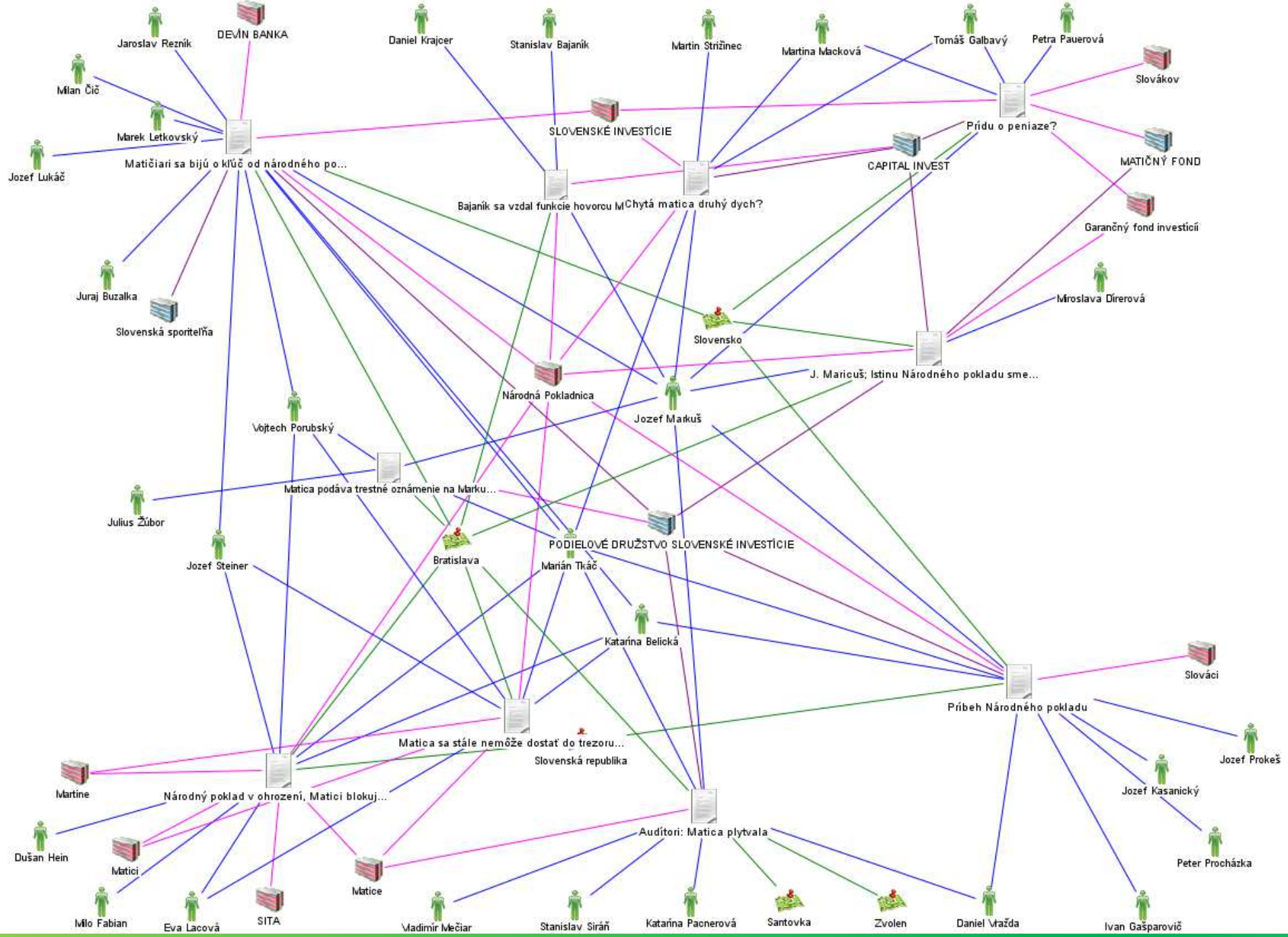
» Nájdené entity

#	☑	Osoba	Akcia
1	☑	Mikuláš Dzurinda	
2	☑	Štefan Soták	
3	☑	Eva Hrinková	
4	☑	Michal Hudoba	
5	☑	Ján Odzgan	

#	☑	Firma	Akcia
1	☑	Heneken	

#	☑	Strana	Akcia
1	☑	SDKÚ - DS	
2	☑	SOP	
3	☑	SDK	

#	☑	Lokalita	Akcia
1	☑	Bratislava	



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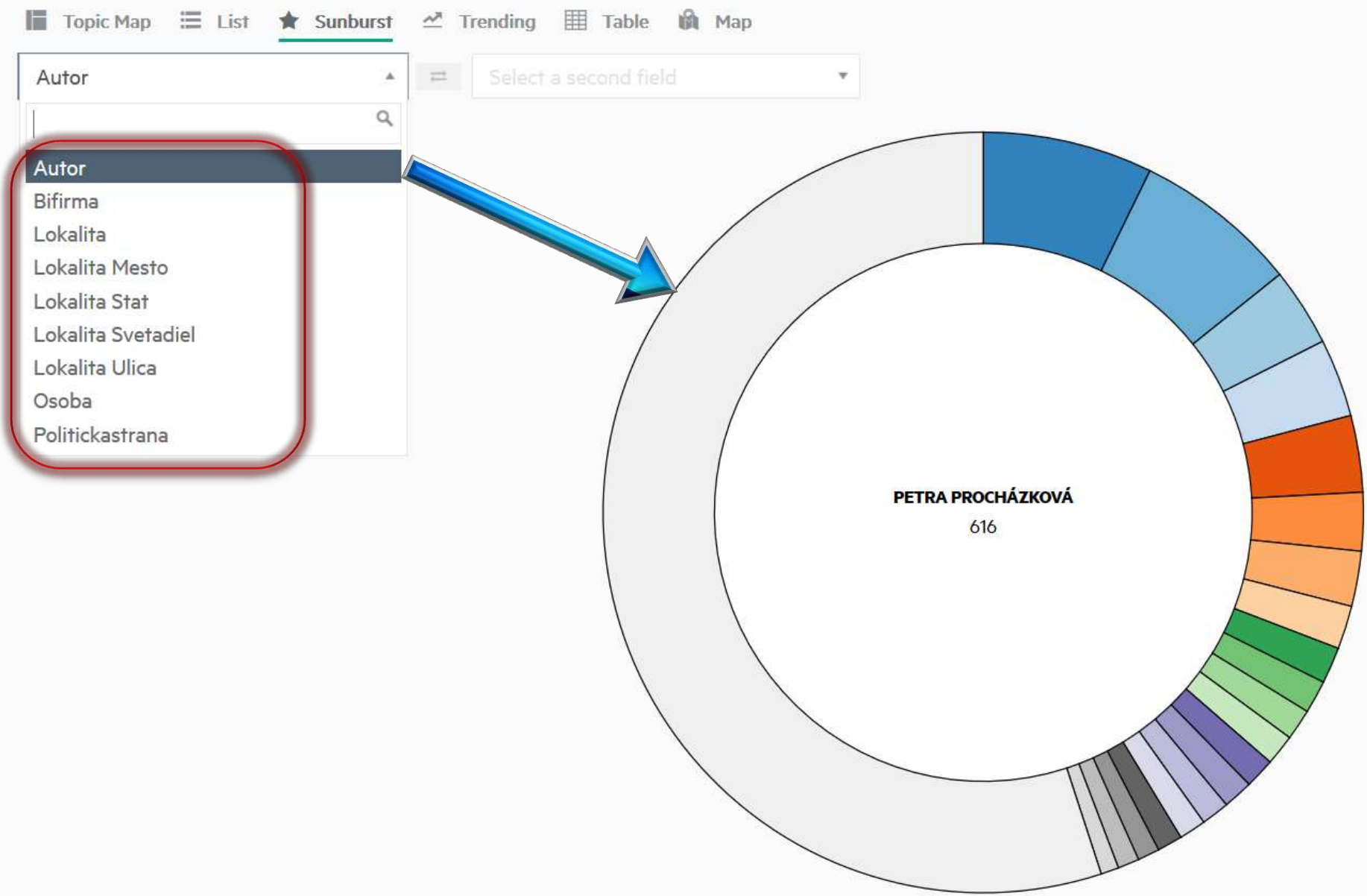
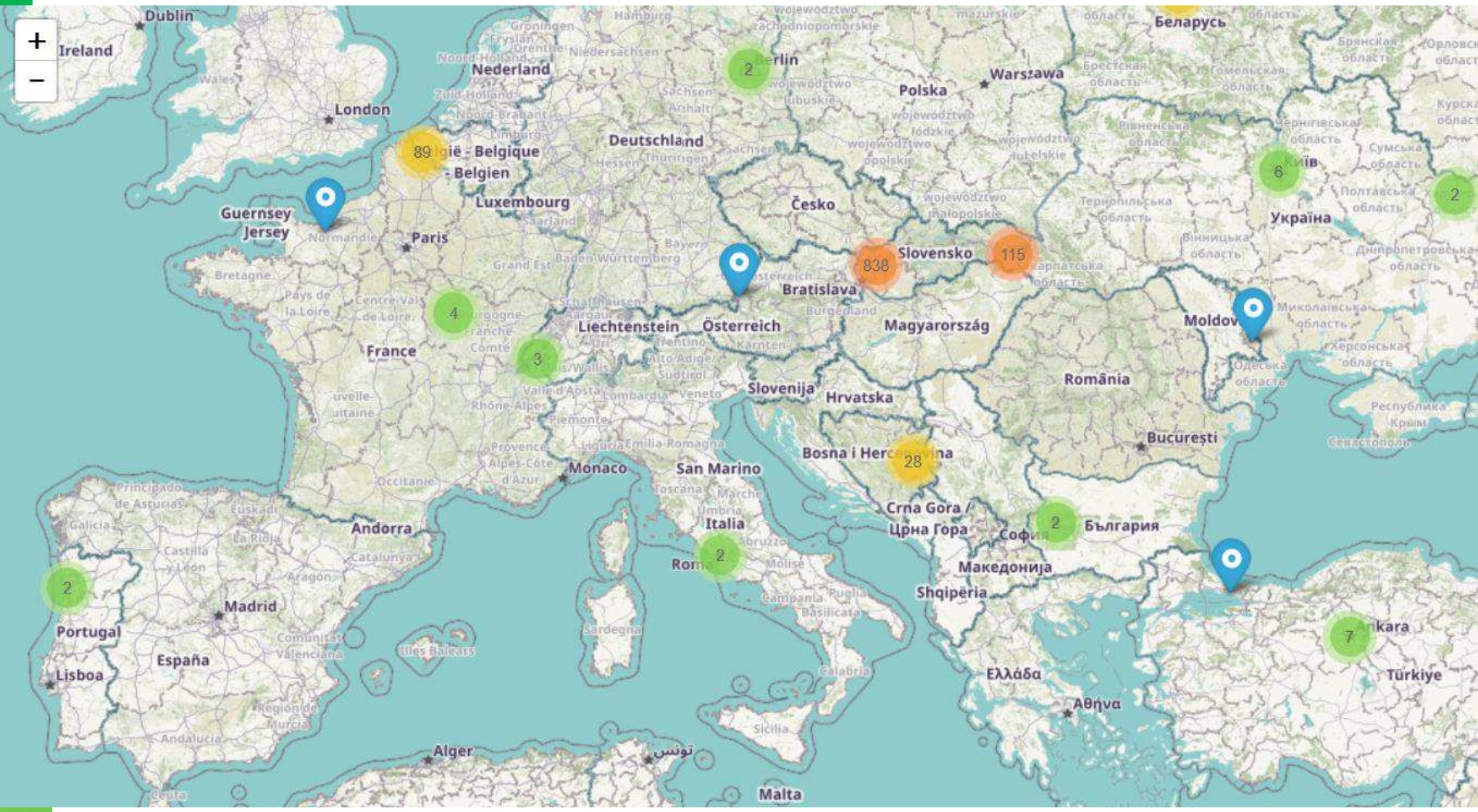


MetaData – trending

Geolocation



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Mon Oct 17 08:48:13 CEST 2011

Rozšírené vyhľadávanie

ketamín

Hľadať v skupine výsledkov:

dopila drink a zavolala si taxík Erik Mihalko injekčnou striekačkou
Ketamínový fantóm
ketamínový šialenec
ketamínových útokov krajský policajný liečbu drogových závislostí
mladé ženy neznámy muž neznámy páchateľ
omamnú látku omámenej ketamínom
prípadoch ketamínového Tatiana Kurucová
taxikára Jozefa zastávke MHD
zastávke MHD na Predstaničnom námestí

Triediť podľa: Date

Kvalita: 70

Hľadať podľa dátumu: Od: 01 01 2000 Do: 14 10 2011

Časová línia

Rok 2009 | Rok 2010 | Rok 2011 | mesiac

Od 01/10/2008 do 01/08/2011 (45 dokumentov)

Výsledky vyhľadávania

Čas dotazu: 0.073s

Celkový počet dokumentov: 45

Upraviť vyhľadávanie

Vytvoriť agenta

Ak zajtra zomriem, budem šťastné dievča

Dátum: 25.07.2011
Relevancia: 81.24
27) Speváčka si namiešala smrtiaci koktail kokaínu, heroínu, extázy a **ketamínu** LONDÝN - Amy Winehouse je mŕtva! Podľa magazínu People si speváčka večer pred smrťou u dílera nakúpila drogy - kokaín, heroín, extázu a **ketamín**.
Zdroj: **c:\Indexing_SlovakiaOnline\NCOut\20110725.txt - Ak zajtra zomriem, budem šťastné dievča**

Talent Amy Winehouse umlčali drogy

Dátum: 25.07.2011
Relevancia: 79.68
Britský denník Daily Mail napísal, že speváčka si kúpila drogový kokteil, v

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FullText – language undestand question: kôň (horse)

Zvýraznený obsah

Legendárny český džokej Josef Váňa:

František Prachař -foto Martin Hurda, anc

Dn[illegible] českých Pardubiciach uskutočnia už po 121. raz jedny z najslávnejších dostihov sveta. Na štarte Veľkej pardubickej sa má stretnúť [illegible] **koní** [illegible] jazdcov. V dostihoch budú súťažiť ib[illegible] **kone** [illegible] českých stajní - zo zahraničia tam budú len slovenský džokej Jiří Kousek, ktorý sa narodil v Brne, a francúzsky džokej Julien Lemée. [illegible] najťažších dostihov sveta je je[illegible]ne Čech Josef Váňa (59), ktorý Veľkú pardubickú vyhral už sedemkrát. Bude jazdiť na desaťročnom anglickom plnokrvníkovi, valachovi Tiumenovi, ktorý s Váňom dobehol vlani aj predvlani ako prvý. Podarí sa to aj dnes? O tom, ale aj o mnohom inom porozprával legendárny český džokej pre nedeľník, ktorý ho navštívil na statku Mlýnce na západe Čiech.

? A[illegible] **kone** [illegible]te poslali na Veľkú pardubickú? Tento rok sme ich prihlásili osem, ale nakoniec pobežia tri. Budú to Tiumen, obhajca vlaňajšieho prvenstva, Six teen, ktorá Veľkú pardubickú už tie[illegible] vyhrala. A tretím je Lirian, ktorý Veľkú bežal ešte u iných majiteľov, ale vlani bol s mojím synom Pepanom šiesty, čo považujem za solídny výsledok. ? Na Tiumenovi budete jazdiť vy, na Sixteen váš spoločník Bartoš a na Lirianovi bude váš syn, ktorý však preteká už dlhší čas v Taliansku. Prečo sa rozhodol postaviť sa na vlastné nohy a opustiť rodinnú stajňu v Mlýncach?

Podľa mňa [illegible], že od nás nedostával na dostihy tak[illegible] **kone**, [illegible]toré by mohli byť šampiónmi a boli by schopné víťaziť. Pepa bol u nás druhý džokej. Prvým je pán Bartoš, ktorý má právo vyberať [illegible] **koňa** [illegible]o dostihov a Pepa v dostihoch párkrá[illegible]l. Tak sa rozhodol, že tu nebude robiť šaška a skúsi jazdiť za iné farby v Taliansku. ? Čiže to bol prirodzený vývoj a nie generačný konflikt?

Konfli[illegible]bol, skôr som bol naňho prísnejší ako na všetkých ostatných. Ale to mi vyčítať nemohol, pretože to, čo dnes vie, vie vďaka tomu, že som mu vždy šiel príkladom. ? Máte pre svoj[illegible] **koňa** [illegible]iumena nejaký špeciálny tréning?

Staviam na mnohoročných skúsenostiach, na poslednú chvíľu nič nedoženiete. Tréning na Veľkú, to je dlhodobý proces, ktorý sa vyvíja podľa **koňa**. Už v jeho štyroch rokoch sa dá rozpoznať, či je [illegible] Veľkú ten správny typ.

? Už taký mla[illegible] **kôň** [illegible] dá odhadnúť?

Áno, ale aj tak je to beh na dlhú tr[illegible]. **Kôň** [illegible] pripravuje celoročne. Začína sa to tvrdou [illegible]nou prípravou, musíte doň dostať čo najväčší tréningový objem, viac sily a fyzického fondu. Zvyšok roka sa to iba oživuje a dolad[illegible]ed vrcholovými pretekmi. ? Koľko denne tak[illegible] **kôň** [illegible]behá?

Netrénuje[illegible] **kone** [illegible] dráhach od - [illegible]. **Kôň** [illegible]rdo pracuje jeden alebo dva dni v týždni, zvyšok odpočíva a snaží sa vstrebať tú únavu, ktorou prešiel.

? Čiže prechádza sa rannou rosou a behá po lese?

Aj to. Okolo Mlyncov je krásne zvlnený terén a my ho využívame. Rieka, ktorá tu tečie, je ideálna na chladenie nôh **koní**. Na ich relaxáciu je dobrá aj rosa a rieka je ako virivka. ? Ako **kone** chránite pred tým, aby ich cudzí ľudia, napríklad v rámci konkurenčného boja, nenadopovali?

Čítate detektívky Dicka Francisa, že? Za všetko, čo sa deje, je zodpovedný tréner. Niekedy je to hrozné. My sme už mali dva-trikrát problémy s tým, že zrazu sa po dostihoch naš[illegible] v **koňovi** stopové prvky, napríklad brufen. Ale kto by asi chcel zbaviť **koňa** bolesti brufenom? To by ho musel skonzumovať aspoň za kýbeľ. Lenže dnes má brufen v kabelke hociiaká slečinka [illegible]

Founded occurrences: **K**ôň, **K**one, **K**oní, **K**oňa, **K**oňovi

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Počet zobrazovaných klasterov: 8

Počet výsledkov v klasteri: 4

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  - Akú rolu zohral Kočner?
  - O Kočnerovi prokuratúra zatiaľ nechce...
  - Vražda stála 70-tisíc eur
- dovršenia dôchodkového, infl áciu, penzista poberá
  - Minimálny dôchodok:
  - Čo dostanete za odvody?
  - Aké dávky dostanúzamestnanci, živnost...
  - Živnostníkom hrozia nízke dôchodky
- Julian Alaphilippe, Step Floors, Innsbrucku, Quick
  - Sagan môže útočiť na najlepšiu trojku
  - Poprad privíta hviezdnu zostavu
  - Do cieľa cez sedem kopcov. A potom pr...
  - V Poprade svetové esá. Bora verí aj d...
- Trinh Xuan Thanha, Denisa Saková, únosu vietnamského
  - – stručne
  - Saková ide do Nemecka, bude vysvetľov...
  - V kauze Vietnamca vypočuli viac ako p...
  - Čižnár opäť hovoril s nemeckým kolego...
- Ruslan Boširov, Ruslana Boširova, Sergeja Skripaľa
  - Obdivovali sme mesto, tvrdia podozriv...
  - Kauza novičok: Briti obvinili dvoch R...
  - Hľadali katedrálu, nie Skripaľa, tvrd...

Breaking News

Vyberte kategóriu, ktorú chcete zobraziť: Správy - posledných 30 dní

Počet zobrazovanách klasterov: 6

Počet výsledkov v klasteri: 4

Aktualizovať

- Claude Juncker, Fidesz, Orbána, Šefčovič
  - S Orbánom majú problém aj ľudovci
  - Prečo Únia otvára atómový kufrík
  - Šefčovič mieri na vyšší post
  - Europarlament rozhoduje o treste pre ...
- Axelom Vossom, europarlamentom ŠTRASBURG, Google, Facebook
  - Európa dala zelenú novej digitálnej dani
  - Google má platiť špeciálnu daň, boj o...
  - Nezničme budúcnosť internetu
  - Na ochranu autorských práv
- Saudská Arábia, Lehman Brothers, Iránu, Tomčiak
  - Pád Lehman Brothers = najväčší krach,...
  - Špirála chýb, epická panika a krach L...
  - 10 rokov po páde Lehman: v lepšej for...
  - Pohonné látky mierne zdražejú
- Crvena zvezda, Fenerbahce, Anderlecht, Godál
  - Nie sme Chelsea, tvrdí tréner Trnavy....
  - Trnava nemá čo stratiť. Pod tlakom je...
  - Prekročili sme tieň, v Lige majstrov ...
  - Kapitán Godál: Mohli sme byť za blbco...
- Kim Čong, Alibaba Jack, severokórejský diktátor, Trump
  - Ďalší krôčik k mieru? Kórey sa opäť r...
  - Kim sľubuje mier. A kladie si podmienky
  - Summit sa skončil na vrchole hory
  - Lídri oboch Kóreí sa znova stretli

Spektograf

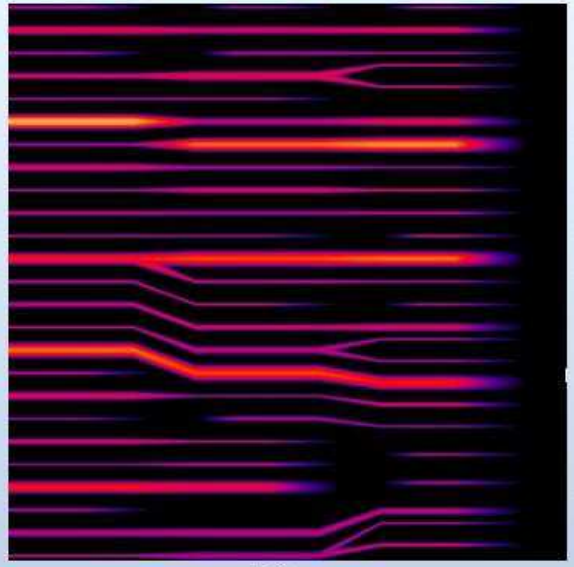
Hot News

Breaking News

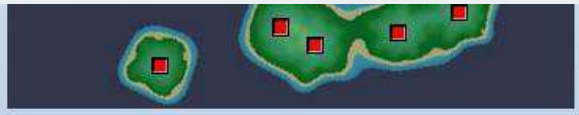
2D Mapa

Spektograf

Názov úlohy: Správy - posledných 7 dní



28 Sep 2018 - Dátum - 17 Oct 2018



Spektograf

Spektograf - výsledky klasterov

Julian Alaphilippe, Step Floors, Innsbrucku, Quick

15 dokumentov

Vytvoriť agenta

★ ★ ★ **Sagan môže útočiť na najlepšiu trojku**

Sagan môže útočiť na najlepšiu trojku. Až štyria cyklisti z tohto tímu štartovali na tohtoročnej Tour de France," uviedol športový riaditeľ pretekov Ľudovít Lučanič. Belgický tím príde na Slovensko s najlepším vrchárom nedávno skončenej Tour a víťazom dvoch etáp Julianom Alaphilippom či silnými klasikármi Bobom Jungelsom a Nikim Terpstrom. Prvý raz budú štartovať sedemčlenné tímy. Cyklisti absolvujú stúpanie na Štrbské Pleso dva razy. september: 3 etapa: Dubnica nad Váhom – Nitra (180 km). | 16.

★ ★ ★ **Poprad privíta hviezdnu zostavu**

Poprad privíta hviezdnu zostavu. Pod Tatrami štartujú cyklistické preteky Okolo Slovenska. Lídrom tímu bude najlepší vrchár tohtoročnej Tour de France Julian Alaphilippe. Podľa vedenia tímu sú preteky Okolo Slovenska pre Alaphilippa aj prípravou na svetový šampionát v Innsbrucku, kde by mu mal vyhovovať hornatý profil pretekov s hromadným štartom. Rozhodne chceme nadviazať na doteraz úspešnú sezónu 2018 aj na Slovensku." Zo slovenských cyklistov sa predstaví dvojica Juraj Sagan a Erik Baška v tíme BoraHansgrohe, dva sedemčlenné tímy – Dukla Banská Bystrica a výber Slovenska. Celkovo neočakávam na Slovensku žiadne ľahké etapy, dôležitú úlohu môže zohrávať aj vietor na otvorených cestách.

★ ★ ★ **Do cieľa cez sedem kopcov. A potom príde Peklo**

Do cieľa cez sedem kopcov. A potom príde Peklo. s dvaapolminútovou stratou. Tohtoročné preteky merajú 258,5 km a celkové prevýšenie je 4670 metrov. Na okruhu im bude stáť v ceste dlhé a náročné stúpanie do lyžiarskeho strediska Igls. Bude mať však silných a mladších súperov – v dobrej forme sa ukazoval kráľ vrchárov na tohtoročnej Tour Francúz Julian Alaphilippe, ktorý nedávno triumfoval aj na pretekoch Okolo Slovenska a predtým na Okolo Británie. Po troch zo štyroch okruhov figuroval na 114.

★ ★ ★ **V Poprade svetové esá. Bora verí aj dvom Slovákom**

V Poprade svetové esá. Bora verí aj dvom Slovákom. Od najbližšej sezóny bude už členom tímu Bahrain Merida. Štyria cyklisti v jeho farbách sa zúčastnili na tohtoročnej Tour. Egídia, prvý jazdec odštartuje o 17.00, posledného čakajú v cieli o 18.15. © AUTORSKÉ PRÁVA VYHRADENÉ Preteky Okolo Slovenska 2018 12.

★ ★ ★ **Kráľ vrchárov môže vyhrať na Slovensku**

Kráľ vrchárov môže vyhrať na Slovensku. Medzi účastníkmi bude aj nemecké zoskupenie Bora–Hansgrohe, v ktorom pôsobí Peter Sagan. Aj my však máme krásne terény a pripravili sme Jána Kučiaka a Martinu Kušnírovu. | Miroslav M. – Tomášov bratranec, podľa prokuratúry mal pri čine zohrať úlohu šoféra.

★ ★ ★ **O Kočnerovi prokuratúra zatiaľ nechce hovoriť**

O Kočnerovi prokuratúra zatiaľ nechce hovoriť. Podnikateľova údajná tlmočníčka za vraždu zaplatila 70-tisíc eur Zasahovalo 150 policajtov, domové prehliadky. Polícia záznam zverejnila v pondelok počas tlačovej besedy na Generálnej prokuratúre. Kočner je krstným otcom jej dcéry, čo pre Nový Čas v pondelok potvrdil Zsuzsovej bývalý partner Marián Markovič. „Zatiaľ sa k osobe pána Kočnera ako prípadného objednávateľa vôbec nebudeme vyjadrovať. Uvidíme, čo sa zistí počas vyšetrovania, a až potom sa uvidí, čo bude nasledovať," povedal špeciálny prokurátor. Aká vysoká bola suma, ktorú na zabezpečenie objednávky vraždy mala dostať Zsuzsová, prokurátori nepovedali. | Počas razie v Kolárove zaistila NAKA zbrane, autá a mobil, ktorý páchatelia použili, a tiež náboj s individuálnymi zhodami po zásobníku použitom pri vražde.

★ ★ ★ **Vražda stála 70-tisíc eur**

Taxonomy and Categorization

Výsledky kategórií

Celkový počet výsledkov: 5
Názov kategórie: penzisti, poberať penziu, dohodári, invalidity

Čo dostanete za prácu popri penzii

16.03.2017

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Kategórie

- home
  - .Kultúra
  - .Nelegálna migrácia
  - .Veda a Výskum
  - Bayern, Mourinho, Robben, Clásico
  - Bezák, arcibiskup, Bezákova, Biskupi
  - Federer, Djokovič, Melbourne, Murray
  - Gréci, Cipras, Syrizy, Ciprasov
  - Organizovaný zločin
  - Porošenko, Kyjeve, Donbase, Donecku
  - Rely Dakar, Svitko, Jakešovi, Aires
  - Sandy, Snehová, fúkať, Meteorológ
  - Svet Zdravia
  - Váhostav, Doprastav, 2019, D1
  - bonitu, dlžníkom, medziúvery, nebankovke
  - **penzisti, poberať penziu, dohodári, invalidity**

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Z druhého piliera dostanú ľudia na ruku pár eur

23.06.2014
Z druhého piliera dostanú ľudia na ruku pár eur. Branislav Toma © Bratislava Predstava ľudí, že pri odchode do dôchodku si vyberú na ruku slušnú sumu peňazí z druhého piliera, je mylná. Parlament už schválil spôsob vyplácania

Databáza Pravda
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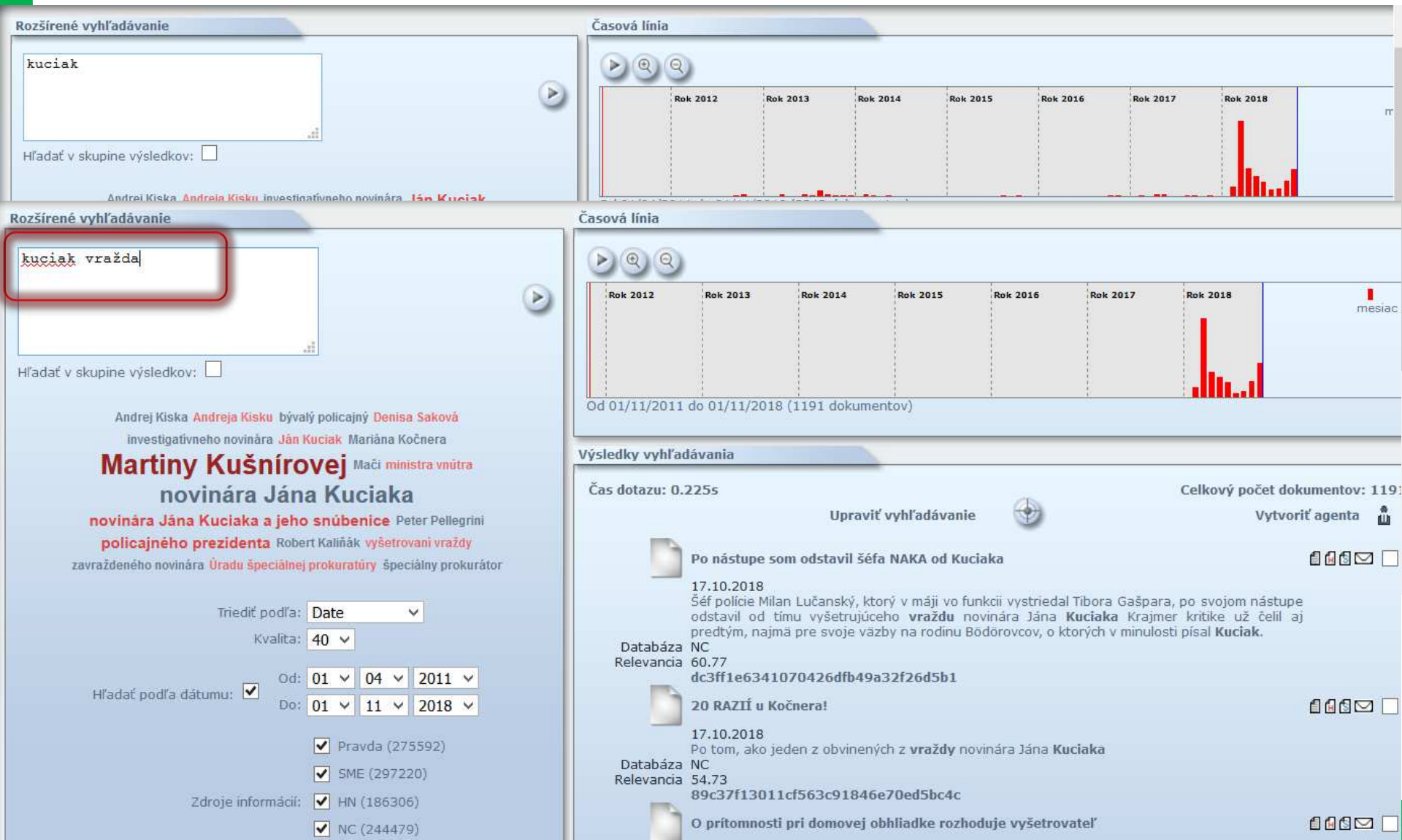
From questions to knowledge



From questions to knowledge

Rozšírené vyhľadávanie

Časová línia

Kuciakov terč: Glance House alebo Donovaly

Ďalší výraz

Zvýraznený obsah

PREHĽAD

NOVÝ TECHNOPOL

Zavraždený novinár Ján Kuciak informoval, že majetok firmy Technopol v hodnote 20 miliónov eur za podozrivých okolností skončil u ľudí blízkych Marianovi Kočnerovi. Kauza sa týkala prevodov nehnuteľností z majetku Technopol Servis.

ZMENKY TELEVÍZIE MARKÍZA

Novinár sa venoval aj prípadu zmeniek Pavla Ruska a Mariana Kočnera, ktoré sa dostali na verejnosť po 15 rokoch a kvôli ktorým začali vymáhať od televízie Markíza 70 miliónov eur. Pre podozrenie z falšovania dokumentov je Kočner stále väzobne stíhaný a Rusko na slobode.

KAUZA DONOVALY

Národná kriminálna agentúra obvinila Kočnera z trestného činu neodvedenia dane a poistného. Išlo o podvody s hotelmi na Donovaloch. Ján Kuciak v tomto prípade našiel nezrovnalosti a takisto vysvetlil schému, podľa ktorej mal podnikateľ prevádzať vlastníctvo hotelov na Donovaloch. Kočnerove firmy mali takto získať od štátu na vratkách milióny eur.

GLANCE HOUSE

Pre nezhody spoluvlastníkov bola stavba apartmánov zablokovaná Špeciálnou prokuratúrou. Nehnuteľnosť neskôr posunul firme blízkej Marianovi Kočnerovi vtedajší generálny prokurátor Dobroslav **Trnka**.

Ten musel kvôli kauze čeliť aj disciplinárke. Kuciak sa vo svojich článkoch venoval dražbe pozemkov, ktoré Kočner predával za 23 miliónov eur, no ich reálna cena mala byť 116-tisíc eur.

FIVE STAR RESIDENCE

Kauza sa začala vyrubením niekoľkomiliónového dlhu pre firmu, ktorá postavila komplex Five Star Residence. Podľa Kuciaka mohol daňový nedoplatok znamenať aj to, že firma nezaplatila z predaja bytov DPH alebo aj daň z príjmov. S apartmánmi je spájaný aj Ladislav Bašternák, ktorý mal prevádzať byty za podozrivo vysoké ceny.

BONAPARTE

Ján Kuciak sa venoval aj rezidencii Bonaparte, ktorú postavil kontroverzný podnikateľ Ladislav Bašternák.

Zdroje informácií: ☑ HN (186306)

☑ NC (244479)

Databáza SME

Relevancia 71.94

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From questions to knowledge

veri2

Zvýraznený obsah

Polícia robila domové pre hliadky aj v zaistených majetkoch Kočnera

BRATISLAVA - Čo všetko hľadali? Mariána Kočnera Koč - (55) má polícia vo svojom hľadáčiku už niekoľko mesiacov. Postupne pribúdali obvinenia - vo viacerých kauzách, čo vyvrcholilo až jeho o vzatím do väzby v známej kauze markizáckych zmeniek za 69 miliónov eur. To však nie sú jediné cenné papiere, pre ktoré mal Kočner slabosť. Vo svojom vlastníctve mal totiž aj zmenky za 10,7 milióna eur finančnej skupiny Penta. Ich vyplatenie zakázala nedávno prokuratúra, no ich fyzickú - papierovú podobu nikto z kompetentných nevidel.

Kočner si zrejme celý život istil zmenkami. Počas leta zástupcovia štátu šokovali, keď Kočnerovi zaistili miliónové majetky na čele s domami, pozemkami či hotovosťou

na účte. Okrem toho však prokurátorka siahla aj na vyplatenie 10,7 milióna eur, ktoré Kočner požičal podľa denníka SME spoločnosti Penta Funding a dostal za ne 30 zmeniek. Prokurátorka sa obávala, že Kočner svoj majetok neustále prevádza a môže ho tak prepísať na iné osoby. Nie je jasné, kedy zmenky vznikli a dokedy sú splatné. Paradoxom je, že kompetentní cenné papiere nezaistili fyzicky, čiže nie je vylúčené, aby s nimi niekto disponoval.

Problémom tak je, že milióny eur môžu skončiť napokon na účte napríklad rodinného príslušníka, na ktorého Kočner zmenky prepíše. ?Zmenka je dokonalý cenný papier. To znamená, že v zásade sa dá previesť len rukopisom, t. j. písomným záznamom na rube zmenky. Kedy a za akých okolností ich majiteľ prevedie, je výlučne na majiteľovi,? opisuje možnosti Kočnera právnik Marek Benedik. Prokuratúra môže podľa neho zakázať prevádzať zmenky, avšak rubopis môže byť spravený aj v tzv. bianco formáte, čiže nie na konkrétnu osobu, ale meno príjemcu sa vyplní neskôr.

?Ktokoľvek sa tam dopíše, tak ju môže predložiť na vyplatenie. Môže sa tiež zmeniť majiteľ, avšak to sa dá spraviť len fyzicky. Musí niekto prísť za Kočnerom do väzby,? dodáva Benedik. V praxi sa tak podnikateľ môže stretnúť s právnikom, s ktorým má podľa zákona možnosť komunikácie v súkromí bez kamerových či iných záznamov.

Podľa hovorcu skupiny Penta Gabriela Tótha si väčšina klientov necháva zmenky v trezore banky, čo je bezpečnejšie. Kočner si ich však vybral. ?Nie, Penta Funding ako emitent nimi nedisponuje,? uviedol Tóth. Kočner má problémy s majetkom pre vyšetrovanie fiktívnych prevodov hotelov na Donovaloch, keď mal štát vyplatiť vratku vyše osem miliónov eur. Sudca tvrdil, že prokurátor sa mohol pokúsiť siahnuť aj na väčší majetok.

ČO PODNIKATEĽOVI PRED ČASOM ZAISTILI * apartmán na Donovaloch * pozemok v bratislavskom Novom Meste * pôdu v Čunove * dom v Bernolákove * 30 zmeniek: 4 v hodnote 2,3 - 2,4 milióna eur a 26 v hodnote 50- až 60-tisíc eur (10,7 milióna eur) * zablokovali mu peniaze na troch bankových účtoch * zaistili akcie dvoch spoločností

Foto autor| Foto: anc

Automatická sumarizácia

Sumarizácia

Aké zmenky u podnikateľa? hľadali. Kočner si zrejme celý život istil zmenkami. To znamená, že v zásade sa dá previesť len rukopisom, t. j. písomným záznamom na rube zmenky. V praxi sa tak podnikateľ môže stretnúť s právnikom, s ktorým má podľa zákona možnosť komunikácie v súkromí bez kamerových či iných záznamov. ČO PODNIKATEĽOVI PRED ČASOM ZAISTILI * apartmán na Donovaloch * pozemok v bratislavskom Novom Meste * pôdu v Čunove * dom v Bernolákove * 30 zmeniek: 4 v hodnote 2,3 - 2,4 milióna eur a 26 v hodnote 50- až 60-tisíc eur (10,7 milióna eur) * zablokovali mu peniaze na troch bankových účtoch * zaistili akcie dvoch spoločností

Foto autor| Foto: anc

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MSA v PALSTAT CAQ

Ing. Renata Janošcová, PhD.
Vysoká škola manažmentu v Trenčíne
rjanoscova@vsm.sk

Seminar S1
Data Mining Tools and measurement data analysis

Vysoká škola manažmentu v Trenčíne
International Workshop on Knowledge Management
IWKM‘2018

October, 18 – 19
Bratislava 2018

Analýza systému merania

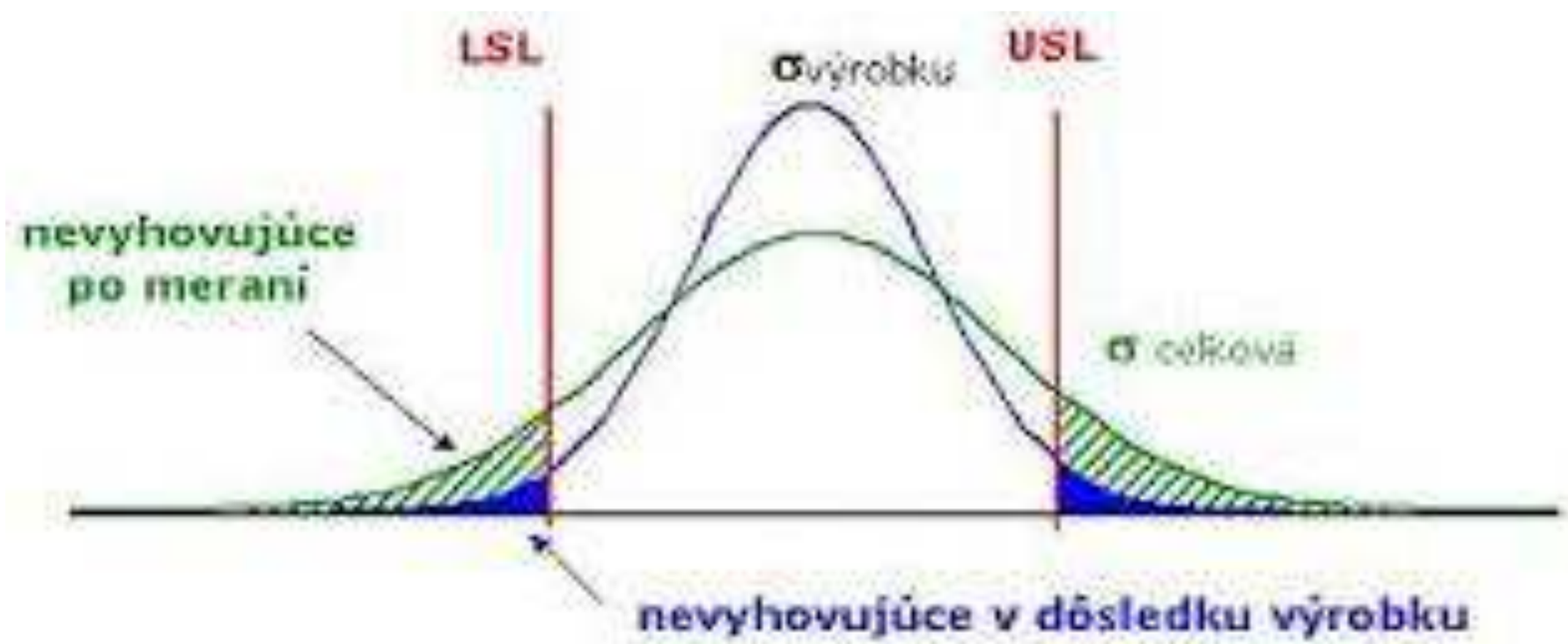
- **Rozptyl** sledovaného parametra výrobku môže byť spôsobený samotným výrobkom (oválnosť, deformácia,..) alebo systémom merania
- **Systém merania** je tvorený **operátorom, meradlom** a **metódou (spôsobom) merania**
- **MSA je nástroj na hodnotenie presnosti a vhodnosti** systému merania
- MSA prebieha t**estovaním (meraním) vybraného parametra operátorom alebo skupinou operátorov**
- Sleduje sa vplyv **opakovateľnosti** (jeden operátor opakuje meranie sledovaného parametra výrobku) a **reprodukovateľnosti** (skupina operátorov meria ten istý parameter) na **celkový rozptyl**
- Výsledkom MSA je určenie presnosti a vhodnosti použitia daného systému merania pre sledovaný parameter - **v akej miere sa systém merania podieľa na výslednom rozptyle**

Vzťah rozptylu systému merania k celkovému rozptylu sledovaného parametra

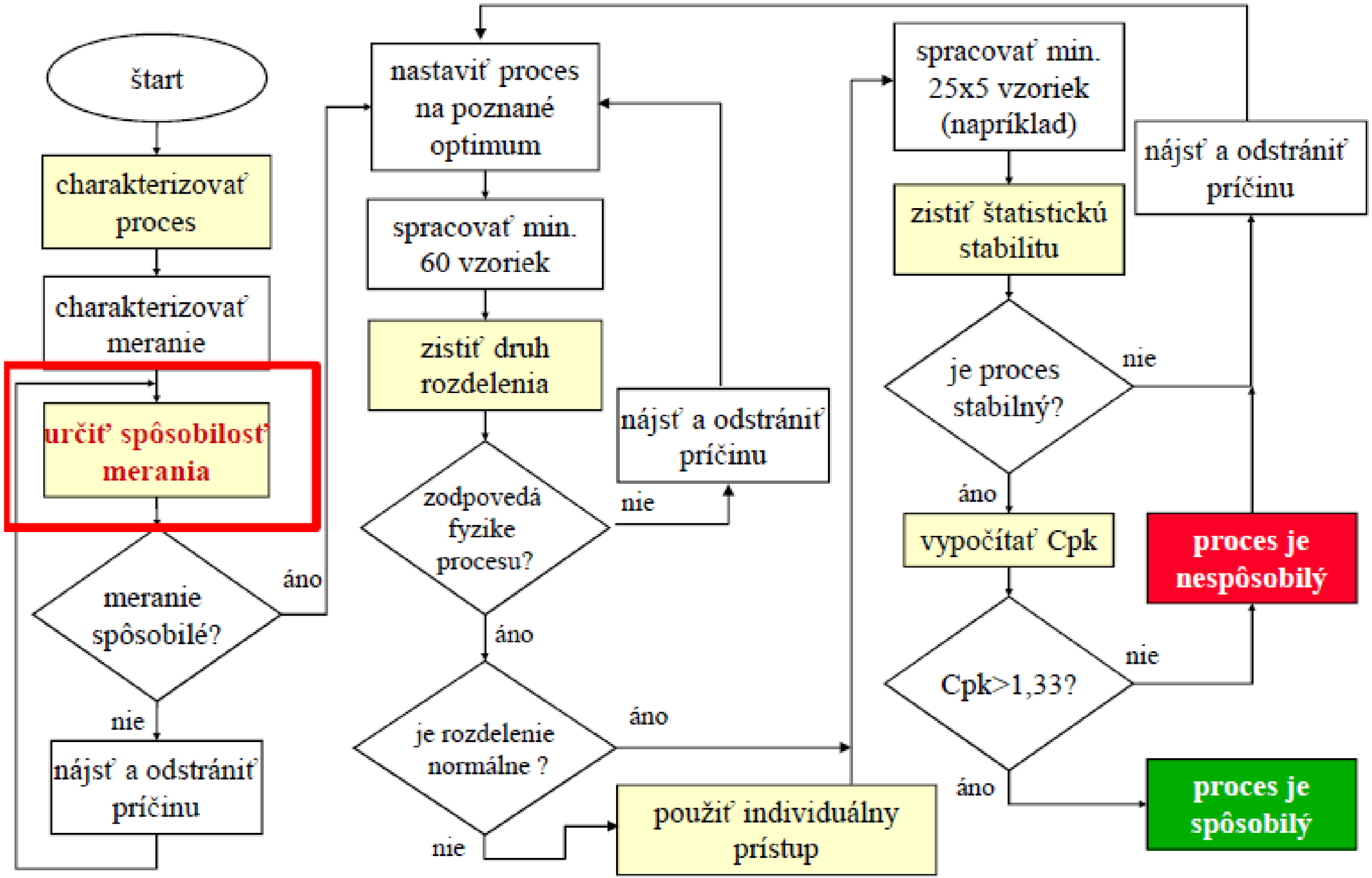
- **LSL** (*Lower Specification Limit* - **Dolná špecifikácia zákazníka**)
- **USL** (*Upper Specification Limit* - **Horná špecifikácia zákazníka**)
- **Tolerancia** = (USL - LSL) - oblasť vyhovujúcich hodnôt pre zákazníka

σ^2 - rozptyl (variabilita)

$$\sigma^2 celková = \sigma^2 výrobku + \sigma^2 systému\ merania$$

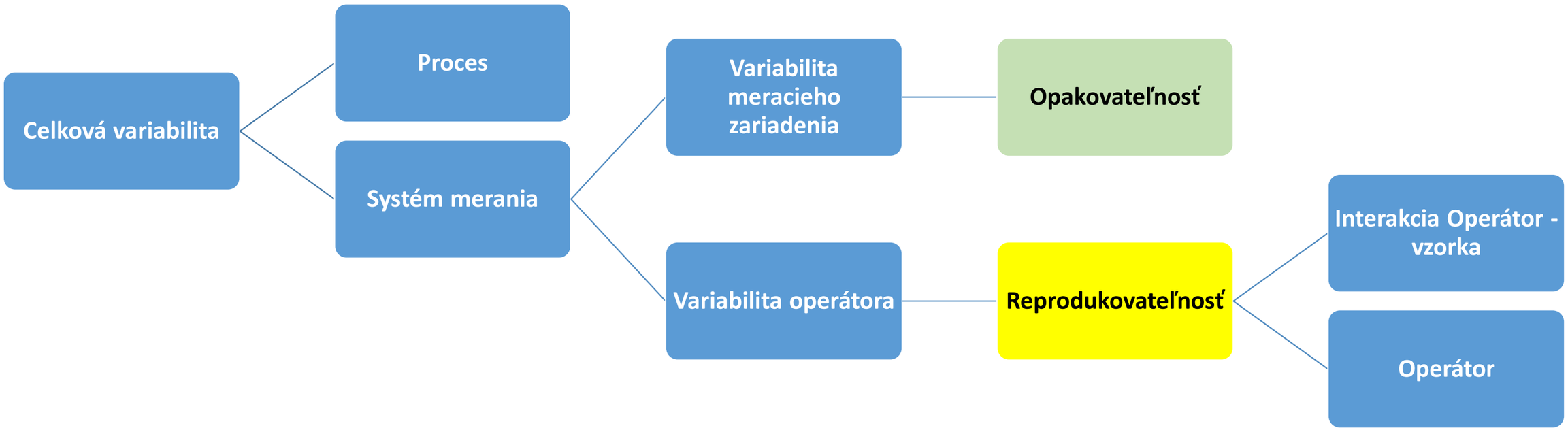


Zisťovanie spôsobilosti procesu



Zdroj: Mikolášek, M.

Rozdelenie celkovej variability zaznamenaných dát

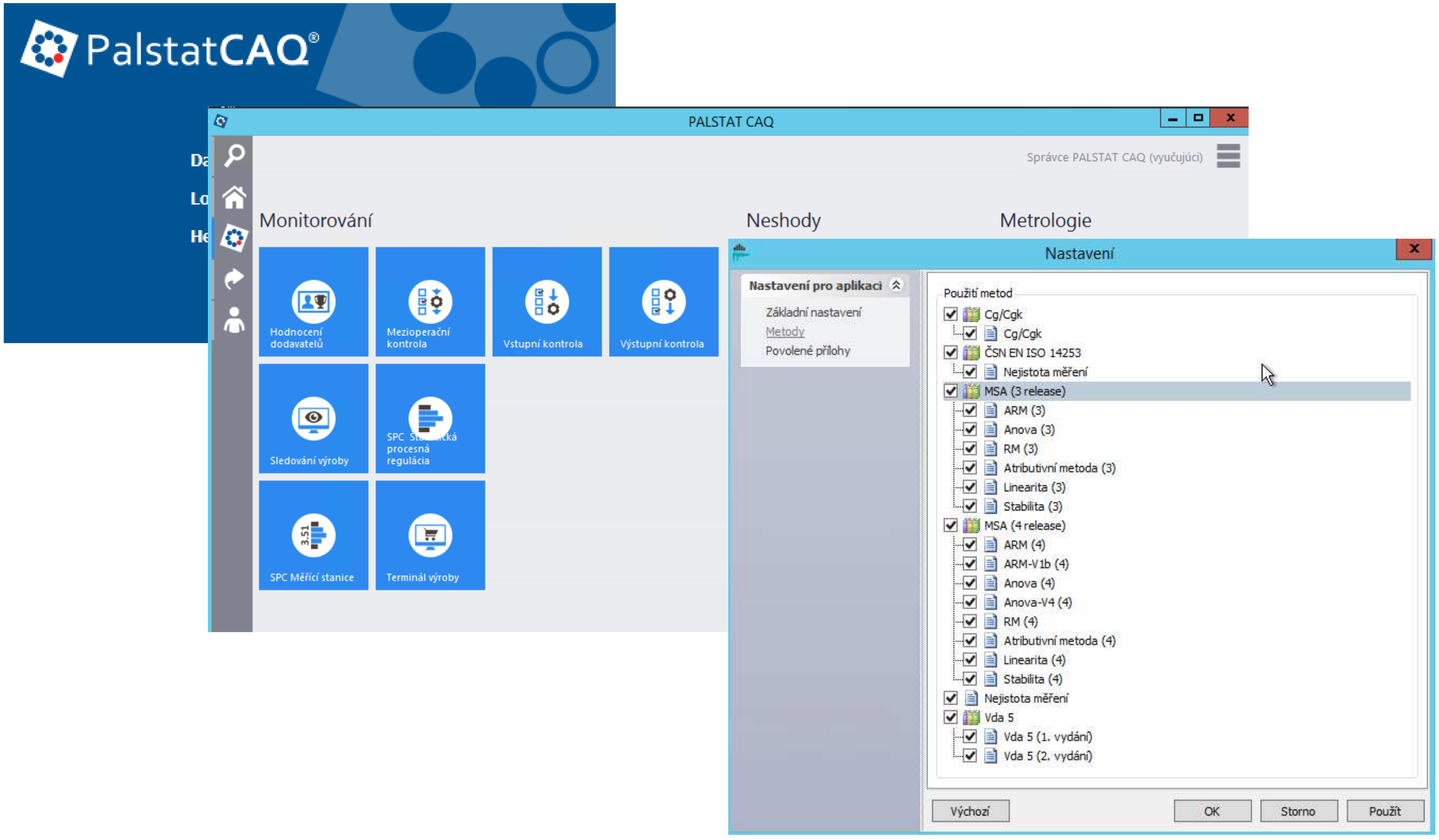


- **Štúdia reprodukovateľnosti a opakovateľnosti** meradla (meracieho zariadenia) umožňuje stanoviť**, koľko pozorovanej variability procesu** vzniká v **dôsledku variability systému merania**
- Doležitý parameter je **%GRR**. (**%** R&R = **%** *Repeatability* & *Reproducibility*), ktorý je **opakovateľnosť** a **reprodukovateľnosť** (R&R variabilita systému merania) **v pomere k žiadanej veličine**
  - k 1/6 tolerančného pásma – (T/6)
  - K celkovej variabilite

Medzné rozhodovacie parametre pre % R & R

< 10 %	**systém merania je spôsobilý**
10 % - 20 %	systém merania je podmienečne spôsobilý u nových meradiel
10 % - 30 %	meradlo a systém merania je podmienečne spôsobilý u používaných meradiel
> 30 %	meradlo a systém merania nie je spôsobilý

MSA v PALSTAT CAQ



Ďakujem Vám za pozornosť

Seminar S2

Measuring Quality of Universities' Functions

(Panel)

Vysoká škola manažmentu v Trenčíne
International Workshop on Knowledge Management
IWKM 2018

October, 18 – 19
Bratislava 2018

Measuring Quality of Universities' Functions

Weak or no language skills
English language is creating an issue in international companies

Insufficient hard skills
MS Office, esp. Excel, PowerPoint

Insufficient soft skills
Issues in decision making, lack of critical thinking

Missing systematic cooperation of the business environment with the academic bodies

Lack of systematic approach is balanced only with effort of individuals on both academic and business sides

Expectations

Hard skills

Language skills

Soft skills

Imbalance between business and graduates expectations

Lack of self-reflection from graduates (potential candidates)

- Year-over-year increasing salary expectations
- Weak decision making, absence of sense of urgency, no willingness to accept responsibility for own mistakes, lack of responsibility, missing presentation skills, no practical experience during the studies
- Regional differences across Slovakia

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