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ALEXANDER DUBČEK UNIVERSITY OF TRENČÍIN

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MOTTO

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Richard Rorty, Stanford University

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ABSTRACTS

MODELLING AND EVALUATION OF OPERATIONAL COMPETITIVENESS OF MANUFACTURING ENTERPRISES

YANG LIU, JOSU TAKALA

Keywords: manufacturing strategy, transformational leadership, overall competitiveness, decision-making, analytical models up to six keywords should be included which encapsulate the principal subject covered by the article.

Abstract: This paper is aiming to connect previous research in global competitiveness analysis. Research is based on doing numerous case studies and creating analytical models to evaluate the overall competitiveness, which is a novel concept by integrating the evaluation of manufacturing strategy and transformational leadership including technology level together. The empirical studies are focused to case companies in China especially Chinese State-Owned Manufacturing Enterprise (CSOME). The main emphasises of this research are manufacturing strategy and transformational leadership for CSOME. We have brought the influence of "China effect" to study how it will impact the operational competitiveness of CSOME on top of their manufacturing strategy and transformational leadership.

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TRIAD: BUSINESSES – UNIVERSITIES – MUNICIPALITY (REGIONS) WITHIN KNOWLEDGE ECONOMY

PETER KUZMIŠIN

Keywords: knowledge economy, information-communication technologies, tertiary education, entrepreneurial university, triad: businesses-universities-municipality

Abstract: The ability to obtain and use knowledge does not only depend on the access and using of information and communication technologies, but also on

working and efficient education system in the state (region) and new approaches to innovations and both economic and institutional frameworks, that support using knowledge by competitive production and services. This paper focuses on the main development trends in the area of tertiary education, link and dialogue within the triad of "businesses, universities and public institutions of state and region" and we formulate suggestions for higher efficiency of cooperation among the three abovementioned subjects.

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BUT WHO LEARNS WHAT ? ON THE RISKS OF KNOWLEDGE ACCUMULATION THROUGH NETWORKED LEARNING IN R&D

TAUNO KEKÄLE, SARA CERVAI AND ANA GOMEZ BERNABEU

Keywords: Knowledge accumulation, expertise, learning, software development, agent simulation, case study

Abstract: In big companies, managerial activities and organizational boundaries will over time hide most unevenly developed skill and knowledge distribution patterns; studying the organizations with the means of modern applied physics is thus quite difficult. People are forced to communicate along the organizational lines, and their personal preferences that could affect the communication networks are often dampened to nearly obsolete. In small companies, however, as well as other less structured non-business organizations, many network patterns exist, based on the preferred cooperation and communication behaviour of human beings, and are observable in various real-life situations. Given their free choice of either to solve the problem themselves or go to one of the colleagues to ask for help, and a preference based on the transactive memory of the organization (a word-of-mouth "reputation" information about who has the skill needed to solve the problem, or who solved the previous one with some similarity) will over time lead to most difficult problems always being solved by one or two key individuals. This paper tests this idea with an agent model to confirm the accumulation of critical knowledge to few individuals. Furthermore, the paper presents a network relation study in a 45-person software solution company. It seems the knowledge is on its way to become distributed according to power law – centralized more and more to a couple of individuals – also in the reality of this case company, even if there are not enough interactions in the five-year history of the company to prove this in a statistically significant way.

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IMPLEMENTATION OF SECURITY CONTROLS ACCORDING TO ISO/IEC 27002 IN A SMALL ORGANISATION

MATÚŠ HORVÁTH, MARTIN JAKUB

Keywords: information security, information security management system, ISO 27001, ISO 27002,

Abstract: Information security should be today a key issue in any organization. With the implementation of information security management system (ISMS) the organization can identify and reduce risks in this area. This the area of information security management covers a numbers of ISO / IEC 27000 standards, which are based on best practice solutions. However, smaller organizations are often discourages with the implementation of these systems, because of fear of high cost and complexity. Especially due to the fact that the standards does not strictly require implementation of all security controls it is possible to implement these systems in small-size organizations. In this article, we want to point on this fact through describing practical experience with ISMS implementation in small-size organization.

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THE CREATION OF QUALITY MANAGEMENT SYSTEM IN THE CONTEXT OF REGIONAL COMPETITIVENESS OF REGIONAL UNIVERSITY ENVIRONMENT OF THE SLOVAK REPUBLIC

DANIELA PALAŠČÁKOVÁ

Keywords: innovation, competitiveness, quality, region, tertiary education, university environment

Abstract: Universities are rare and the persisting elements of the European culture foundations. The most brilliant minds and the most noble hearts, which shared their wisdom with the people of the world, have always been attracted by universities. University today - applying new curriculum and developing new courses, which correspond with the needs of the labour market – is in the centre of dramatic changes of the quality of life in Europe. The quality of university environment is a significant determinant of the qualitatively or knowledge-based competitiveness. Presented results of the contribution represent the identification and evaluation of the mechanism of the creation of quality management system in university environment and application of the approaches of quality evaluation of university environment using Index of quality of regional university environment in the conditions of the self-governed regions of the Slovak Republic.

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EFFECT OF STRESS AND PSYCHOLOGICAL OVERLOAD AT WORK ON PERFORMANCE OF EMPLOYEES

MAREK ŠOLC, ANDREA SÜTŐOVÁ

Keywords: stress, mental overload, monotony, working conditions, employees.

Abstract: The workload represents a factor which acts burdensome on human organism and, depending on its level affects well-being, or leads to disease or injury. As a result, there is a distortion in optimal working relationship in the system man – machine – environment, which may be reflected in the reduction of productivity and efficiency throughout the system. The contribution deals with the issue of the effects of stress and psychological overload at work, which

affects significantly the performance of employees. The article describes the basic legislation regarding the workload in conditions of the Slovak Republic, it describes the types of loads, different causes, manifestations and consequences of load. According to theoretical knowledge about stress and loads, the questionnaire method was applied for assessment of mental workload in terms of working conditions level in the unnamed service organization.

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UTILIZATION OF STATISTICAL METHODS WITHIN THE EUROPEAN PERFORMANCE SATISFACTION INDEX (EPSI) RATING METHODOLOGY

ANDREA SÜTŐOVÁ, MAREK ŠOLC

Keywords: customer satisfaction, customer satisfaction measurement, EPSI model, latent variable, manifest variable.

Abstract: The paper deals with the customer satisfaction quantification and factors influencing customer satisfaction. It describes the EPSI Rating methodology, the EPSI causal model and statistical methods, which can be used for estimation of components and magnitude of the connections between components in the EPSI model. This methodology allows to quantify customer satisfaction and to estimate the impact magnitude of factors influencing it. The results of customer satisfaction measurement realized in the service organization according to EPSI Rating methodology are presented in the paper.

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ABSTRAKTY

VYTVORENIE A VYHODNOTENIE KONKURENCIESCHONOSTI VÝROBNÝCH PODNIKOV

YANG LIU, JOSU TAKALA

Kľúčové slová: stratégia výroby, transformačné vedenie organizácie, globálna konkurencieschopnosť, rozhodovanie, analytický model

Abstrakt: Článok nadväzuje na predchádzajúci výskum analýzy globálnej konkurencieschopnosti. Výskum bol realizovaný na základe početných prípadových štúdií a vytvorení analytických modelov na posúdenie a vyhodnotenie celkovej konkurencieschopnosti, čo predstavuje novú koncepciu integrujúcu hodnotenie stratégie výroby a transformačné vedenie organizácie zahŕňajúce aj úroveň technológií. Empirické štúdie sú orientované na čínske, štátom vlastnené výrobné organizácie – State-Owned Manufacturing Enterprise (CSOME). Hlavný dôraz je kladený na hľadanie a určenie vhodnej stratégie výroby a zavedenie transformačného vedenia. Tzv. „čínsky efekt“ je použitý na skúmanie operačnej konkurencieschopnosti CSOME a následne na tvorbu vrcholovej stratégie a transformačné vedenie organizácií.

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TRIÁDA: PODNIKY – UNIVERZITY – SAMOSPRÁVA (REGIÓNY) V ZNALOSTNEJ EKONOMIKE

PETER KUZMIŠIN

Kľúčové slová: znalostná ekonomika, informačno-komunikačné technológie, terciárne vzdelávanie, podnikateľská univerzita, triáda: podniky-univerzity-samospráva

Abstrakt: Schopnosť získavať a využívať znalosti súvisí nielen s prístupom a využívaním informačných a komunikačných technológií, ale aj s funkčným a efektívnym vzdelávacím systémom v štáte (regióne) novými prístupmi k inováciám a ekonomickým a inštitucionálnym rámcom, ktorý podporuje využívanie znalosti pri konkurencieschopnej produkcii a službách. Príspevok sa zameriava na hlavné vývojové trendy v oblasti terciárneho vzdelávania,

prepojenie a dialóg v rámci triády „podniky, univerzity a inštitúcie štátnej správy a samosprávy“ a formuluje návrhy na vyššiu efektívnosť spolupráce uvedených subjektov.

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KTO SA UČÍ ČO? RIZIKO VEDOMOSTÍ ZÍSKANÝCH POMOCOU UČENIA SA V SIETI VÝSKUMU A VÝVOJA

TAUNO KEKÄLE, SARA CERVAI, ANA GOMEZ BERNABEU

Kľúčové slová: zber vedomostí, skúsenosti, učenie sa, tvorba softvéru, simulácia agentov, prípadová štúdia

Anotácia: Vo veľkých podnikoch manažérske aktivity a organizačné obmedzenia vždy skrývajú nerovnomerne vytvorené zručnosti a príklady/vzory nevyváženého rozdelenia vedomostí. Sledovanie organizácií pomocou modernej aplikovanej fyziky je preto teda pomerne ťažké. Ľudia sú nútení komunikovať v organizácii podľa štruktúry organizácie a ich osobné preferencie, ktoré môžu ovplyvniť sieť komunikácie, sú často znevýhodnené, skoro nepoužiteľné. V malých výrobných organizáciách, ale aj v iných menej štrukturalizovaných nevýrobných firmách existuje veľa vzorových sietí, ktoré sú založené na preferovanej kooperácii a komunikácii ľudí ktoré sa dajú vypozorovať v reálnych situáciách. Slobodná voľba riešiť nejaký problém vlastnými silami alebo požiadať kolegu o pomoc alebo ak majú ľudia možnosť preferencie založené na transaktívnej pamäti organizácie (ústne podanie informácií o reputácii, kto má aké schopnosti riešiť problém, alebo kto riešil nejaký problém v minulosti) povedie po čase k tomu, že najťažšie problémy sa vyriešia pomocou jedného alebo dvoch dôležitých jednotlivcov. Príspevok rozoberá túto myšlienku na modeli jedného prvku/agenta, ktorý potvrdí akumuláciu dôležitých vedomostí u niekoľkých jednotlivcov. Príspevok informuje o štúdii v ktorej bolo zainteresovaných 45 ľudí zoskupených v tzv. „sieti“. Aj napriek tomu, že nemáme dosť interakcií počas päťročnej histórii podniku, ktoré by mohli štatisticky potvrdiť naše pozorovania sa zdá, že vedomosti sa budú distribuovať podľa práva sily a budú čím ďalej tým viac centralizované u zopár jednotlivcov tak, ako to opisuje prípadová štúdia.

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IMPLEMENTÁCIA BEZPEČNOSTNÝCH OPATRENÍ V SÚLADE S ISO/IEC 27002 V PODMIENKACH MALEJ ORGANIZÁCIE

MATÚŠ HORVÁTH, MARTIN JAKUB

Kľúčové slová: informačná bezpečnosť, systém manažérstva informačnej bezpečnosti, ISO 27001, ISO 27002

Abstrakt: Informačná bezpečnosť by mala byť v dnešnej dobe kľúčovou otázkou každej organizácie. Pomocou implementácie systému manažérstva informačnej bezpečnosti dokáže organizácia identifikovať a znižovať riziká v tejto oblasti. Oblasťou manažérstva informačnej bezpečnosti sa zaoberá rad noriem ISO / IEC 27000, ktorý vychádza z overených riešení z praxe. Menšie organizácie ale často odrádza od implementacie týchto systémov strach z veľkých nákladov a náročnosti. Najmä vďaka tomu, že dané normy nevyžadujú striktnú implementáciu všetkých opatrení, je možné implementovať tieto systémy aj v podmienkach malých organizácií. V tomto článku sa snažíme poukázať na túto skutočnosť prostredníctvom popísania praktickej skúsenosti implementácie systému manažérstva informačnej bezpečnosti v podmienkach konkrétnej malej organizácie.

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TVORBA SYSTÉMU RIADENIA KVALITY V KONTEXTE KONKURENCIESCHIOPNOSTI REGIONÁLNEHO VYSOKOŠKOLSKÉHO PROSTREDIA SR

DANIELA PALAŠČÁKOVÁ

Kľúčové slová: inovácia, konkurencieschopnosť, kvalita, región, terciárne vzdelávanie, vysokoškolské prostredie

Abstakt: Univerzity sú vzácnymi a trvajúcimi prvkami základov európskej kultúry. Najbrilantnejšie umy a najušľachtilejšie srdcia, ktoré zdieľali svoju múdrosť s obyvateľmi tohto sveta, boli vždy priťahované univerzitami. Dnes je univerzita - angažujúca sa v aplikácii nového kurikula a rozvoji nových kurzov, ktoré korešpondujú s potrebami trhu práce – opäť v strede dramatických zmien kvality života v Európe. Kvalita vysokoškolského prostredia je významným determinantom tzv. kvalitatívne, resp. znalostne založenej konkurencie-schopnosti. Prezentované výsledky príspevku predstavujú identifikáciu a hodnotenie mechanizmu tvorby system riadenia kvality vo vysokoškolskom prostredí a aplikáciu prístupov na hodnotenie kvality vysokoškolského prostredia pomocou Indexu kvality regionálneho vysokoškolského prostredia v podmienkach samosprávnych krajov SR.

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VPLYV STRESU A PSYCHICKÉHO PREŤAŽENIA PRI PRÁCI NA VÝKONNOSŤ ZAMESTNANCOV

MAREK ŠOLC, ANDREA SÜTŐOVÁ

Kľúčové slová: stres, psychické preťaženie, monotónia, pracovné podmienky, zamestnanci.

Abstrakt: Pracovnú záťaž reprezentuje faktor, ktorý pôsobí zaťažujúco na organizmus človeka a v závislosti od miery pôsobenia narúša pracovnú pohodu, resp. vedie k vzniku chorôb alebo úrazov. To ma za následok, že dochádza k narušeniu optimálnych vzťahov v pracovnom systéme človek – stroj - prostredie, čo sa môže prejaviť v znížení produktivity a efektívnosti celého systému. Príspevok sa venuje problematike vplyvov stresu a psychického preťaženia pri práci, ktorá ovplyvňuje v značnej miere výkonnosť zamestnancov. V článku sa popisujú základné legislatívne predpisy v oblasti pracovnej záťaže v

podmienkach SR, popisujú sa v ňom druhy záťaže, jednotlivé príčiny, prejavy a dôsledky záťaže. Na základe teoretických znalostí z problematiky stresu a záťaží sa aplikovala dotazníková metodika pre hodnotenie psychickej pracovnej záťaže z hľadiska úrovne pracovných podmienok v podmienkach nemenovanej organizácií služieb.

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VYUŽITIE ŠTATISTICKÝCH METÓD V RÁMCI METODIKY STANOVOVANIA EURÓPSKEHO INDEXU SPOKOJNOSTI ZÁKAZNÍKA

ANDREA SÜTŐOVÁ, MAREK ŠOLC

Kľúčové slová: spokojnosť zákazníka, meranie spokojnosti zákazníka, model EPSI, latentná premenná, merateľná premenná.

Abstrakt: Článok sa zaoberá kvantifikáciou spokojnosti zákazníka a faktormi vplývajúcimi na spokojnosť zákazníka. Článok popisuje metodiku EPSI Rating, kauzálny model EPSI a štatistické metódy, ktoré sa môžu použiť na výpočet komponentov modelu EPSI a sily vzťahov medzi týmito komponentmi. Táto metodika umožňuje kvantifikovať spokojnosť zákazníka a stanoviť veľkosť vplyvu jednotlivých faktorov, ktoré ju ovplyvňujú. V článku sú uvedené výsledky merania spokojnosti zákazníka, ktoré sa vykonávalo v organizácii služieb podľa metodiky EPSI Rating.

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MODELLING AND EVALUATION OF OPERATIONAL COMPETITIVENESS OF MANUFACTURING ENTERPRISES

YANG LIU, JOSU TAKALA

1 INTRODUCTION

With the fast growing economics, China will become the second largest economic entity in the world by 2010 according to Chinese economist's forecast. The Chinese manufacturing industries are more competitive than ever before in the global market. China is now a strong manufacturing country and Chinese economics has influenced the global market in many different areas. Everything seems to have been changed with the global economic downturn in which China prevails with its ongoing growth and huge market.

Chinese state-owned manufacturing enterprise (CSOME) is the most representative type of companies in China and most significant representative of Socialism with Chinese characteristics. CSOME produce majority of Chinese GDP (e.g. over 75% in 2007) and they are also majority portion of top 500 companies in China. As a fact the CSOME is the backbone and primary driving force of the growing Chinese economics even despite of the global economic downturn. Although the case studies are done for several subsidiaries of different industries which all belong to one large CSOME group, the results are commonly representative for majority since mostly they share very similar characteristics.

In this study we mainly focus on the integration of manufacturing strategy and transformational leadership for Chinese State-Owned Manufacturing Enterprises (CSOME), based on empirical studies in China. "China effect" has influenced business and manufacturing strategies globally in many different business areas (Takala et al., 2007a). We have brought the influence of "China effect" to study how it will impact the operational competitiveness of CSOME on top of their manufacturing strategy and transformational leadership. We promote a novel concept of overall competitiveness to evaluate performance of companies in global context by integrating the evaluation of manufacturing strategy and transformational leadership including technology level altogether using analytical models created in this paper.

The theoretical reference framework of this study starts from resource-based view of a firm for case study (Wernerfelt, 1984). Takala et al. (2002) have presented justification of multi-focused manufacturing strategies. Miles and Snow (1978) have defined four company groups which include prospector,

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analyzer, defender and reactor. According to Miles and Snow (1978), on the contrary to the three groups which are prospector, analyzer and defender, reactor does not lead to a consistent and stable organisation and therefore it is advised to change over to one of the other three groups. Based on this theory, Takala et al. (2007b) have introduced unique analytical model to evaluate global competitiveness rankings for manufacturing strategies in prospector, analyzer and defender groups according to the company's multi-criteria priority weights of Q(Quality), C(Cost), T(Time) and F(Flexibility). Such analytical models are used to gain insight into the influences and sensitivities of various parameters and processes on the alteration of manufacturing strategies by Takala et al. (2007c). In China, the most dynamic market, Liu et al. (2008) has first time applied such analytical models to analyze and improve operational competitiveness of one private middle-size Chinese manufacturing company by adjusting competitive priorities in manufacturing strategy. Liu, Si and Takala (2009) has compared the operational competitiveness strategies in China and other countries in a global context by utilizing same analytical models, in order to analyze different characteristics of manufacturing strategies in different markets and suggest how the companies can improve their operational competitiveness. But the adjustment of manufacturing strategy alone is not just enough to improve the overall competitiveness to develop the business. This is one important factor and there is another important and necessary factor to improve the overall competitiveness no matter in adversity or in prosperity, which can be even more decisive and that is leadership (Bass, 1985). Bass and Avolio (1994) provided evidence on the benefits and effectiveness of transformational leadership on leadership and training of leaders. Transformational leaders help their subordinates to learn and develop as individuals, by encouraging and motivating them with versatile repertoire of behavioural and decision making capability (Bass and Avolio, 1994; Bass, 1997). Takala et al. (2008a) introduced another unique analytical model to evaluate the level of outcome direction, leadership behaviour and resource allocation of transformational leadership. In this paper transformational leadership is further extended by adding technology level as part of resource allocation. The final idea in this paper is to create a new analytical model to integrate manufacturing strategy and transformational leadership including technology level together for more comprehensive evaluation of overall competitiveness to develop the business operations further. The study continues further in China with deeper insight analysis of overall competitiveness of CSOME and suggests how to improve the overall competitiveness. The related case study includes benchmarking and development of overall competitiveness of CSOME case CN_WG group in global context which emphasize more on the adjustment of its manufacturing strategy and transformational leadership to improve overall competitiveness in regional and global market.

The structure of this paper is as follow. Section 2 introduces research methodologies. Section 3 models the integration of manufacturing strategy and transformational leadership including technology level to evaluate overall competitiveness with case study. Section 4 discusses briefly the analysis results and proposes the future research areas. Section 5 draws the conclusion.

2 RESEARCH METHODOLOGIES

2.1 Analytic Hierarchy Process (AHP) method

Analytic Hierarchy Process (AHP) method (Saaty, 1980) is a multi-attribute decision instrument that allows considering quantitative, qualitative measures and making trade-offs. The AHP is used in this study to deal with the empirical part, which includes analyzing questionnaires and calculating weights of main criteria and sub-criteria. AHP is aimed at integrating different measures into single overall score for ranking decision alternatives with pair wise comparison of chosen attributes (Rangone, 1996). This utilizes pair wise comparison by interviewing the experts within the whole organization. The AHP based instruments (forms and questionnaires) have been used in our case studies for more than 20 years in successful analysis of case companies and proved to be reliable. Further more, some open questions are used in additional to the pair wise comparisons in the AHP questionnaires to add internal validity to the answers. The inconsistency ratio (icr) has been calculated to assure the reliability of pair wise comparison results. Only matrixes with inconsistency value of 0.10 or less, and 0.30 or less in smaller groups with competent informants, can be used for reliable decision-making. Otherwise the answers are considered as invalid and will not be used in the case study.

The procedures of utilizing the AHP are as follows in this paper. The first step is to establish the model of hierarchy structure for the goal. In this study, the hierarchy models are constructed for the evaluation of manufacturing strategy by Takala et al. (2002) and transformational leadership by Takala et al. (2005), which servers as theoretical framework of this study. The second step is the comparison of the alternatives and the criteria. They are pair wise compared with respect to each element of the next higher level. The last step is connecting the comparisons so that to get the priorities of the alternatives with respect to each criteria and the weights of each criteria with respect to the goal. The local priorities are then multiplied by the weights of the respective criterion. The results are summed up to get the overall priority of each alternative.

2.2 Data collection and analysis

The data of CSOME case CN_WG group has been collected by answering questionnaires from senior managers or directors of 15 different subsidiaries. The interviewees are normally decision makers and middle management groups in the

case companies, who have good knowledge about the operations of the case companies, and the number of informants is depended on the size of case company. From same case company the inconsistent results are left out. Firstly, the senior managers or directors were trained to understand every criteria of the questionnaire by email, telephone or interview. Secondly, after they finished the questionnaires, the answers were analyzed by AHP software. Thirdly, the discussion with managers or directors revealed the results and verified the reliabilities of the data further.

For studying the manufacturing strategy, competitiveness priorities are listed in the AHP questionnaires as main criteria consisting of quality, cost, delivery, and flexibility. The main criteria are typical items used in evaluating the competitiveness priorities in multi-focused manufacturing strategies (Takala et al., 2002). They are formed based on typical case studies and instruments used in interviews. The sub-criteria involve 19 criterions, such as low defect rate, low cost, fast delivery, broad product line, etc. The weights are statistically measured for further analysis with analytical model (Takala et al., 2007b).

For studying the transformational leadership, leadership profiles are empirically measured with the theoretical frame of reference by AHP questionnaires (Takala et al., 2005). Statistical tests are made to find out the logic in the leadership profiles to increase the accuracy in the profiles, and in parallel by induction analytical model is built and tested statistically to measure leadership skills by leadership indexes from resource utilizations to leadership behaviours and finally to outcome directions and outcomes. Analytical model is further used to measure the effectiveness of leadership actions within different areas of outcomes and try to find out the correlation between these outcomes and leadership indexes in a forecasting way (Takala et al., 2008b).

2.3 Research assumptions

(1) CSOME can have strong competitiveness of manufacturing strategy in prospectors under normal business situation and may change to analyzer or even defender under different business situation e.g. economic crisis.

(2) Strong competitive CSOME in manufacturing strategy do not necessarily have strong outcome index, leadership index, resource index in transformational leadership since government behaviour (national policies, macro control) normally plays a key role rather than leadership in the operations of CSOME.

(3) Overall competitiveness will be decided by both the level of manufacturing strategy and transformational leadership. For successful cases there should be positive relationship between manufacturing strategy index and total leadership index.

2.4 Case study and case company

The research is based on doing numerous case studies for CSOME to analyze with existing analytical models and to create new analytical models for further evaluation, therefore the selection of case company must be mostly representative, well performed and highly experienced in its operations. Among 10 major backbone industries of Chinese economics, iron and steel industry is ranked as No. 1. Case CN_WG group is the first giant iron and steel manufacturing enterprise established after the founding of the People's Republic of China and one of the backbone enterprises under the leadership of the central government and the state council. Case CN_WG group is ranked top 3 CSOME in iron and steel industry in China. It has a production scale of more than 30 million tons, with over 120 thousand employees and 123.7 billon RMB revenue in 2008. Its operational concept is taking quality-profitability development route to produce high quality and high value-added products, since quality factors and key principles of quality management are important for financial decision-making (Zgodavová, 2004). Its strategic goal is to enter top 500 enterprises in the world, and become a world first-class enterprise with powerful self-innovation capability and market competitiveness by the year of 2010.

3 EVALUATION AND INTEGRATION OF MANUFACTURING STRATEGY AND TRANSFORMATIONAL

In this study, we propose to evaluate overall competitiveness based on two core factors, i.e. manufacturing strategy and transformational leadership. Existing analytical models are examined and new analytical models are proposed to integrate the two core factors as a holistic model to evaluate overall competitiveness. Another factor, which is technology level, is proposed to be considered as part of resources of leadership.

3.1 Analytical models for manufacturing strategy

The analytical models for manufacturing strategy are used to calculate the operational competitiveness indexes of companies in the different groups, which are prospector, analyzer and defender. According to Takala (2002), the responsiveness, agility and leanness (RAL) holistic model supports the theory of the analytical models using four main criteria, i.e. quality, cost, time and flexibility. The analytical models are developed from our research group based on over 100 case company studies in over 10 countries worldwide, whose industrial branch varies from one to another and company size varies from big to small but they share one thing in common which is that they all compete in a highly dynamic business environment and therefore such analytical model has good transferability.

The Manufacturing Strategy Index (MSI) is modelled as function . In the analytical models (Takala et al., 2007), the equations to calculate weights of core factors are as follows.

$$Q\% = \frac{Q}{Q+C+T}(1); C\% = \frac{C}{Q+C+T}(2); T\% = \frac{T}{Q+C+T}(3);$$

$$F\% = \frac{F}{Q+C+T+F}(4);$$

The analytical models to calculate the operational competitiveness rankings in each group are given.

The analytical model for prospector group:

$$\phi \sim 1-\left(1-Q\%^{1/3}\right)(1-0.9*T\%)(1-0.9*C\%)*F\%^{1/3} \quad (5)$$

The analytical model for analyzer group:

$$\lambda \sim 1-(1-F\%)\left(ABS\left(\begin{matrix}(0.95*Q\%-0.285)*(0.95*T\%-0.285)* \\ (0.95*C\%-0.285)\end{matrix}\right)\right)^{1/3} \quad (6)$$

The analytical model for defender group:

$$\varphi \sim 1-\left(1-C\%^{1/3}\right)(1-0.9*T\%)(1-0.9*Q\%)*F\%^{1/3} \quad (7)$$

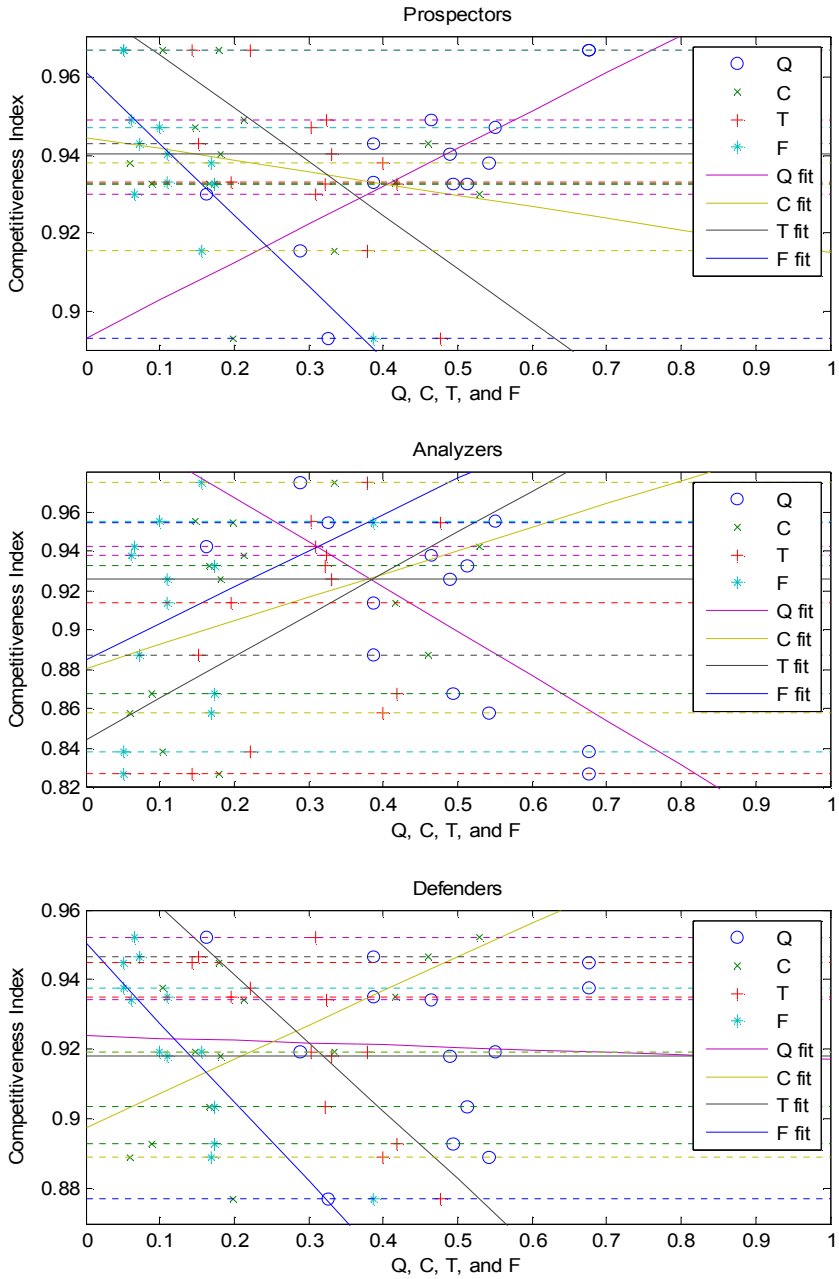

Figure 1. Competitiveness indexes of 12 subsidiaries of case CN_WG in Prospector, Analyzer and Defender groups, solid horizontal lines are the median values

Table 1. Evaluation of manufacturing strategies of the subsidiaries of case CN_WG

					Prospector		Analyzer		Defender	
Subsidiaries	**Quality**	**Cost**	**Time**	**Flexibility**	**Competitive index**	**Ranking**	**Competitive index**	**Ranking**	**Competitive index**	**Ranking**
CN_WG-1	0.4070	0.0740	0.3450	0.1740	0.9327		0.8679		0.8929	
CN_WG-2	0.6410	0.1710	0.1370	0.0510	0.9669*	8	0.8275		0.9449	
CN_WG-3	0.4940	0.1320	0.2730	0.1000	0.9470		0.9556		0.9194	
CN_WG-4	0.4360	0.1990	0.3030	0.0620	0.9488		0.9382		0.9341	
CN_WG-5	0.4510	0.0490	0.3320	0.1690	0.9381		0.8583		0.8892	
CN_WG-6	0.3590	0.4280	0.1410	0.0720	0.9430		0.8876		0.9468	
CN_WG-7	0.2000	0.1210	0.2920	0.3870	0.8933		0.9546		0.8772	
CN_WG-8	0.4230	0.1370	0.2660	0.1740	0.9326		0.9328		0.9037	
CN_WG-9	0.3450	0.3710	0.1750	0.1100	0.9332		0.9140		0.9349	
CN_WG-10	0.6400	0.0980	0.2100	0.0520	0.9667*	8	0.8383		0.9378	
CN_WG-11	0.1520	0.4930	0.2880	0.0670	0.9302		0.9426		0.9521*	7
CN_WG-12	0.2430	0.2810	0.3190	0.1570	0.9155		0.9749*	4	0.9192	
Median of subsidiaries	0.4348	0.1613	0.2939	0.1100	0.9401	38	0.9258	28	0.9181	32
Mean of subsidiaries	0.3993	0.2128	0.2567	0.1313	0.9336	43	0.9718	6	0.9181	32

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Table 2. Evaluation of transformational leadership indexes of subsidiaries leaders of case CN_WG

Leaders	OI	OI (Prospectors)	OI (Analyzers)	OI (Defenders)	LI	RI	TLI	TLI (Prospectors)	TLI (Analyzers)	TLI (Defenders)
Leader-1	0.7732	0.9355	0.7908	0.9274	0.3235	0.3947	0.0987	0.1195	0.1010	0.1184
Leader-2	0.6608	0.9149	0.8566	0.9424	0.0786	0.5386	0.0280	0.0387	0.0363	0.0399
Leader-3	0.7667	0.9326	0.7788	0.9316	0.1747	0.1779	0.0238	0.0290	0.0242	0.0289
Leader-4	0.8552	0.9328	0.8925	0.9226	0.1371	0.3024	0.0355	0.0387	0.0370	0.0383
Leader-5	0.8657	0.9377	0.7874	0.9388	0.2366	0.6145	0.1259	0.1364	0.1145	0.1365
Leader-6	0.7982	0.9329	0.7834	0.9337	0.1750	0.4750	0.0663	0.0775	0.0651	0.0776
Leader-7	0.9167	0.9397	0.8404	0.9451	0.3420	0.3641	0.1141	0.1170	0.1046	0.1177
Leader-8	0.9647	0.9580	0.7958	0.9561	0.2510	0.3401	0.0823	0.0818	0.0679	0.0816
Leader-9	0.8677	0.9258	0.8520	0.9392	0.1974	0.4031	0.0690	0.0736	0.0678	0.0747
Leader-10	0.8113	0.9236	0.8328	0.9383	0.1449	0.6027	0.0709	0.0807	0.0727	0.0820
Leader-11	0.9698	0.9583	0.7739	0.9593	0.0391	0.4571	0.0173	0.0171	0.0138	0.0171
Leader-12	0.8968	0.9380	0.7965	0.9427	0.2311	0.3231	0.0670	0.0700	0.0595	0.0704

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Table 1 shows the evaluation results of manufacturing strategies of 12 subsidiaries of case CN_WG. According to Liu et al. (2008) and Si et al. (2010), normalized median values and mean values can be reliably used to evaluate combined competitiveness ranking of an organization's manufacturing strategy based on individual values from its different departments or subsidiaries. Based on such theory, the competitiveness of case CN_WG is tested by calculating with median and mean values in Table 1. The top competitive subsidiaries, also the medians and the means of subsidiaries of case CN_WG in prospector, analyzer and defender groups are ranked in our global manufacturing strategies (GMSS) database. From the rankings it can be seen that case CN_WG is most competitive in analyzer group with mean value ranked 6th. The top competitive subsidiaries are marked with asterisks in Table 1. Case CN_WG-12 is most competitive among all subsidiaries, which has highest ranking 4th in analyzer group. The top competitive subsidiary in prospector group, case CN_WG-2 and CN_WG-10, both have nearly equivalent strong competitiveness which ranked 8th. The top competitive subsidiary in defender group, case CN_WG-11, has also strong competitiveness which ranked 7th. It can be seen that case CN_WG group has highly competitive subsidiaries in prospector, analyzer and defender groups, which indicates that it is a highly competitive group corporation and in overall it has strong competitiveness especially in analyzer group. This has proved research assumption (1).

3.2 Analytical models for transformational leadership

Takala et al. (2008a) have developed analytical models for the evaluations of leadership indexes and its outcomes of different parts of leadership. These models are outcome direction index (OI) by balancing the directions, leadership behaviour index (LI) by measuring deep leadership, and by measuring maximum of passive and/or controlling leadership and by measuring in different ways the utilization of the cornerstones of deep leadership, and resource allocation index (RI) by balancing utilization of human resources. Originally the Transformational Leadership Index (TLI) is modelled as function $f_{TLI}(OI, LI, RI)$. However, in this paper we propose that technology level index (TI) to be considered into transformational leadership as a special part of resources of leadership. Therefore the new proposal is to model Total Leadership Index (TLI) as function $f_{TLI}(OI, LI, RI, TI)$.

The theoretical frame of the analytical models is based on theory of Transformational Leadership (Bass 1997). A holistic but very simple model of a human being from resource allocations to behaviour and finally to outcome directions and outcomes has been built basing on psychic, social, functional, organizational and structural factors and put together according to the sand cone model (Takala et al., 2005) and participation objectives in leadership of an organization.

Sand cone model from operations management literature presents a model of cumulative layers of manufacturing performance dimensions (Takala et al., 2006). The model implies an idea that companies need to develop their performance in certain stages, in order to achieve higher levels of competitive performance. The prescriptive order of mutually supportive and enabling success factors is to proceed from quality, to delivery performance, then flexibility and finally to cost effectiveness. Financial results cannot be achieved if non-financial aspects of performance are improved first. In this manner, the often-competitive dimensions of performance need to be viewed as a whole, to think about performance and capabilities on a longer-term basis. The conceptual model with sand cone has similar basic ideas as the model of deep leadership (Nissinen 2001) in which the potential in professional skills and resources is transformed to outcomes of activities with the help and support of leadership process and behaviour.

The analytical models for evaluation of leadership are as follow.

Outcome Index: $OI = f_{OI}(EF, SA, EE)$

Leadership Index: $LI = f_{LI}(DL, PL, CL, IC, IM, IS, BT)$

Resource Index: $RI = f_{RI}(PT, PC, IT, OR, TI)$

Technology Index: $TI = f_{TI}(SH, CR, BS)$

Outcome index (OI):

Without classification: $1 - \max\left\{\left|\frac{1}{3} - EF\right|, \left|\frac{1}{3} - SA\right|, \left|\frac{1}{3} - EE\right|\right\}$ (8)

Prospector: $1 - (1 - EE^{1/3}) \cdot (1 - EF) \cdot (1 - SA) \cdot Std\{EE, SA, EF\}^{1/3}$ (9)

Analyzer: $1 - (1 - SA^{1/3}) \cdot (1 - Std\{EE, SA, EF\}^{1/3})$ (10)

Defender: $1 - (1 - EF^{1/3}) \cdot (1 - EE) \cdot (1 - SA) \cdot Std\{EE, SA, EF\}^{1/3}$ (11)

EF = Effectiveness

SA = Satisfaction

EE = Extra effort

Leadership index (LI):

$$DL \cdot (1 - \max\{PL, CL\}) \cdot \left(1 - \left|\frac{1}{4} - \max\{IC, IM, IS, BT\}\right|\right) \quad (12)$$

DL = deep leadership

PL = passive leadership

CL = controlling leadership

IC = individualized consideration

IM = inspirational motivation

IS = intellectual stimulation

BT = building trust and confidence

Resource index (RI) integrating with Technology index (TI):

$$\left(1 - PT \cdot \left(1 - TI\right)\right) \cdot \left(3 \cdot \min\left\{PC, IT, OR\right\} \cdot TI\right) \tag{13}$$

PT = people, technology, know how

PC = processes

IT = information systems

OR = organization (groups, teams)

$$TI = 1 - \max\left\{\left|SH_{optimal} - SH\right|, \left|CR_{optimal} - CR\right|, \left|BS_{optimal} - BS\right|\right\} \tag{14}$$

SH=Spearhead, CR=Core, BS=Basic

Combined total leadership index (TLI):

$$TLI = OI \cdot LI \cdot RI \tag{15}$$

In this paper we propose a brand new idea to model the effect of technology index (spearhead, core, and basic technology) to resource index. The definition is proposed as follows according to the principles how resource index has been built.

A. The excessive know how, meaning that caused by not the right technology belongs directly as an extra weight to the warehouse of know how (PT), and/or lowers weights in PC, IT or OR, lowering in both the cases the resource index RI in a linear manner.

B. The right technology, meaning that fitting to the manufacturing stages increases PC, IT or OR, and/or decreases the know how (PT) warehouse that caused by not the right technology, and increases in both the cases the resource index RI in a linear manner.

Definitions A and B with the expert opinions from the case companies and equation for modelling RI are used for the analysis. The weights of SH/CR/BS are collected by interviewing the experts especially how significant or how much effect they are or have to be for PT and min(PC, IT, OR) and then the effects of how TI affects RI is analyzed. The optimal weights of SH, SR, and BS are obtained theoretically from the chosen competitor and market benchmark with

some tolerance. Then the case company data are compared with the optimal values to get the differences for calculating TI. TI is defined to reflect how good the technology level allocation is by using 1 minus the worst deviation from the optimal weights of technology levels. The higher value of TI directly decrease PT caused by using not the right technology and increase min(PC, IT, OR), therefore increases RI eventually.

Table 2 shows the transformational leadership indexes of subsidiaries leaders of case CN_WG of the 12 leaders of their respective subsidiaries of case CN_WG. Figure 2 shows transformational leadership indexes (OI, LI, RI, and TLI) of subsidiaries leaders of case CN_WG. It can be seen that with different categories to calculate OI in prospectors, analyzers and defenders, the final results of TLI are not significantly different, therefore the analysis of TLI is considered without classification of prospectors, analyzers and defenders.

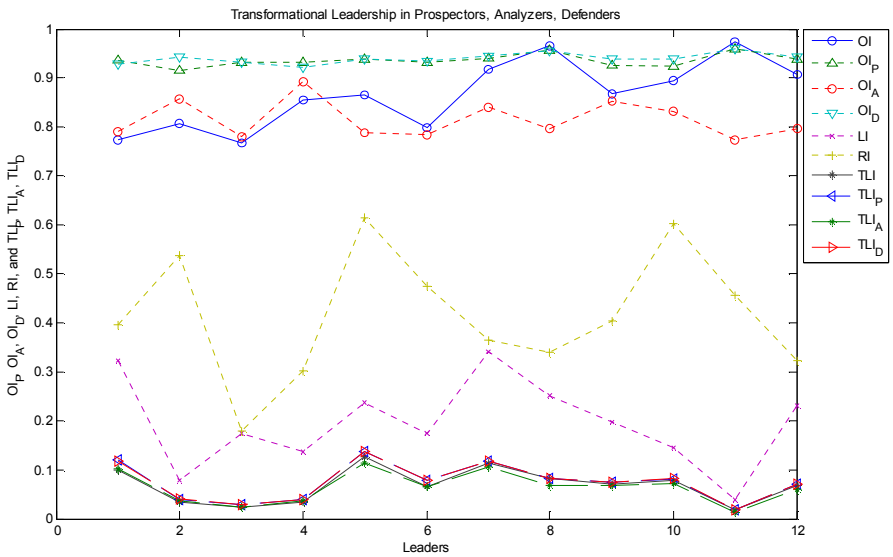

Figure 2. Transformational leadership indexes of subsidiaries leaders of case CN_WG

3.3 Evaluation of overall competitiveness

Manufacturing strategy and transformational leadership are integrated together to evaluate the overall competitiveness. Figure 3 plots the correlations between manufacturing strategy index (MSI) and total leadership index (TLI). It can be seen that MSI in all groups have positive relations with TLI especially the slope of MSI in analyzer group against TLI is highest, which also proves that CSOME is most competitive in analyzer group, and this is directly caused by the improvement of leadership. This has proved research assumption (2) and (3).

The overall competitiveness index (OCI) is proposed to be modelled as function:

$$OCI = f_{OCI}(f_{MSI}, f_{TLI}) = f_{MSI} \cdot f_{TLI} = MSI \cdot TLI$$

According to above analysis, the OCI can be modelled as reduced function:

$$OCI = f_{OCI}(f_{MSI}, f_{TLI}) = f_{MSI} \cdot f_{TLI} = MSI \cdot OI \cdot TI$$

This is because that the OI of transformational leadership is the key factor to direct the strategic goal of manufacturing strategy and MSI is the driving force of the company, taking the effects of TI into account in which TI are evaluated as approximately constant factors during certain period. In such cases, OI is more decisive to overall competitiveness but other factors like LI, RI, and TI can be influenced also by government macro control. In case CN_WG, since it's most competitive in analyzer group, the OC is evaluated based on MSI and OI in analyzer group. The 3-Dimentional plot of MSI, OI and OCI is shown in Figure 4. The rectangular region shows the potentials where the OCI can be developed.

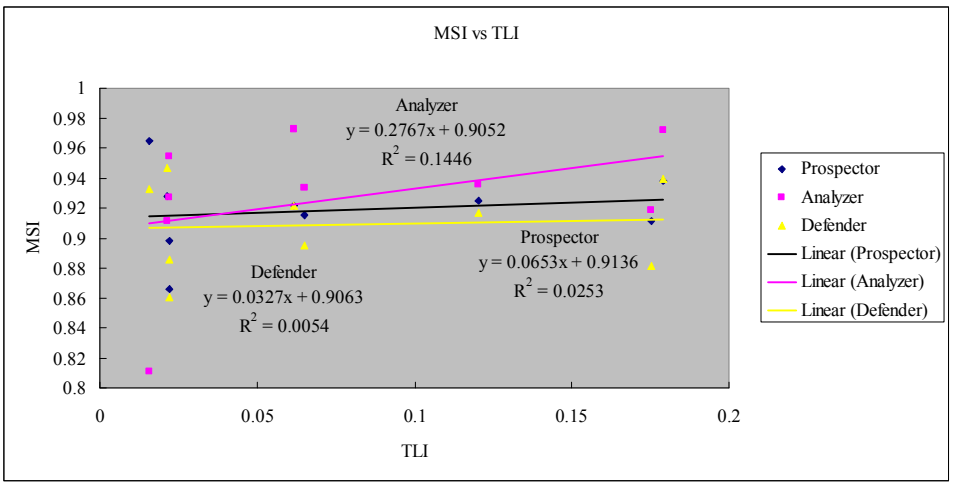

Figure 3. MSI vs TLI

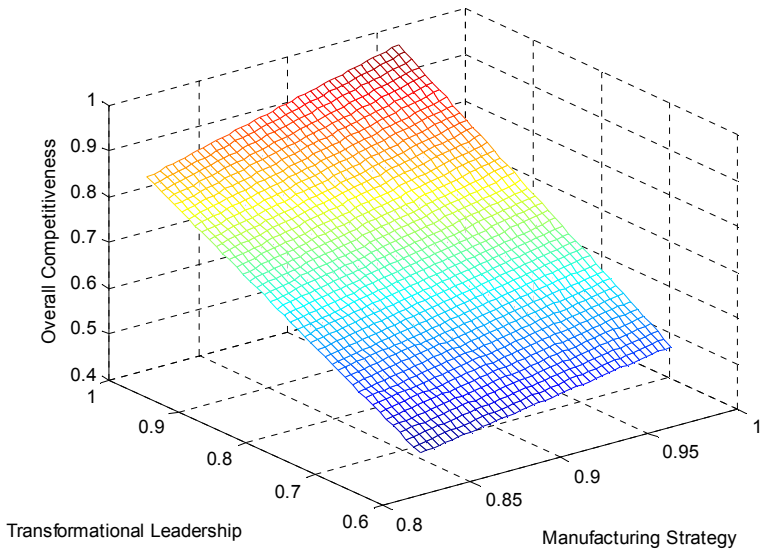

Figure 4. 3-Dimentional plot of OCI evaluated based on MSI and OI

4 DISCUSSION AND FUTURE RESEARCH

In this paper, the following has been done:

- case studies to management and decision making
- manufacturing strategy analysis: model as function $f_{MSI}(Q,C,T,F)$
- transformation leadership with technology level analysis: model as function $f_{TLI}(OI,LI,RI,TI)$
- overall competitiveness analysis by integration of manufacturing strategy and transformation leadership: model as function $f_{OCI}(f_{MSI},f_{TLI})$
- case studies and analysis of CSOME case CN_WG using analytical models

The experience learnt from this case study can become a model for companies in other countries.

In the future research, several ideas have been proposed as follow:

(1) For manufacturing strategy it will be everlasting and challenging work to calibrate the GMSS database in global context concerning more issues, such as different levels of cost, quality, time and flexibility, especially in technology level, as they all have important impact on competitiveness level of companies. The analytical models will be more intensively examined and calibrated by doing case studies with purpose to adapt to new business situation e.g. crisis and be

able to advise solutions based on the evaluation results obtained from analytical models. These may include:

- new measurement of customer behaviour through interview and case studies
- customer and market behaviour analysis under new situation
- how to change strategies according to different market needs and customer behaviour. Strategies should change according to new measurement of the differences, e.g. to overcome the currency depreciation, change of product line, change of supplier network, increase flexibility in certain area to gain new customer and new market (for example case Wärtsilä's high flexibility in service intensive business)
- simulate the operational performance with new adjusted strategies by utilizing analytical models
- forecast the effects of crisis and the effects of adjusted strategies
- other adjustments except strategies

(2) For transformational leadership, the OI value should probably be scaled to have more meaningful results. A brand new group, reactor, will be introduced. The definition and calculation of reactor group is worth to study in both theoretical and practical level. The actual modelling of TI as part of RI will be implemented. These give better simulation models to new business situations such as crisis.

(3) For overall competitiveness, the evaluation will be compared with more case studies with successful companies to verify its validity further.

(4) How government behaviour (national policies, macro control) will affect enterprises may also be taken into account, whether to put them into crisis (e.g. economical sanctions) or save them from crisis (local protection, government support for the CSOME). Since many large international orders are only based on bilateral government contracts, political reasons cannot be neglected and sometimes decisive. The analytical models can be further optimized according to different characteristics of markets behaviour and economical situation.

5 CONCLUSION

In this paper, a novel concept to model and evaluate overall competitiveness has been proposed by integrating manufacturing strategy and transformational leadership including technology level together. The empirical studies are focused to case companies in China especially Chinese State-Owned Manufacturing Enterprise (CSOME). From the case CN_WG group, a typical CSOME studied in this paper, some conclusions can be summarized as following: (1) the case CN_WG is a highly competitive group corporation and in overall it has strong competitiveness especially in analyzer group. (2) Leadership index (LI) has a most significant impact on deciding total leadership index of the case CN_WG.

Manufacturing strategy index (MSI) has a negative effect on total leadership index (TLI) in all groups. Leaders should take the resource of the company into account when deciding manufacturing strategy of the company, as RI has a significant negative effect on MSI. (3) Manufacturing strategy index (MSI) has significant relationship with outcome index (OI), which implies that the outcome direction of leadership will have an important effect on manufacturing strategies. The OI is the key factor to direct the strategic goal and MSI is the driving force of the company, therefore the OC is proposed to be evaluated based on MSI and OI.

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TRIAD: BUSINESSES – UNIVERSITIES – MUNICIPALITY (REGIONS) WITHIN KNOWLEDGE ECONOMY

PETER KUZMIŠIN

1 INTRODUCTION

1.1 Formulation of a problem

The idea of *knowledge economy* is connected with works of P. Drucker which he wrote in late 1960's of 20th century *(The effective Executive, The Age of Discontinuity, Post-Capitalist Society)*. In the respective period, Drucker [3] identifies significant macroeconomic changes in marker environment. It is the processes connected with the transition from industrial towards post-industrial society and the transition to both society and economy based on pieces of knowledge, which are closely connected to the onset of new information-communication technologies (IKT). According to Drucker, knowledge in the knowledge economy is used to produce knowledge; i.e. to search for the best ways of using disposable information, for new solutions, for evaluation and decision, which new knowledge is necessary, if obtaining these pieces of knowledge is meaningful and what is necessary to do to ensure the efficiency of their usage. In other words, knowledge is used for systematic and deliberate production of new knowledge and innovation. Science, technology, progress with no limits – this is the characteristics of the global knowledge society nowadays, which will be built on knowledge workers, their cooperation and creative communication. Similar approaches can be found in works of other authors as well [e.g. 12, 20, 21, 22, 23, etc.]

In the knowledge economy, human (intellectual) and knowledge capital represent the main sources of development of both society and regions, because it contributes to the creation and spreading of technological progress, increases the efficiency of capital usage which also contributes to increases in productivity. Many empirical studies have already confirmed its positive influence on economic development, as well as its indirect impact upon on standards of living in a society. Changes, which are taking place in the economy in both this and future time periods towards knowledge based activities, increase the demand for human resources, namely their quality/qualifications and creativity. Society, regions and businesses therefore become dependent on the ability to create, develop and use knowledge and skills in their value-creating transformation process. Based on the abovementioned, investing into quality (qualifications) of

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human capital seems to be an adequate tool of both business and human resource policies. Therefore, institutions and processes that produce knowledge become very significant. Quality of education and science, qualified human resources have an irreplaceable position in the process of creation and transfer of knowledge, which we perceive as a prerequisite of long-term economic development. Quality education system in the country (region) is the determinant of creation and usage of knowledge and skills for economic development.

Education and economy need to be interactively connected: education should be adjusted to the needs and possibilities of economy (regions) and the same vice versa; the potential and productivity of the economy (regions) are influenced to a great extent by the quality of education and its product – qualified and creative labour force. Education systems in the country (regions) should therefore flexibly react to technological changes in production and contribute to the growth of economy and ensuring its competitiveness in the world. Quality of education is a reflection and manifestation of the abilities of educational environment to create necessary conditions, to offer quality education programs and link education with research and practice. On the other hand, the existence of motivating environment is a necessary prerequisite so that the development of qualification of each individual in the society is a full picture of not only their abilities, but also willingness to react to changes in labour market, learn new skills which are adequate to requirements of knowledge based society. Increasing intellectual capacity of the society and regions is possible by building quality and flexible education system. The main investor in education should be the state and regions.

The development of a society in future shall therefore depend on solving the problem of adequate level of development of business and education systems. This will affect convergence (or divergence) model in future, which determines progress (or regress) of countries and regions. Determining direction and character of both education and business components in regions is very important not only because it will reflect in the competitiveness, but also because of the fact, that region itself will be the main user of services, which are provided by the institutions of tertiary education (TV) and business subjects. On the other hand, it is expected from education, that it will formulate a competitive model of development or businesses and regions. In this context, identification of mutual interaction among education, doing business and regional development becomes very important as a resort for determination of development strategy of the abovementioned components. Reciprocal relationship between regional development and development of its both business and educational dimensions is a precondition of the formulation of development strategy that should result into a concept of new sphere of regional interests of the triad: “businesses-universities-municipality (regions)” as a determinant of innovation culture and so “anchoring” the region into global knowledge economy [24].

2 METHODOLOGY

In the study we are coming from the methodology of quantitative competitiveness, which is expressed in various indicators. Comparing sources and results of knowledge based competitive advantage is expressed by KAM - *Knowledge Assessment Matrix,* by World Bank. The application of abovementioned methodology appears in various outputs of a team Kadeřábková, A. a kol. [10]. We are using the *index of knowledge economy*, which is calculated from the average of normalised values of indicator of knowledge economy pillars and it is obtained from the values: the quality of administration, human resources, innovation system and both information and communication technologies.

In international comparisons within the area of the quality of human resources, the share of public expenses spent towards education and the ratio of students are evaluated. The ratio of graduates from natural sciences' and technical courses to all graduates is significant[1].

Complex approach to evaluation of innovation based competitiveness on the state level is represented by the *European Innovation Scoreboard – EIS.* In the summary innovation index (SII) in 2006 is SR on the 27th place, out of 32, with the value of 0.23 (on the first places are Sweden 0.73, Switzerland 0.69, Finland 0.68, Denmark 0.63, Japan 0.61 etc) [2]. On regional level *European regional innovation scoreboard* –RIS – is used. In the Annual competitiveness report by the World Economic Forum two summary indexes are presented – *index of global competitiveness* and *index of business competitiveness.* In the summary index of global competitiveness in the group of factors increasing efficiency the availability of developed human capital is mentioned as a significant factor.

Among the other significant international evaluations is The International Institute for Management Development in Lausanne, which places primary importance on the area of the quality of human resources and research.

As a starting point of analysis of the quality of human resources a standard methodology of EU (Labour Force Survey), ISCO 88 (International Standard Classification of Occupations) was used, namely in the class of achieved education, whereas ISCED 1997 (International Standard Classification of Education) is accepted. For individual comparisons within international framework methodology ILO (International Labour Organization) is used. As for the institutional quality it uses aggregated indicators, which are analysed by the World Bank in the project *Governance Matters* (GM). Expenses for research and

[1] According to the publication of OECD Education at e Glance and conlusions of the project Thematic Review of Tertiary Education, materials of EU ECFIN and European Association of Universities. Available at: http:// www.oecd.org; http:// www.eua.be.

[2] According to: European Commission, 2006. http:// www.eua.be.

development (R&D) are observed by GERD (*Gross expenditure on research and development)*, as a complex input indicator into R&D, which serves in some parts of evaluation of development trends in TV on international level. Its significance is perceived at the background of the GERD in % of GDP, which in the EU statistics belongs to the group of indicators assessing fulfilment of the Lisbon Strategy goals. A vital source of information about the trends in TV and its quality were publications of OECD *Education at e Glance* and conclusions of a project *Thematic Review of Tertiary Education*, materials of *EU ECFIN* and *European association of universities.*

Another very important source of data during the process of writing this article were the materials of EU, Commission of European Council, Slovak Rector Conference, ARRA, Institution for information and prognoses of education (UIPS), Business Alliance of Slovakia, World Bank, regional study of municipalities, official web sites of the government and its ministries, programmes for economic and social development of regions, national materials, namely National strategic reference framework for actual forming period, Strategic documents for the area of universities' development in Slovakia, Annual reports about the state of university education in Slovakia according to the Ministry of Education in Slovakia (MS SR) and Programmes for economic and social development of chosen regions in Slovakia. Home and foreign literature and professional publications [1, 2, 4, 6, 9, 11, 15, 16] as well as various surveys and analyses were used. Data sources were also statistical data from Slovak statistical office and regional statistics, databases of EUROSTAT and OECD [18], surveys of the World Bank, indicators of innovation performance of the database New Cronos published by the EUROSTAT.

2.1 Aim/structure

The aim of this paper is to identify place and position of TV in the economic development of the country (region) within set links at the background of formation of relationships among TV institutions, namely universities with business subjects and institutions of state and public administration. Our basis is bibliography of relevant publications in given area, while the main point of this paper lies in the analysis and identification of changes in both forms and content of competitiveness criteria. This is interlinked with the position of individual subjects of social and regional development (businesses-universities-public administration) at the background of trends leading towards formation of knowledge economy.

2.2 Results

Economic growth starts with talented people. Creativity become a driving force of economic growth and begins to be perceived as a new type of competitive advantage. Although creativity and its link to learning and experience is usually considered a condition for arising and spreading of

innovations, putting emphasis on creativity itself becomes the basis for a brand new direction with the potential of creation of new economic paradigm, so-called *creative economics*.

OECD wants to help individual countries understand how organization, management and ensuring of TV can help them fulfil their aims in the economic and social area, and therefore based on its analytic activities identifies main problem areas, which are at the same time a manual for creating an efficient system of TV. Their role is:

- To limit economic and social aims of TV,
- Determine how individual countries can provide for sustainable economic system of TV and a convenient structure, with efficiently linked elements and with particular mechanisms for ensuring its quality,
- Set how individual countries can mobilise particular sources for TV system,
- Plan, which mechanisms and which policy on national level can ensure an efficient management of the system as a whole.

The importance and irreplaceable task of education by forming an active and creative labour force as the most efficient source of knowledge economy are being realised on all levels of management[3] and adequate attention and financial support are given to tackle this problem.

The European Union is realising a joint *Labour Programme for education and professional training 2010* in the forthcoming decade after 2000. This includes EU27 and European Economic Area (EHP) [4] and the area of increased

[3] **OECD** – using conceptual approaches in the process of determining development trends in the direction of creative and initiative activity stimulation and participation in comparative analyses.
EU – fulfilling commitments that are related to the membership of Slovakia in the EU in the area of education, research and development, stimulating activities of educational institutions in their participation in educational programmes of the EU, supporting activities of agencies ensuring their realisation, using structural funds of EU in the area of education, R&D.
European Council – cooperation in the area of education towards democratic citizenships and social coherence, multicultural education, education of minorities, and teaching foreign languages.
UNESCO – supporting realisation of the World Declaration on education for everyone, passed in Jomtien and efforts for adequate help in education in developing countries.
CEEPUS – supporting participation of our universities in this exchange programme for students and teachers with the focus on its complex programmes and creating networks of universities with creation of necessary infrastructure.
Visegrad fund – support and common use of fund means in the area of education and sport.
Bologna declaration –supporting activities, in the framework of whose Slovakia joined convergence processes of university systems in the area of academic and professional mobility.
Bilateral co-operation – commitments to government and resort contracts, especially in the area of providing information about the actual state of school and educational policy in individual contract countries, namely in pedagogic documentation, exchange of professionals, support of language courses of the other contractual side, mobility of students and teachers, deepening of cooperation in bilateral projects and projects of foreign help etc.
[4] EHP = EU + Norway, Iceland, Liechtenstein

interest is the growth of quality of education, access to education, sharing the best experiences and partnership building. European Commission presented in December 2008 its new initiative of the *New skills for new jobs*, which can help to predict skills required in future. The goal of the before-mentioned initiative is to better expect changes, so that people can better prepare for a job in the knowledge economy. In the set context and in the cooperation scheme, European Commission and member states were identifying *strategic goals for education system* for forthcoming decade:

- Life-long education (in relation to future jobs),
- High quality of education and professional training for creation of higher skills,
- Systems that are more objective and more efficient at the same time fighting inequality and which prepare each child, a young or an adult person for the requirements of future,
- Schools and universities which will lead students to entrepreneurship, creativity and innovations for economic prosperity and also personal fulfilment (Figeľ, 2009).

Table 1 - The quality of tertiary education- evaluation from the perspective of the competitiveness of the economy

	2001	2002	2003	2004	2005	2006
EU-27	5,7	5,8	5,8	5,7	5,4	5,4
Belgium	7,3	7,1	7,6	7,6	7,0	7,2
Czech Republic	5,4	6,0	6,3	5,1	5,7	6,1
Denmark	6,7	6,8	6,8	7,0	6,6	7,1
Estonia	5,9	5,7	5,4	6,1	5,5	6,1
Finland	8,2	8,9	8,7	8,2	8,0	7,7
France	5,3	6,3	6,1	6,0	5,7	5,0
Ireland	8,1	8,0	7,6	7,6	7,5	7,7
Italy	3,9	4,3	4,3	4,1	3,8	4,1
Luxembourg	3,0	3,4	4,5	4,0	3,5	4,4
Hungary	7,0	7,0	6,7	6,1	6,4	5,5
Germany	5,5	4,5	4,6	5,1	5,0	5,9
The Netherlands	6,8	7,0	5,3	6,2	6,6	6,0
Poland	4,4	3,9	4,7	5,3	4,3	4,8
Portugal	4,2	3,9	4,2	4,9	4,0	4,8
Austria	6,3	7,2	7,3	7,0	6,4	7,3
Romania	N	N	N	N	N	2,5
Greece	4,6	3,9	4,3	4,3	4,1	4,1
Slovakia	6,2	6,4	5,9	5,7	5,2	4,0
Slovenia	4,7	5,0	4,5	3,8	3,3	3,8
Spain	5,5	5,1	5,0	4,7	4,2	4,0
Sweden	6,0	6,3	6,0	6,6	6,0	6,5
United Kingdom	5,4	5,4	5,2	5,0	5,2	5,6
EU-15	5,8	5,9	5,8	5,9	5,6	5,8

Source: IMD, 2007, available at: www.imd.ch

Note: The highest quality = 10, the lowest quality = 1. Average for EU is non-weighted arithmetic from the available data

The average quality of tertiary education in Slovakia achieved between 2001-2006 5.56 points, which is comparable to France (5.7) and Czech Republic (5.8). However, it is significantly lower than in Austria (6.9), but higher than in Germany (5.1). It is unfavourable, that the evaluation in observed period deteriorates and in 2005 and 2006 Slovakia does not achieve even the average of EU-27.

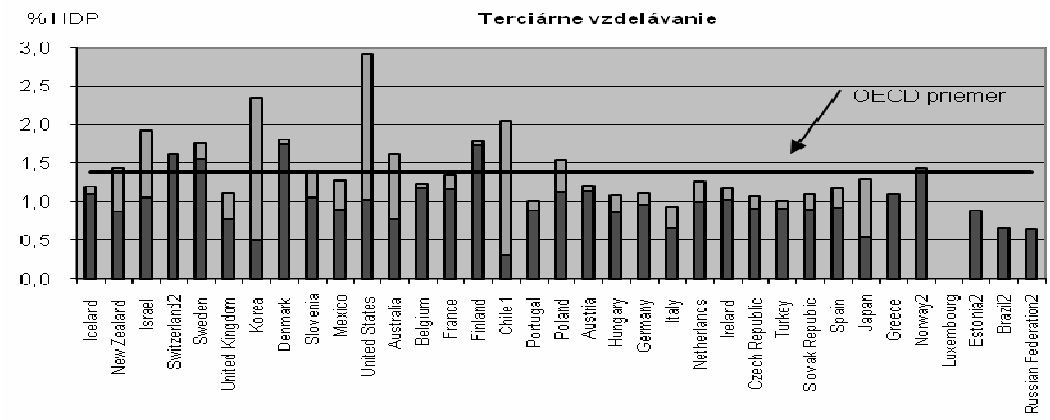
In the area of TV system modernisation for future needs and job places (of states, regions, businesses), European Commission wants to focus on these areas:

- *Curricular reform*: system of three educational stages, learning based on competences, flexible educational procedures, acknowledgement, and mobility.
- *Management reform*: autonomy of universities, strategic partnership, involvement of businesses, and ensuring quality.
- *Financial reform*: diversification of university income sources reflecting more the results of universities, supporting justice, approach and efficiency, involvement of possible tuition fees, grants and tuition loans[5].

It is therefore necessary for governments, educational institutions and business sector to understand movements in labour market and be able to forecast, which new skills will be demanded for in future. Universities still play a central role in creating knowledge Europe[6]. A reform agenda has been processed for universities. Universities should adjust their curricula to the necessities of current era and provide for a professional training of people for future higher positions, ensure equipping graduates not only with knowledge, but also with know-how and practical skills. For this reason, involvement of business sphere is essential – as a partner, who helps modernise and adjust school and university curricula to the needs of labour market, develop skills, namely entrepreneurship and innovations. Better and more intensive cooperation is thus useful for academia on one hand, and for business sphere on the other. It is mutually beneficial for an exchange and development of knowledge – from both business and academic perspective. Involvement of business sphere by curriculum development will contribute to graduates having knowledge and skills necessary for the successful start in employment and their further adaptation for the needs of labour market [7, 25].

[5] Main representatives of EU made promise in Hampton Court that all investments into education are necessary to be allocated on a minimal basis of 2% of GDP. Even worse situation has been with investments in research. In the EU, the average is 1.9% of GDP, while in the USA, Japan and Korea it is 3%. The development of investment in science in Slovakia from the EUROSTAT data – in1998 it was 0.79%, in 2000 it was 0.65% and in 2003 only 0.57% of GDP (http://europa.eu.int).

[6] Europe has a great education potential: 4 000 institutions, more than 17 millions students and about 1.5 millions of employees.



Legend: Terciárne vzdelávanie – Tertiary education, OECD priemer – OECD average, HDP - GDP
Explanations: lower part of column graph –public expenses; upper part –private expenses on educational institutions
Note: 2/only public expenses
Graph 1 - Expenses for educational institutions in the area of TV % GDP in the countries of OECD (2004)
Source: processed according to: OECD. TableB2.4 See Annex 3 form noex available at: http://www.oecd.org

2.3 Triad: businesses – universities – municipality (regions)

2.3.1 The third role of universities

In relation to the joint role of universities and the quality of university environment, time brings new challenges. The vision of competitive, highly diversified university system has crystallised unto three basic functions of universities:

a) in the area of education, the system develops and fully uses the potential of individuals, prepares young people for the entry to the labour market and in the long-run provides for their employability, provides education of active citizens striving for building a democratic society, supports graduates on their way for further education and life-long learning and further develops knowledge in wider array of courses,

b) in the area of R&D, universities create appropriate conditions for the development of R&D on the top level, spread the results of R&D or they apply them in practice as a significant source of innovations,

c) universities co-operate with business sector (businesses, employers, and other clients), they contribute to establishing innovation and technological partnerships and influence within the regional development, where they are active.

At the OECD level as well, the position of TV institutions is being highlighted from the perspective of their role in regions. These employ a

significant number of people, educate students and are the places of basic and applied research, which in turn helps to support business environment on the competitiveness level in a sustainable way. Therefore, member states of OECD are trying to mobilise/orientate tertiary education this way, too. In 2004, OECD started to compare systematically, how this effort helps to mobilise social, cultural and economic potential for the regional growth and to identify the ways, how these institutions for higher education can contribute to building regions in knowledge society.

2.3.2 New partnership for university modernisation: dialogue universities - businesses

Changes in the position of universities from the perspective of their co-operation with business sphere and subjects of regional management have found their expression in the Announcement of the Commission to the European Parliament, Council, European Economic and Social Council and the Regional Council under the new name of *New partnership for the modernisation of universities: EU forum for the dialogue between universities and businesses* [13].

Universities are in the centre of European Knowledge Triangle with their triple role of provider of the highest level of education, sophisticated research and discovering innovations. They have the potential to act as a driving force of the European ambition to become a leader in knowledge economy and society on the world level. This fact has been known in the EU policy since the summit in Hampton Court in October 2005; should their potential be used, however, the need of change is obvious. In the Commission announcement, Realisation of the universities' modernisation programme: education, research and innovations from May 2006, nine areas of activity have been detected. The programme has been the subject of an extensive political exchange since, whereas the Council of Ministers has been regularly checking achieved progress. The Commission further suggested modernisation of universities as one of the main topics in the new framework for political cooperation in the area of education and professional training within Lisbon Strategy.

The key element in the framework of the programme set in 2006 was that the universities should create structured partnerships with businesses, so that they could become important actors in the economy, being able to react better and faster to the demands of the market and build partnerships that use scientific-technological knowledge. In the announcement it was suggested that businesses should help universities to re-create study programmes, managing structures and to contribute financially. On this basis the Commission established a forum "universities-businesses" as a European platform for the dialogue between the two environments.

2.3.3 The concept of entrepreneurial university

In the concept of the entrepreneurial university (PU), geographical proximity of individual actors in regional development is used [5]. The position of universities as creative centres of regions comes to the forefront – the ability to keep creative talent, and at the same time absorptive ability to use these talents from the side of given locality – this is the chain, which ensures the regional attractiveness with subsequent beneficial economic effects and significant non-economic stimuli that jointly influence the quality of human lives.

The basis of the understanding of the PU essence is the application of the knowledge in education process. According to M. Zeleny [24], knowledge is not information. Getting knowledge is not only gathering information. Knowledge is an action, it is information, knowing used in transformation process creating added value. The richest are those countries that are focusing towards using knowledge and skills in business, no only for equipment, work or natural resources. In the entrepreneurial university, students look for knowledge – i.e. information used in real action – workshop, project, business. Resources, money, machines, information – this all becomes useless without usable knowledge. The prerequisite for knowledge is their usability and usage. Useless and unused knowledge stays being a piece of information, unless they are transformed to an action. Many countries are rich in information (symbolic description of actions), but poor in knowledge (using them in productive actions and acts as such).

One of the first entrepreneurial universities in Slovakia is the Entrepreneurial University in Zilina, which will start to be prepared in autumn 2009 and its guaranty is IPA Slovakia Zilina[7]. The aim is to prepare two groups of participants in a complex study for businessmen and managers of small and medium businesses from Slovakia and Czech Republic. It should be elite college with

[7] **Fraunhofer IPA Slovakia** is an association of natural persons as well as legal entities that was established in 2000 as a result of long-term cooperation of Slovak consultants, architects, and researchers Fraunhofer IPA Stuttgart. At present, members of the association Fraunhofer IPA Slovakia are Univ. Prof.Dr.-Ing. Wilfried Sihn, Univ.-Prof. Dr.-Ing. Prof.e.h.Dr.-Ing. E.h. Dr.h.c. mult. Engelbert Westkämper, Prof.Dr.-Ing. Kurt Matyas, Prof. Ing. Ján Košturiak, PhD., Doc. Ing. Róbert Debnár, Fraunhofer Gesellschaft and University of Zilina.

Fraunhofer IPA Slovakia belongs to the leading firms in consultancy, architecture, research and education for the industry in Central Europe, professional services are based on a long-term building of know-how in Germany and Slovakia, on knowledge of local environment and long-term experience of the employees of Fraunhofer IPA Slovakia from industrial sphere. Team of internal employees of Fraunhofer IPA Slovakia is complemented by external specialists from important firms, as well as a group of internationally known experts from Europe, USA and Japan (according to www.ipaslovakia.sk).

international academic team (businesspeople, professors from foreign universities, financial professionals, consultants and coaches) who are practice-oriented. It is aimed at people who want their firms to be better than their competitors, to use modern processes, to be innovative and productive at the same time. The main pillars of PU are:

1) **School** (lectures, consultations, projects, training, coaching).
2) **Practice** realisation and testing of learnt information in either school or own firms)
3) **Research and development** (new methods, approaches, procedures, ideas).
4) **Innovation centre** (change of ideas and innovation projects into business).

Concept of PU according to M. Zelený [24] substitutes MBA programme, which is considered old-fashioned and unsuitable for global era. MBA programme was created after WWII as a reaction to narrow-scoped, technical-apprentice-like concept of managerial education of previous era. Programme was modelled according to functioning specialisations of science, especially economics, physics, chemistry and mathematics. MBA programme was successful and brought scientific approaches to managerial education. However, it did not lead management towards profession. The aim of PU is to promote management and business to the level of profession.

In the global era is seems more and more urgent, that professional practice of management and business should in its essence be a profession, as are either law or medicine. Management is not a science, such as economics, and it also is not an arts or craft, such as music or carpentry. Management is a profession. Schools of business and management should therefore educate professionals, not craftsmen or scientists, nor artists. Business faculties should be comparable with faculties of law or medicine.

What characterizes profession? Profession is based on 4 pillars [24]:

1) Accepted and acknowledged complex of verified pieces of knowledge(not information)
2) Certification and guarantee of minimal quality of work
3) Public-service work orientated at the needs of clients
4) Verifiable and implementable code of ethical behaviour.

The criterion of professional (e.g. doctor, lawyer) is conducting an acceptable practice, using verified knowledge with the guarantee of the quality of results, service to clients and keeping professional rules of business ethics. Profession integrates knowledge and practice in a wise and ethical approach to services for public and orientation for the needs of a client.

The PU is based on practical knowledge, wisdom and ethics. Educational axis of the PU is based on “4E” and is expressed by following sequence:

Efficiency → Effectiveness → Explicability → Ethics

2.3.4 The component of education in the concept of PU

The basic aim of PU education is production of people able to create new things (people who are creative, innovative and discovering), and not only repeat contributions of previous generations. Another contribution of PU education is production of critical thinking that can verify everything and does not accept everything which is offered. Educated people are supposed to differentiate between fact and opinion, between evidence and dogma. Danger of modern era lies in slogans, collective opinions and mass ideological movements. The task is to find and educate students who are active, learn fast to think independently, differentiate and create their own opinion, can recognise original and verifiable ideas, do not accept the very first idea that is offered to them or that comes to their mind. PU is to teach that it is important not only to accept, repeat and reproduce knowledge, but to produce and use them in practice.

PU is a concept yielding from global formation of knowledge society, where knowledge and both their creation and usage are the basis for competitiveness, innovativeness and economic-social development of a region.

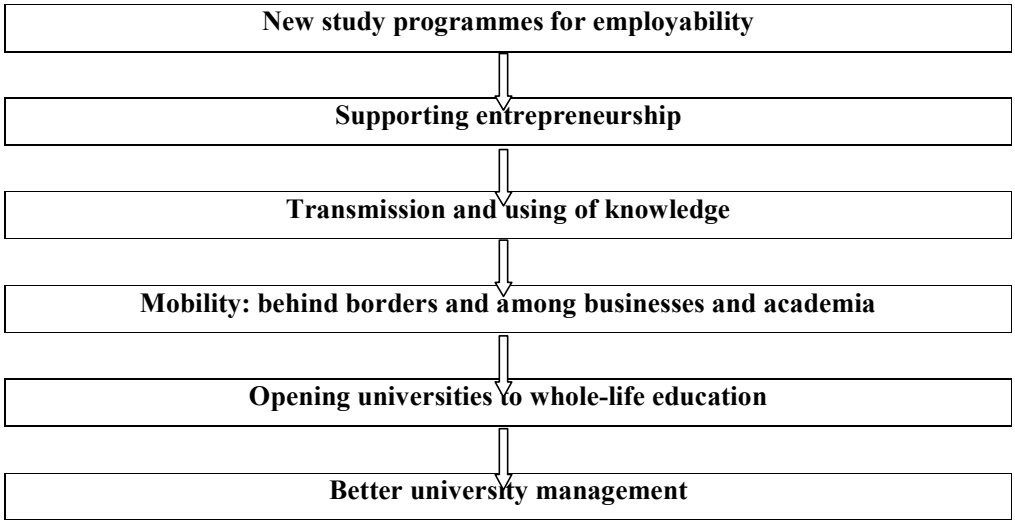
The concept of PU (Entrepreneurial University) expresses its dual aim:

1) University of business people and for businesspeople
2) University, that is a businessperson itself, does business and is a business institution.

3 CONCLUSION

1) OECD defines knowledge economy as an economy, where creation, distribution and using knowledge are the main factors of growth, creation of riches and employment in all the areas.
2) According to [14], the idea/concept of knowledge economy evokes three levels of institutional research. First level – economy, institutionally represented by businesses, whose knowledge are used in form of technologies and innovation, in form of primary inputs (component of doing business) to ensure societal and regional development. Second level – represented by knowledge that is created and distributed by educational institutions (component of education) and third level – space where both components synergistically interact – state, regions (regional component).
3) To organisational link between institutions of TV and business sphere belong e.g. contact centres, centres for transfer of technologies, strategic alliances of societies and universities, networks of academic, private and governmental research centres, business incubators etc.

Forms of dialogue "Universities - Businesses"



Source: own processing according to *KOM (2009) in final version*. Brussels, 2.4.2009

Figure 1 - Dialogue: universities - businesses

4) Real fulfilment of the third role of universities according to experience from other countries requires:

- Radical changes in managerial approach on all levels of strategic management on individual universities, regions and on national level, too – concurrently with the categorisation of TV institutions,
- Realisation of analysis of possibilities and risks in individual regions, adequate timing of steps and political decisions,
- Processing of legislative changes in the area of purposeful allocation of subsidies for research from the perspective of relation to the application sphere, limiting of management structures and competences for TV institutions in a way, that an efficient institutionalisation and management of commercial relations is possible; revision of the law of public financing of research, that would enable access to the results of research and commercial co-operation,
- Create new workplaces, or re-structuralise current institutional arrangement, including workplaces on the level of regional structures that would lead to professional transfer of knowledge and technologies,
- Elaborate motivational system in firms from the perspective of investments in research and development in co-operation with public sector,
- Change the attitude towards the problem from the academic side in the direction of commercial utilisations on research results. It is about the disposal of commercial skills, managerial approaches, especially in the area of project management, as well as in the area of communication and

organisation skills. Those competences should be present at those graduates of TV, who take particular managerial competencies namely on the side of application sphere.

5) Universities pay great attention to ensuring the quality of both educational and scientific-technological process and to high professionalism during university management. Term "entrepreneurial university" starts to be formed in the sense of professional university directed according to market principles on the basis of applying required managerial procedures. In this area, even success of the activities in the area of transfer of both knowledge and technologies is anticipated [25].

6) From the system point of view, closer attention will need to be paid to in future: abilities of universities to react to changes in labour market and to qualification prerequisites by employers, to the area of imbalance in competences and responsibilities of the administrative boards, management and academic senates of universities, to conditions in the area of co-operation between universities and application sphere and other actors in the society, to better link of education and research at universities to strategic needs at the area of the society as a whole as well as in its regional context.

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BUT WHO LEARNS WHAT ? ON THE RISKS OF KNOWLEDGE ACCUMULATION THROUGH NETWORKED LEARNING IN R&D

TAUNO KEKÄLE, SARA CERVAI, ANA GOMEZ BERNABEU

1 INTRODUCTION

Product development has long been recognized as an activity vital for a company success (Roussel et al., 1991; Cooper, 1998; Golder, 2000). Many factors influence it and there is no consensus among researchers which of them have positive or negative effects (Balachandra and Friar, 1997). Similarly, there exist different points of view on what product development process is (Brown and Eisenhardt, 1995). Clearly, when people communicate with each other they exchange knowledge. Researchers study such issues as knowledge transfer, knowledge sharing, knowledge management in R&D teams (Cummings and Teng, 2003; Boutellier et al., 1998). These issues are important since new products are often complex and their development requires multidisciplinary areas of expertise (Zirger and Maidique, 1990). So every new product can be seen is a result of collective work, utilizing individual knowledge brought in by the team members.

According to Cohen & Levinthal (1989) – a view that we also share – the product development processes not only create new information, but also enhance the firm's ability to assimilate and exploit existing information. Thus, as Cohen & Levinthal state, innovation and learning are two coinciding and interacting faces of the R&D activity, and while the product development work itself is more important for the current fiscal year, we may even argue that the learning facet is what makes the firm's success in the long run. This view, again, is shared in the majority of the organizational learning literature.

The question that is seemingly less discussed is how organizational learning actually takes place. Three levels in which learning occurs within an organization have traditionally been identified (Huber, 1991; Crossan et al., 1999): the level of an individual, the work group, and an organization. There are many technical descriptions that stem from the idea of managing the organizational knowledge, that suggest that the learning is equal to establishing the formal material that describes the correct and effective ways to work. This would mean that the knowledge accumulates in the organizational systems and procedures, especially on the mentioned organizational level. But, returning to the two facets of the product development process, that normally takes place within a work group or

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team, not the whole organization, the effective ways of working do not bring the actual innovation aspect in the product development task. If product development creates a capacity to assimilate and exploit new knowledge (Cohen and Levinthal 1989), and because this new knowledge still is to a great deal tacit and cannot be made fully explicit, it follows that the capacity at least partly means that the individual members of the personnel of the company learn things that are useful in the following projects, such as fault-seeking procedures, shortcuts, tiny informationlets that make the development quicker and more effective. Using the capabilities and learning capacity of individuals, operating models and solutions can be generated inside companies and within networks of workers. Learning by individuals is the prerequisite, the foundation and the key for the learning of these networks and the companies (Kekäle & Viitala, 2003). In this vein, the base of the current paper lies in the autopoietic tradition of epistemology: "unlike the congnitivist epistemology, a theory of knowledge rooted in autopoiesis theory suggests that knowledge is not abstract but embodied: 'everything known is known by somebody'." (von Krogh & Roos 1995:50, italics in original).

The next step from the individual learning to the work group learning is the learning of who-knows-what in the work group, often called transactive memory. As with the term "organizational learning", it is generally accepted that the organization does not have a "memory". Nevertheless, it seems that a great deal of the tacit cultural learning in an organization concerns persons' roles and past heroic deeds such as success in difficult tasks in the past; mostly people know who has done something even if they do not know the details of what has been done. Since people use others as "external repositories" of information, they may provide answers to questions that are far beyond their own personal expertise. Thus a memory system of a group is larger than memories of its members. It develops over time and may be understood as a property of the group. The main stream of research on transactive memory is based to on the seminal work of Wegner (1986, 1995) who defines a transactive memory system as "a set of individual memory systems in combination with the communication that takes place between individuals." (Wegner, 1986).

Some individuals may be recognized as experts in certain domains. In this case they become responsible for encoding, storage and retrieval of any incoming information relevant to this domain. Other members of the group deliver new appropriate information to them, thus storing this information externally in the experts. People may be recognized as experts on the basis of their personal expertise or as a result of circumstances in which they take responsibility for the information encountered by the group. Formal groups may assign responsibility for certain domains to individuals, but if it is not done and if there is no obvious expert in a certain domain, a group may have difficulties with information allocation within the group. Thus efficient group memory system requires accurate knowledge of every group member of others' domains of expertise.

Clearly, these processes require that experts have been identified. In other words, this means people know who knows what. Such memory about memories is

called metamemory (Kitaygorodskaya & Kekäle 2005). By analogy with computer memory it is seen to have directories about others' memories. These directories are created and updated during the process of directory updating, but they cannot include the complete learned "sum" knowledge of the organization. The autopoiesis theory also states that knowledge develops in an autonomous manner in individuals, and thus cannot be transferred directly to other humans. The trial and error processes, For example, can only partly be captured by individual retrospection and representation (von Krogh & Roos 1995). Furthermore, all these processes require at least reasonably complete communication between members of the group.

Cohen & Levinthal (1990) and Helo & Kekäle (2006) claim that the work group-level learning is a path-dependent process. Cohen and Levinthal state that prior knowledge permits the assimilation and exploitation of new knowledge. This prior knowledge "should be closely related to the new knowledge to facilitate assimilation, and some fraction of the knowledge must be fairly diverse, although still related, to permit effective, creative utilization of the new knowledge" (1990:206). Our own standing stems from the emergency school that we have understood is also seen as the basic mechanism of culture creation (Schein 1997). This idea is based on the preferred selection idea (Barabasi 2002) and the thoughts on transactive memory presented above: whenever a difficult task arises, any individual faces the options of either solving it by him/herself, or asking for help from somebody. In a system where the transactive memory of who knows what is effective and communication channels are well developed, the individuals tend to prefer asking for the person with the right kind of knowledge and skills for help, for the benefit of the project.

Learning takes place by doing: by solving problems, people increase their knowledge. It seems, in line with the path-dependency idea, that in small knowledge-based/specialist companies or work groups the knowledge of others' specialized skills and ease of communication lead individuals to ask for help in problems that they cannot solve. This leads to learning for both the person who asks and the one who solves the problem. However, only for the person who solves the problem based on his/her previous skills this learning becomes embedded as Cohen and Levinthal state (1990:136): he/she firstly learns by accumulating capacity to do the next similar task more effectively than the previous; but this accumulated capacity also makes him/her better suited to study intermediate or new but related technology advances, thus again accumulating his/her expertise in relation to that of the others. For the original problem stating person, the learning is of transactive memory character only.

Learned preference in asking help leads to learning taking place with the people who already know most about the problem ("Pareto principle"; this idea is quite widely discussed e.g. in Barabasi 2002:90-99). This leads, over time, to centralization of knowledge about the most difficult tasks to a couple of individuals in a power-law fashion.

2 AGENT-MODEL SIMULATION

As stated above, some people may be recognized as experts on the basis of their personal expertise or as a result of circumstances in which they take responsibility for the information encountered by the group. This leads to the persons in the work group or otherwise persons who share the common product development task to use preference tactics in sharing the actual work: work is given to those who know how to do it, and their knowledge in the area then expands as explained above. This phenomenon should be exaggerated the more remote technology areas that are involved in the tasks; it is increasingly unlikely that somebody would be expert in every aspect of complex products and systems. One such example that still is readily available for study might be embedded systems. According to Simon (1999) embedded systems programmers must handle problems beyond those involved in typical application software. They must respond to external events that are solution-specific rather than general, and they must also understand the unusual conditions that may take place as well as the deadlines (time frames) that there are in the embedded systems. For example, while we readily wait a minute or two for Excel to start, a core meltdown at a nuclear plant given a one-minute head start before the security systems start to operate would not be good. Simon gives further examples such as elevators, automobile engine and industrial control equipment, and scientific and medical instruments; all these include embedded systems where the electrical or mechanical systems are operated by software without human intervention.

We first have computer simulated the development this theory would lead to. Preference-based actions in a group are reasonably simple to model by the agent-based modeling techniques. We have attempted such a model, comprising a network of 20 individuals ("software coders", named in the model by numbers from 1 to 20). In the model, we have assumed them an initial level of coding-related expertise of 1 (low, P=0,66) or 2 (high, P=0,33). The probabilities are just proposed on the basis of the idea that the top-level experts might anyway be a minority in a real software team, and most of the team would be junior coders. In Table 1, these initial levels of expertise are shown in the left-side yellow field. The model then assigns tasks in random order to individuals; each time an individual receives a task and "completes" it, his/her skill level is increased with 1 (=learning).

However, randomly (P=0,50) the model makes this individual ask for help from someone in the team. In order to duplicate what we think would be a realistic action in a team, we have made this model ask help from the physically closest neighbor. The model solves this by asking help from the programmer whose number is closest to the programmer in need of help (e.g. if programmer 12 needs help and programmer 13 and 16 have expertise levels higher than he/she does, then programmer 13 is approached. After 20 the list goes back to number 1, and if two programmers with a higher expertise level are precisely as close physically then they both are asked for help in the model). After having completed the task with the help of a colleague, the skill level of the original

individual and of the closest neighbor(s) with same or higher skill level who help in the task are all increased with 1 (even if the theory of Cohen and Levinthal would suggest that the higher expert actually would gain more in reality).

The development in Table 1 shows that in the simulation, the expertise starts to clearly accumulate to a couple of persons after a relatively short time (middle yellow field: expertise levels after 100 task assignment repetitions, right-hand yellow field after 200 task assignments). The orange fields in the table indicate programmers whose expertise is within 25 % of top skill level; the top-expertise programmers defined in this way decrease in number, which suggests a power-law accumulation of skills in such a team.

1	3	4	2	6
2	9	11	8	19
1	7	8	6	14
1	16	17	19	36
1	3	4	9	13
1	5	6	7	13
2	5	7	10	17
1	4	5	9	14
1	12	13	12	25
2	6	8	7	15
1	9	10	10	20
2	12	14	20	34
1	0	1	4	5
2	8	10	6	16
1	6	7	6	13
1	4	5	8	13
1	10	11	10	21
2	10	12	8	20
1	7	8	9	17
1	6	7	7	14
1		16		31

Chart 1. Accumulation of expertise in an agent model computer simulation.

(Columns from left: initial expertise; learned expertise, during first 100 tasks, then after the 100 tasks; then during the next 100 tasks and finally after the 200 allotted tasks. The dark grey fields show the programmers within 25 % of the expertise level of the top programmer).
The bottom cells show average expertise level at each stage.

The increase of average expertise level in the simulation shows that the organization is indeed learning, but some programmers learn much more than some others; the organizational learning does not spread evenly even in such a small team. Depending on a task an organization has, either differentiated or integrated transactive memory will facilitate its fulfillment. If the task requires that all members of the organization carry out the same functions (e.g., sales persons), integrated transactive memory where the same items of information are stored in individual memories is desirable. On the other hand, if task requires generation of new knowledge, differentiated transactive memory will ease its fulfillment. Transactive memory is called differentiated if different people store

different items of information. Discussions in organizations with differentiated transactive memory can lead to integration of these different items and generation of new ones.

3 REALITY: COMPANY X

To study whether the simulation makes any sense, and to eventually find reasons why it would be so also in reality, we have conducted an one-case study in a company working with embedded software. The company "X" had been working in this field for about 5-6 years at the time of the study, and expanded relatively rapidly at a pace of about 5 persons the first year, then about 10 persons annually.

"Communication networks are the patterns of contact that are created by the flow of messages among communicators through time and space" (Monge and Contractor, 2003). In the context of organizational communication, people are identified as nodes of the network where links represent such relations as "provides information to", "gets information from", "knows about" or "provides information to".

In addition to communication networks, knowledge networks are recognized. In such network there are two types of nodes: people and knowledge. They, in effect, answer the question "who knows what". Within this network knowledge may reside with one actor (be centralized) or exist among many (be distributed). Distributed knowledge refers to two phenomena. First, it may describe the flow or diffusion of knowledge, which increases the level of knowledge among all actors. Second, it may refer to the situation when separate network actors bring different types of knowledge that allows the group to accomplish difficult tasks.

Further, people usually have their own ideas of who knows what, that in other words can be called their "cognitive" perceptions of knowledge networks. These perceptions may be incomplete and/or inaccurate but they do exist, and should, according to theory, get more accurate over time when the common activity continues.

The programmers who were working at X (40 engineers aged 20 and 34, all within the same physical premises in an open office floor partitioned by loose half-height cubicle walls) were asked to list the five colleagues that they most often asked for help in their tasks, and for each of these also to assess the number of times they requested coding help from these during a typical month. It turned out that asking for help was much less common occurrence than what was expected. Only a few persons "ever" had asked a colleague to help with difficulties in software programming (total N= 40, edge values relate to the number of times help was asked on average within a month; the 30 outsiders with edge value of 1 or less omitted in picture 1). While this study was conducted without names, on request of the management at "X", we do not know for sure who asked whom for help; it might make sense that the persons requesting help might be the relative newcomers at that given moment. However, in line with the

previous theory, most of the events where programming help of some kind was needed included one of two "knowledge wells" at the company.

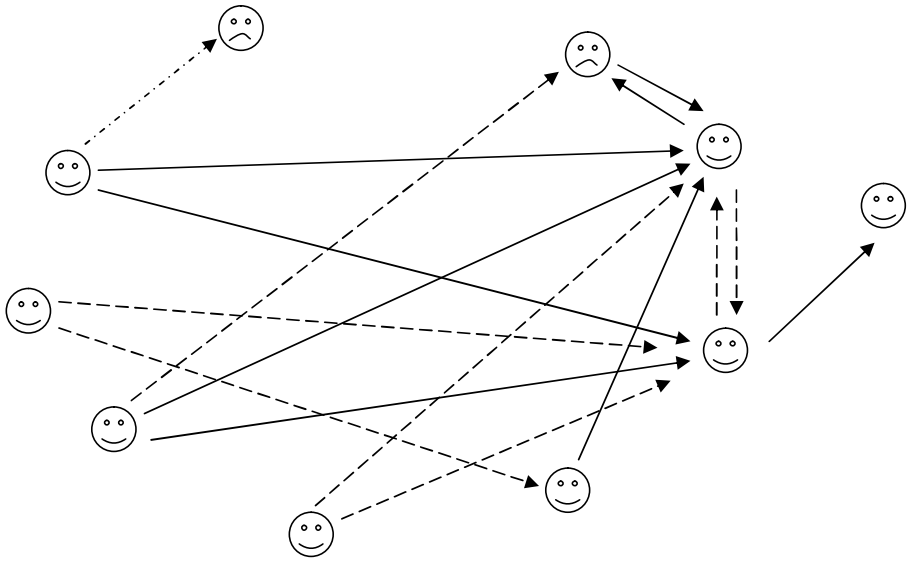

Figure 1. *Programmers asking for help or second opinion (the network is drawn here so that the "asking for help" goes from left to right, and the programmers who haven't asked, or haven't been asked, for help at least once a month have been left out; original N=40).*

Legend: dash dotted line: about once-monthly request for help;
dashed line: about once-weekly request;
solid line, about daily request for help or opinion.

For a better comparability with the computer simulation, we then arranged for an interview with the two central persons in the expertise network. While the management refused to reveal the identities of the persons behind the numbers, this interview was conducted by the secretary of the company according to our list of questions. Naturally, in such a setting, a complete thematic interview – that would have led us towards the "why" – was too difficult to arrange. However, even with this small-scale interview managed to confirm that the solving of others' problems is a necessary source of increasing expertise. Individuals 5 and 7 stated that up to 10-20 % of their software skills are due to solving others' problems (the answer alternatives for this question were for simplicity of analysis classified "none", "less than 10 %", 10 to 20 %" and so on).

Furthermore, another important finding in X was the unanimity of the other workers; it seems that a full 100 % of the "transactive memory", of the knowledge who knows what and thus also the future preferences on where to find help, is due to the previous events where the experts have managed to help. No telephone books, knowledge catalogues, knowledge brokers or such were used in this smallish company. This would suggest that the knowledge spreads in the legends and myths of organizational heroes precisely as culture is seen to be

strengthened (Hatch 1993) and after that the knowledge helps to strengthen the previous preferences on where to ask for help, which again at least to some extent leads to increased expertise among the preferred experts. This seems to be quite in line with what the computer modeling suggested.

Due to the arrangement with the empirical part of the research in the case company, we could not study the eventual effects of distance (e.g. Gerstberger and Allen 1968) or practical obstacles (Hatch 1987) to the communications (see Savolainen 2006 for a more complete discussion of the "spatial effects on communication" research tradition). From our visits to the company we know the following: the office is smallish, about 30 meters times 15 meters, open "landscape" type office with movable partitions of about 1.20 meters height dividing the area to the programmers. The maximum distance between two programmers thus would be about 30 meters, which can, according to the above-mentioned studies, reduce the time spent for communication significantly. However, one corner of the office is a coffee area where everybody gathers for joint coffee breaks twice each day, sometimes more often. This could enhance the knowledge of the programmers on who is the specialist in which type of software-related problems and counteract the effects of the distance. Furthermore, the person in the study are software programmers, a group that a higher than average propensity of using electronic, distance-independent methods of communication.

Typically, no partition of the office forms a "cubicle; the partitions are raised only on two sides of every workstation, leaving two sides open to others. Thus the distance and the partitions would not to our opinion restrict the communication. The distance could, however, to some extent steer the communication; it is possible that the two persons that get most of the queries are "local" authorities close to the persons who need help, maybe one at each end of the office. This does not in any way affect our conclusions, but it may affect the preference mechanisms that lead to these two persons becoming the authorities among the programmers, and may also thus affect the bipolar development of the communication patterns.

4 CONCLUSION

In big organizations, the managerial arrangements traditionally are generally seen to direct the queries for help and resources to some key individuals. In more self-directed small organizations and organizations based on open-source mentality, these are based on preferences to get the work done, and emerge informally through learning and cultural myths in a path-dependent way (even if it is possible that they can also change when the skill base of the work at hand changes).

The management can to some degree – but ONLY to some degree – affect the human processes of communication flows and knowledge management. A major

part of the reality of the organizational knowledge could be created by complexity/emergence phenomena and, thus mainly unaffected by management actions (and path-dependent). Even in work groups of bigger organizations with open-enough communication, similar "wells" or informal communities-of-practice of top knowledge can emerge through learning. The theory emerging from these two small cases does not tell us whether there is any threshold in organization size where the system would cease to work. However, it is generally held that the increasing physical distance diminishes communication. Again, communication can be similarly path-dependent: for example, Keller (1986) found that through communication team cohesion is built that, in its turn, breaks communication barriers further and thus increases information flow.

Brown and Eisenhardt (1995) define cross-functional teams as "those project groups with members from more than one functional area such as engineering, manufacturing, or marketing". Dougherty (1992) found that different functional departments not only possess different knowledge but have different "systems of meaning" as well, which is a good thing for creativity when these people meet for a project. However, that also means that when people from different functional areas communicate they may have different interpretations of the same thing, thus communication barriers between different functional areas appear. Projects could then be similar wells: projects generate knowledge on some persons, and in the end of the project it is very possible that the knowledge walks out with the key persons.

Researchers also pay attention to external communication of team members that facilitates acquisition of new information by the team and helps keep abreast with new technological and scientific developments (Ancona and Caldwell, 1990, 1992; Tushman and Katz, 1980). As, according to Cohen & Levinthal (1990) and similar micro-level learning theories (e.g. Kolb 1984, Knowles 1980) suggest, the persons with the tacit knowledge that the person has acquired through experience are also best suited to learn new related matters, this uneven accumulation of knowledge may even accelerate further with the addition of external learning.

While learning a skill and acquiring knowledge are beneficial for individuals, there clearly is a risk for the company that the key persons disappear. It might be a good idea for the management to really keep track of the learning and knowledge levels and ranges of individuals, rather than monetary investments; the human capital and personnel accounting schools are currently working with just this. The manager of our case study company indeed asked us not to publish the name o the company nor refused to reveal the names of the persons in the company, because it would make the buying-out of the knowledgeable persons too easy for competitors. The often-quoted phrase "the staff is our main success factor" should be true in all knowledge-based work, but it might turn out that the real success factor is sitting in room 236. And he/she might be on his/her way off to the competitor.

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IMPLEMENTATION OF SECURITY CONTROLS ACCORDING TO ISO/IEC 27002 IN A SMALL ORGANISATION

MATÚŠ HORVÁTH, MARTIN JAKUB

1 INTRODUCTION

Managerial work is directly dependent on information, it is therefore logical that the success of managerial decisions is directly proportional to the extent and quality of information background. The expansion of computer technology expand also the possibilities in what form information may exist in the organization. Therefore, we use the term asset inside the field of information security (asset ang.), which represents everything that is of value to the organization [1], thus it may be information in the paper (eg a contract), electronic form (eg sales figures) but also services (eg e-mail server organization) or equipment (eg cash register), which are essential for the proper functioning of the organization processes. With protection of information organization's assets and its governance deals Information Security Management System (ISMS). Generally speaking, the ISMS serves to achieve credibility, integrity and availability of organization's information assets

ISO / IEC 27001 is international valid standard that specifies requirements for establishment, implementation, monitoring and review, maintenance and improvement of an Information Security Management System. The standard covers all types and sizes of organizations. An organization can be certified to ISO IEC 27001, that enables organizations to assure its stakeholders about the level of information security. Implementation of security controls is one of the key steps in the process of implementing information security management system according to ISO / IEC 27001. Organization responds to security requirements by setting the security controls and thus ensures the security of their information assets. Security controls within organization take the form of guidelines, procedures and measures.

Organization Profile

The area of information security is certainly important also for organizations with few employees. The implementation of security controls in this type of organization is linked with some specifics. In small organizations (up to 20 employees and 2 levels of management) should be the requirements of ISO / IEC 27001 applied, taking into account the possibilities of such organizations (financial and personnel). However it will not change the main goal of the

implementation process, the establishment of procedures, rules and system of responsibilities through which an organization can maintain and improve its information security and protect their assets.

The article describes the implementation of security controls in a real organization as one of the key steps. Due to the sensitivity of the information given, we decided not to put a specific name of the organization. The organization operates in the construction industry, focusing on construction work, repairs and capital works in the thermal energy with extension to other areas of construction industry. It is a small-sized organization by number of employees (16 employees and two levels of management). Organization is certified against STN EN ISO 9001:2009 standard. As it is a construction organization, planning and implementation of security controls took place for the project-operational department.

2 SECURITY CONTROLS IMPLEMENTATION

2.1 Security Requirments

At the beginning the whole process of selection and implementation of security controls are the safety requirements set by the organization (Figure No. 1). These requirements may come from several areas. The first and most important area is the output of risk assessment of information security. It is a methodical review of the risks in the organization.

In our case, the risk assessment was carried out by using the method of FAIR (Factor Analysis of Information Risk). This method successively disassembles the risk to partial risk factors that influences its ultimate size and offers the possibility to use the quantitative and qualitative expression of these factors for qualitatively expressing the overall risk.

Tab.1 - Identified hazards and qualitative expression of risk

Threat	Risk
Fire	Critical
Power failure	High
Break-in	Medium
Information theft	High
Internet connection failure	Medium
Organization network failure	Medium
Failure of PC 1	Medium
Failure of PC 2	Medium
Organization e-mail failure	Medium
Hackers attack on organization website	Medium
Computer virus / spyware	Medium
Hackers attack on organization infrastructure	Medium
Hackers attack on organization e-mail	Medium

Another source of security requirements are requirements defined by law, decrees and government regulations. In the case of an organization for which the whole process was carried out, the Law on Personal Data Protection No. 428/2002 and Act about archives and registries 395/2002 were evaluated as relevant requirements.

The third area is requirements arising from contracts and agreements where the other party may impose requirements for confidentiality and security of the information provided. Within the organization the agent identified just one requirement to address information security in contracts with third parties.

The last area is the information security requirements of the practice, resulting from the requirements of current practice in information security in organizations. As the source of these requirements, we used the standard ISO / IEC 27002 Security techniques – Code of practice for Information Security Management.

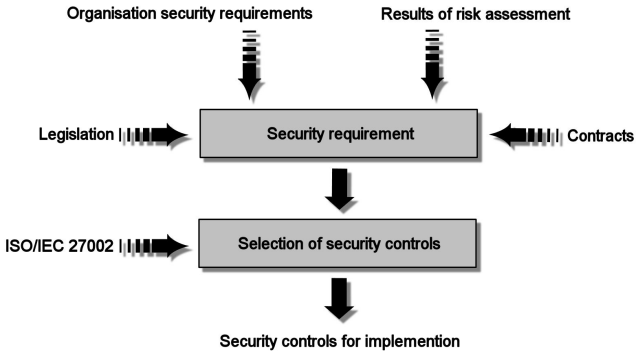

Figure 1 - Process of implementation security controls

2.2 Selection of security controls

Based on the identified security requirements is needed to establish such security controls which ensure compliance with security requirements of the organization. The main documents that we used in establishing security controls were standard ISO / IEC 27002. This standard includes guidelines and advices how to implement security controls which are listed in Annex A of ISO / IEC 27001. Annex A of ISO / IEC 27001 standard contains a set of 133 security controls covering general requirements and objectives of organizations in the field of information security.

ISO / IEC 27002 standard also sorts these controls according to the areas in which they operate into 11 groups. Based on the identified security requirements of organizations and systems and technologies used by organization, 88 security controls have been identified that needed to be implemented in the organization. The whole process was documented by a declaration of applicability. Statement

on the applicability is required document in standard ISO / IEC 27001 that lists all the controls implemented from the standard ISO / IEC 27002 in the organization.

In our case, this document identified other than the implemented security controls the reason for the implementation (e.g. the outcome of risk analysis). Since ISO / IEC 27001 also requires justification and a record in case when any of the listed security controls in standard ISO / IEC 27002 is not implemented, it contains a statement of applicability and reference to such record. Due to the limited size of article, just a percentage of the implemented and not implemented security controls for each group of security controls from the ISO / IEC 27002 is listed (Fig. 2).

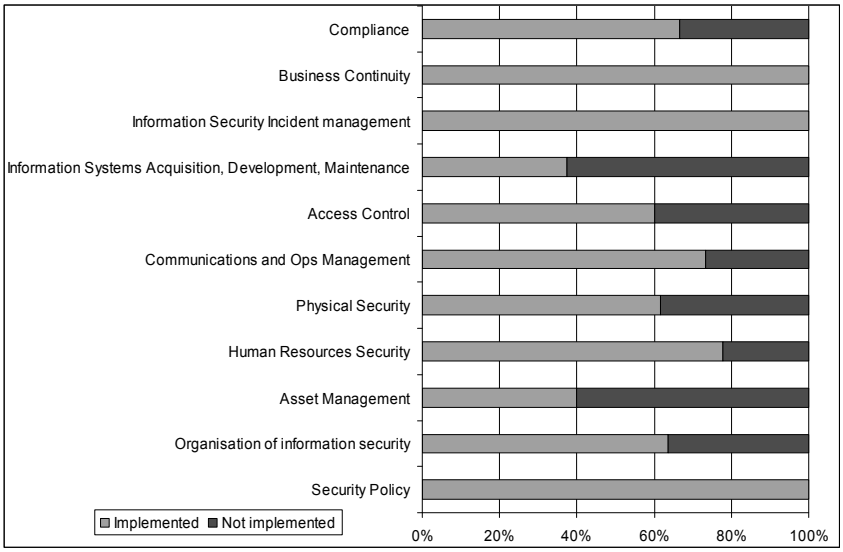

Figure 2 – Implemented security controls across groups

The most common reason for the decision to implement security controls was a requirement arising from the praxis and reaction to the outcome of risk assessment in the organization. (Fig. 3).

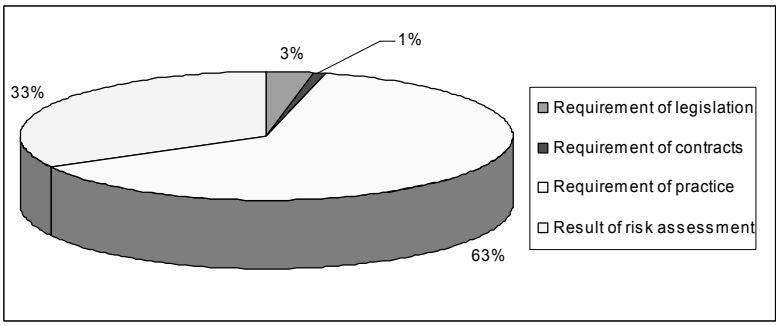

Figure 3 – Reasons for the selection of security controls

2.3 Security controls implementation

ISO / IEC 27001 do not strictly set the form in which it is necessary to implement and document the particular security controls. In our case we implemented the controls through guidelines.

The form of directives we have chosen because of flexibility and easy to use options.

The security guidelines of organizations have been prepared in compliance with the quality manual and therefore they can be easily incorporated within the document management system and system of records in organizations.

During the process, 19 documents were created, meeting the objectives of identified security controls. Established security guidelines cover different fields of information security in the organization through achieving the objectives of security controls in these fields of information security. (Tab No. 2). The only exception is the guideline BS02. FAIR method, which was established under the requirement of ISO / IEC 27001 standard as a supporting guideline for periodic repetition of the process of risk assessment in the organization. All established security guidelines include the following sections.

- Title page
- Purpose
- Scope
- Definitions
- Policies, controls, procedures
- Penalties
- Attachments

2.4 Description of established system

The main security guideline is BS00 - Information Security Management, on the basis of which information security policy and information security objectives are established. Safety guidelines (BS03 - BS15) covers partial fields of information security.

Monitoring the state of information security is carried out by two security guidelines BS16. Monitoring, in addition to general practice, calls for regular review of fulfilling safety principles and controls by employees (at least 1x every 3 months) in field of physical security, information assets, equipment configuration, use of portable media in organization and its content and backup.

Security guideline BS17 - Managing security incidents describes the necessary steps in case of presence or doubt of security incident. State of information security and document management within organization is monitored through internal audits of information security, which are performed in compliance with quality manual. The effectiveness of information security management system is assessed at yearly intervals through the process of management review.

The assessment report is prepared by the agent once per year. Syllabus report consist of:

- Assessment of timeliness of information security policy
- Evaluation of the implementation of the objectives of information security
- Evaluation of implementation and adequacy of resources
- Evaluation of security incidents identified by the previous management eview
- Overall evaluation of information security organization
- Action draft arising from the report

The implemented system uses and respects the organizational structure of the organization documented in the Quality Manual. Organization agent is member of the top management and is also the highest official ISMS of the organization. The agent is also responsible for maintaining the integrity of the ISMS in the organization.

Other responsibilities and powers within the ISMS are listed in specific guidelines of information security. Security manager is responsible for the technical aspects of information security and incident management, while the role takes the software supervisor takes of the organization. Responsibilities and powers of individual employees within ISMS are listed in specific information security guidelines and their violation is considered as causing a security incident.

Tab. 2 Documents created in the organization

Label	Name of document	Number of imple-mented controls
Document	Information security policy	2
BS00	Information security management	10
BS01	Identification of assets	2
BS02	FAIR method	0
BS03	Physical security and security of environment	5
BS04	Security of equipment	4
BS05	Security of computers	8
BS06	Security of network	4
BS07	Security of communication	6
BS08	Management of access	7
BS09	Third party access	5
BS10	Management of changes	8
BS11	Handling of removable media	4
BS12	Security of personal data	1
BS13	Creating password	1
BS14	Backuping	1
BS15	Operating procedures and training	2
BS16	Monitoring	6
BS17	Managing security incidents	6

3 CONCLUSION

Area infromation security is becoming increasingly critical for any organization. However, for small organizations is the implementation and operation of the ISMS often seen as impossible or very expensive. In this article we have tried to introduce a procedure of one of the key steps in the process of establishing ISMS and its application in terms of small organizations. In many small organizations is not necessary to implement various security controls of ISO / IEC 27002 standard for the simple reason, that the organization doesn‘t use related technology or processes.

Also, the implementation of security controls is not as difficult as in the case of large organizations with many levels of management and various information systems. Further more, integration of ISMS with QMS at the documentation level allows the organization to save on financial and human resources. Also, by delegating the role of security manager to software supervisor, organization can reduce operational system costs. We hope we succeeded in this article to illustrate the real possibility of implementing the requirements of ISO / IEC 27001 even in small organizations at reasonable cost of implementation and operation.

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THE CREATION OF QUALITY MANAGEMENT SYSTEM IN THE CONTEXT OF REGIONAL COMPETITIVENESS OF REGIONAL UNIVERSITY ENVIRONMENT OF THE SLOVAK REPUBLIC

DANIELA PALAŠČÁKOVÁ

1 INTRODUCTION

Competitiveness has become one of the important features of the current development of national economies. Apart of the traditional view on economy, which was related with productivity and economic growth, the main focus today is aimed on modern technology development, service and knowledge-based economy.

Education in the placed context is increasingly proving its being strategic goods and power, which is shaping ability of the society (state, community, family) to face current challenges and to adequately meet their needs, or even survive as a organized unit. The quality of university education and research is an important sign of international attractiveness and competitiveness of Europe. Ensuring quality education at universities is a permanent process of organising, providing and checking their educational, scientific, artistic and managerial activities to ensure their efficient and perspective function. At universities, it is necessary to focus on capacity expansion and quality increase. The key to achieve this goal is a flexible system where universities respond to the particular requirements of young people same as to demand for lifelong learning and the most premium of them are at the same time the centres of research and development on internationally comparable level.

Questions of quality at universities – to ensure quality, to evaluate quality or to verify quality – have always been extremely sensitive area. This sensitivity is also reflected in the wording of the declaration, which is quite broad and includes only the expression is of „ the support of European cooperation in ensuring the quality with the intent to establish comparable criteria and methodologies.[1]

[1] The recommendation of the Council from 24.9.1998 on European cooperation in ensuring quality in higher education (98/561/EC) published in Official journal L 270/56 7.10.1998; Bologna declaration of ministers responsible for higher education (19.6.1999), Prague Communiqué (19.5.2001); Berlin Communiqué (19.9.2003); draft of recommendation of the Council and European parliement on further European cooperation in ensuring quality in higher education from 12.10.2004 as COM (2004) 642 final.

There has not yet been processed any broader analysis of the university environment (later „UE“) from the point of view of competitiveness in the separate regions in Slovakia. Certain examples of the analysis are „Reports on the evaluation of universities in Slovakia“, realized by the ARRA agency,[2] Sector report about the state of university schooling in Slovakia[3] and accreditation of universities in Slovakia [4].

Our primary concern in this area is the identification and evaluation of the mechanism of the creation of quality management in UE and implication of the issue on regional framework within the terms of the criteria of competitiveness on the basis and example of public universities[5] in Slovakia.

The issue and the methods are a continuation of the approaches from the contribution published in the journal „Quality Innovation Prosperity XII/1-2008“, where the selection of regions was made the way that from the level NUTS II (Slovakia – East, Central, West) four regions with the comparable parameters (the Košice Region, the Prešov Region, the Banská Bystrica Region, the Nitra Region) were chosen. At this stage of the considered problem we expand the regional application to all eight regions of Slovakia.

2 METHODOLOGY

As there is no finality of life, so the lasting existential effect of concepts and theories is not possible too. Under development it is necessary to make revisions in the conceptual apparatus of science itself, but also in the methodology of science.

On the basis of above mentioned we considered following as the main starting points of investigation:

[2] Academic ranking and rating agency, whose aim is to provide the information about the quality of individual university institutions in Slovakia to public, and to adopt a way of evaluation and increasing the quality of education provided by university institution in Slovakia.

[3] Project of two-year evaluation of 24 universities in Slovakia by European association of universities (EUA) has been finished by the conference called „Sector report about the state of university schooling in Slovakia“, which took place in Bratislava between 18 and 19 of February 2008.

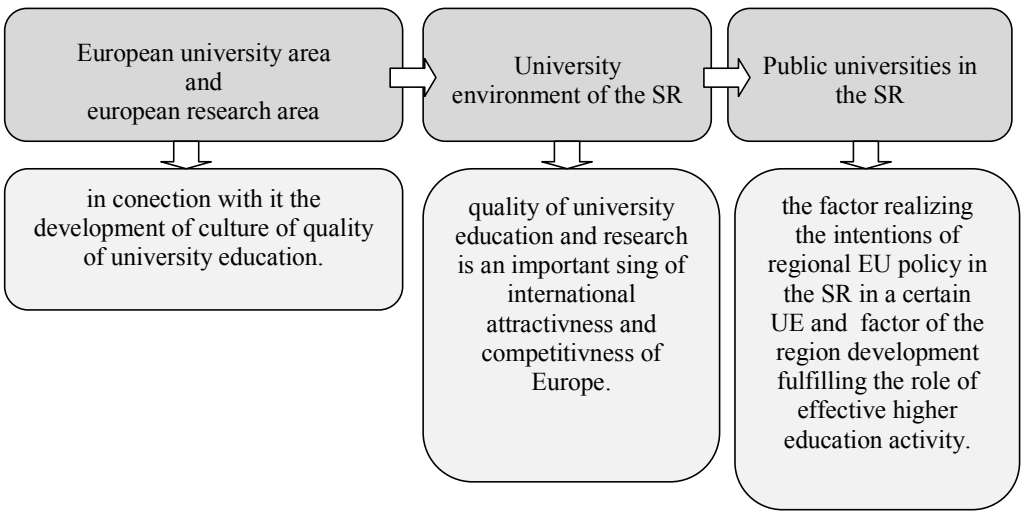
[4] Main evaluative organ, that will issue its proposal, is Accreditation Committee, advisory body of the Slovak Government (later only AK). All university materials of all-university package character, or for individual faculties, were processed on the basis of the Regulation of the Government of Slovak Republic, nr. 558/2007 about AK, the resolution of the Ministry of Education about the criteria of assessing the fitness of universities to realise facilitation procedures and procedures to name professors, valid since 15 June 2008, as well as the decision if the minister, who set the criteria for incorporation of certain schools into the category University, High School or Technical High School (KZU 1 to 6, valid from 1 January 2008)

[5] <www.minedu.sk>

- competitivness and revival of economy and society based on knowledge,
- importance of quality in UE: „Quality is the basic condition of trust, relevance, mobility, compatibility and attractiveness in university education“ (Salamanca Convention, 2001),
- the possibilities of implementation of Quality management system following the requirements of the ISO 9001:2000 norm in UE,
- implementation of process approach in Quality management system: external and internal evaluation, identification of processes and interrelations among them. Starting point thesis: „Process approach is the way to achieve the desired results through managing activities and related resources such as processes“,
- strategy of quality in the conditions of universities - overall intentions and directions of university in the area of quality formulated and authorized by top management,
- goals of quality: desired results in the context of efficient use of resources to achieve these results,
- documentation of quality management processes at universities,
- human resources as a factor of time in the quality management system, ensuring the changes, information and engagement in the „quality“ direction,
- UE in Slovakia in the context of legislative changes and European trends.
- processes and phase changes as the key to success in a competitive environment.

Based on previous knowledge, we set a target of the contribution, which is the theoretical development and practical generalization of quality management mechanism applied to public universities in the separate regions of Slovakia and to determine the order of regions in terms of competitiveness in the UE segment.

Key variables:



Monitoring regional differences across Slovakia and the evaluation of regional university environment under the conditions of regions in Slovakia from the perspective of their quality was realised based on the own evaluative implement, namely **Index of quality of regional university environment** (later only "IK RVŠP") was a supportive process**.**

3 RESULTS AND DISCUSSIONS

IK RVŠP is a summary index which tells us about the quality of university environment in municipalities in Slovakia and it is the combination of values of four chosen statistical indicators. It was constructed from four sub-indices and each of the sub-indices has particular indicators. Sub-indices are the result of calculations obtained based on statistical data from individual indicators in each sub-index.

Name of sub-index	Weight in IK RVŠP
Macroeconomic performance and stability	25 %
Institutional quality	15 %
Innovative performance	30 %
Human resources	30 %

Figure 1 – IK RVŠP Sub-indices (Source: Own working-out)

During calculations the weights of the sub-indices were defined, which were attributed to them by respondents from both external and internal segment of university environment, where we conducted the survey. The content of respective sub-indices and indicators was maintained in synchronicity with the content of the questionnaire in order to be able to compare them. This enabled us to compare the data and it meets the methodology and the formulation of the target. The data are from 2006, and it is the last year where the statistical data are available in needed indicators. In the sub-index Institutional Quality we used the methodology to follow the trends in the framework of two-year time period – the years 2006 – 2007, because there are available statistic data.

Methodology:
Basic formula for the calculation of IK RVŠP on the example of the sub-index of Macroeconomic performance and stability (later "MEVS"):

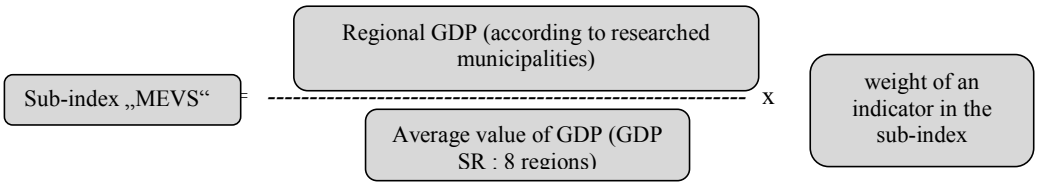


Figure 2 - Basic formula for the calculation of IK RVŠP (Source: Own working-out)

3.1 The Macroeconomic performance and stability sub-index

Education and training are determining factors for potential of excellence, innovation and competitiveness of each country. At the same time they form an integral part of the social dimension of Europe, because they are the implement to transmit the values of solidarity, equal opportunities and social participation and they are of positive influence to health, reducing crime, environment, democratization and general quality of life. The sub-index of Macroeconomic performance and stability is a significant factor influencing the interest in studying at a university in a municipality, and it is also related to the opportunities for getting employed after graduation and characterizes given environment from the economic and social perspective. **Growth performance** and stability includes GDP growth and GDP dependent economic level of the country (expressed in GDP per capita). The essential growth factor is labour productivity, the development of which is usually followed by economic growth (Table 1).

If the height of regional development and regional added value are domineering in the Region of Bratislava and the Region of Košice, then it is important to point out the differences in the productivity of labour, where absolutely dominates the Region of Bratislava, which is given by the economic structure of the municipality and the share of activities with higher added value. The last place is occupied by the Region of Prešov. The Region of Bratislava dominates also in the indicator of the number of the employed, which is closely related to the size of the region as well as the number of population. The first place belongs to the Region of Košice in the indicator of the number of people willing to get employed, and both the Region of Banská Bystrica and the Region of Prešov are close behind, as it is generally known that these municipalities belong in Slovakia to the ones with relatively high unemployment rate.

Table 1 – Resulting values of indicators in the sub-index "Macroeconomic performance and stability" (Source: Own calculations)

Region	Resulting values of indicators in the sub-index Macroeconomic performance and stability				
	Regional GDP (in mill. Sk)	**Regional value added (in mill. Sk)**	**Labour productivity (in mill. Sk)**	**Average employment rate (in thousands of persons)**	**Disposable number of applicants for a job (thousands of persons)**
BSK	2,10	1,88	20,36	1,22	-0,25
TTSK	1,00	1,04	9,75	0,87	-0,49
TNSK	0,83	0,94	4,54	0,73	-0,51
NSK	0,89	0,82	4,19	0,79	-1,00
BBSK	0,72	0,70	4,61	0,68	-1,67
ŽSK	0,83	0,91	5,27	0,78	-0,74
PSK	0,65	0,68	3,57	0,76	-1,64
KSK	0,97	1,03	8,22	0,79	-1,71

Legend:

BSK – The Region of Bratislava
TTSK – The Region of Trnava
TNSK – The Region of Trenčín
NRSK – The Region of Nitra
BBSK – The Region of Banská Bystrica
ZSK – The Region of Žilina
PSK – The Region of Prešov
KSK – The Region of Košice

3.2 The Institutional quality sub-index

In this indicator internal segments of UE are prevalent, while the number of public universities in the region and their faculties as well as the capacity of business subjects both are a significant factor for the opportunities for studying for people interested in tertiary education and for getting employed in the labour market.

In this sub-index we used the methodology to follow the trends in the framework of two-year time period – the years 2006 – 2007, because there are available statistic data. It was based on the number of 20 public universities and 101 faculties in Slovakia in 2006 and 2007. Other data were calculated based on the data from the Annual report about the state of universities in Slovakia in 2006 and 2007, the number of business subjects was based on the Report of the statistical office of the Slovak Republic in 2006, 2007.

Table 2 - Resulting values of indicators in the sub-index "Institutional quality" (Source: Own calculations)

Region/ year		Indicators in the sub-index "Institutional quality"					
		Number of universi-ties	Num-ber of facul-ties	The volume of paid social scholarships	Economic result of universities (million Sk)	Accommodation capacity of the universities (number of beds)	Number of business subjects
BSK	2006	2,00	2,29	2,11	2,03	3,74	1,52
	2007	2,00	2,29	2,18	1,01	3,77	1,52
TTSK	2006	0,80	0,63	0,42	-0,08	0,04	0,85
	2007	0,80	0,63	0,41	2,37	0,04	0,85
TNSK	2006	0,40	0,39	0,16	0,01	0,05	0,88
	2007	0,40	0,39	0,18	-1,55	0,05	0,86
NSK	2006	1,20	1,12	1,01	0,52	0,75	0,95
	2007	1,20	1,12	1,01	0,87	0,76	0,95
BBSK	2006	1,20	0,87	0,78	-0,41	0,69	0,85
	2007	1,20	0,87	0,85	1,52	0,66	0,84
ŽSK	2006	0,80	0,87	1,27	4,46	0,99	1,07
	2007	0,80	0,87	1,19	3,06	0,97	1,07
PSK	2006	0,40	0,63	0,75	0,08	0,32	1,02
	2007	0,40	0,63	0,78	0,05	0,32	1,05
KSK	2006	1,20	1,19	1,51	0,23	1,41	0,85
	2007	1,20	1,19	1,39	0,66	1,41	0,86

Even in this case the Municipality of Bratislava dominates by the opportunities for studying, accommodation capacities, as well as getting employed in the labour market, which is given by the potential of Bratislava as the capital of Slovakia. In comparison to 2006 the region has experienced a slight increase in a volume of paid social scholarships and the accommodation capacities. After the Region of Bratislava the worst social position by the amount of paid social scholarships is occupied by the Regions of Košice, Žilina and Nitra, respectively. In the year 2007 the situation got worse in the Regions of Košice and Žilina. On the other hand the slight improvement in comparison to 2006 has been

experienced by Bratislava, Trenčín, Banská Bystrica and Prešov Region. The lowest accommodation capacity for students is in the Regions of Trnava and Trenčín. In 2007 the accommodation capacity increased only in Bratislava and Nitra Region. In contrast in Banská Bystrica and Žilina Region the accommodation capacities slightly decreased. In the number of business subjects the first place is occupied by the Region of Bratislava, and close behind there are the Regions of Žilina and Prešov. This signalises that they create comparable conditions for doing business and this could in turn increase the ability of graduates to get employed particularly in these regions and thus increase competitiveness as well. The number of business subjects slightly increased in the Prešov and Košice Region. It is worth noticing the negative results of the Regions of Banská Bystrica and Trenčín (thus economic losses) in the area of economic result of universities in the region in 2006. Relatively distinctive success in this indicator is in the Region of Žilina, and behind it the regions of both Bratislava and Nitra. In 2007 the Region of Žilina was still the first, followed by Trnava and Banská Bystrica Region, which showed negative results in 2006.

3.3 The Innovative performance sub-index

As has already been mentioned, achieved values in the indicator of Science and research are the result of 14 data groups that express the potential and results of universities of given region in a complex way. The methodology of ARRA was based on the division of universities according to the Frascati manual to sciences: natural sciences, technical sciences, medicine sciences, agricultural sciences, social sciences, humanities. Faculties were assessed according to this division. Given averages from the report were then divided by the number of assessed faculties, so that achieved results would not be distorted by the different number of faculties (Table 3).

This index is dominated by the Bratislava Region in two indicators. Is it surprising to see that the position of a university in the Region of Nitra (3rd place from assessed universities and close behind the Region of Bratislava).

3.4 The Human resources sub-index

Without high-quality human resources as one part of the R & D infrastructure it will be impossible to carry out research and development at the top European level. Sufficiency of qualified labour force is both the assumption and condition for growth of qualitative competitiveness on national and regional level. This was the basis for the construction of the sub-index and its indicators (Table 4).

Table 3 - Resulting values of indicators in the sub-index "Innovative Performance" (Source: Own calculations)

Region	Indicators in the sub-index "Innovative performance"		
	Number of employees in science and research at universities (employees with degree and higher qualifications)	Science and research*	Expenses for science and research in the municipality(thousands of Sk)
BSK	3,70	33,91	3,91
TTSK	0,30	27,59	0,61
TNSK	0,41	18,50	0,98
NSK	0,72	33,29	0,64
BBSK	0,54	22,18	0,30
ŽSK	0,80	15,38	0,50
PSK	0,33	16,87	0,17
KSK	1,11	67,33	0,88

Note:

* Average value according to the faculties of given university in the region, own calculations according to the results of ARRA 2007 evaluation, marked VV1A-VV10 (Source: www.arra.sk)

Table 4 - Resulting values of indicators in the sub-index "Human resources" (Source: Own calculations)

Region	Indicators in the sub-index Human resources		
	Population in the municipality with university degree	Studying and education*	Registered unemployed university graduates (AP 2006*)
BSK	1,90	87,42	-0,51
TTSK	0,74	47,58	-0,74
TNSK	0,92	41,66	-0,79
NSK	0,78	53,91	-1,26
BBSK	0,89	52,83	-0,85
ŽSK	0,90	44,43	-0,89
PSK	0,81	38,50	-1,63
KSK	1,04	67,22	-1,33

Note:

* Average value according to the faculties of given university in the region, own calculations according to the results of ARRA 2007 evaluation, marked SV1 –SV8 (Source: www.arra.sk).

* AP – arithmetic mean calculated from the values of May and September 2006 (Source: statistical results about unemployment of university graduates and youth)

If the position of all the assesses municipalities is the same in the indicator of university graduates, then in the indicator of Studying and education the Region of Bratislava achieves the results, followed by the regions of Košice, Nitra and Banská Bystrica respectively. This gives the evidence for the fact, that from the perspective of activities structure the universities are orienting equally towards academic activities, as well as towards science and research. The position of the Region of Prešov is given by the fact, that there is only one public university. It is important to note, that the results in the indicator of Studying and education were calculated similarly as in the indicator Science and research from the assumptions of ARRA, from 7 groups marked SV1-SV8. They expresses different aspects of performance of the assessed universities and their faculties and even in this case the average values from the ARRA report were divided by the number of faculties in two blocs of SV1-SV4 and SV6-SV8, so that the different number of faculties would not distort the objective position of given faculty/university/region in the assessment.

3.5 The summary of results from the Index of Quality of Regional University Environment

IK RVŠP should have mapped the UE in selected regions of Slovakia and identify its strengths and weaknesses from the perspective of quality evaluation. To illustrate the extent of background material we note, that 17 indicators in all the 8 Slovak regions have been defined in the framework of 4 sub-indices of IK RVŠP with the background in the statistical data on regional and national level. This helped to achieve its resulting values.

If we compared obtained results of IK RVŠP with the results from the questionnaire survey, all the relevant characteristics in the area of quality determinants, problem areas and the direction of UE development in assessed regions were confirmed (Table 5).

As can be seen in the summary table and graph, the highest values in all sub-indices are achieved by the Region of Bratislava, whereas the biggest differences among assessed regions occur in the sub-index of macroeconomic performance and stability and Innovation performance. Relatively high value in the sub-indices of Innovation performance (Indicator of Science and Research) and Human Resources (Indicator Studying and Education) is given by the construction of these sub-indices, as the data were taken from the ARRA report. There, the areas of Science and Research are complex activities of assessed universities evaluated under marking of VV1A - VV10 and thus relatively high number of data such as number of publications, number of citations, the ratio of PhD. students to lecturers and to the number of other students, the volume of finance obtained for granted programmes etc. Similarly, in the sub-index of Human resources in the indicator of Studying and education (marked in the ARRA report by SV1 - SV8 the main sides of activities of assessed universities

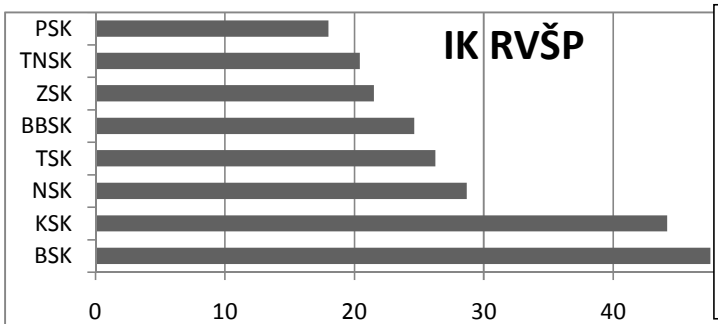
are expressed by the number of students, ratio of lecturers according to individual categories and in relation to students, the extent of interest in studying at given university from home and international students. The reason for processing such an extensive database is the essence of the Index of Quality of Regional University Environment, as the key characteristics of the UE quality are in the logic of index construction the areas of Innovation performance and Human resources. This fact is expressed by the weights of sub-indices in the framework of the IK RVŠP.

Table 5 – Resulting values of sub-indices of IK RVŠP according to municipalities (Source: Own calculations)

Region	Sub-indices of IK RVŠP				
	Macroekonomic performance and stability Weight 25%	Institutional quality Weight 15%	Innovative performance Weight 30 %	Human resources Weight 30 %	Summary index Weight 100 %
BSK	6,33	2,05	12,46	26,64	**47,48**
TTSK	3,04	0,40	8,55	14,27	**26,26**
TNSK	1,63	0,28	5,97	12,54	**20,42**
NSK	1,42	0,83	10,40	16,03	**28,68**
BBSK	1,26	0,60	6,91	15,86	**24,63**
ŽSK	1,76	1,42	5,00	13,32	**21,50**
PSK	1,01	0,48	5,21	11,30	**18,00**
KSK	2,33	0,96	20,80	20,08	**44,17**

Resulting values of IK RVŠP for the assessed time period and on the basis of chosen methodology determined the order of regions in such a way, that the highest value is achieved by the Region of Bratislava, followed by the regions of Košice, Nitra, Trnava, Banská Bystrica, Žilina, Trenčín and Prešov. This is the reflection of reality, that the potential of the regions of Bratislava and Košice and universities in the regions have the best results from the perspective of competitiveness. The state of UE in its external and internal segment in the regions of Žilina and Trenčín is comparable, while if the Region of Žilina shows higher performance in the sub-index of Human resources, the Region of Trenčín shows the higher value in the sub-index of Innovative performance. It is given by the number of business subjects in the region. The Region of Prešov belongs to regions with highest unemployment rate. Compared to other regions, there is only one public university in the Region of Prešov containing 8 faculties. Other

regions have the comparative advantage from the perspective of portfolio of study programmes offered, while in the Region of Prešov the choice is limited in relation to the standard indicators of the competitiveness.



1.	BSK	47,48
2.	KSK	44,17
3.	NSK	28,68
4.	TTSK	26,26
5.	BBSK	24,63
6.	ZSK	21,50
7.	TNSK	20,42
8.	PSK	18.00

Figure 3 - Resulting values of IK RVŠP
Source: Own calculations

4 CONCLUSION

Obtained results of the evaluation of quality of regional UE has confirmed the correct construction and usefulness of the IK RVŠP for the identification of conditions in both external and internal segment of UE in the context of criteria of qualitative competitiveness. Used methodology can be used for this purpose in observing development trends in the framework of long-term time horizon and in the framework of all Slovak regions.

AFFILIATION

The contribution has been worked out as the continuation of the problems described in the dissertation thesis under the name Creation of the system of quality management in the context of european trends (on the example of university environment in the Slovak Republic).

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EFFECT OF STRESS AND PSYCHOLOGICAL OVERLOAD AT WORK ON PERFORMANCE OF EMPLOYEES

MAREK ŠOLC, ANDREA SÜTŐOVÁ

1 INTRODUCTION

Everyone's life is a process full of contradictions, which requires a solution of less or more complex load situations. They are milestones on our path through life. Their requirements test our adaptability, set demands on health, physical fitness and mental strength of each of us. The load situations are not generally undesirable because they contribute to the mobilization of psychic forces, encourage learning, exploring new routes, stimulate further development of human personality. It is interesting that nowadays, the psychic load belongs to the dominant loads at work. Repairing of a tragedy is more difficult than trying to preclude it by various preventive measures. In today's daily life, there are ever more stress factors, originating in the surrounding environment and work - noise, lack of time, interpersonal relationships at the workplace, shift work, impending job cuts, etc.. All these stressful situations negatively affect the physical and psychical well-being of people.

2 LEGISLATION IN THE AREA OF MENTAL WORKLOAD

The Decree of the Ministry of Health of the Slovak Republic no. 542/2007 on details of health protection against physical strain at work, mental workload and sensory load at work in § 2 section 1 defines:

a) the mental workload is a factor which represents the sum of all evaluable effects of work, working conditions and working environment, influencing cognitive, sensory and emotional processes of humans that affect it and induce a state of increased psychic stress and overload of psychophysiolgical functions

b) the psychic load is a factor acting adversely on the organism, requiring mental activity, mental processing and coping with the requirements and environmental impacts where:

1. environment means everything that surrounds man, including working environment, community ties, events and behavioral requirements,

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2. environmental and work reqirements are greater than the individual's mental prowess, his work potency,

3. there are distinguished three forms of mental load: sensory, mental, and emotional;

c) **sensory load** resulting from requirements for a peripheral sensory organs and their corresponding structures of the central nervous system,

d) the **mental load** resulting from the information processing requirements on the psychological and mental processes, namely attention, imagination, memory, thinking and decision making,

e) the **emotional load** resulting from requirements causing affective response,

f) the **psychosocial load** is a factor acting adversely on the organism, requiring mental activity, mental processing and coping with the requirements and environmental impacts resulting mainly from social processes and social ties, the interactions between individuals in groups, in the crowd, etc. [1]

3 STRESS AND LOAD

Stress and load are two quite freqently used terms. What do they actually mean? How to describe them? Are they synonyms or different terms? There are different opinions that seek to explain the problem of understanding stress and load. Universally applicable definitions are being searched. Křivohlavý summarizing several definitions of stress determined that "stress usually means the internal state of a person who is directly threatened by something, or such a threat is expected, while he/she considers that his/hers defense against the adverse effect is not strong enough." Our understanding of the stress will therefore adhere to this definition.

An important role in explaining the psychic load plays the interaction approach, which assumes:

a) critical for load assessment is the relationship of external impacts and internal conditions;

b) the load under the same objective conditions of the external environment on different humans and on the same man in different internal states is different.

To clarify the terminology, J. Daniel (1997) proposed to "reserve the concept of stress for physical stress, or the heavy psychic stress, while for medium and light psychic stress would be more appropriate concept of load. "

The related view has J. Timko (1986), by whom it is optimal to use the term "load" for physiological and psychic states induced by load situations, and the term "stress" for an extreme form of load induced by risk situations where integrity or even the existence of a living system is compromised. Thus, the term

"load" is used in current, somewhat challenging situations, while the term "stress" in extremely difficult situations.

What kinds of load do we know?

According to the nature of stimulus and primary response is possible to distinguish three types of load:

- Biological load (stress): factors are of physical, chemical or biological nature, the responses of an organism are primarily biological, psychic reactions are subsequent and secondary.
- Physical load (stress): the requirements deal primarily with muscle activity, the body acts as an energy source. The physiology of work recognizes dynamic work (the criterion is energy expenditure, muscle contraction and relaxation alters in less than 3 seconds), static work (the criterion is the proportion of maximum muscle contraction force, muscle contraction and relaxation takes more than 3 seconds) and work performed in the inappropriate body position.
- Psychic load (stress): the process of primarily psychic treatment and coping with the requirements of life and work situations. Physical reactions are secondary, triggered by psychological process.

What are the causes of the emerging load?

If we should rank the causes of the load according to the impact, prominent places would be taken by natural catastrophes and disasters such as earthquakes, floods, storms and other climatic or physical changes of external environment, followed by wars, events associated with the death of a close loved one, loss of life perspectives, with the disintegration of family , with health threats, status and place in our social environment, the loss of the job, time pressure, with risk activities performed with the knowledge of far-reaching consequences of faulty decisions and performance.

For clearer views in this area is a decisive moment to constantly explore the causes.

Epstein distinguishes three types of stressors, depending on induced anxiety (according to Křivohlavý, 1994):

a) biological stressors – threatening the life or existence of certain organs;

b) stressors threatening our ability to cope with problems threatening assimilation capacity (the ability to absorb the new);

c) the self-esteem threatening stressors.

What are the symptoms and consequences of load?

Life sometimes offers to each of us its bitter taste.

At least once, each of us had the feeling that we are at the bottom, that our power have left us, nothing goes well, we are fed up with everything.

Symptoms of stress:

1. Physiological signs of stress (migraine, palpitations, headache, etc.),
2. Emotional symptoms (excessive feelings of fatigue, sudden and significant changes in mood, increased irritability, anxiety, etc.),
3. Behavioral symptoms (excessive smoking, indecisiveness, impaired quality of work, feeling tired, etc.).

To these categories can be added other symptoms. Human individuality translates into inner life and behavior under the load – for some the load will show in the former for others in the latter. Impact effects on human are often disastrous. Therefore, we do everything to avoid stress. We are not always successfull. It can affect our physical and mental health, relationships to other people, functioning in work and at home.

3.1 Causal dependence of stress

In the causal chain of stress, the stressor is at the beginning. Organism of the employee assesses the seriousness of stressor and on the basis of its ability to cope with stress arises the response to stress. It may be manifested in behavior, the psychic and physiological inner life, which causes the fluctuations in the performance of employee and in the safety and health at work.

The process of stress arising and following consequences take place in stages [Fig.1].

3.2 Workload

Workload or work stress represent a subset category of overall life load or stress, associated with working conditions in a broader sense. The workload has a direct effect on psychic and physiological functions of workers and influences the comfort and satisfaction of people in work. It is therefore imperative that the organizations take this fact into consideration and pay sufficient attention to improvement of the work environment, use of modern technologies, removal of dangerous places in the workplace, improving occupational safety and health at work and support of optimal working conditions.

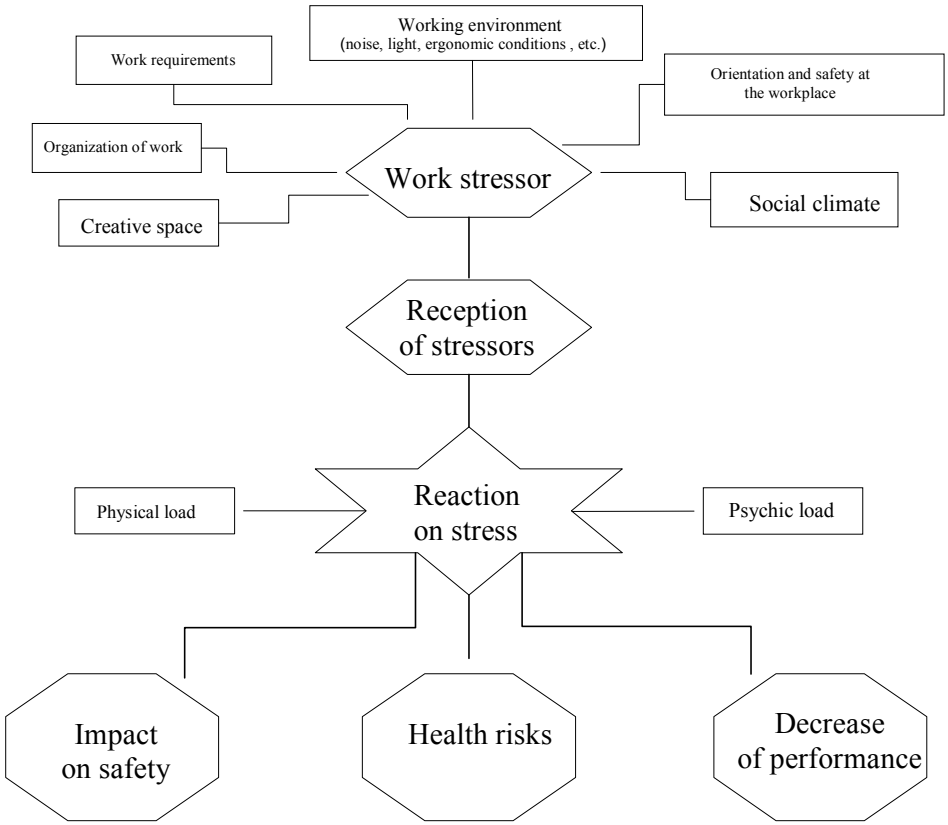

Figure 1. Causal dependence of stress and its effects [1]

3.3 Workload

Workload or work stress represent a subset category of overall life load or stress, associated with working conditions in a broader sense. The workload has a direct effect on psychic and physiological functions of workers and influences the comfort and satisfaction of people in work. It is therefore imperative that the organizations take this fact into consideration and pay sufficient attention to improvement of the work environment, use of modern technologies, removal of dangerous places in the workplace, improving occupational safety and health at work and support of optimal working conditions.

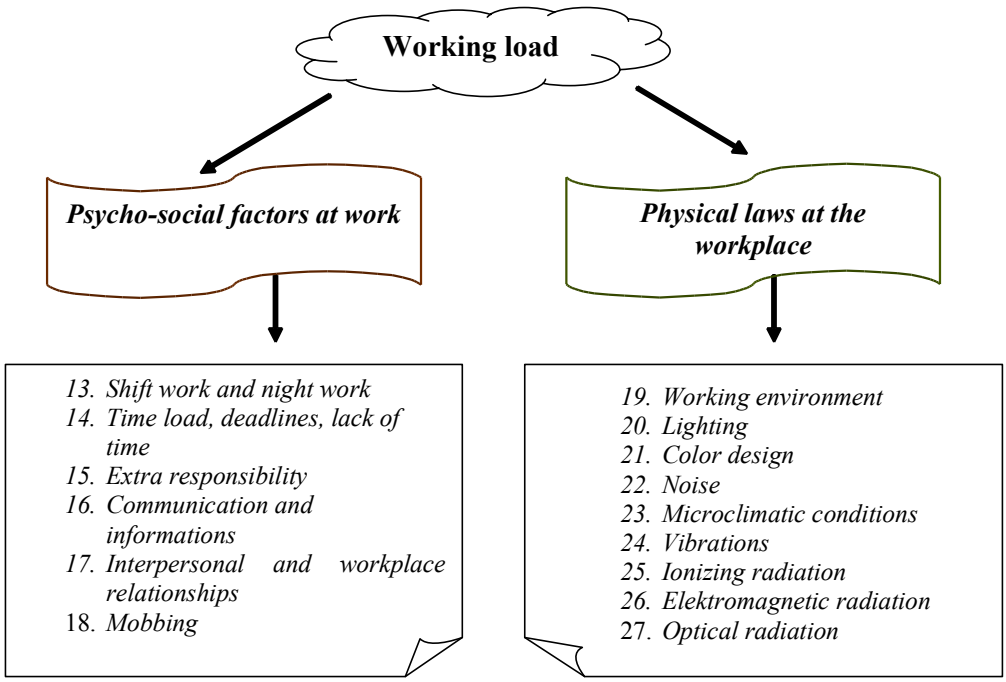

Figure 2. Distribution of workload

4 FORMULATION OF THE STUDIED PROBLEM

The research of given issues took place in a service organization, which operates on the market of information and telecommunication technologies for some time, already. It is one of the leading companies providing advanced telecommunications services in Slovakia. It was studied how the employees themselves assess the subjective mental load at work in ten characteristics: the intensity of work and time pressure, forced pace of work, monotony, concentration distorting effects, social interactions, personal risk, the risk of endangering own health and the others, shift work, the work environment, physical discomfort. In research, we focused on how the manager perceives mental overload of employees in terms of working conditions level.

4.1 Research method

The participants of the research were employees of the unnamed studied company. The sample consisted of 84 persons (24 men and 60 women). The average age was 28.3 years (22 yr - 55 yr). Each participant was given a test, which represented a method for assessing mental workload in terms of working conditions level. The questionnaire has high validity and reliability, whereas it

was standardized and its reliability was confirmed also by our sample. The testing was anonymous.

The method we used in the evaluation and testing:

- **The method for assessing mental workload in terms of working conditions level**

This method is intended as a basic screening tool of preventive occupational medicine for evaluation of mental workload in terms of working conditions level, that can affect the health of employees and their well-being. It assesses mental workload in 4 stages (a, b, c, d) according to 10 work characteristics and environment: the intensity of work and time pressure, forced pace of work, monotony, concentration distorting effects, social interactions, material and organizational responsibility, the risk of endangering own life and health or the others, shift work, the work environment, physical discomfort and other sources of load.

4.2 Processing of results, analysis

Studied hypothesis was qualitatively verified by analysis of a questionnaire filled out by manager of the studied company.The manager assessed the load on employees in ten categories, choosing among four levels of load. The results of this analysis can not be generalized, of course, but they are very useful to compare the perception of load among managers and employees. Ultimately, the expectations of management may be one of the main sources of load for employees.

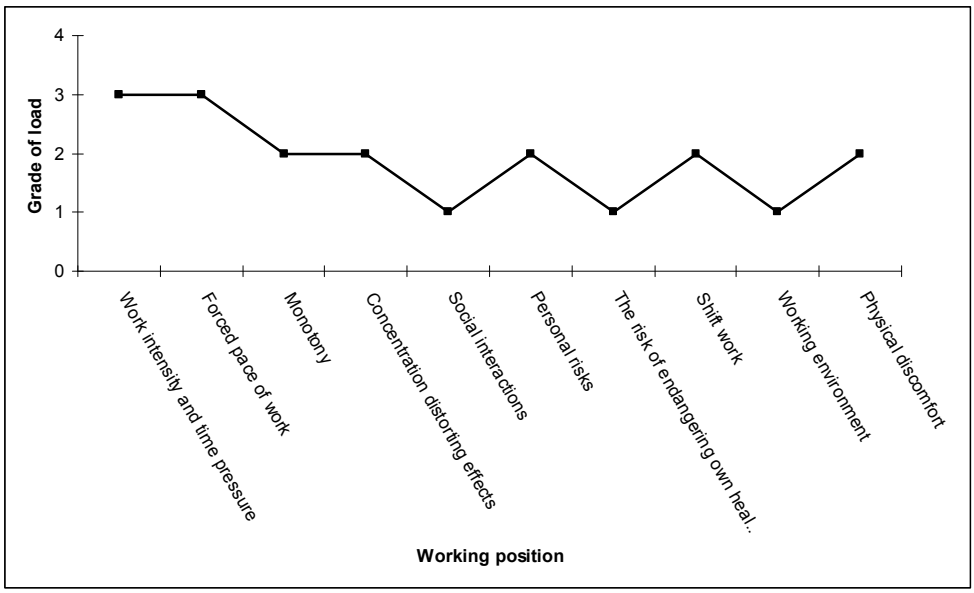

Fig. 3 Assessment of employee mental load by manager with regard to working conditions (Note: 1 – grade a, 2 – grade b, 3 – grade c, 4 – grade d)

The psychosocial loads were evaluated by the manager as follows:

1.1. Load – intensity of work and time pressure: ***the grade c*** – very intensive work with limited breaks, not alowing sufficient regeneration during the operation, which translates as overloading of information processing capacity, decision making under time constraints. Sensory and mental activity leads to rapid onset of fatigue, after max. 4 hours of work the activity must be interrupted. Overloading of attention at maximum use of sensory capacity, attention could not be lifted from monitored events. Tasks with regular daily occurrence of peak load at given time with duration up to 2 hours.

2.2. The load – forced pace of work: ***grade c*** - the pace and rhythm of activities are given by machine mechanism, but it is not hard subordination to machine rhythm, the worker has some freedom. Time to perform the operation need not to be strictly adhered to. Workers may leave their place for a short period of time.

3.3.The load – monotony: ***grade b*** – work with brief and temporary presence of repetitive actions or tasks. Performing of the alternating monotonous tasks.

4.4. Effects impairing concentration: ***grade b*** – interference occur to a lesser extent than in *grade c* (nonconstant disturbance and interruption of activities requiring a high concentration, but occurring every day), occasionally, not every day.

5.5. Social interaction: ***grade a*** – high likelihood and frequency of interpersonal conflicts.

The exercise of professional activities lies in influencing and guiding the behavior of persons that violate the social standards of conduct or require a special care.

6.6. Personal risks: ***grade b*** – increased (versus normal), responsibility for the partial economic and moral values. Decision-making mostly in near certainty situations. Limited amount of personal risk for the consequences of own behavior. Operational management and provision of work under normal conditions.

7.7. The risk of endangering own health and others: ***grade a*** – work without the risk of accidents and without risk to the health for others.

8.8. Shift work: ***grade b*** – irregular distribution of working hours during the day, divided shifts, waiting periods, prolonged shifts. Permanent work in the afternoon shift only.

9.9. Working environment: ***grade a*** – work without discomfort conditions.

10.10. Physical discomfort: ***grade b*** – work of 3rd category in terms of physical load, working position, microclimatic conditions.

Work with personal protective equipment slightly limiting the movement of limbs, visual field or hearing.

Hypokinesis: Continuous work in a sitting position with minimal physical activity.

The result of psychosocial loads assesment by manager falls into the category No. 2 , where indicators of factors to which employees are exposed do not exceed given limits, but it is possible that at this level of exposure, adverse effects will affect the well-being of more sensitive subjects.

5 CONCLUSION

Currently it is very important to address and pay necessary attention to the psychological load on the working environment. High exposure to stress factors was not expected, given the subjective view of the manager. Excessively high load on employees would show unacceptable working conditions in the organization. The load to low would on the other hand testify about the insufficient labor deployment.

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UTILIZATION OF STATISTICAL METHODS WITHIN THE EUROPEAN PERFORMANCE SATISFACTION INDEX (EPSI) RATING METHODOLOGY

ANDREA SÜTŐOVÁ, MAREK ŠOLC

1 INTRODUCTION

A number of studies have shown that the long-term success of an organization is closely related to its ability to adapt to customer needs and changing preferences. Every organization should identify carefully the various parameters, which may be indicative of the satisfaction of their customers. Customer satisfaction, according to ISO 9000:2005, is defined as customer`s perception of the degree to which the customer` s requirements have been fulfilled. Customer satisfaction studies are carried out in order to assist organizations in understanding the factors influencing customer satisfaction and ultimately helping with decision making, thus their significance in quality management is unquestionable. In order to measure and monitor customer satisfaction, and to take action for improving it, a number of different methods have been developed and tested.

EPSI Rating methodology is used for measuring customer satisfaction at national scale in Europe. Currently customer satisfaction measurements have been conducted in 15 European countries in 5 common industries (retail banking, fixed line telecoms, mobile phones, insurance and supermarkets) and a number of country-specific sectors. These measurements can partially substitute customer satisfaction measurements at organizations scale or to complete them. Utilization of EPSI Rating methodology enables quantification of customer satisfaction and estimation of impact magnitude of factors influencing customer satisfaction and loyalty through the use of various statistical methods.

2 EPSI RATING METHODOLOGY

EPSI Rating methodology is based on the EPSI causal model, where the drivers of satisfaction as well as its resulting effects on loyalty are explicitly introduced. This approach of customer satisfaction survey is based on a principle of EFQM Excellence model. The EPSI model contains seven components (latent variables). The causal connections between components are described in figure 1. The components on the left side represent driving factors and the components on the right side represent results.

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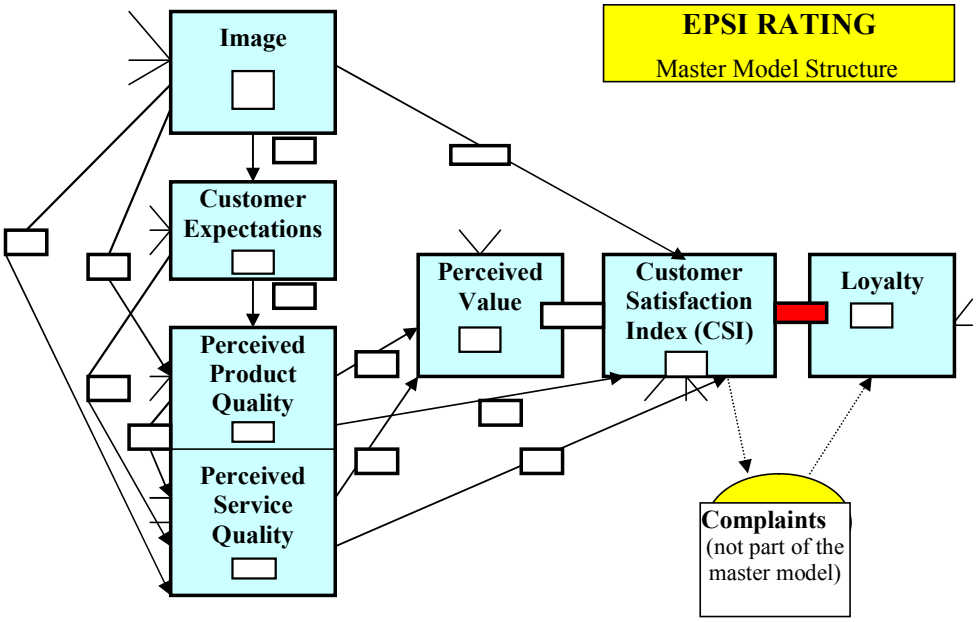

Figure 1 –EPSI model

The components are viewed as latent variables determined by a set of manifest variables. Each manifest variable is measured, the index value of each component estimated, the relevant connections between the components established and the magnitude of the connections estimated. In order to estimate the model, to calculate the index values of components and the magnitude of the impacts, data must exist that is representative for the customers of the organization. Survey design considered consists of:

- the design of a questionnaire for measuring the latent variables via the manifest variables (manifest variables are evaluated by customers on a scale from 1 to 10),
- the selection of a representative sample of customers,
- the field operations for collection the data from the sample using the questionnaire
- the data analysis.

2.1 EPSI model estimation

Before the index value estimation of each latent variables, the 1-10 scale (from questionnaire) is, for ease of interpretation, transformed into a 0 -100 scale.

$$\hat{x}_{ij}^{l} = \frac{10}{9}\left(x_{ij}^{l} - 1\right) \tag{1}$$

The index values of latent variables are estimated as arithmetic mean according the following equation:

$$\boldsymbol{e}^{l} = \frac{\sum_{j=1}^{k^{l}} w_j^{l} \cdot \hat{\boldsymbol{x}}_j^{l}}{10\sum_{j=1}^{n} w_j^{l}} = \sum_{j=1}^{k^{j}} \tilde{w}_j^{l}.\tilde{\boldsymbol{x}}_j^{l}; \quad \text{where} \quad \tilde{w}_j^{l} = w_j^{l} / \sum_{j=1}^{k^{j}} w_j^{l} \quad \text{and} \quad \tilde{\boldsymbol{x}}_j^{l} = \boldsymbol{x}_j^{l} / 10 \qquad (2)$$

$\boldsymbol{e}^{l}$ is a vector of l^{th} latent variable

$\hat{\mathbf{x}}_j^{l}$ are vectors of j^{th} manifest variable connected with lth latent variable

w_j^{l} are weights of $\hat{\boldsymbol{x}}_j^{l}$ vectors

The weights are estimated as: $w_j^{l} = cov\left(\hat{\boldsymbol{x}}_j^{l}, \boldsymbol{y}^{l}\right)$; where $\boldsymbol{y}^{l} = \sum_{j=1}^{k^{j}} \hat{\boldsymbol{x}}_j^{l} / k^{l}$

where:

k^{l} is a number of manifest variables connected with l^{th} latent variable, number 10 at the equation (2) deals with the used scale (1- 10) in questionnaire

$\tilde{w}_j^{l}$ are standardized weights $\left(\sum_{j=1}^{k^{l}} \tilde{w}_j^{l} = 1 \right)$ of respective $\hat{\boldsymbol{x}}_j^{l}$ vectors

$\tilde{\boldsymbol{x}}_j^{l}$ are rescaled $\hat{\boldsymbol{x}}_j^{l}$ vectors ($0 < x_{ij}^{l} \leq 1$)

Except the above mentioned method, the Partial Least Square (PLS) can be also used for index values estimation.

After calculation of latent variables, the magnitude of the connections between them can be estimated. The causality model described in figure 1 leads to linear equation relating the latent variables:

$$\boldsymbol{e}^{l} = \beta_0^{l} + \sum_{n=1}^{n} \beta^{ln} \cdot \boldsymbol{e}^{n} + \boldsymbol{r}^{l} \qquad (3)$$

where:

$\boldsymbol{e}^{l}$ is a vector of l^{th} latent variable

β^{ln} is unknown regression coefficient of l^{th} latent variable connected with $\boldsymbol{e}^{n}$ vector

$\boldsymbol{r}^{l}$ is error vector of l^{th} latent variable

n is a number of connection of l^{th} latent variable with the other variables in the EPSI model.

3 UTILIZATION OF EPSI RATING METHODOLOGY IN THE ORGANIZATION

EPSI Rating methodology was applied for measuring customer satisfaction in the wholesale organization with metallurgical products. Before the survey realization, customers of the organization were selected into three segments (A, B, C) according to their share on organization profits. Questionnaire for customer satisfaction measurement was designed according to EPSI model. Manifest variables used in a questionnaire were tailored to the character of the metallurgical product wholesale distribution. Manifest variables designed in the questionnaire are related to following aspects:

- Image – customer orientation, credibility of organization, innovation and forward looking,
- Customer Expectation – expectation about the product quality, expectation about the quality of service delivery, expectation about the service flexibility and reliability
- Perceived Quality – product quality, range of the products assortment, range of service delivery, material portioning, service reliability, reaction flexibility to a customer`s requests, communication and contact accessibility, information about new products and services, employees competency and attitude
- Perceived Value – price with regard of product quality, price with regard of service quality
- Customer Satisfaction – overall satisfaction, level of expectation fulfillment, comparision of organization with ideal organization
- Loyalty – price tolerance, future purchase probability, purchase probability in other organizations
- Complaints – method of complaint handling

For evaluation of manifest variable the Likert 1-10 scale was used, where „1“ means the lowest evaluation and „10“ the highest evaluation. Because of organization character (service organization) the latent variable Perceived Quality was not divided into service and product quality. Index value for complaints was not estimated. Complaints are not part of the EPSI master model too.

After data collection, in order to estimate the latent variable index values and magnitude of the connections between them, the Octave software was used. Octave is a freely available open-source software. It provides an interactive environment for numeric computations and number of matrix operations and functions. The estimated index values and magnitude of the connections between latent variable for customer segment A (highest share on organization profit) are described in figure 2.

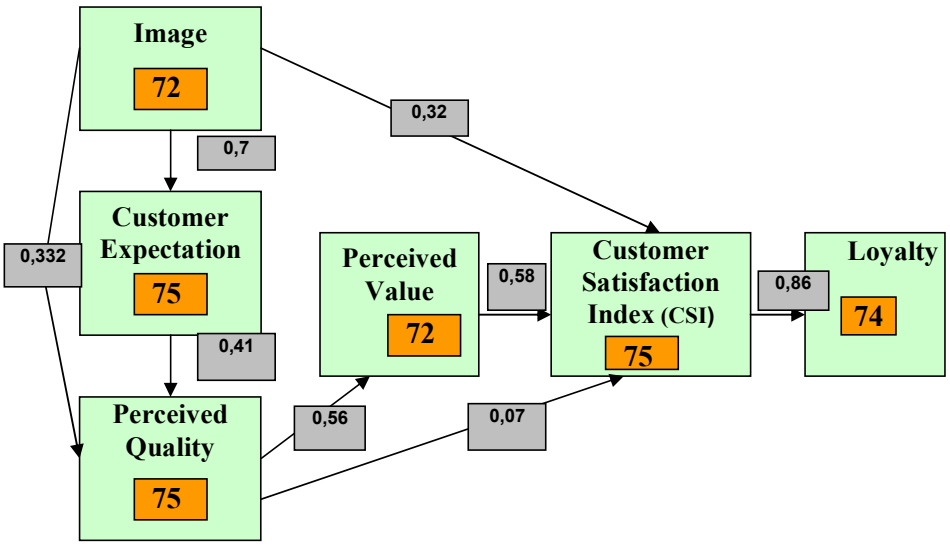

Figure 2 –EPSI model with results

4 CONCLUSION

The values of each latent variable in the EPSI model are above the level of 70%. Customer Satisfaction Index is reaching the 74% level, which can be classified according to EPSI score category as an average level (from 75% good level). Latent variables Image, Perceived Quality and Perceived Value have a direct impact on Customer Satisfaction according to EPSI model. Perceived Value has significant impact on Customer Satisfaction (0.58), subsequently Image (0,32). Perceived Quality has the lowest direct impact on Customer Satisfaction, but it influences Customer Satisfaction in the model indirectly, through Perceived Value, too. Loyalty is very important factor and significantly influenced by Customer Satisfaction (0.86). Improving customer satisfaction by 1 unit increases loyalty with 0, 86 unit. The significant impact of Image on Customer Expectation creation (0,7) can be also seen from figure 2.

Customer satisfaction measurement according to EPSI model is based on the sophisticated and reliable methodology, which brings quantified and comparable results. The information value of these measurements increases with time over which the measurements are conducted.

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