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Sun Tzu's "The Art of War" and Implications for Leadership: Theoretical Discussion

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We present a study of the Art of War from a leadership perspective, one in which we make a closer connection to the context of general organization and management. The Art of War written by Sun Tzu is one of those books that could be classified in the genre of pop-culture. Although its content used to be considered as a carefully protected state secret in the past, it is now available to everyone. Its use has in the past century of moved from warfare also to other areas of human activity. Strategic advices that it contains can be used in many more areas than just the conduct in the times of war. In fact, the success in wars, as well as in business, of course, depends on leadership, which is why we identify the positive and negative attributes of a leader in relation to strategic leadership. People are those who fight in battles and are also those who win them; and the most important person in every battle is the general. Historically, a number of successful military commanders ascribe the credit for their victories to Sun Tzu's principles. In addition, this wisdom is now being examined and used by senior executives from all around the world, especially in Asia, because it can be utilized in many business and political situations. The Chinese classic "The Art of War" is still considered as one of the most influential and important works on strategy, why a discussion on theoretical and practical implications of Sun Tzu's strategic leadership theory in a global environment is also included.

Keywords: Sun Tzu, leadership, organization

1 Introduction

In 500 B.C. probably the most renowned and revered ancient general in the world today (Low and Tan, 1995) – Sun Tzu – wrote the highly influential book *The Art of War*, which offered a framework for waging war and valuable observations on the nature of battle. The Art of War has been very influential in Chinese political and military history and there is evidence that it has influenced the thinking and practice of political and military leaders in modern China (e.g. Mao's guerrilla war), Japan, and the West (Cleary, 2000; Griffith, 1971; Lord, 2000). So important was this text that over the millennia it's been translated into many languages, updated and adapted to describe everything from the internal workings of sales processes to investment strategies to modern politics. Carl von Clausewitz (von Clausewitz, 1968), the famous Prussian military theorist and author of the classic "On War" noted

that business was a form of human competition that greatly resembled war. Within the field of business studies, *The Art of War* has been applied to the areas such as strategic management (Tung, 1994; Boar, 1995; Rarick, 1996; Lee, Roberts, Lau, & Bhattacharyya, 1998; Marber, Kooros, Wright, and Wellen, 2002; Wu, Chou, and Wu, 2004), project management (Pheng and Chuvessiriporn, 1997; Hawkins and Rajagopal, 2005), security management (Watson, 2007), innovation management (Martin, 2009; Foo, 2011), patent management (Lo, Ho and Sculli, 1998; Wanetick, 2010), quality management (Pheng and Hong, 2005), change management (Fernandez, 2004), human resource management (Wee, 2000; Lamond and Zheng, 2010), organizational behavior (Ko, 2003; Ahlstrom, Lamond and Ding, 2009), marketing (Low and Tan, 1995; Ho and Choi, 1997; Michealson and Michealson, 2003; Gagliardi, 2004), e-commerce (McCarthy, 2001), management education (McCallum, 1998; Li and van Baalen, 2007), leadership (Chen and Lee, 2008; Hee and Gurd, 2010; Reichard and Johnson,

2011), negotiation (Fang, 2006), international business (Wong, Maher and Lee, 1998), and the newly emerging discipline of systems engineering (Foo, 2008; Foo, 2009). Maxims of competitive strategies and tactics directly and indirectly attributed to the Art of war permeate speeches by Chinese and Western business executives. In Singapore, there is even the Sun Tzu Art of War Institute. This ancient classic has also been applied to such unexpected areas as construction industry (Pheng and Fang, 2005; Pheng and Hong, 2005), writing (Bell, 2009), patient care (Tremayne, 2008), rhetoric (Combs, 2005), personal success (Michealson and Michealson, 2003), and even dating (Rogell, 2011).

Sun Tzu is also known as Sun Wu with Sun being the family name, as we read in Chen and Lee (2008, pp. 143-144). Tzu was a honorary title meaning "master." Sun Tzu and his ancestors obtained their family name by a historical coincidence as their original name was Chen and then Tian. Sun Tzu's grandfather, under the family name of Tian, was awarded a large piece of land under the official title of Sun by the king of the Qi state for his military achievement in a war against the state of Lü. Over time, the family came to be known as Sun instead of Tian. Being born into a family of experts on military and political affairs and living in the state of Qi, which boasted many great military and political philosophers of the Warring States Period, Sun Tzu was blessed with an invaluable rich inheritance of political and military philosophies and practices. He later came to the state of Wu and presented to the king of Wu his thirteen chapters of the Art of war. He became a principal strategist of the Wu state and is believed to have contributed greatly to its ascendance.

Beyond the major religions such as Confucianism, Daoism, and Buddhism, Chinese leadership culture also has its underpinnings in the writings of well-known thinkers not affiliated with any of these schools of thought. One such writer was Sun Tzu (Gallo, 2011). In writing the Art of War, Sun Tzu, however, drew upon the wisdom of the previous philosophical schools. Confucianist thoughts on benevolence, righteousness, ritual propriety, and wisdom can be recognized in the Art of War, where these concepts are used to define, evaluate, and guide leadership, strategy, and tactics. Among the Daoist ideas that have the greatest impact on Sun Tzu's strategic leadership theory are the dialectic relationship between the contradictory forces of yin and yang, and the significance of the five basic natural elements of water, fire, wood, metal, and earth in warfare. The Legalist ideas of law, authority, and tactics were also key concepts used by Sun Tzu in discussing leadership strategies and tactics.

In this paper we study the Art of War from a leadership perspective, one in which we make a closer connection to the context of general organization and management. Following Chen and Lee (2008, p. 143), we study how, in the view of Sun Tzu, military commanders exercise strategic situationalism, namely, situation-making (zhao shi) to lead an army to victory. We identify the positive and negative attributes of a leader in relation to strategic leadership. Furthermore, we elaborate Sun Tzu's strategic situationalism into (a) creating positional advantage in the environment, (b) creating organizational advantage within the organization, (c) building morale within the troops, and (d) leveraging and adapting to situations.

Finally we discuss theoretical and practical implications of Sun Tzu's strategic leadership theory in a global environment.

2 Sun Tzu's Strategic Leadership

Based on the Sun Tzu's views on warfare and his prescriptions to the focal commander on how to achieve organizational outcomes through strategic maneuver on the key elements of an organized action, we frame Sun Tzu's philosophy in terms of strategic leadership, following Chen and Lee (2008, p. 153). While paying attention to ways of organizing, developing, and motivating a highly effective organization we also highlight the importance of factors external to the leader-member relationship including the higher authority, the larger community, and alliances and enemies, and the immanent situational and contextual factors. The term strategic leadership also suggests a system or institutional perspective as opposed to the supervisor-subordinate perspectives taken by theories of leadership such as the situational theory (Hersey and Blanchard, 1981, 1993), the path-goal theory (House, 1971), and the LMX theory (Liden and Graen, 1980).

Sun Tzu's adherence to the holistic approach to warfare makes his leadership theory fundamentally situational. Of the five determinants of a victory in war, three are external factors (the socio-political environment, the weather, and the terrain) and two are internal to the organization (the quality of the leader and the condition of the army). Sun Tzu devotes two full chapters to physical terrain (Chapter 10, Wu, 2001) and regions (Chapter 11, Wu, 2001) and one full chapter explicitly to varying tactics according to situational contingencies (Chapter 8, Wu, 2001). In other chapters about strategies, there are clear themes of using unorthodoxy and surprise, and of varying tactics according to circumstances. As we read in Chen and Lee (2008, p. 157), Sun Tzu's situational approach to leadership is also reflected in the importance he places on situational psychological factors relative to individual ones. He argues that "one who is skilled in directing war always tries to turn the situation to his advantage rather than make excessive demands on his subordinates" (Chapter 5, Wu, 2001), which suggests that success depends more on how the troops are strategically and situationally deployed by the leader than on the quality or psychological state of the individual soldiers per se. Furthermore, Sun Tzu sees followers' cohesion and morale as largely a function of situation rather than a purely chronic condition of the army. He predicts that troops will have greater morale when they are at the beginning of a campaign, when they find themselves deep in the enemy's territory, when they are rested, and when they have no way to back out (Chapter 11, Wu, 2001). He concludes that "an army under such conditions will be vigilant without admonishment, will carry out their duties without compulsion, will be devoted without constraint, will observe discipline even though they are not under close surveillance" (Chapter 11: 103, Wu, 2001). However, Sun Tzu's strategic situationalism of leadership is closer to the notion of strategic choice (Child, 1995) than the notion of situational determinism in the organizational behavior literature (Davis-Blake and Pfeffer, 1989). Despite, or indeed because of, his situational views of individual psychology and organi-



Figure 1: Sun Tzu's model of strategic situationalism (Chen & Lee, 2008, p. 158)

zational effectiveness, Sun Tzu believes strongly that success lies in the ability of the leader on the one hand to comprehend and appreciate the power of a situation and, on the other, to rise above the situation by creating, leveraging, and adapting to the existing and emergent environment. This is what Chen and Lee (2008, p. 158) call strategic situationalism.

We depict the strategic situationalism model in Figure 1, in which the first component describes attributes of the leader, which enable strategic leadership activities to affect the situation and the followers, which in turn lead to success. Solid lines in the Figure 1 refer to causal relationships on which Sun Tzu focused; dotted lines are possible but obscure causal relationships.

3 Individual Attributes of the Strategic Leader

The Art of war contains many descriptions of the attributes of an ideal leader. In describing an ideal sovereign the most common terms Sun Tzu uses are humaneness (benevolence and righteousness) and enlightenedness. In describing an ideal general, Sun Tzu lists five attributes: wisdom, trustworthiness, benevolence, courage, and firmness (Chapter 1: 5, Wu, 2001). While benevolence is the most important virtue of the Confucian Dao of government, wisdom appears to be the most important attribute of the strategic leader for Sun Tzu's Dao of war. It is a much broader concept than intelligence as it refers to the acquisition of knowledge and skills through accumulation and the ability to fulfill one's responsibility. In fact, wisdom may arguably be the overarching attribute for Sun Tzu, as it is capable of incorporating courage, firmness or even benevolence and trustworthiness. In describing the wisdom of the general, Sun Tzu refers to understanding the broader political mission of war, seeing the Dao of yin and yang (seeing danger inherent in advantages, but advantage

in dangers), having foreknowledge of the enemy and the battleground situation, recognizing emergent changes of the situation, and having the skill to use unorthodox strategies, to leverage situations (e.g. different kinds of region), to deploy troops according to the situation, and to win the troops' loyalty and compliance through soft and hard means. In superior-subordinate relations, trustworthiness, for Sun Tzu, seems to refer primarily to loyalty to the superior whereas, in contrast, benevolence is directed downward toward the subordinates. Courage may be the ideal attribute that is most special to military organization and combat situations, but to a large extent so is firmness. However, firmness may be more universal to all organizations as it counterbalances benevolence, for Sun Tzu believes that benevolence without firmness creates loyalty but not deployability. McNeilly (1996, p. 128), who in his book interprets Sun Tzu from the business perspective, also lists five desirable traits of an ideal leader: a) build your character, not just your image, b) lead with actions, not just words, c) share employee's trials, not just their triumphs, d) motivate emotionally, not just materially, e) assign clearly defined missions to all, avoiding mission overlap and confusion, f) make your strategy drive your organization, not the reverse.

Sun Tzu also lists five fatal flaws of a strategic leader that can bring calamity to the leader and the troops (Chapter 8, Wu, 2001). "Those who are ready to die can be killed; those who are intent on living can be captured; those who are quick to anger can be shamed; those who are puritanical can be disgraced; those who love people can be troubled" (Cleary, 2000, p. 135). These are vulnerabilities of the leader that can be strategically exploited by the enemy in combat situations. Although these have been typically viewed as character or trait flaws (e.g. Griffith, 1971), they can also be viewed as cognitive and emotional errors committed in response to extremely turbulent and volatile situations. Regardless of whether they are chronic traits or situationally induced characteristics, they are flaws. Notice that except for fear of death and quick tem-

per, three qualities could be viewed as positive attributes of courage, honor, and benevolence if they exist in moderation or are counter-balanced by other attributes. When a leader is wedded to an otherwise good value or a course of action to the exclusion of other values and options, the otherwise good attribute becomes a flaw. Courage without wisdom and benevolence without firm discipline are examples. So it is single-mindedness that is fatal because the leader is unable to adapt to the complex and changing situation or more vulnerable to strategic maneuvering by more skillful opponents. In pointing out these flaws, Sun Tzu in effect is holding a holistic and situational view of positive leadership characteristics. Furthermore, because the single-minded overzealous leader is typically guided by emotion rather than by knowledge of the objective situations and the sound reasoning of strategic thinking, Sun Tzu points to the importance of emotional stability and balance for strategic thinking and strategic operation. He repeatedly warns against launching wars and battles as a result of the emotion of the sovereign and the general. Emotions, he warns, can be reversed but perished states and lost lives cannot be brought back.

4 Strategic Situationalism

Key to Sun Tzu's leadership theory is the Chinese concept of situation (*shi*), situation-making (*zhao shi*), and situational adaptation (*yin shi*). The Chinese term *shi* has been translated into English as force, position, power, or momentum. In the *Art of War*, Sun Tzu devoted one chapter (Chapter 5, Wu, 2001) to the topic of *shi*. The purpose of strategies and tactics regarding *shi* is to create a positive position (*you shi*) relative to an opponent, i.e. relative advantage, and the more overwhelming the advantage, the greater the likelihood of swift and complete victory. In the *Art of War* strategic situational advantage is further divided into subtypes of advantage: positional (*terrain*), organizational, and morale/spirit (*qi shi*).

4.1 Positional Advantage

The most potent advantage according to Sun Tzu lies in placing the organization in an advantageous position vis-a'-vis other organizations in a given field of operation. This involves creating a strategically favorable environment for the organization. In the most basic sense of the term, Sun Tzu refers to the positional advantage of terrain (*di shi*). "When torrential water moves boulders, it is because of its momentum [*shi*] ... Logs and rocks remain immobile when they are on level ground but fall forward when on a steep slope. The strategic advantage of troops skillfully commanded in battle may be compared to the momentum of round boulders rolling down from mountain heights." Sun Tzu emphasizes that it is far more effective for commanders to create situations (*zhao shi*) in which troops are advantageously positioned and ready than to demand bravery and heroism when faced with adversity. Strategic leadership should therefore pay more attention to creating favorable situations than accepting and working within given situations. The former requires strategic thinking, foreknowledge, and proactivity. Sun Tzu prescribes many proactive behaviors for

creating a preponderance of positional advantage relative to opponents, ranging through full preparation, arriving early, employing more troops, and providing better logistics, etc. However, positional advantage seems to start with or boil down to advantage in knowing, especially in having information, as can be seen in the great importance of "knowing yourself and knowing your enemy." It is no wonder the book starts with war parameter assessment, which requires information on warring parties and ends with the importance of using secret agents for information advantage. Lord (2000, p. 304) observed that because Sun Tzu believed in "the manipulability of the strategic environment," he is remarkably different from Western military strategists such as von Clausewitz. While von Clausewitz emphasizes the chance and uncertainty of warfare and highlights the importance of intuition and the will of the leader, Sun Tzu places high priority on intelligence about the actual conditions of the battle, and affords it a strategically decisive role.

4.2 Organizational Advantage

One of the five parameters of winning is the organization of the army, by which Sun Tzu refers to the unity of command, the consistent enforcement of rules and regulations, clear rewards and punishments, and the coordination of different parts of the army. Sun Tzu starts the chapter on momentum by stating that whether commanding many or few troops, a large or a small army, it is a matter of organization, of instituting layers of control, and of communication. As an aside, it is amazing to discover how so many of Sun Tzu's ideas on the science of war are reflected in the Western science of management, especially in the essential managerial functions of planning, organizing, commanding, and controlling as proposed by Henri Fayol (1916), who wrote his book about two thousand years after the *Art of War*. According to Griffith, the *Art of War* was translated into French in Paris in 1772. One wonders if Fayol had read and reflected on Sun Tzu. Sun Tzu proposes constant variations of orthodox and unorthodox formations in deploying troops. The conventional formations are generally used to engage the opponent while the surprise tactics are employed to win victories. Yet, unconventional and deceptive tactics such as feigning confusion, weakness, and retreat rely heavily on the order, strength, and unity that lie in the organizational advantages.

There seems to be a paradox in Sun Tzu's insistence on a rather rigid structure of unity of command and organizational discipline on one hand but flexibility, innovation, and variation of actions on the other. Sun Tzu's answer to the paradox lies in the leader's strategic discretion (Hambrick and Finkelstein, 1987) as well as the leader's ability to create and leverage situational and psychological advantages. Sun Tzu insists on non-interference from the sovereign on matters of military operation and on the autonomy and discretion of the commander. While acknowledging that the commander receives his mandate from the sovereign, after the commander sets out, "there are commands of the sovereign he should not obey" just as there are situations in which "there are roads he should not take, armies he should not attack, walled cities he should not assault, territories he should not contest for" (Chapter 8:

69, Wu, 2001). He warns of three ways that a sovereign could bring disaster to the army: arbitrarily ordering the army to advance or retreat when in fact it should not, interfering with the administration of the army, and interfering with the commander's strategies and tactics (Chapter 3, Wu, 2001).

Clearly, Sun Tzu believes that although the mandate is set from the top (which itself is subject to the criteria of righteousness and benevolence) subordinates should be fully empowered to execute the mandate without interference from above especially when the higher authority has no full knowledge of the situation in the field. Sun Tzu also believes in following the Way of war (zhan dao), namely, following the rationality of acting according to the objective contingent requirement of the war rather than the subjective wishes of the sovereign or the general. "Thus, if the Way of war guarantees you victory, it is right for you to insist on fighting even if the sovereign has said not to. Where the Way of war does not allow victory, it is right for you to refuse to fight even if the sovereign says you must. Therefore, a commander who decides to advance without any thought of winning personal fame and to withdraw without fear of punishment and whose only concern is to protect his people and serve his sovereign is an invaluable asset to the state" (Chapter 10: 93, Wu, 2001).

4.3 Moral Advantage

Morale advantage refers to a psychological advantage, the degree of superiority of a troop over its enemy in terms of a conviction of morality and efficacy and a determination to win victory. With such momentum of spirit and energy the army will be like the cascading of pent-up water thundering through a steep gorge. How then is such morale momentum created? First, the legitimacy of command, for example, that of the sovereign over the general, the army, and the populace in general, originates from the Way, namely, righteousness and benevolence of those invested with authority. Sun Tzu sees the psychological identification and attachment of the rank and file with the leader and the organization as essential. "If troops are punished before their loyalty is secured they will be disobedient. If not obedient, it is difficulty to employ them" (Chapter 9: 85, Wu, 2001). Second, benevolence must be coupled with discipline through training and deployment. Officers should be benevolent but strict with the soldiers, gain their loyalty, and have a harmonious relationship with them (Chapter 9, Wu, 2001). Such hard-soft tactics, of course, reflect the Daoist way of thinking and are consistent with the paternalistic model. It should be noted, as we did earlier, that in Sun Tzu's strategic situationalism, morale is not merely a function of internal subjective qualities of the organizational members. Organizational and positional advantages outside the person are other ways of inducing psychological advantage.

4.4 Leveraging and Adaptation

While situation-making stresses creating favorable positional, organizational, and psychological situations, taking advantage and adapting to existing situations is also part of strategic situationalism, and this is closest to the contingency approach of

leadership in the West (Fiedler, 1977; Hersey and Blanchard, 1981). In Chinese, leveraging and adaptation are called yin shi, literally meaning "following the situation." Change of operations and tactics in response to emergent situations is a major component of strategic leadership. The emergent situations may present opportunities to be leveraged and constraints to be adapted to. Like Laozi, the master of Daoism, Sun Tzu likens the leader's ability to change to a property of water. Sun Tzu asserts that as water changes its course in accordance with the contours of the terrain so do commanders change their tactics in accordance to the situation. "There is no fixed pattern in the use of tactics in war just as there is not constant course in the flow of water" (Chapter 6: 57, Wu, 2001). The variation and change of tactics are based on understanding all aspects of the situation: the location, the time, the state and condition of one's own army versus those of the opponent's. The key is to understand fully the emergent and the potential favorable and unfavorable factors. It is in the context of adaptation and change that Sun Tzu identifies those five fatal flaws of the commander (Chapter 9, Wu, 2001). These flaws orient the commander to staying on a wrong course because of adherence to some predetermined doctrine, high authority, or emotion.

5 Discussion and Conclusions

We present here the theoretical and practical implications of the Art of war in a global context, following the thoughts of Chen and Lee (2008, p. 165) on this issue. What needs to be emphasized first and foremost is Sun Tzu's non-relational approach to leadership. Admittedly one can see a reflection of the Confucian dyadic model of interpersonal role relationships such as that between the sovereign and the minister and between the parent and the child. Yet, Sun Tzu is mostly concerned with the whole organization: its legitimacy, its systems of operation and administration, the collective followership, or the unity and morale of the organizational members. His unit of analysis and his target of leadership actions are more often than not at the collective rather than the individual or the dyadic levels. His collectivity also tends to be at the highest collectivity level, that is, the overall organization rather than its individual divisions and subdivisions. Such an approach speaks to the Western literature on strategic leadership (Boal and Hooijberg, 2001; Finkelstein and Hambrick, 1996) and contributes to it by emphasizing the creation of external and internal winning environments. The system and situational approach to leadership complements dyadic models of leader-member relationships (Graen and Uhl-Bien, 1995). Leadership in the global context calls not only for cross-cultural relationship-building but also for attention to issues of external and internal environments, system-level adaptation, and collective identification.

Second, Sun Tzu's theory of situationalism provides interesting critiques on the person-situation debate in the organizational behavior literature and on cross-cultural research on cognition. The person-situation debate centers on whether it is individuals' stable internal characteristics or the external situation that determine people's behavior (Davis-Blake and Pfeffer, 1989; Ross and Nisbett, 1991; Salancik and Pfeffer,

1978). Dispositionists believe that the impact of individual characteristics is more significant whereas situationalists believe in the power of the situation. Cross-cultural comparative research on cognition and behavior shows that the Chinese are more holistic in that they see more situational causal factors, whereas Westerners are more analytic and agential as they are more likely to see individual actors as causal agents of events (Nisbett et al., 2001). Both these bodies of literature might suggest that Chinese leaders, relative to their Western counterparts, believe more in the power of situation than in that of individuals, so that Chinese leadership is expected to be less agential, less assertive, or less proactive with regards to situation or environment. This, however, is not what we observe in Sun Tzu's leadership philosophy as manifested in the Art of war. What we observe is that while Sun Tzu does believe in the causal power of the situation he nevertheless also believes in great leaders being masters of situation-making, situation manipulation, and situation leveraging. Sun Tzu's theory of strategic situationalism fits well with the Daoist way of contradictory thinking but in our view has great significance for leadership research and practice as organizations become more complex, dynamic, and global.

The third point of both theoretical and practical importance is Sun Tzu's concept of wisdom and the importance of information. We pointed out that the Chinese concept of wisdom or enlightenment bears some resemblance to the concept of intelligence in Western psychology and leadership (Kirkpatrick and Locke, 1991). But there may be important differences. First, the Western concept of intelligence is a personality trait that is largely hereditary and non-malleable whereas the Chinese concept of wisdom is acquired through continuous study and practice. Second, the Chinese concept of wisdom is also broader than managerial wisdom as conceived by Boal and Hooijberg (2001) or job-related knowledge (Kirkpatrick and Locke, 1991). Most likely the Chinese concept of wisdom is multidimensional and, in Sun Tzu's conceptions, it could be a meta-characteristic of what leadership is about. More conceptual work is needed to refine and specify wisdom and establish its validity in leadership research. Wisdom could very well be the key leader characteristic that accounts for or moderates strategic situationalism.

Another point relating to wisdom is about strategic information-seeking. Lord (2000, p. 304) credited Sun Tzu for "anticipating the information-oriented strategic approach of the contemporary revolution in military affairs" and, we want to add, in the affairs of business and management as well. It can be further argued that if information-seeking becomes the norm, information quality in terms of completeness, relevance, and accuracy and information management may be important factors that affect the effectiveness of strategic situationalism.

Lastly, issues of ethics are becoming more salient as companies are facing greater global as well as domestic competition. Sun Tzu's infamous quote that "war is a game of deception" (Chapter 1: 9, Wu, 2001) needs to be considered in its historical context as well as in the context of war being ridden with conflict and violence. Sun Tzu's aversion to aggression and destruction for the sake of vengeance and his appeal to justice and benevolence reflected the Confucian philosophy of benevolence and humaneness. However, his deception tactics

were severely condemned by Xunzi, a Confucianist contemporary of Sun Tzu, on the grounds of morality and ethicality. It is obvious that Sun Tzu's deceptive tactics are almost always directed toward the enemy but in Chapter 11 (Wu, 2001) he also entertained situations in which the officer needs to be inscrutable and to keep the soldiers ignorant of the military plan and the battle situation, all in the name of maintaining the unity and morale of the army. The question arises of whether, and, if so, to what extent and on what bases, organizations and leaders may use deception or information asymmetry in their transactions with their opponents or their employees. Where should the benchmark of moral and ethical standards in military, political, and business conflicts be set, and should there be different ethical standards for domestic and international conflicts? In summary, future researchers must seriously consider the incorporation of ethics into their model of strategic leadership and must address the ethical challenges raised in Sun Tzu's Art of war.

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Teoretični pomen Sun Cujeve umetnosti vojne za vodenje

V članku je predstavljen voditeljski vidik Umetnosti vojne, ki to kitajsko klasiko umešča v kontekst splošnega managementa in organizacije. Sun Cujeva Umetnost vojne je ena tistih knjig, ki jih lahko uvrstimo v žanr pop kulture. Čeprav je bila njena vsebina v preteklosti skrbno varovana kot državna skrivnost, pa je danes dostopna širšim množicam. V preteklem stoletju se je njena uporaba iz vojskovanja prenesla tudi še na ostala področja človeškega delovanja. Strateški nasveti, ki jih vsebuje, so namreč uporabni ne le za vojskovanje, pač pa tudi v mnogih drugih primerih. Tako v vojni, kot tudi v poslu, je uspeh seveda odvisen od vodenja, zato so v članku identificirane pozitivne in negativne lastnosti vodje v povezavi s strateškim vodenjem. Ljudje so tisti, ki bijejo in zmagojejo bitke; najpomembnejša oseba vsake bitke pa je gotovo general. Medtem ko je množica uspešnih vojskovodij v preteklosti zasluge za svoje zmage pripisovala sledenju Sun Cujevim načelom, pa danes te modrosti preučujejo in uporabljajo vodstveni delavci širom sveta, še posebej v Aziji. Zaradi široke uporabe teh načel v mnogih poslovnih in političnih situacijah je Umetnost vojne še vedno smatrana kot ena najvplivnejših in najpomembnejših del na temo strategije. V članku sta zato predstavljena teoretični ter praktični pomen teorije Sun Cujevega strateškega vodenja v globalnem okolju.

Ključne besede: Sun Cu, vodenje, organizacija

Attitudes Toward Workplace Mobbing in Slovenian Research Organisations

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Creating a “mobbing-safe” working environment can be a real challenge; to achieve it, a better understanding of related constructs is necessary. To obtain insight into researchers’ attitudes toward workplace mobbing and behavioural intentions, we used a case scenario method. The results show that respondents, on average, consider the mobbing cases presented in a questionnaire to be very serious. Their attitudes and behavioural intentions depend more on their opinion about colleagues’ attitudes and related intentions and less on their own, which shows a lower integrity than desired. Low willingness to report the violator, lenient discipline sanctions and the absence of proper organisational rules create favourable conditions for workplace mobbing in Slovenian public research organisations. This paper also proposes measures based on the research findings of various authors and identifies new questions that could be addressed in further research.

Key words: workplace mobbing, organisational culture, integrity, public research organisation, researcher.

1 Introduction

The working conditions in which researchers are employed are also important to the European Commission^{1,2}. Researchers are members of one of the professions most frequently exposed to workplace mobbing³. Slovenian employers are obliged, by Slovenian legislation, to ensure a safe and attractive working environment^{4,5}. With workplace mobbing, this obligation can present a true challenge to employers due to the covert nature of mobbing.

Workplace mobbing has been very difficult to conceptualise due to its covert nature (Leymann, 1990); because of this, prevention measures are not easy. Mobbing can happen to anybody (Yildirim and Yildirim, 2010). In spite of its cov-

ert nature, it cannot remain unnoticed by co-workers. This is also the reason why the attitudes toward workplace mobbing and related behavioural intentions of employees, including top management, have or could have a crucial role in its prevention. This paper, therefore, explores the attitudes toward workplace mobbing cases in public research organisations, the willingness to report the violators, and related factors. It also explores the existence of organisational rules defining mobbing behaviour as a violation and respondents’ beliefs about fair sanctions applied to mobbers. We have searched different electronic databases (Web of Science, SAGE, Science Direct, Elsevier) and have not found any research on such a narrow topic as workplace mobbing in research organisations at national levels that would be comparable to ours. This is also

- 1 European Commission (2005). The European Charter for Researchers and The Code of Conduct for the Recruitment of Researchers, <http://ec.europa.eu/euraxess/index.cfm/rights/europeanCharter>.
- 2 Commission Of The European Communities (2008). Communication From The Commission To The Council And The European Parliament. Better Careers And More Mobility: A European Partnership For Researchers, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52008DC0317:EN:NOT>
- 3 European Foundation for the Improvement of Living and Working Conditions (2005). Violence, bullying and harassment in the workplace, <http://www.eurofound.europa.eu/pubdocs/2006/98/en/2/ef0698en.pdf>.
- 4 Republic of Slovenia (2007a). Zakon o delovnih razmerjih [The Slovenian Labour Code], http://zakonodaja.gov.si/rpsi/r00/predpis_ZAKO1420.html.
- 5 Republic of Slovenia (2007b). Zakon o varnosti in zdravju pri delu [Law on Safety and Health at work], <http://www.iusinfo.si/Register/Besedilo.aspx?SOPI=Z99A5CHT&Datum=2001-08-18%2000:00:00&Doc=Zakoni>.

the reason direct comparisons of our findings with the findings of many respected authors in this field are not reliable due to differences in research questions, population, sample and methodology.

Public Research Organisations in Slovenia and Status of Researchers

Current legislation defines public research organisations as bodies governed by public law, established by the Republic of Slovenia or public bodies authorised by law. That embraces public research and infrastructure as well as higher education institutions. A researcher is a person engaged in research or development activities (Republic of Slovenia, 2006).

Workplace Mobbing

Leymann (1990) describes workplace mobbing as psychological terror in a workplace caused by individual or a group on almost a daily basis, for at least six months, until the victim leaves the organisation or becomes incapable of practicing of his or her profession. Leymann claimed that co-workers or management are responsible for such tragic situations. Different authors used different concepts to describe workplace mobbing. Ståle (1999, 2000) found that different concepts describe same phenomena: the systematic attacking of colleagues, superiors or subordinates.

It can also be said that workplace mobbing is actually a form of deviant or antisocial behaviour, which can be understood as the voluntary behaviour of groups or individuals,

Table 1: Mobbing - definition and terms used by different researchers (Ståle, 2000, pp. 382)

Reference	Term	Definition
Brodsky (1976)	Harassment	Repeated and persistent attempts by a person to torment, wear down, frustrate, or get a reaction from another person; it is treatment that persistently provokes, pressures, frightens, intimidates or otherwise causes discomfort in another person.
Thylefors (1987)	Scapegoating	One or more persons who during a period of time are exposed to repeated, negative actions from one or more other individuals.
Matthiesen, Raknes & Rrökkum (1989)	Mobbing	One or more person's repeated and enduring negative reactions and conducts targeted at one or more persons of their work group.
Leymann (1990)	Mobbing/ Psychological terror	Hostile and unethical communication that is directed in a systematic way by one or more persons, mainly towards one targeted individual.
Kile (1990a)	Health endangering leadership	Continuous humiliating and harassing acts of a long duration conducted by a superior and expressed overtly or covertly.
Wilson (1991)	Workplace trauma	The actual disintegration of an employee's fundamental self, resulting from an employer's or supervisor's perceived or real continual and deliberate malicious treatment.
Ashforth (1994)	Petty tyranny	A leader who lords his power over others through arbitrariness and self-aggrandisement, the belittling of subordinates, showing lack of consideration, using a forceful style of conflict resolution, discouraging initiative and the use of non-contingent punishment.
Vartia (1993)	Harassment	Situations where a person is exposed repeatedly and over time to negative actions on the part of one or more persons.
Björkqvist, Österman & Hjelt-Bäck (1994)	Harassment	Repeated activities, with the aim of bringing mental (but sometimes also physical) pain, and directed towards one or more individuals who, for one reason or another, are not able to defend themselves.
Adams (1992b)	Bullying	Persistent criticism and personal abuse in public or private, which humiliates and demeans a person.

harmful to organisations or employees. Such behaviour is conscious, of different intensities, and always presents the opposite of pro-social and ethical behaviour (Lobnikar et al., 2000). Lobnikar et al. (2000) used the social undermining definition by Duffy (1998; in Lobnikar et al., 2000), who differentiated between social undermining as process and social undermining as behaviour. This description referred to as a process fits the mobbing concept, because it represents the exchange of negative interactions at the workplace and has a gradual, cumulative effect on the attenuation of individual self-confidence, effectiveness, and the ability to achieve organisational goals (Lobnikar et al., 2000).

Mobbing is also similarly defined by Slovenian labour relations law, i.e. as repeated or systematic reprehensible, obviously negative or offensive behaviour, directed against individual employees at the workplace or in relation to work. This paper discusses workplace mobbing in the sense of the aforementioned Slovenian labour relations law definition.

Anyone can become a target of workplace mobbing (Yildirim and Yildirim, 2010). Long-lasting repeating mobbing can cause to a target a great deal of social, psychological and psychosomatic (Leymann, 1990; see also Duffy & Sperry, 2007; Yildirim, Yildirim & Timucin, 2007; Gul et al., 2010; Escartin et al., 2009; UK National Workplace Bullying Advice Line (2006)), economic organisational problems, economic problems of families as well as wider society (Sheehan, 1999; Sheehan, 2004; cf. Enache, 2010). The costs of mobbing can extend to 1-3.5% of the GDP of a country (Hoel et al., 2001).

The consequences of workplace mobbing are the reason this phenomenon has become the subject of so much research in different working environments and contexts. Employees in public, education, health and social organisations are most often exposed to mobbing (Zukauskas and Vveinhardt, 2009; European Foundation for the Improvement of Living and Working Conditions, 2007). This includes researchers in public research organisations. In Turkey, research showed that 90% of academic respondents have spotted workplace mobbing while 17% of them had been mobbed. Because of that, 7% of them think of suicide occasionally and 2% almost always (Yildirim and Yildirim, 2010).

Research on organisational reasons for workplace mobbing show that it is most often a consequence of poor management, high stress levels at the workplace, a low level of decision-making authority (Dolinar et al., 2010, see also Zapf, 1999, Roscigno et al., 2009; Balillien, 2009), negative organisational culture and weak moral principles (Yaman, 2010). Research covering about 1,000 workplaces in the United States of America (Ståle, 1999) shows that for workplace mobbing to appear, it is necessary that the favourable organisational culture allowing and rewarding mobbing behaviour be present. Many other researchers also confirmed the close connection between the organisational culture and climate (Blase and Blase, 2003; Bren and McNamara, 2004; DiMartino, 2003; Davenport, Schwartz, and Elliott, 2003; Einarsen, 1999; Einarsen, Raknes and Matthiesen, 1994; Vartia, 1996; Vickers, 2006; Zapf, 1999 in Yaman, 2010). Vandekerckhove and Commers (2003) had similar findings, concluding that among most important reasons for workplace mobbing were dysfunctional organisational structures and cultures. Particularly

interesting, from the public research organisation's point of view, is a three-year study of 212 mobbed employees in the Australian public sector who eventually left their organisation (Shallcross et al., 2010). The interviewed respondents admitted that they had not shared the same culture with dominant group or they have not been ready to get involved in what they have perceived as destructive, in some cases illegal, behaviour.

An organisation's views about mobbing are communicated by the imposed sanctions, or their absence, for those who are breaking norms and values together with the existence and enactment of anti-mobbing organisational politics (Ståle, 1999). Data collected for the Great Britain show that 85% of managers and 15% of co-workers are mobbers (violators); 84% respondents included in research were convinced that violators had caused mobbing before, and 73% respondents were convinced that the management had known about it (Rayner, 2009). We have not found a report with these kinds of data for Slovenia.

The abovementioned research findings show that organisational culture accompanied by poor management is the key factor of mobbing. This is also the reason that the preparation of measures of any kind, should they be successful, must be based on knowledge about an existing organisational culture (Bluedorn and Lundgren, 1993; in Parker and Bradley, 2000). As in approaches for prevention of corruption, which may be linked with workplace mobbing (Kečanović, 2008) and in which the responsibility for creation of environment that encourages integrity and professional culture with no tolerance for corruption is emphasised (Haberfeld et al., 1999), we can similarly say that it is the obligation of organisations to create an environment that encourages integrity and professional culture, with no tolerance for workplace mobbing.

Existing research has contributed enormously to the understanding and conceptualisation of the mobbing phenomena, and the understanding of causes, consequences as well as mobbing frequency and risk groups in different environments. Review of existing research gave insight into three organisational dimensions, which reflect organisational culture, similar to those that have been examined in cases of corrupt behaviour in Slovenia and internationally (Haberfeld et al., 1999; Pagon et al., 2003; Mevc, 2005), namely: the existence of organisational rules (rules communication and understanding), the approach to control (organisational actions, prevention activities) and the existence of informal rules. All three of these could be used to protect potential mobbing victims and to increase the willingness to report mobbing. Our research is informed by approaches used in the research of corruption; both mobbing and corruption are actually forms of deviant behaviour that match the aforementioned definition of deviant behaviour as a process (Lobnikar et al., 2000). Mobbing, as well as corruption, cannot remain unspotted while the management is obliged to prevent it.

This paper explores whether organisational culture in Slovenian public organisations protects mobbers, which factors and how influence the respondents' attitudes about workplace mobbing, their behavioural intentions and their integrity. It examines willingness to report the violators, i.e. whistleblowing.

It first gives a basic description of related theoretical concepts, important for a proper understanding of the research results and the recommended actions. Related concepts are only briefly presented, since a broader presentation would exceed the space limits of this paper.

Ethical Organisational Culture, Ethical Climate and Ethical Behaviour

There are many different definitions of organisational culture: as the way that groups of people are solving problems (Trompenaars, 1993; in Smit and Schabracq, 1997); a glue that binds organisations together (Baron, 1994; in Lomas, 1999); that which incorporates the beliefs and behaviours that are existing in different levels and manifest itself in different forms of organisational life (Hofstede et al., 1990; in Rashid et al., 2004); they refer to a number of commonly shared beliefs, assumptions and practices that form and direct the attitudes and behaviour of organisational members (Davis, 1984; Denison, 1990; Kotter and Heskett, 1992; O'Reilly and Chatman, 1996; Wilson, 2001; in Rashid et al., 2004); organisational cultures are complex combinations of formal and informal systems, processes and interactions (Cohen, 1993; in Ardichvili et al., 2008). A deeper level of cultures is reflected through stable ways of solving problems and interpersonal relations among employees on various hierarchical levels (Rothwell and Scedl, 1992; Kanter et al., 1992; in Brunetto, 2001).

Ethical organisational culture stimulates the organisational environment, which is directed by common values and beliefs (Trevino, 1990; in Ardichvili et al., 2008). Moreover, it is not expected that employees distinguish between what is right or wrong as a basic minimum, but also, most importantly, to explore and perform ethical decisions even when all possible decision options seem correct (Ardichvili et al., 2008). Accordingly to Ardichvili et al. (2008), in ethical organisations managers walk their talk and are role models to the other organisational members, who (when ethical issues are discussed) gather facts and act without retaliation while the construction and maintaining of ethical culture entirely depends on top management, who require ethical behaviour on each hierarchical level.

The ethical climate is the abstract of individually perceived ethical norms in an organisation (Cullen, Victor and Bronson, 1993; in Rothwell and Baldwin, 2006). It is an ethical dimension of organisational culture, which is perceived by organisational members as an organisational ethical identity (Victor and Cullen, 1988, in Rothwell, Baldwin, 2006).

Cultures that accept improper or illegal acts as normal ensure the logic of corruption (Misangyi et al., 2008; in Miceli et al., 2009). The creation and maintaining of a positive culture in the long term can be roughly described as achieved by human resources policies and systems for examining and responding to appeals (Miceli et al., 2009).

At this point, we must also mention the mistaken notions of leaders regarding the sense and usefulness of ethics and morality in business environment (Cooke and Ryan, 1988; in Pagon and Lobnikar, 1996):

- a) Ethical behaviour is not compatible with economic profit;
- b) Ethics deals with higher, absolute standards of good and evil, which is why it is useless for daily decision-making in uncertain situations;
- c) Business ethics is the same as corporate social responsibility, which is why the moral responsibility of managers is shown particularly in what and how much a company contributes to the development of the environment in which it works;
- d) A line can be drawn between private and business life, which is why someone can be highly moral in his private life while in his professional one he is subordinated to "game rules", which are valid in certain circumstances;
- e) Business ethics and morality cannot be learned; a person either has moral values or does not, which is why education in field of ethics is pointless.

As one of the main reasons for the persistence of the abovementioned mistaken notions, Pagon and Lobnikar cite a lack of education and training in the field of ethics and morality. Students should be taught not only managerial skills but also principles about what is right and wrong (Palmer, 1986; in Pagon and Lobnikar, 1996). Not only students, but also managers should be trained in ethical decision-making in daily work.

Ethical Whistleblowing

Whistleblowing is the willingness to report violators, those who might be co-workers, organisational members, in cases when his or her actions deviate from existing norms, while in practice the complainant is viewed with more suspicion than the reported alleged violator (Gadlin, 1998). This is understandable, because the whistle blowing policy is often in conflict with three assumptions of organisational life: the accountability of professional standards, the culture of collegiality, and the loyalty to institution (Gadlin, 1998). After reporting a violation, it is possible that the report is not taken into account at all or that a management take appropriate actions corresponding to report; or it is also possible that management can reward the informant or take retaliatory measures against him or her (Mesmer-Magnus and Viswesvaran, 2005). Retaliatory measures can be different: movements between different jobs or different forms of social undermining (Alford, 2001; De Maria, 1999; Dempster, 1997; Glazer and Glazer, 1989; Hunt, 1995, 1998; Miceli and Near, 1992; Miethe, 1999; Vinten, 1994, in Brian, 2003; Parmerlee et al., 1982; in Mesmer-Magnus, Viswesvaran, 2005). Observers in organisation are most affected by the events that follow the report (Near and Miceli, 1986; in Mesmer-Magnus and Viswesvaran, 2005). Different organisational cultures have different impact on the willingness to report violations; the most important are the consequences of the reporting (Miceli et al., 2009).

Integrity

"Integrity" is often used in management literature as term with a different meaning than that in philosophy and other

areas (Palanski and Yammarino, 2007). Integrity is especially important in the environments in which people work or live together (Kaptein, 1999). The Slovenian Integrity and Prevention of Corruption Act⁶ defines integrity as “the conduct and responsibility expected of individuals and organisations in the prevention and elimination of risks related to the use of any authority, office, mandate or any other decision-making power contrary to the law, legally admissible objectives and codes of ethics”. In this paper, integrity is understood in sense of Vicchio’s view: firstly, that individuals have reasonably consistent and relatively stable sets of moral virtues; secondly, that these moral virtues are reflected in the deeds and speech of these individuals (Vicchio, 1997; in Pagon et al., 2003). Rules give concrete meaning to integrity: they explain which behaviour is unacceptable and which one is desired (Paine, 1994, in Kaptein, 2003).

Ethics Position in Research and Among Researchers in Slovenia

The question of ethics is of extreme importance, both in research and among researchers. The commission of the Republic of Slovenia for Medical Ethics, and the Ethics Commission for Animal Experiments deal with questions related to ethics in research. The rest of areas related to research activities are at least partially subject to further codes of moral integrity and good practice in science (Resolution of Research and Innovation Strategy of Slovenia 2011–2020; in continuation: ReRISS)⁷. One of the many ReRISS tasks to be accomplished by 2020 is ensuring a high level of ethics among researchers at their work as well as in broader context.

2 Method

We have explored the respondents’ perceptions of severity of workplace mobbing in public research organisations, their knowledge of related organisational regulations, whether the mobbers are protected by the ‘code of silence’ (in other words, the respondents’ willingness to report mobbing), what their attitudes regarding disciplinary measures for workplace mobbing are, and if, in their opinion, the mobbers are properly sanctioned.

A scenario method has been used to avoid questions about concrete cases, which respondents have witnessed or taken part in. A more detailed description of the method used is presented in continuation.

2.1 Sample

The researchers who anonymously took part in this research were employed in Slovenian public research organisations, which are legal entities (Republic of Slovenia, 2006) and whose founder is Republic of Slovenia (including universities). The data of the Statistical Office of the Republic of Slovenia show that 8,077 researchers were employed in such public research organisations in 2008⁸, which represents more than half (55.28%) of all Slovenian researchers, including experts and technical personnel involved in research activities.

We randomly selected 2,060 e-mail addresses, some of which were published on web pages of different public research organisations or published in the Slovenian Current Research Information System (SICRIS). Some of the collected e-mail addresses were incorrect, which is why we asked for the support of the three largest Slovenian universities. They responded positively and distributed the questionnaire among their research personnel with a request to forward it to their colleagues as well. That is the snowball principle, which is why it is impossible to define the percentage of response.

In whole or in part, 898 questionnaires were completed, which represents 11.12% of the population of researchers. 511 completed questionnaires were used in subsequent analyses, which represent 6.32% of the total population (8,077). We are convinced that we would have received many more completed questionnaires if we would have had a higher number of possible simultaneous accesses to the computer server where the questionnaire database was hosted. We increased the number of possible simultaneous accesses from 15 to 35 after we received the e-mails stating that the access to the questionnaire was not possible. Our assumption is that respondents answered the questions truthfully according to their best knowledge.

Demographic features of the sample are presented in Table 1 below.

Table 1: demographic features of the sample

Demographic features	Frequencies	Percentages
Gender		
Female	263	51.5
Male	248	48.5
<i>N</i>	511	100.0
Education		
Bachelor’s degree	144	28.2
Specialisation	6	1.2

6 Republic of Slovenia (2011). Zakon o integriteti in preprečevanju korupcije [Slovenian Integrity and Prevention of Corruption Act], <http://www.uradni-list.si/1/objava.jsp?urlid=201169&stevilka=3056>.

7 Republic of Slovenia (2011). Resolution of Research and Innovation Strategy of Slovenia 2011–2020 [Resolucija o raziskovalni in inovacijski strategiji Slovenije 2011–2020], <http://www.uradni-list.si/1/content?id=103975>.

8 Republic of Slovenia, Statistical Office of the Republic of Slovenia (2010). Statistični letopis [Statistical Yearbook 2010], http://www.stat.si/letopis/2010/07_10/07-03-10.htm.

Master's degree	67	13.1
Doctorate	294	57.5
<i>N</i>	511	100.0
Working period (in years)		
0–9	209	40.9
10–19	140	27.4
20–29	94	18.4
30–39	60	11.7
40–49	7	1.4
50+	1	0.2
<i>N</i>	511	100.0
Age		
20–30	127	24.8
31–40	169	33.1
41–50	128	25.1
51–60	72	14.1
61–70	15	2.9
<i>N</i>	511	100.0

2.2 Instrument

As the basic instrument of our research, we have used a modified version of the questionnaire that had been previously used for the study of police integrity in the United States of America, Croatia, Poland, and Slovenia (Haberfeld et al., 1999) and later adjusted for the examination of corrupt behaviour in Slovenian public administration (Mevc, 2005). We have added those factors that we believed were related with the attitudes of researchers toward workplace mobbing. The factors are divided into general and special factors.

General factors are:

- gender,
- education,
- age,
- total amount of work experience,
- work experience in a public research organisation, and
- job title (position).

Special factors are:

- respondent's own experience of workplace mobbing,
- respondent's opinion about co-workers' experience of workplace mobbing,
- attitudes toward violation of organisational rules,
- attitudes toward deserved sanctions,
- attitudes toward sanctions that would actually be assigned,
- respondent's own willingness to report the violator, and
- respondent's opinion about co-workers' willingness to report the violator.

The questionnaire contains six cases of workplace mobbing (Table 2). The cases refer to a case of a hospitalised researcher, allegations of plagiarism, an attempt to stop the cooperation of a researcher with a foreign research organisation, the allocation of a course to a less appropriate candidate with the simultaneous rejection of the more appropriate one, the systematic social undermining of six researchers and the denial of their promotion, and the termination of a researcher's employment and the ignoring of a court verdict.

The cases used in research are based on stories that have been recounted by researchers' from their own experience. During collection of completed questionnaires, many researchers who participated in research confirmed that presented cases were unfortunately similar to events that very often occur in their organisations. One researcher said that so many cases of mobbing had been swept under the carpet that it "looked like the Alps".

Each of the six cases was followed by questions regarding the following attitudes and intentions of respondents:

- **Respondents' belief about severity of workplace mobbing.** This variable was measured with the question: "How severe is such behaviour in your opinion?" Possible answers of the respondents were presented on a five-point Likert scale (1– Very Mild, 5 – Very Serious). In the context of studying mobbing, we considered the replies to these questions as an indirect measure of respondents' moral standards. We are convinced that for individuals with higher moral standards such behaviours and phenomena are perceived more seriously than for those with lower moral standards.
- **Respondents' belief regarding co-workers' opinions about the severity of workplace mobbing.** For the purposes of measurement of this variable, we used the question: "How severely would, in your opinion, the majority of your co-workers evaluate such behaviour?" Possible replies were same as with the previous question.
- **Respondents' willingness to report the violator.** This variable was measured with the question: "Would you report the superior?" Possible replies were introduced on a five-point Likert scale (1– Definitely Not, 5 – Certainly). The obtained result was counted as a measurement of the behavioural intent of the respondents about reporting mobbing and, by doing so, protecting the mobbing target(s).
- **Respondents' belief about co-workers' willingness to report the violator.** This belief was measured with the question "Would, in your opinion, the majority of your colleagues report the superior?" Possible answers were same as with previous question.
- **Belief about violation of organisational rules of respondent's organisational unit.** This variable was measured with the question: "Would such behaviour be considered a violation of rules in organisational unit where you are employed?" The respondents answered according to a five-point Likert scale from 1 (Not at All) to 5 (Very Much), or with "No, because such rules do not exist."
- **Belief about appropriate discipline.** In order to measure a belief about proper discipline, we used the question:

Table 2: *Mobbing cases used in questionnaire*

No.	Description
1	A researcher works for more than one year in increasingly difficult working conditions. The superior gives her more and more obligations with unreasonably short deadlines. During the fulfilment of assigned obligations, in which also other co-workers were included, she encounters intractable barriers. The superior does not help her, although able to do so. In time, visible signs of physical exhaustion appeared, accompanied by increasing psychophysical difficulties, about which her superior is insensitive. The researcher is hospitalised due to health issues. When she receives a bouquet of flowers from her superior, as a form of silent ridicule, her health condition worsens. Please, evaluate the behaviour of researcher's superior.
2	A researcher receives a fellowship for research work in Japan. His superior tries to ruin his relationship with the Japanese partner, accusing him of plagiarism of published scientific research works, while sending the researcher's superior in Japan documentation supposedly proving the accusations. Upon his arrival from Japan, his superior refuses to recognise his excellent research results at deserved habilitation and promotion. The superior also prevents the payment of contractual funding of costs incurred by related activities of the research work in Japan. The superior also degrades the researcher with a document that supposedly proves students' negative opinions about his teaching work. The students' opinion is related to the period of the researchers' work in Japan. Please, evaluate the behaviour of the superior.
3	After two-and-a-half years, a researcher returns to his home research organisation with excellent, financially significant results, which makes his superior jealous. When researcher submits his application to obtain the title of Assistant Professor, his superior calls him to a conversation in which he recommends the researcher withdraw the application and rather apply for research position. The researcher insists on his application for the title of Assistant Professor, to which his superior replies that would be better for him not to apply for this title otherwise he will be meeting him in "many faces and forms". At first, the researcher cannot grasp what his superior really means. Soon he discovers that the superior's forecast relates to individuals they both have in common on more important positions in different local research organisations and individuals in organisations that are suppose to protect the researcher. Please, evaluate the behaviour of the superior.
4	The application of a researcher for election to a teaching position is (despite fulfilling all necessary criteria) denied by commission, the chair of which is his superior. Following the instructions of same superior, it is also decided that application for a subject area be denied, despite of the fact that researcher's results in scientific research are very high, even according to international benchmarks. Furthermore, the subject is assigned to a person with insufficient knowledge of it. This person frequently asks for help from the abovementioned researcher. Please, evaluate the behaviour of the superior.
5	A researcher occasionally notices that his co-workers do not feel comfortable talking to him and that they are noticeably avoiding him. He helplessly observes how more and more rumours, lies and accusations are spread about him. Slowly, he determines their source: his superior. In the entire research organisation: he finds only five researchers with whom he can have a conversation without visible discomfort on their part. He notices over time that these five are sharing with him a similar destiny of lack of recognition of research achievements, rumours, destroying of partner relationships and a general undermining of their research and teaching work, rejections of applications for deserved position progress. He recognises that research achievements for deserved promotion are not sufficient and that they are much less important than the readiness to cooperate, support and agree with all superior's activities. If a researcher does not agree with him or refuses to work outside the contractually defined volume of work, the superior immediately recognises such a researcher as someone who is "against him" with which the researcher becomes a target of workplace mobbing. Please, evaluate the behaviour of the superior.
6	A day before Christmas Eve, the superior gives a researcher a work booklet as symbolic gift and that seems to be a silent mockery of his moral values. With this, without a real reason, he suspends the working relationship and ends years of degradation, the devaluation of research achievements in international benchmarking, social isolation, the spreading of rumours and the inciting of co-workers. The researcher decides to press charges against employer in court. Soon afterward, he notices that he is being followed by a car. He also notices the same car during the night close to his home. He writes down the licence plate number. The next day, he notices the same car in the parking place of his ex-employer. Appalled, he discovers that his ex-co-worker is stalking him. Later, this co-worker admits that he has been stalking him because he has been told to do so by his superior. The next shocking finding for the researcher is that his attorney has been working for him since very beginning because the researchers' superior told him to. The superior has been kept informed about all confidential information about researcher. The researcher also finds out that even the trade union representative who had helped him to "get a good attorney" is following orders by the same superior. He changes his attorney. The court decides in favour of the researcher and orders his ex-employer to immediately re-employ the researcher. The ex-employer does not recognise the court's verdict and does not re-employ the researcher. Please, evaluate the behaviour of the superior.

“Which sanctions, in your opinion, should the superior receive?” The possible answers were: 1 – None, 2 – Verbal Warning, 3 – Written Warning, 4 – Financial Penalty, 5 – Suspension, 6 – Termination of Employment. These sanctions are reflections of the Law on State Employers⁹ and the Law on Civil Servants.¹⁰

- **Belief about actual discipline.** As measurement of this belief, we used the question: “Which punishment, in your opinion, would the superior actually receive?” Possible answers were same as with previous question. Replies to this question helped to estimate the respondents’ conviction if punishments for such behaviour existed and if they were fair.

The Chronbach’s Alpha coefficients, presented in the Table 3 below, show an acceptable internal consistency of the questionnaire.

Table 3: Chronbach’s Alpha coefficients

Special factors:	Chronbach’s a
Respondent’s own experience of workplace mobbing	0.789
Respondent’s opinion about co-workers’ experience of workplace mobbing	0.882
Attitudes toward violation of organisational rules	0.884
Attitudes toward deserved sanctions	0.905
Attitudes toward sanctions that would actually be assigned	0.895
Respondent’s own willingness to report the violator	0.830
Respondents’ opinion about co-workers’ willingness to report the violator	0.820

For each question, we have calculated the average value of the responses for all cases and in this way obtained seven derivative variables, which we then used in all subsequent statistical analysis. We have analysed the replies with the statistical program SPSS, version 18.0; this paper presents the results of descriptive statistics and regression analyses.

It should be mentioned here that some of our variables are ordinal in nature (such as discipline sanctions). We included them in our regression analyses anyway, in line with the claims of several authors (e.g. Allan, 1976; Borgatta, 1968; Kim, 1975, 1978); Labovitz, 1967, 1970; O’Brien, 1979 – all cited in Winship and Mare, 1984) that multivariate methods for interval-level variables should be used for ordinal variables, because the power and flexibility gained from these methods outweigh the small biases that they may entail. As not everybody agrees with this assertion, our results regarding the ordinal variables should be treated with caution (see Winship and Mare, 1984, for an in-depth discussion).

3 Results

The results show that, on average, researchers in public research organisations consider mobbing to be very serious. The average for respondents’ own opinion is almost five (on a scale from 1 – 5).

The failure to respect a court verdict in the case of a fired mobbed researcher is recognised as the superior’s worst violation. Closely following were the cases of false accusations of plagiarism of research work and spreading slanderous rumours to foreign partners of the aforementioned research work.

The average scores for severity, as assigned to their co-workers by the respondents, are lower in all six cases. Differences in the average of the respondents’ own perception of mobbing and levels that respondents believe their co-workers perceive mobbing are statistically significant in all six cases. The same results also show in the comparisons of respondents’ own willingness to report violators and their beliefs about their co-workers’ willingness. Respondents believe that their willingness to report a violator is higher than

Table 4: The average scores, standard deviation, t-test results – presented by individual cases and for all cases together:

- Respondents’ own perceptions of mobbing severity in comparison to their beliefs of co-workers’ perception,
- Respondents’ own willingness to report the violator in comparison to their beliefs of co-workers’ willingness to report,
- Respondents’ belief of actual discipline in comparison to deserved discipline.

Case No.:	Own belief of mobbing severity		Perception of co-workers’ belief		t-test		Own willingness to report the violator		Perception of co-workers’ willingness		t-test		Belief of actual discipline		Belief of deserved discipline		t-test	
	Average	Std. dev.	Average	Std. dev.	t	p	Average	Std. dev.	Average	Std. dev.	t	p	Average	Std. dev.	Average	Std. dev.	t	p
1.	4.35	0.89	3.59	1.08	14.959	0.000	3.05	1.16	2.21	1.04	17.980	0.000	1.45	0.76	3.91	1.31	39.663	0.000
2.	4.80	0.62	4.10	1.09	15.877	0.000	3.90	1.13	2.92	1.24	20.426	0.000	1.98	1.22	4.95	1.13	46.204	0.000
3.	4.47	0.82	3.60	1.14	17.587	0.000	3.32	1.16	2.40	1.12	18.381	0.000	1.5	0.99	4.22	1.36	40.384	0.000
4.	4.49	0.78	3.60	1.13	17.205	0.000	3.42	1.18	2.51	1.12	17.352	0.000	1.57	0.96	4.19	1.32	36.940	0.000
5.	4.41	0.82	3.43	1.19	16.631	0.000	3.20	1.19	2.41	1.08	14.526	0.000	1.49	0.94	4.19	1.35	37.504	0.000
6.	4.89	0.43	4.29	0.98	12.933	0.000	4.40	0.99	3.36	1.28	17.874	0.000	2.71	1.71	5.56	0.89	32.188	0.000
Average	4.57	0.73	3.77	1.01	19.973	0.000	3.55	1.13	2.63	1.15	22.026	0.000	1.78	1.09	4.50	1.22	49.989	0.000

9 Republic of Slovenia (1990). Zakon o delavcih v državnih organih [Law on State Employers]. http://zakonodaja.gov.si/rpsi/r00/predpis_ZAKO280.html.

10 Republic of Slovenia (2002). Zakon o javnih uslužbencih [Law on Civil Servants]. http://zakonodaja.gov.si/rpsi/r07/predpis_ZAKO3177.html.

that of their co-workers. We can say that respondents are convinced that they are morally more sensitive in comparison to their co-workers. However, as showed by regression analysis, their willingness to report the violator is influenced mostly by the opinions of those who are, in their eyes, less morally sensitive, i.e. their co-workers. The more sure they are about their co-workers' willingness to report the superior, the more ready they are to report the violator.

In all six cases, the disciplinary actions that the violator in the presented cases would receive are (in the opinion of respondents) lower in comparison to the sanctions that the respondents believe that violator should receive. On average, the violator would receive a written warning while respondents believe that they should be suspended.

Table 5: The average scores and standard deviations for organisational rules violation

Case No.:	Average	Std. dev.
6	3.75	2.17

2	3.20	2.07
4	2.66	1.88
3	2.57	1.86
1	2.30	1.78
5	2.25	1.67
Average	2.80	1.91

Almost half of the respondents replied that the described behaviour would not present violations of organisational rules because they do not exist. The average for all cases is 2.80, while the scores for individual cases are rather dispersed (standard deviation is 1.91).

We further performed regression analysis, to examine which factors most influenced attitudes toward workplace mobbing; the willingness to report the violator and what proportion of variance was explained by factors, which were

Table 6: Hierarchical regression analysis for own beliefs about workplace mobbing severity as a dependent variable – average for all cases

Factor – variable	β values and ΔR^2 models	
	1	2
Gender	-0.16 ^b	-0.07 ^d
Age	0.52 ^c	0.28 ^d
Education	0.01	0.03
Years of service	-0.48 ^c	-0.33 ^c
Years of service in public research organisation	0.00	0.12
Job title (position)	-0.13 ^d	-0.09 ^d
How severe would, in your opinion, the majority of your co-workers view such behaviour?		0.44 ^b
Would, in your opinion, your co-workers report the superior?		-0.33 ^b
To what extent would such behaviour be a violation of the rules in your organisational unit of employment?		-0.01
What punishment, in your opinion, should the superior receive?		0.41
Which punishment, in your opinion, would the superior actually receive?		-0.14 ^b
Would you report the superior?		0.34 ^d
R2	0.04^c	0.50^b
ΔR^2	0.04^c	0.46^b

^a $N=511$

^b $p < 0.0001$

^c $p < 0.01$

^d $p < 0.05$

Table 7: Hierarchical regression; own willingness to report the violator as a dependent variable – average for all cases

Factor – variable	β values and ΔR^2 models	
	1	2
Sex	0.08	0.05
Age	0.35 ^d	0.12
Education	-0.01	-0.04
Years of service	-0.07	0.14
Years of service in public research organisation	-0.28 ^c	-0.18 ^c
working post/title	-0.03	0.02
How severe is such behaviour, in your opinion?		0.36 ^b
How severe would, in your opinion, the majority of your co-workers estimate such behaviour?		-0.30 ^b
Would, in your opinion, your co-workers report the superior?		0.66 ^b
To what extent would such behaviour be a violation of the rules in your organisational unit of employment?		0.04
What punishment, in your opinion, should the superior receive?		0.14 ^b
Which punishment, in your opinion, would the superior receive?		0.04
R2	0.04^c	0.67^b
ΔR^2	0.04^c	0.63^b

^a $N=511$

^b $p < 0.0001$

^c $p < 0.01$

^d $p < 0.05$

divided in two groups: demographic factors and specific factors (beliefs).

4 Discussion

Similar to findings of other researchers about the severity of different kinds of workplace mobbing (Escartin et al., 2009; Rodríguez-Carballeira et al., 2010) and in accordance to our expectations, the researchers in our study considered workplace mobbing to be very serious. The ignoring of a court verdict was perceived as the most severe; closely followed by false accusations of plagiarism of research and slandering of a researcher to foreign partners. The perceived severity of other mobbing cases was, on average, only slightly lower. Despite that, the willingness to report the violator was lower. Respondents' perceptions depended on their beliefs of how

their co-workers would perceive the severity of cases. The violators were not, according to the respondents, sufficiently punished; with the increasing perceptions of the severity of cases the punishment even declined. Almost a half of the respondents believed that there were no organisational rules by which the presented cases would constitute a violation of workplace rules, while the rest of them were convinced that cases did not present a serious violation of existing organisational rules.

The demographic characteristics of the sample of researchers in public research organisations accounted for 4% of variance, while specific factors (beliefs) accounted for 46% of variance of the dependent variable "own belief of severity". Results show that women, on average, perceived mobbing more severely, which is probably related to their position in organisations¹¹ and sense of security. Such results were expected, since Eurofound research shows that, irrespective of age, women are mobbed more often than men (European

¹¹ The position of women in science is monitored by the Slovenian Commission for Women in Science, established at the Ministry for Higher Education, Science and Technology (http://www.mvzt.gov.si/si/delovna_podrocja/znanost_in_tehnologija/dejavnost/zenske_v_znanosti/dejavnosti_komisije/).

Foundation for the Improvement of Living and Working Conditions, 2007).

Older respondents in public research organisations (on average) perceived mobbing more severely than younger respondents; those in less-valued working posts perceived described mobbing cases more severely than those in higher-valued working posts. Respondents' perceptions of mobbing severity declined with increasing of total number years of service, which is quite surprising.

On basis of results of attitudes toward mobbing severity, we would have expected that those who most severely perceived mobbing were also the most ready to report the violator: women, older workers and respondents in lower-valued working posts. The results show that those demographical factors actually did not have statistically significant influence on the willingness to report the violator. All demographic factors together only explained 4 % of variance of dependent variable "own willingness to report the violator", while specific factors (beliefs) explained 63% of it.

The willingness to report the violator declined with increasing of years of service in the same public research organisation. The respondents' attitudes might be influenced by the experience of their own social weakness or safety. Gadlin (1998) found that in practice the one who reports is viewed with more suspicion than a violator who is reported; furthermore, the willingness to report the violator is in contrast with the culture of collegiality and loyalty to the institution as assumptions of organisational life. In case of longer working period in the same public research organisation, social networks are naturally developed in different circles of the public and private sectors, since a researcher's profession offers variety of possible career opportunities¹². The next possible factor is that respondents with experiences in such cases within their organisation determine over time what the actual management responses to the applicant and to the reported violations are. The influence of different factors on lower willingness to report by those with longer working periods in the same public research organisation should be examined in further research.

Demographic factors only explained 4% of variance of dependent variable "own willingness to report the violator", while special factors (beliefs) accounted for 63% of variance.

While respondents perceived themselves to be more morally sensitive compared to their co-workers, regression analysis shows that respondents' opinions were mostly influenced by their opinion of their co-workers' beliefs and behavioural intentions. This finding could be used for increasing the workplace mobbing awareness and the willingness to report mobbing. We can expect a higher willingness to report the violator if we enforce the severity beliefs about co-workers and their willingness to report workplace mobbing. It is important to emphasize the right information about the seriousness and consequences of workplace mobbing, as well as desired behavioural intentions, while we must not neglect the importance of management reaction and support mechanisms that

prevent retaliation (Mesmer-Magnus and Viswesvaran, 2005, Miceli et al., 2009, Near and Miceli 1986, in Viswesvaran, 2005).

On basis of replies to the questionnaire, as well as comments received by e-mail, we can assume (on average) inappropriate management responses to workplace mobbing cases. In the respondents' opinion, the actual discipline was declining with severity of workplace mobbing; their own beliefs of severity and of actual discipline were significantly negatively correlated. Violators were, in the respondents' opinion, not disciplined properly, which also explains why actual discipline was not significantly related to respondents' willingness to report the violator; perceived differences between the punishment that violator deserved and actually received were also confirmed by significant t-test results. On the other hand, the higher the punishment that (in the opinion of respondents) the violator should receive, the higher was the respondents' willingness to report the violator.

The perceived reason for overly mild discipline of violators should be examined in further research. However, it might be possible that managers know that workplace mobbing is happening and they tacitly consent or they even cooperate in it (Rayner, 1999). The organisational attitude to workplace mobbing is communicated by the sanctions that would be assigned to the violator of norms and values together with the existence and enactment of organisational politics against mobbing (Ståle, 1999), which can be indirectly seen in the indulgent attitudes that public research organisations and their management have in relation to violators. Almost half of the respondents in our research said that there were no organisational rules by which the presented cases would be seen as violations; where such rules existed, the cases would not be considered severe violations. It is also possible that respondents were not informed about those rules. Furthermore, it is possible that respondents believed that workplace mobbing was practically allowed since violators would not receive proper sanctions or that violator's benefits were higher than costs or received punishment (Bjorkqvist, 1994; Rayner and Hoel, 1997; in Rayner, 1999). Speculating in this direction, even on the basis of research implemented abroad, is also meaningful because of the comments received by e-mail to the address published in the questionnaire. During the survey, many various responses arrived. While many reacted out of their distress, looking for help and asking what they could do to alleviate their long-term suffering, of even greater concern were the diametrically opposite responses. Some were convinced by their own experiences that mobbing was the only way to keep only the best personnel and to get rid of inappropriate employees. That suggests that workplace mobbing already is the part of organisational culture, and is wrongly perceived as strong management and as an effective way to get things done and problems solved.

Mobbing is anything but effective workplace management; rather, it is a very costly management response to leadership and organisational problems. Cultures that normalise

12 Commission of the European Communities (2003). Communication from the commission to the council and the European parliament. Researchers in the European research area: one profession, multiple careers, http://ec.europa.eu/research/fp6/mariecurie-actions/pdf/career-communication_en.pdf.

illegal behaviour ensure the logic of corruption, which is best addressed by outsourcing the task to consultants to review top management, to eliminate such behaviour and to prevent the appearance of new ones (Misangyi et al., 2008; in Miceli et al., 2009).

Organisations that encourage "moral muteness" do not encourage the development of moral integrity (Weaver, 2006; in Miceli et al., 2009), which would lead to more moral interpersonal relationships among employees. If we want to increase the willingness to report violators, we have to create appropriate environment and culture, which will build positive moral identity among employees in the long term (Miceli et al., 2009; cf. Haberfeld et al., 1999) and which will not be tolerant of workplace mobbing. The creation and maintenance of ethical culture depends on top management, which requires ethical behaviour in single hierarchical level (Ardichvili et al., 2008).

The extent, to which the respondents' own beliefs are influenced by their perception of their co-workers' opinions, is a reflection of lower than desirable integrity. That is probably a reflection of the general situation, since few organizations are dealing with education and training programs that would encourage the integrity of employees. It would be ideal if employees' own perceptions of severity and their own willingness to report violators were most strongly correlated. In such a case, the behavioural intention would reflect actual attitudes and beliefs, respondents' moral norms and the integrity of individual (Vicchio, 1997; in Pagon et al., 2003), which have a special meaning where people work together (Kaptein, 1999). In order to gradually come closer to this condition, it is necessary to create an organisational environment and culture in which the integrity of the individual is encouraged and in which the individual is protected from retaliation. As it has already been mentioned, integrity is given a concrete meaning by rules that explain which behaviour is acceptable and which not (Paine, 1994; in Kaptein, 2003).

A quite interesting connection revealed by regression analysis is that respondents' beliefs regarding co-workers' opinion on the severity of mobbing cases were significantly negatively related to their own willingness to report the violator, which means that the higher the perceived co-workers' opinion about the severity of mobbing case was, the less they were willing to report the violator (and vice versa). This negative relationship should be investigated by further research.

One of the reasons for these findings might be a lack of on-the-job training related to a system of values and integrity development in public research organisations (cf. Mevc, 2005). Training is also insufficiently linked to workplace mobbing awareness, its consequences for violators, mobbing targets, organisations and wider society.

Despite the fact that we have modelled a research approach for workplace mobbing on corruption research in police forces (Haberfeld et al., 1999; Pagon et al., 2003) and in Slovenian public administration (Mevc, 2005), our results are not compared with results of that research because of differences in the nature of the examined phenomena of workplace mobbing and corruption as well as differences in the observed populations.

Recommendations

We would recommend that public research organisations prepare policies and systems of human resources management that establish and maintain a positive ethical organisational culture and climate as well as systems for the prevention of and responses to received reports of mobbing (Miceli et al., 2009). Because the establishment and maintenance of ethical culture depends on top management, who should require ethical behaviour at each organisational level (Ardichvili et al., 2008), management training for ethical decision making in everyday work is highly recommended (Pagon and Lobnikar, 1996) as well as developing leadership and managerial skills, especially in the field of emotional intelligence (Sheehan, 1999).

On the basis of research findings, we would also recommend, similarly to other authors (Yildirim, Yildirim and Timucin, 2007; Escartin, 2009; Roscigno et al., 2009; cf. Mevc, 2005; Dolinar et al., 2010), increasing the awareness of employees at all levels about possible forms of workplace mobbing and the implementation of strategies and codes that will define procedures involved in dealing with workplace mobbing in different roles and at all levels. All messages, written and verbal, but especially acts, should express zero tolerance for workplace mobbing, since organisational mobbing attitudes are expressed with sanctions for violators together with the existence of preventive, anti-mobbing politics and strategies (Ståle, 1999). It is very important to put into practice what is written for (at least) two reasons: first, in this way violators can get the message that workplace mobbing simply does not pay off, since sanctions will not be mild or merely symbolic; second, because the management response to reports on mobbing as well as the events that follow have strong impact on observers in the organisation (Miceli et al., 2009; Mesmer-Magnus and Viswesvaran, 2005).

During the preparation of prevention actions aimed at raising awareness about the severity of workplace mobbing, special attention should be given to younger workers and those employed in higher-valued work positions as well as those with longer work experience. It would be useful to use the statistically significant relationship between perceptions of co-workers' beliefs and respondents' own beliefs, and enforce the beliefs of these target groups that their co-workers also perceive work place mobbing as a very severe phenomenon.

Another issue that should also be considered in designing appropriate measures is whether or not organisations have support mechanisms that prevent retaliation; this could be answered by further research. If these mechanisms are missing, then this lack should be met with the establishment of the abovementioned mechanisms, prior to implementation of activities for the stimulation of workplace mobbing reports. As already mentioned, it is important to carefully set actions, strategies and policies, since the reporter can easily become a target of retaliation (Alford, 2001; De Maria, 1999; Dempster, 1997; Glazer and Glazer, 1989; Hunt, 1995, 1998; Miceli and Near, 1992; Miethe, 1999; Vinten, 1994 in Brian, 2003). Along with measures for the protection of reporters, measures of the sanctions for misleading and false reports should also be determined (Gadlin, 1998).

5 Conclusion

Research reveals that the attitudes of Slovenian researchers toward workplace mobbing are quite serious, but that they are less ready to report violators. Both factors are significantly influenced by respondents' beliefs about their co-workers' attitudes, which reveals a lower integrity of researchers than desired. Discipline for violators is too mild, according to respondents' opinion. Almost half of respondents replied that there were no organisational rules under which the scenario cases would be defined as violations. The rest of respondents' answers showed that none of the cases would represent a very serious violation of organisational rules in the unit of their employment.

The study opens new questions for further research; for example, the reasons for the lowering of perceived severity of workplace mobbing with the increase in total years of work experience. It would also be interesting to reveal the reasons for lower willingness to report violators among researchers with longer tenure in the same public research organisation; the existence of organisational formal rules and mechanisms that protect reporters from retaliation. Last but not least, knowing more about the factors causing at least some of researchers to find workplace mobbing to be an acceptable way of solving problems would additionally contribute to our understanding of the reasons for the existence of workplace mobbing in public research organisations. It is possible that one of these factors is the conviction that workplace mobbing is an allowed behaviour (Rayner, 1999).

We can summarise on the basis of our research findings that the organisational environment of public research organisation protects violators, thereby offering favourable conditions for the existence of workplace mobbing. The reasons for this are most probably in the insufficient qualification of employees for proper responses and reactions, as well as in a lack of training and education in the fields of ethics and building integrity, difficulties with collecting evidence of workplace mobbing and the fact that Slovenian legal practice regarding this is still developing.

The practical value of this paper is in recognising factors that influence attitudes toward workplace mobbing as well as behavioural intentions of researchers. Knowing that, we can gradually direct them to a higher level of integrity of individuals and organisations, with the help of organisational actions and measures based on the aforementioned significant relations.

Let us conclude with the conviction that the most efficient weapons against all kinds of deviant behaviours are the ethical behaviour and personal integrity of individuals (Pagon, 2000).

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Stališča do trpinčenja na delovnem mestu – študija slovenskih javnih raziskovalnih organizacij

Zagotoviti varno delovno okolje tudi pred trpinčenjem na delovnem mestu je lahko, zaradi prikrite narave pojava, pravi izziv. Da bi trpinčenje na delovnem mestu lahko učinkoviteje preprečevali tudi v slovenskih javnih raziskovalnih organizacijah, smo z metodo scenarijev merili stališča in vedenjske namene, povezane z različnimi vedenji, ki nakazujejo na trpinčenje. Raziskava je pokazala, da respondenti zelo resno doživljajo trpinčenje na delovnem mestu. Njihova integriteta je nižja od želene, saj so stališča respondentov v največji meri odvisna od njihovega prepričanja o stališčih sodelavcev. Nizka pripravljenost prijaviti kršitelje, prizanesljivi disciplinski ukrepi in pomanjkanje ustreznih organizacijskih pravil, ustvarjajo ugodne pogoje za razvoj trpinčenja v slovenskih javnih raziskovalnih organizacijah. Prispevek ob ugotovitvah in predlaganih ukrepih odpira tudi nova vprašanja.

Ključne besede: trpinčenje na delovnem mestu, organizacijska kultura, integriteta, javna raziskovalna organizacija, raziskovalec

Influence of Demographic Factors on Employee Satisfaction and Motivation

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Nowadays, human resource management and development is becoming more significant due to the fact that a man has gained a new place and a new role in all social processes and in their management. The sheer employees' characteristics, i.e., demographic factors, besides the organisational factors, have a certain influence in this area. By adequate understanding of both demographic factors and their influence, it is possible to apply measures to make the employees satisfied and motivated. This paper points out such influences on the employees' satisfaction and motivation. Also, the interaction of certain demographic factors is presented, such as the professional qualification, years of working experience and age, onto employees perceiving satisfaction and motivation and onto respective consequences. In order to determine the employee satisfaction and motivation, the responses from the employees to questions divided into six groups (material conditions, security, acceptance and social component, respect and status, self-confirmation and loyalty), were used. The research was done on a set of 328 employees in the telecommunications sector in Serbia.

Key words: satisfaction in business operation, motivation, demographic factors, employees

1 Introduction

Human resources undoubtedly represent the most important resource in all industries. This is why, if the company wants to achieve its objectives, it is necessary to pay maximum attention to the employees and achieve the atmosphere which results in satisfaction and motivation. Therefore, the management has to perform a series of complex tasks in order to achieve employee motivation and satisfaction at work.

Many authors are interested in the problem of motivation because if understood, it results in: improving efficiency and creativity, improving the quality of working life in the organization, improving the competitive advantage and the company's success. In order to improve personal motivation we need to define our own boundaries, secure various choices, adjust work and private life, set new challenges, define objectives clearly, improve and develop new skills, cooperate with others and assist them. But one should have in mind that no theory is good enough to envisage what will motivate each employee, because what motivates some does not necessarily motivate all others (Unčanin et al. 2006).

It is quite difficult to define motivation properly and concisely. People are simply just motivated on their own or it is forced upon them. The answer to the question "What is

motivation?" was different through the ages and in different cultures. Motivation can be defined as a process, which triggers an activity in a man, which is directed towards certain objects and needs coordination, in order to achieve a certain goal (Kulić, 2003).

Motivation is regarded as energy which guides us towards fulfilling a goal. That is a complex phenomenon which channels human behavior. Numerous motivation theories provided basic answers, such as, what triggers human activity (motives) and how the motivation process comes into being. They are divided according to the content and processes, depending on the fact whether they were looking for answers to what motivated people or how the motivation process came into being. If we consider people's needs which trigger motivation as a generator of human activities and behavior, we can conclude that those who studied this phenomenon agreed on the list of people's needs.

Work motivation is a complex set of influences which make one start working and keep the job on a specific post within the organization. From a personal point of view, that is an inner state which leads to goal fulfillment while being influenced by numerous factors. From a manager's point of view, motivation is an activity, which secures the employees tend to fulfill the predefined goals.

Motivation is closely linked to work and the organizational efficiency. Motivation in an organization can be defined as a guided behavior of the employees towards organizational goals but also towards satisfying personal needs and goals at the same time. The main aspects of motivation are:

- Motives of the employees,
- Organizational goals,
- Individual goals.

Motivation in an organization is efficient if employees fulfill their personal needs and goals through organizational goals. Motivation as such emphasizes willingness in a man's behavior and represents the energy which urges him to act and behave in certain ways.

Employee motivation is one of the key preconditions for success in business. That is why it is important to constantly nourish and improve this system. Highly motivated workers know what to do and how to reach the predefined goal in the quickest and most efficient manner. This is important both for the organization and the individual who gets a certain reward for his work and effort. Therefore, according to this, motivation is a process which initiates and channels efforts and activities in order to fulfill personal and organizational goals (Bahtijarević Šiber, 1999).

There is a set of factors which influence motivation. Namely, they actually influence a person, his perceptions, values and needs. There are other important factors which influence the motivation process, such as, a wider environment, social and economic development, etc. There is a wide array of factors which influence individual motivation and can be divided into four categories:

- Personal traits,
- Characteristics of a certain post,
- Characteristics of an organization,
- Wider environment.

Human Resource development and management is becoming more important day by day because of a new place and role of a man in all social processes and in their management. The basic task that a manager has is to comprehend how complex human nature is, to evaluate all motivation theories and to select an adequate material and nonmaterial motivation technique having in mind all of the characteristics of a company. The oldest and the most usual way for motivating people is money. If connected with the success at work, and if not the only motivator, its efficiency as a motivator is even bigger. In developed countries money is relatively low on the motivator scale, not because it is less important but because it is considered as a regular follow-up. In developing countries, money is very important.

Today the contemporary human resource management is mainly interested in the employee motivation and satisfaction, because only by establishing a high quality motivation system can an organization increase its competitive ability and advantage on the market. Moreover, the importance of employee motivation and satisfaction is envisaged in the fact that a lot of faculties provide an opportunity to their students in order to develop their skills in this by interacting with a number of experienced professionals (Beebe et al., 2009).

The experience shows that the growth of the employee satisfaction and motivation is reflected on the productivity growth and better business results of the company as a whole. Even though it seems simple and logical, the relationship between satisfaction and motivation on one hand and organisation's results on the other hand is very complex, and numerous factors influence it such as: business characteristics, employee behaviour, personal value system and other demographic and organisational factors (Gill et al., 2008). Numerous authors have studied the satisfaction factors and elements of work. Rutherford et al. (2009) pointed out in their research that the employee work satisfaction key elements are satisfaction with the superior officer, work description, business policy and support, the possibility to improve and advance in career, material conditions, human relations and finally satisfaction with clients. Beebe et al. (2009) point out a special significance of material conditions on the employee motivation and satisfaction with work. The organisational structure and employee perception, shaped by the former, have a very important role in the employee satisfaction with work (Ogaard et al., 2008).

Employee motivation and satisfaction with their work will be on a higher level if people are not treated in the same way. Acuna with a group of researchers states these conclusions (Acuna et al., 2009) after relating employee satisfaction and personal characteristics. Personal characteristics of the employees, or the term demographic data, as often used in the literature, combined with the key aspects of the employee satisfaction and motivation enable the formation of valid and reliable instrument for measuring motivation and satisfaction. In such a way, very important data for finding new solutions and improvements are becoming accessible (Weiss et al., 1967; Smith et al. 1969; Cammann et al., 1983; Bowling and Hammond, 2008).

However, besides the tool used for data collection, the employees being individuals with unique characteristics, one wonders whether and in what way certain personal traits of the employees influence their attitudes and perceptions of satisfaction and motivation. Fabra and Camison (2009) studied the relation of the educational level and satisfaction with work. Clark et al. (1996) examined the influence of employees' age on satisfaction with work. Warr (2008) examined the influence and significance of demographic factors (sex, age, type of employment contract and level of education) on certain values, as well as on satisfaction and motivation. As previously illustrated, the goal of this paper is to examine the influence of certain demographic factors (level of education, age and number of years the employee has spent in a company) on employee perception regarding satisfaction and motivation with work.

2 Methodology

This paper is a part of a broader study which aims at investigating the factors which influence the employee motivation and satisfaction. The goal of the paper is to discuss the interactions of certain demographic factors – professional qualification, years of working experience and age, onto employees perceiving satisfaction and motivation.

In line with the subject and the goal of the research, the following starting hypothesis was established:

- H_0 – Interaction of certain demographic factors - qualification level, years of working experience and age and their influence on employee satisfaction and motivation.

The following research hypotheses were also established:

- H_1 – There is no difference between answers to the questions in the survey and the professional qualification and age, as well as between these two factors when interacting.
- H_2 – There is no difference between answers to the questions in the survey and the professional qualification and the years spent in the company, as well as between these two factors when interacting.
- H_3 – There is no difference between answers to the questions in the survey and age and the years spent in the company, as well as between these two factors when interacting.

The employee satisfaction and motivation is presented though their answers and the survey according to the following variables - material conditions, security, acceptance and social component, respect and status, self acknowledgment and loyalty.

In this research, a questionnaire was used as a method to collect data. The pool was anonymous and conducted in P.E. PTT Communication Serbia in Pomoravlje District. All of 700 employees, employed at the time, participated. Out of that, 328 (46,85%) forms were correctly filled in and processed, while the rest were not valid. This is a satisfactory rate because it is similar to the rates in some other similar researches. (Das et al., 2000; Kayank 2003; Molina et al., 2007).

The questionnaire consists of two sections. The first part contains 3 questions related to demographic data. The second part contains 33 questions divided into 6 groups, in respect to employee motivation and satisfaction. The instrument is based

on the literature review. Likert's five point rating scale was used to grade the answers, where 1 represented the item of the least importance, and 5 represented the item of the greatest importance. Basic demographic data about the employees are shown in Table 1. The core of this research is based on the demographic data - the employee professional qualification, years of working experience and age – and their influence onto answers to six question groups (material conditions, security, acceptance and social component, respect and status, self acknowledgment and loyalty).

The influence of three demographic factors onto employees perceiving satisfaction and motivation - professional qualification, years of working experience and age – is investigated in the study. GLM method (General Linear Model) and software package SPSS (SPSS Software v. 18) were used for data processing. GLM multivariable procedure provides regression analysis and variance analysis for multiple dependent variables towards one or more factor variables. Factor variable divides the population into groups. GLM tests the null hypothesis: the influence of the factor variables on dependent variables groups. GLM examines interdependence of factors, its consequences and the influence of certain factors. It is also possible to examine the influences of covariables and the interdependence of covariables and factors. In the regression analysis, independent variables are marked as covariables (Ho, 2006; Pallant, 2008). GLM method examines the accuracy of the established null hypothesis, which can be formulated in the following way: H_0 – There is no difference in the respondents' answers in relation to demographic factors.

The employee perception of satisfaction and motivation was examined using the answers, divided into six groups, of the examined employees: material conditions, safety, acceptance and social component, respect and status, self-confirmation and loyalty (dependent variables). In the following sections the research results are presented in relation to the influence of demographic factors onto answers to these six groups of questions. Apart from this, the synergetic effect of

Table 1: Demographic data of the respondents

Variable	Category	Number of the respondents that filled the paper correctly	Percentage
Professional qualification	Unqualified worker	25	7.6
	Qualified worker	28	8.5
	Secondary school	147	44.8
	Vocational college	68	20.7
	University graduates	60	18.3
Years of professional experience	Up to 1 year	21	6.4
	1 – 3 years	41	12.5
	3 – 10 years	77	23.5
	10 – 20 years	96	29.3
	20 and more	93	28.4
Age	Up to 25 years	24	7.3
	26 – 35 years	83	25.3
	36 – 45 years	85	25.9
	46 – 55 years	93	28.4
	56 and more	43	13.1

demographic factors on the respondents' answers was examined, i.e., on their perception of satisfaction and motivation with work.

3 Results and discussion

3.1 Influence of interaction of the employees' professional qualification and age on motivation and satisfaction

Certain conclusions can be made on the basis of the results (see Table 2) of all four multivariate significance tests (Pillai's, Wilks', Hotelling's, Roy's) for the main effects between the variable groups: professional qualification and age, professional qualification - age. The hypothesis that states that there is no difference in answers in comparison to the professional qualification is rejected, while the hypothesis that states that there is no difference in answers in comparison to the age is confirmed. Finally, the influence of the interaction between professional qualification and age confirms hypothesis H_1 (there is no difference in respondent's answers).

The results showed that the professional qualification of the respondents has statistical significance ($p < 0.005$), unlike the respondents' age ($p > 0.005$). The interaction of these two factors does not have statistical significance on the respondents' answers ($p > 0.005$). According to the data from Table 3, one can conclude on which, out of six, predictors of employee satisfaction and motivation, demographic factors have a significant influence. Professional qualification has statistical significance on all of the 6 predictors of satisfaction and moti-

vation ($p < 0.005$). Even though the respondents' age does not have any statistical significance on the responses ($p > 0.005$), it has the influence on certain satisfaction and motivation predictors: safety, respect and status, self-confirmation and loyalty ($p < 0.005$).

The interaction between the professional qualification and age on the basis of the six satisfaction and motivation predictors confirms H_1 hypothesis – There is no difference in the respondents answers in relation to demographic factors.

3.2. Influence of the interaction of professional qualification and years spent in a company on motivation and satisfaction of the employees

Table 4 shows the results of all four multivariate significance tests (Pillai's, Wilks', Hotelling's, Roy's) for the main effects between the variable groups of professional qualification and the years spent in a company.

Based on the results, the hypothesis H_2 stating there are no differences in answers in relation to professional qualification is rejected. On the other hand, the hypothesis stating there are no differences in answers in relation to the years an employee has spent in a company (H_2) is confirmed. Finally, the influence of the interaction of professional qualification and the years spent in a company, confirms the hypothesis H_2 stating there is no difference in the respondents' answers.

For further analysis, the information on which of the six employee satisfaction and motivation predictors the main effects between the variable groups have significant influence,

Table 2: Multivariate significance test for the main effects between the variable groups: professional qualification – age

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.933	695.834(a)	6.000	299.000	.000
	Wilks' Lambda	.067	695.834(a)	6.000	299.000	.000
	Hotelling's Trace	13.963	695.834(a)	6.000	299.000	.000
	Roy's Largest Root	13.963	695.834(a)	6.000	299.000	.000
Professional qualification	Pillai's Trace	.186	2.460	24.000	1208.000	.000
	Wilks' Lambda	.823	2.506	24.000	1044.296	.000
	Hotelling's Trace	.205	2.541	24.000	1190.000	.000
	Roy's Largest Root	.136	6.826(b)	6.000	302.000	.000
Age	Pillai's Trace	.111	1.436	24.000	1208.000	.080
	Wilks' Lambda	.893	1.435	24.000	1044.296	.080
	Hotelling's Trace	.116	1.433	24.000	1190.000	.081
	Roy's Largest Root	.060	3.038(b)	6.000	302.000	.007
Professional qualification * Age	Pillai's Trace	.283	1.003	90.000	1824.000	.474
	Wilks' Lambda	.746	1.003	90.000	1688.072	.474
	Hotelling's Trace	.304	1.003	90.000	1784.000	.474
	Roy's Largest Root	.114	2.314(b)	15.000	304.000	.004

Table 3: GLM results, satisfaction and motivation predictors influence on overall satisfaction and motivation in relation to professional qualification and age

Effect	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Professional qualification	1. Material conditions	33.587	4	8.397	8.479	.000
	2. Safety	20.182	4	5.046	7.154	.000
	3. Acceptance and social component	18.377	4	4.594	5.344	.000
	4. Respect and status	19.901	4	4.975	6.309	.000
	5. Self confirmation	16.998	4	4.250	5.401	.000
	6. Loyalty	6.862	4	1.715	3.093	.016
Age	1. Material conditions	8.675	4	2.169	2.190	.070
	2. Safety	11.014	4	2.753	3.904	.004
	3. Acceptance and social component	5.541	4	1.385	1.611	.171
	4. Respect and status	9.302	4	2.326	2.949	.020
	5. Self confirmation	8.635	4	2.159	2.744	.029
	6. Loyalty	6.940	4	1.735	3.128	.015
Professional qualification * Age	1. Material conditions	18.381	15	1.225	1.237	.242
	2. Safety	15.134	15	1.009	1.431	.131
	3. Acceptance and social component	9.368	15	.625	.726	.757
	4. Respect and status	10.194	15	.680	.862	.608
	5. Self confirmation	11.078	15	.739	.939	.521
	6. Loyalty	6.556	15	.437	.788	.691

Table 4: Multivariate significance test for the main factors between the variable groups professional qualification –years spent in a company

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.944	835.797(a)	6.000	298.000	.000
	Wilks' Lambda	.056	835.797(a)	6.000	298.000	.000
	Hotelling's Trace	16.828	835.797(a)	6.000	298.000	.000
	Roy's Largest Root	16.828	835.797(a)	6.000	298.000	.000
Professional qualification	Pillai's Trace	.133	1.731	24.000	1204.000	.016
	Wilks' Lambda	.872	1.737	24.000	1040.808	.015
	Hotelling's Trace	.141	1.739	24.000	1186.000	.015
	Roy's Largest Root	.077	3.863(b)	6.000	301.000	.001
Years spent in a company	Pillai's Trace	.052	.660	24.000	1204.000	.892
	Wilks' Lambda	.949	.658	24.000	1040.808	.894
	Hotelling's Trace	.053	.657	24.000	1186.000	.895
	Roy's Largest Root	.033	1.676(b)	6.000	301.000	.127
Professional qualification * Years spent in a company	Pillai's Trace	.288	.956	96.000	1818.000	.602
	Wilks' Lambda	.740	.965	96.000	1695.132	.577
	Hotelling's Trace	.316	.975	96.000	1778.000	.551
	Roy's Largest Root	.146	2.773(b)	16.000	303.000	.000

Table 5: GLM results, influence of satisfaction and motivation predictors on overall satisfaction and motivation in relation to interaction: professional qualification – years spent in a company

Effect	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Professional qualification	1. Material conditions	14.822	4	3.705	3.725	.006
	2. Safety	11.965	4	2.991	4.140	.003
	3. Acceptance and social component	7.975	4	1.994	2.295	.059
	4. Respect and status	9.128	4	2.282	2.886	.023
	5. Self confirmation	8.665	4	2.166	2.764	.028
	6. Loyalty	3.547	4	.887	1.608	.172
Years spent in a company	1. Material conditions	3.933	4	.983	.989	.414
	2. Safety	1.375	4	.344	.476	.754
	3. Acceptance and social component	2.354	4	.589	.677	.608
	4. Respect and status	1.581	4	.395	.500	.736
	5. Self confirmation	1.502	4	.376	.479	.751
	6. Loyalty	2.034	4	.509	.922	.451
Professional qualification * Years spent in a company	1. Material conditions	21.159	16	1.322	1.329	.177
	2. Safety	26.789	16	1.674	2.317	.003
	3. Acceptance and social component	12.092	16	.756	.870	.605
	4. Respect and status	22.019	16	1.376	1.741	.039
	5. Self confirmation	19.579	16	1.224	1.562	.078
	6. Loyalty	13.599	16	.850	1.541	.084

is very important: professional qualification - years spent in a company (see Table 5).

The influence of professional qualification on satisfaction and motivation is statistically significant in all the six dependent variables ($p < 0.005$), except for the question from group 3. – acceptance and social component and group 6. – loyalty ($p > 0.005$). Despite the demographic factor, the statistical influence of the years spent in the company shows significantly lower values in all answers to questions within all of the six groups ($p > 0.005$).

Observing the relation between the professional qualification and the years spent in a company, based on the six satisfaction and motivation predictors, the confirmation of the hypothesis is noticeable – H_2 . The exceptions are the predictors 2 - safety, and 4 – respect and status, which are sensitive to the interaction of factors.

3.3. Influence of the interaction of age and years spent in a company on motivation and satisfaction of the employees

Multivariate significance tests (Pillai's, Wilks', Hotelling's, Roy's) for the main effects between the variable groups: age,

years spent in a company, age – the years spent in a company, i.e., their results, are shown in Table 6. These demographic factors are not statistically significant ($p > 0.005$), so in this case the hypothesis stating there is no difference in the respondents' answers in relation to their age and years spent in a company is confirmed, when observed individually and in synergetic interaction.

Table 7 contains information on which of the six employee satisfaction and motivation predictors significantly influence the main effects between the variable groups; age, years spent in a company, age – years spent in a company.

The respondents' age is not statistically significant related to answers according to groups ($p > 0.005$). Identical situation appears when observing the influence of years the respondent has spent in a company on motivation and satisfaction, i.e., the complete absence of statistical significance is noticeable in the case of all six groups of questions ($p > 0.005$).

The relation between the age and years spent in a company, based on five satisfaction and motivation predictors (1 - material condition, 2 – safety, 4 – respect and status, 5 – self-confirmation, and 6 – loyalty) confirms the H_3 hypothesis – There is no difference in the respondents answers in relation to demographic factors. The hypothesis is rejected in the groups of question 3 – acceptance and social component.

Table 6: Multivariate significance test for the main effects between the variable groups age –years spent in a company

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.906	487.547(a)	6.000	304.000	.000
	Wilks' Lambda	.094	487.547(a)	6.000	304.000	.000
	Hotelling's Trace	9.623	487.547(a)	6.000	304.000	.000
	Roy's Largest Root	9.623	487.547(a)	6.000	304.000	.000
Age	Pillai's Trace	.098	1.287	24.000	1228.000	.160
	Wilks' Lambda	.905	1.289	24.000	1061.739	.159
	Hotelling's Trace	.102	1.290	24.000	1210.000	.158
	Roy's Largest Root	.059	2.999(b)	6.000	307.000	.007
Years spent in a company	Pillai's Trace	.094	1.227	24.000	1228.000	.207
	Wilks' Lambda	.909	1.226	24.000	1061.739	.208
	Hotelling's Trace	.097	1.224	24.000	1210.000	.209
	Roy's Largest Root	.053	2.708(b)	6.000	307.000	.014
Age * Years spent in a company	Pillai's Trace	.187	.993	60.000	1854.000	.491
	Wilks' Lambda	.825	.995	60.000	1597.806	.489
	Hotelling's Trace	.198	.996	60.000	1814.000	.486
	Roy's Largest Root	.092	2.833(b)	10.000	309.000	.002

Table 7: GLM results, influence of satisfaction and motivation predictors on overall satisfaction and motivation in relation to interaction: age – years spent in a company

Effect	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Age	1. Material conditions	5.905	4	1.476	1.374	.243
	2. Safety	7.424	4	1.856	2.283	.060
	3. Acceptance and social component	1.544	4	.386	.440	.780
	4. Respect and status	1.697	4	.424	.490	.743
	5. Self confirmation	2.856	4	.714	.850	.494
	6. Loyalty	2.578	4	.644	1.136	.340
Years spent in a company	1. Material conditions	3.543	4	.886	.825	.510
	2. Safety	1.452	4	.363	.447	.775
	3. Acceptance and social component	2.327	4	.582	.662	.618
	4. Respect and status	2.166	4	.541	.625	.645
	5. Self confirmation	1.482	4	.371	.441	.779
	6. Loyalty	2.262	4	.566	.997	.409
Age * Years spent in a company	1. Material conditions	11.959	10	1.196	1.113	.351
	2. Safety	10.892	10	1.089	1.340	.208
	3. Acceptance and social component	19.318	10	1.932	2.200	.018
	4. Respect and status	8.830	10	.883	1.019	.427
	5. Self confirmation	14.064	10	1.406	1.674	.086
	6. Loyalty	6.567	10	.657	1.158	.319

Based on these results, one can conclude that the relation between the age and years spent in a company does not have statistical significance on overall satisfaction and motivation of the employees.

4 Conclusion

One of the most influential elements for achieving the success within a company is undoubtedly satisfaction and motivation. On the other hand, numerous factors affect employee satisfaction and motivation such as job characteristics, employee's behaviour, personal value system and other demographic and organisational factors. There is no unique way to approach each employee satisfaction and motivation element. On the contrary, it is company specific and depends on the management, employees, employee perception of satisfaction and motivation, employee attitude towards work, moral values and personal characteristics. The main influential factors, when speaking about the employees and their satisfaction and motivation, are differences within individual human characteristics (Acuna et al., 2009).

By using the multivariate variance analysis and General Linear Model (GLM) we examined the influence of the respondent's professional qualification, age and number of years spent in a company on answers. We also examined the effect of their synergetic interaction. The research shows that the professional qualification has influence on employee satisfaction and motivation. Therefore, the level of education is set as a significant element in respect to achieving organisational goals. However, professional qualification, in different employee categories, does not influence satisfaction and motivation significantly, according to professional experience. There is no significant influence either of the professional qualification in different age groups. This means that employees with the same professional qualifications, regardless of their age, have the same or similar attitudes and perceptions towards satisfaction and motivation. The employee's age does not, or does to a small extent, influence satisfaction and motivation. Low influence of age, or its complete absence, is evident when different categories of employees are observed in respect to education. The same happens when different groups of employees are differentiated according to their past employment. Years spent in a company do not influence, or hardly influence, the differentiating of employees regarding satisfaction and motivation. This demographic factor is not significant for employees with different educational level or. It is important to point out that the only satisfaction and motivation element of safety (question group number 2.) is dependent upon different age of the employees. Employees with different past employments have different attitudes regarding safety. The result is logical because as time passes, safety (material and safety at work) gains higher priority.

Complexity of satisfaction and motivation is perceived based on these results and conclusions. In broader sense, management of human resources, achieving satisfaction and motivation and organisational goals is not a simple task at all. It becomes tougher and more complex knowing the company only has its own ways for solving these tasks. This and similar studies will not produce ready made solutions, but they can be

useful and provide directions for inducing employee satisfaction and motivation as extremely important factors for achieving organisational goals.

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Vpliv demografskih dejavnikov na zadovoljstvo in motivacijo zaposlenih

Razvoj in management kadrov dandanes postaja vse bolj pomemben, saj je človek pridobil novo mesto in vlogo v vseh socialnih procesih in njihovem managementu. Če ustrezno razumemo demografske vplive v organizacijskem okolju, lažje poiščemo ukrepe, ki motivirajo zaposlene in povečajo njihovo zadovoljstvo. V članku smo raziskovali vplive demografskih dejavnikov na zadovoljstvo in motivacijo. Proučili in predstavili smo tudi medsebojne vplive nekaterih demografskih dejavnikov, na primer poklicne kvalifikacije, delovne dobe in starosti na zaznano zadovoljstvo in motivacijo. Zadovoljstvo in motivacijo smo merili z vprašalnikom kjer smo uporabili 6 skupin vprašanj (materialni pogoji, varnost, sprejetost v socialnem okolju, spoštovanje in status, samozavest in lojalnost). V empiričnem delu raziskave je sodelovalo 328 zaposlenih v telekomunikacijskem sektorju v Srbiji.

Ključne besede: zadovoljstvo, poslovanje, motivacija, demografski dejavniki, zaposleni

Integration of Technology Management and Selected Specifics of Best Technology-Integrated Companies

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Technological know-how is a very significant determinant of success that can primarily depend on a systemic, integrated approach to Technology management (TM), on a well-defined and implemented technology strategy, but also on adequate overall socio-environmental characteristics of the technological system. The main tasks of integrated TM are to ensure systematic monitoring, analysis, planning, organizing, controlling, assessment, and effective use of the technological system to more effectively integrate it into a functional entity and to support also other related business goals and processes. This article deals with the specification of key parts of the TM integration with the particular emphasis on the selected specifics of the best technology-integrated companies in the world.

Keywords: integrated technology management, integrated technology system, technology-integrated companies, efficiency

1 Introduction

Since the 1980s, Technology management (TM) has become a part of managerial strategies and processes in many institutions (companies, research and financial organizations, government institutions, etc.) (Pelc, 2002). Later, the processes of more *radical technology innovation* stimulation caused the increasing importance of the TM development (Leifer, 2000) that meant better business opportunities in the long time, but required also more systematic managerial efforts. Another important determinant in the TM history has become the so-called *trade-offs* between making quick profits, through the technology imitation or transfer, and on the other side more intensive investment in technological R&D in a long period. Later, *efficient technology investment* became the foundation for the success of many companies and projects. Increasingly, there have been more successful many *technologically specialized companies* (IBM, Microsoft, Dell, Apple, later Intel, Cisco, Corning, Google, etc.) that have integrated their R&D with changing and emerging needs of customers. These technology oriented companies have been more and more using *venture capital*, and applying new *cooperative business models* (holdings, alliances, clusters, etc.) in order to maintain and improve their market positions. Since the 1990s, approxi-

mately 25 of the most innovative companies in the world have had in about 3% higher the average profit margin than the first 1200 companies ranked by Standard&Poor's (Larson, 2007). For these reasons, many companies have started to develop a new business, i.e. *sale/lease of technology*. At the same time, there was a boom of *start-up science invention and intellectual ventures*, i.e. companies that were primarily focused on R&D of new technologies. In the last two decades, the expansion of *intelligent ICT* in many areas has caused increasing requirements also for TM. Classification, simulation and modeling of technological processes from development of a technological concept, zero series, and beta-testing to commercial production increasingly reduce innovation time, but also production and operating cost (Larson, 2007). So-called traditional indoor TM is being completed by cooperative TM within *open-innovation networks*, and *Living labs*. The important factors of business success have become the management of different stakeholders and capacities, or taking advantage of the higher openness of technology strategies. Thus, the development of integrated TM can be characterized by a gradual process of dissemination, updating, and an integrated use of new technology and related know-how.

2 Integration of technology elements, processes, levels, and capacities

In accordance with the definition of the *European Institute of Technology and Innovation Management* (EITIM), we can define the processes of technology management (TM) as: *effective identification, selection, acquisition, research, use and protection of technologies (elements, processes and infrastructure) required to achieve and sustain market positions and business performance in conformity with business objectives* (EITIM, 2010). TM should enable an organization analyzing, planning, R&D, implementation, control and commercialization of its technology so that this organization becomes more flexible towards the implementation of new know-how, innovation, entering new markets, or better resistance to its competitors. These activities of TM, however, require adequate systemic integration, for more effective operations of the technology system. TM is not only a certain amount of managerial processes, objectives, rules and experience, but also a methodological and scientific discipline, which requires systematic identification, categorization, and integration of technological and related information and know-how. TM should systematically integrate technology elements, processes, TM levels and capacities in order to achieve strategic business objectives through the technology. *This integration and selected trends of technology-oriented companies are more specified in this article.*

2.1 Integration of key elements in technological system

Technology is an artificial process, set of related processes or synergies that have a particular purpose. This purpose may be from a simple production activity: drilling, cutting, joining to complex fully automated production technologies, for example in automotive, chemical, or ICT industry. These technologies should create an integrated technology system (TS) to accelerate, improve and to streamline the production and related business processes. At first, integration of the TS means an integrated use of *material elements of TS (hard technology, i.e. machines, equipment, vehicles, hardware, tools, channels), non-material elements of TS (soft technology, i.e. technological procedures, methodologies, processes, rules, algorithms, models, concepts, norms, standards, software, databases, services, brands etc.), and human elements of TS (human technology, i.e. explicit and tacit know-how, employees' performance, attitudes, approaches, objectives, assessment, control, culture, ethics etc.)*. These last mentioned elements are often overlooked, respectively underestimated in TM, although they can characterize the quality of the TS. Other elements of the TS are all inputs (raw materials, semi products, information, energies, external services, legislative standards, etc., *Figure 1*).

Though, *Soft technology* is generally older, *Hard technology* has been more systematically codified and understood in the history. Hard technology exists because of the invention process itself, but the use made it comes from the

soft side. As an example, *Microsoft* has not achieved its success only by depending upon the advanced hard technology development, but just taking advantage of soft and human technologies. In fact, the company has developed an association with the prestigious *Cambridge University* to address specific needs in education and training of its personnel (Jin, 2005). Generally, the rule is that investment in hard and soft elements of technology should be balanced to some degree, but clear in their effectiveness and efficiency. But, it is also necessary to keep adapting human elements to this degree and all necessary inputs of TS - in terms of market changes, technology progress, new legislative norms, changes in strategy and higher business ethics.

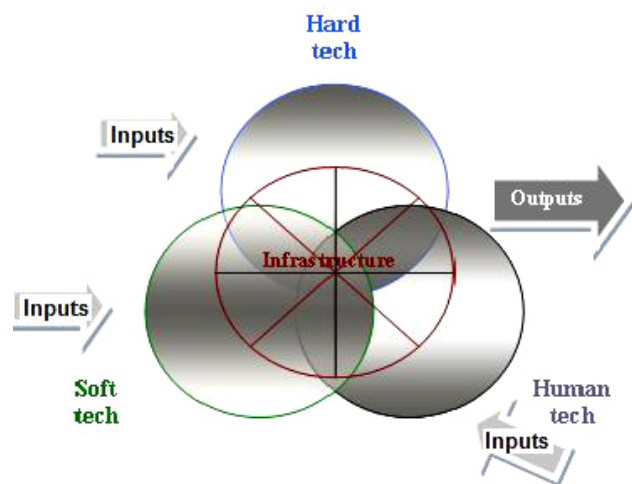


Figure 1: Integration of key elements in model technological system

Soft/human capital and services have become an object of business of many technology companies. *Cisco, Hewlett-Packard, Oracle, Yahoo*, and other tech companies have formed a new nonprofit consortium dedicated to the advancement of service innovation. Consortium members advance the state-of-the-art in customer service practices through a process of collective thinking and experience. The Consortium integrates academic research and emerging business trends with operational goals of its members in order to develop innovative strategies, models, and standards. As a member of the Consortium, a company can help influence the direction of support services, be on top of emerging trends, become an early adopter of innovation, and benefit from professional growth through a wide range of opportunities (CSI, 2012).

For another example, *IBM* reported a strategic shift in its technology strategy by focusing even more on supply chain consulting and computer services. It shifted about \$1 billion for hard technology R&D to soft technology consulting services. The consulting and computer services make up nearly 50% of the IBM revenue. For this purpose, the company formed so called *On Demand Innovation Services* that employed about 200 scientists and analysts (Collier and Evans, 2007). *Microsoft, IBM, HP, Cisco, Corning* and many other technological companies provide customers with "*technology solutions looking for problems*". These companies develop and adopt perspective technologies and are looking out for

applications of those technologies by offering a targeted array of products and services, but serving a broad spectrum of customers and market segments (Ramos-Aquino, 2003).

Each element of technology usually has its own specific input and role. Thus, a technological activity is a specific process of dynamic interactions between all elements in the technological system, which takes place in a particular *technological support infrastructure/integration/network* (technology support net). This technology infrastructure is a key area for technology integration, because it can directly affect other technology elements and processes. A form of this technological infrastructure primarily depends on whether it is a product or organizational technology. *Integration of a product technology usually requires greater demands on hard-tech elements synchronization. Organizational integration of technology requires better soft and human-tech elements synchronization.* For example, the *Cisco Network Foundation* integrates routers, switches, and wireless access points in the network managed by Cisco SW. This infrastructure is the integrated technology solution (product/service) in which network devices contain also some intelligence functions that support higher quality of services, availability, manageability, and multimedia wired and wireless communications capabilities of the network. By implementing this network, administrators get an integrated technology solution that can support critical business capabilities and provide a scalable platform for adding new applications, features, and capabilities as business needs

evolve (Cisco, 2011). For an organizational example, *Oracle Technology Network* is the Oracle official organizational online community integrating Oracle technical experts and their experience, sources and know-how. It is reported that it is the world largest online network of developers, administrators, and architects using Oracle products and computer-industry-standard technologies such as Java, Linux, and PHP (OTN, 2011). So-called *right social infrastructure* should also create an important part of each technological system of an enterprise (Jones et al., 2000). Within this infrastructure, well defined objectives, procedures, performance standards, rules for internal communication, learning and innovation may create important determinants of TM integration and effectiveness.

Every technological infrastructure should be adequately planned and managed, so there is a need for appropriate decentralization of TM. *Functional and operational autonomy* may help to increase flexibility and effectiveness of various technological processes within a technological system. A *product technology infrastructure* requires adequate planning and management as well. For example, for high-tech characteristics are specific rapid changes just in technology infrastructure, which modify a purpose, performance, outputs, linkages, information flows and technological demands of the system (Chandra and Kumar, 2001), that imposes higher demands on the integration of such systems. Each technological infrastructure should be based on the *target driven integration* of technological elements and flows. These flows

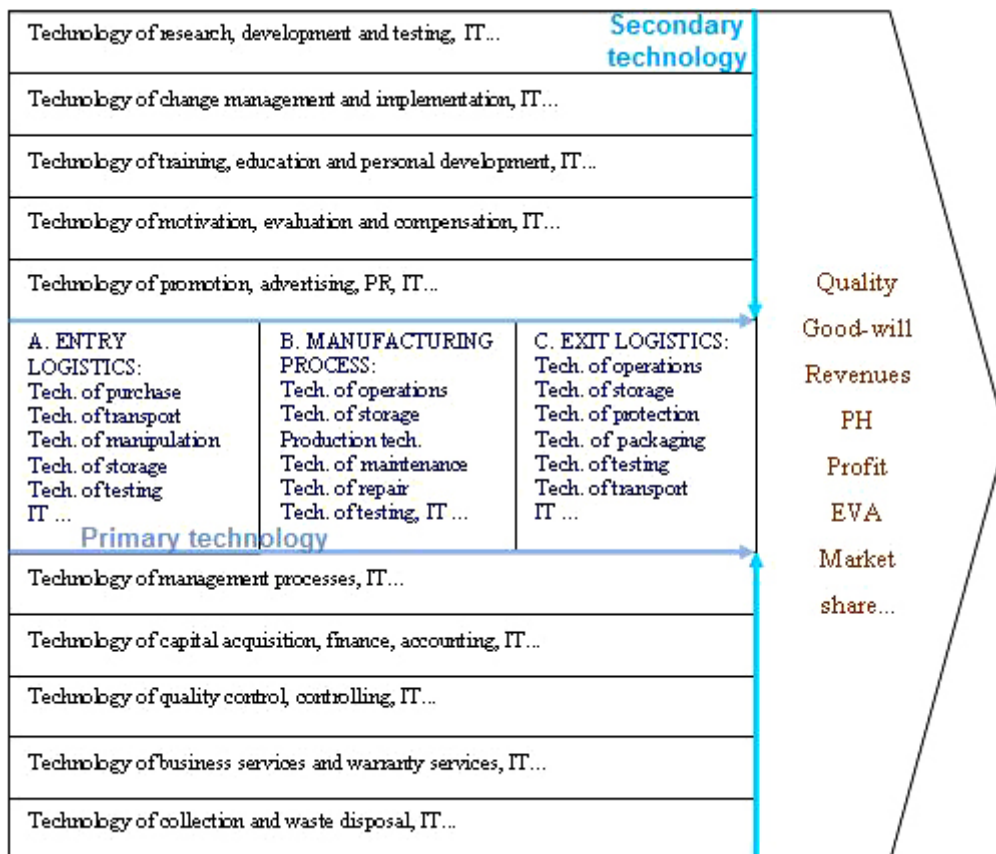


Figure 2: Integration of primary and secondary technological processes
 Source: Modified according to (Porter, 2009).

can be material, information, flows of resources, know-how etc. And they create partial outcomes and subsequently inputs of specific technological processes, or a final output of the technology (finished product, service, network, information etc.). There is also a need here to adequately measure the value added of individual technological processes by systemic process analysis and controlling. Recently, there is a general rise in importance of research, which focuses on the relationship of effective technological infrastructure and TM processes.

2.2 Integration of primary and secondary technological processes

In general, technology can also be defined as know-how of business (Probert et al., 2000) or a set of goal-oriented business processes. But, this does not only mean the production know-how, but the *know-how of all guided business processes*. Integrated TM should be a process of guided technology changes and systemic integration in any type of organization. Therefore, TM should not only integrate technology elements and processes, but also adapt and integrate technology with strategy, multiple business capacities and technology processes, technology infrastructure and business organization, so that the company could adequately cope with new market challenges. Such integration should lead towards a unified interdisciplinary teamwork approach to TM at all levels and stages of the company (not only at the production level). This approach should mainly balance the tradeoffs between organizational stability and technology flexibility, process efficiency and production quality, increase in an absorption capacity and risks of external cooperation, as well as technology related decision-making competences (subsidiarity) and team responsibility for fulfilling business objectives.

Thus technology affects not only production activities (*primary technology*), but also processes in virtually every part of a company (*secondary technology*) in order to support strategic objectives of the company (profit, EVA, margin, goodwill, market value, etc.), *Figure 2*. And integrated TM should be a concept integrating the main, but also cross-enterprise processes, mainly those in connection with the main production process (R&D and testing, logistics, quality control, controlling, waste disposal, etc.). Thus TM has become a more interdisciplinary discipline, which requires more and more complex demands on managers. The selection and integration of primary and secondary technologies should be a systemic process, because the complexity of the technology context can imply a broad array of interactions between each technology process and level.

For example, *Intel's* recent production equipment facilities cost about \$3.5 billion, a third of which had not been used before. The requisite facilities were systemically combined to create a manufacturing process comprising about 6000 processing steps, each of which had to work in perfect coherence. But, in the early phase of the integration, no one had planned which primary and secondary technologies would function in the future plant environment, let alone produce reliably once combined to create the new technology system.

Microsoft faced the similar problem with its Windows. The basic product technology was based on the simple principle: *plug and play*. However, this goal implied the technology functioning with a number of other application software (SW) combinations, and each of the new functions included in Windows must have had to work seamlessly in any situation. The systemic integration must have had to include millions of precise technology instructions and number of technological standards and diverse approaches (Iansiti and Levien, 2004). Intel and Microsoft faced the challenge: how to integrate their technologies with a large number of technological processes and elements with an unclear system impact on a technology system, and come up with a product that would work coherently. Finally, for Intel and Microsoft only a proactive systemic integration approach was the most important for their results.

But, creating well integrated technology should not be the only goal of integrated TM. Better internal research and production facilities, external technology progress, and changing stakeholders' needs provide many other challenges and requirements for TM. In well-integrated organizations, when a technological path is unclear, integration can follow other well-established managerial processes. Thus the diversity and complexity of technological solutions also highlight the issue between integration efficiency within traditional internal TM versus TM outsourcing, as well as sharpening the need for a more proactive systemic TM approach.

2.3 Integration of different levels of technology management

On the level of internationalized companies, we can recognize *three levels of TM*, which also require appropriate integration. This integration should be primarily based on systematic implementation of strategic objectives through the technology tasks on different management levels, defining roles, responsibilities and competences for partial technological elements and processes, and the division of competences in an innovation process. But, this integration can also take place in the "opposite direction", where partial needs of individual business units are driving decisions at a higher level of TM:

Operative TM is generally mostly applied in small and medium sized enterprises (SMEs) and focuses on implementation and coordination of operational technology processes, projects, mainly production technologies, primarily in a connection with cost, efficiency and flexibility of specific technologies, current capacities and operational results. Operative TM should ensure implementation of strategic business objectives into technology and its outcomes. The managerial tasks here are mainly to ensure conditions related to a required level of efficiency, regular monitoring and daily optimization of technological projects, elements and processes. These require the determination of appropriate tools and criteria for technology monitoring, analyses and controlling, feasible operational solutions to technology collisions, and systematic optimization of downstream technology processes. Well selected tools, especially for collection and analyses of information are required for operative TM. Information and knowledge management systems create the bases for func-

tioning of the technology infrastructure and are also used to properly plan and manage technological asset of the company (Sahlman and Haapasalo, 2009). Regarding the criteria for operative technology monitoring and analyses at this level, these are mostly quantitative, financial characteristics such as: technology expenditure, production cost, and volumes, VA of technology processes, and in-house prices, etc. Operative TM should provide strategic TM with actual information about the technology system for more realistic strategic decisions and investment.

Strategic corporate TM focuses mainly on the proper use of corporate resources/investment and capabilities in connection with a technology system, eventually resources and capabilities of specific business units with a technology strategy, so that they were in accordance with strategic business objectives. The link between effective technological activities and market demands is another important task of strategic TM, e.g. by an effective use of technology transfer, joint technology research and funding, outsourcing, entering a cluster, etc. Strategic TM should first and foremost define an organizational structure for TM processes, considering the size of business, path dependencies, traditions and principal decisions about the degree of TM centralization and decentralization. Strategic TM can also comprise functions like R&D or production management, although these are usually organized as separate units. Processes of strategic TM require corresponding personnel for appropriate planning and communication of strategic technology objectives (Sahlman and Haapasalo, 2009). Foresight and technology assessment within strategic TM are suggested to have a time horizon at least 5 years, depending on a technology and company. Strategic tools like Technology roadmapping or variant scenarios can be very valuable source of information also for operative and global TM. (Figure 3) As a positive example, every year the *Qualcomm* managers (similarly with *Microsoft*) must undergo intensive training at *Cambridge University* to learn about how to apply technology frameworks, new technology introduction tools, or strategic TM techniques. Topics of this course include: integration of technological considerations into business strategy and long-range planning processes; understanding and communicating the value of technology investment, or how to assess technology and TM processes (CTM, 2010).

Global TM is applied more in larger international companies that have several separate business units in different locations. Such global TM focuses mainly on the global use of resources and capacities, but also on a global transfer or sale of technologies (Probert et al., 2000). Usually, different types of alliances, coalitions and agreements form the basic structure of global TM, technology collaboration and networks. These networks consist of different institutes, sub-contractors, suppliers, industry analysts, regulatory bodies, customers and other stakeholders (Sahlman and Haapasalo, 2009). Global TM cooperation can be also realized between companies in different industries. For example, in 2000, *IBM and Nissan* announced the creation of the *global TM initiative* in which Nissan outsourced the information systems (IS) operations from IBM. These services included the operative TM activities within its IS, regular maintenance, and a part of the application development, but excluded the planning and design of new IS.

IBM has taken over a portion of Nissan information technology (IT) operations that have enabled Nissan to use the latest IT know-how, adding them to their capabilities accumulated in providing advanced solutions in the automotive industry (IBM, 2000). Thus this Global TM has also enabled to manage and prioritize modern automotive IT, properly allocated technology investment, eliminate duplication in R&D, reduce launch times, improve business cooperation, and increase the effectiveness in both companies. But, the main issue within this global TM cooperation remained undisclosed, i.e. the increased demand for better technology coordination and communication within individual partners that could have improved the overall TM effectiveness.

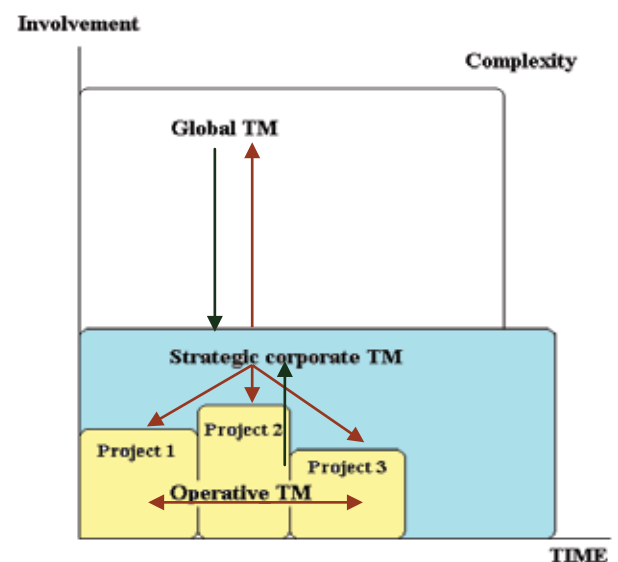


Figure 3: Model integration of different levels of TM

2.4 Integration of technology management capacities

Many technological systems such as a traditional client/server system or a cellular manufacturing system can be characterized by their possible *modularity*, *adaptability* and *reconfiguration*, which means that their physical design/platform may be separated from the technological system so that it is possible to individually use and replace various parts of this technology (Chandra - Kumar, 2001) and thus to improve overall technology capacities. The basic idea of so-called *Group technologies* (GT) is to divide a technological system into several subsystems/components that can be individually combined afterwards. This effective combination of GT within a given technology system can reduce production times, business cost, and increase technology capacities, because it allows “*work-in-process*” (changes during operations of technology). Among the key instruments for the division and integration of GT belong *technology classification* and *coding system*. These enable to categorize and assign codes to different parts of the technology according to its functions, individual capacities, or production requirements. Based on these codes, different technological parts and capacities can be

integrated into specific groups. Thus the entire technology system consists of several technology groups with homogeneous technological parts and capacities, which enables TM to easier implement effective technology changes. The disadvantage of this classification is that considerable efforts and time should be paid to the distribution and subsequent effective integration of technology elements.

As an example, new *Cisco CleanAir Technology* (custom HW/SW technology solution) was developed to overcome the visibility limitations of standard Wi-Fi chipsets. Cisco created a new technology solution behind the Cisco Spectrum Expert Analysis, and integrated it directly into the current CleanAir Technology infrastructure within the group technologies solution. The new HW/SW solution is capable of detecting any interference that might be used in the future, and requires only a SW update. In the CleanAir technology integrated solution, the SI (The International System of Units) information is fully integrated into the network architecture and TM systems - to enable intelligent and dynamic operations (Cisco, 2011).

Dynamic technology capabilities can form the basis for new capacities in other business areas, and thus also the potential for a new competitive advantage. Targeted classification and integration of technological elements should allow its flexible modification if necessary. There are some important supporting techniques for this process like *Simulation and modeling of a technological change*, eventually *Technology roadmapping* within Strategic TM. Flexible technology capa-

bilities create an important capacity of TM to continually adapt and integrate its technology resources, skills and other business capacities with market requirements. But, all *TM capacities should be adequately integrated within TM. These capacities can be divided into four basic groups:*

Social capacity - is a general TM ability to constantly adapt employees to changes in principles, know-how, requirements, or corporate culture. Social TM capacities form the basis for other capacities of TM.

Absorption capacity - is a TM ability to recognize and adapt new specific information, know-how, procedures, standards, or external help in a company, not only by employees, but by the whole company. An absorption capacity creates the basis for organizational and innovation capacities.

Organizational capacity - is a TM ability to adapt its technology infrastructure to new conditions, investment, markets, culture, acquired know-how, technology and business course, depending on changes in business strategy. This capacity creates the basis for innovation capacity.

Innovation capacity - is a TM ability to improve its technology system based on new current and expected market requirements and technology progress (Da Silveira, 2002), and to carry out purposeful and effective changes in related business processes. Innovative capacity requires the integration of all these TM capacities (*Figure 4*).

In a chronological view, integrated TM capacities and specific technology know-how many times create a certain

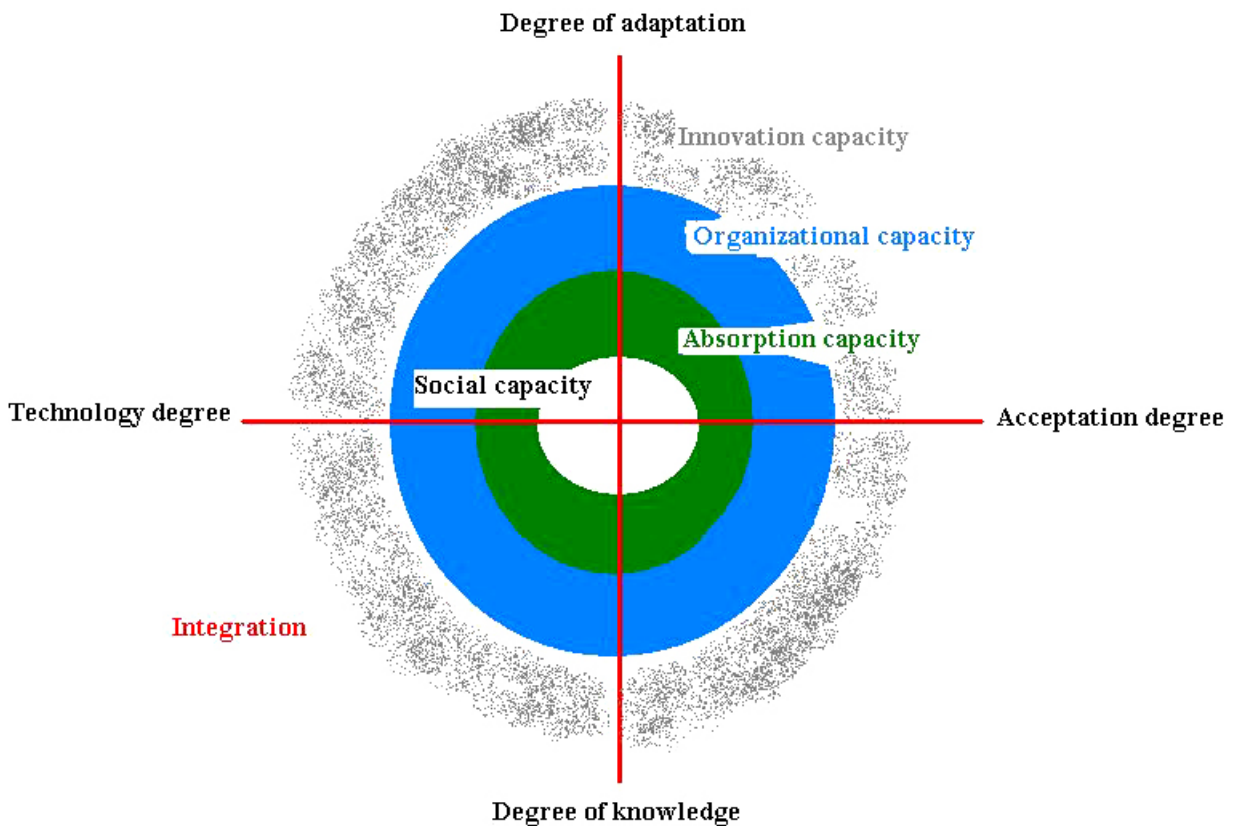


Figure 4: Model integration of TM capacities

kind of either negative or positive historical dependence of an enterprise (*Path dependence*) (Da Silveira, 2002). In a negative sense, this may affect development, acquisition, integration and implementation of new technology by an obsolete outdated way. In a positive sense, this dependence can save a lot of time, managerial activities and cost for new technology integration, automation and exploitation. Implementation of new technology can be thus influenced to a large extent by past and existing internal (also managerial) processes and corporate culture, although this often requires a new kind of leadership, organization, integration, motivation, control, or evidence. Improper innovation of new technology can bring many imbalances in different areas, from a decline in customer demand and higher demand on investment and operational resources, through increased laboriousness of technology processes, imbalances in logistics, more difficult coordination and control, to incorrect values and culture in the enterprise. Thus the path dependencies may also induce disintegration of TM capacities.

As an example, *IBM* products have not been performing as well as *Apple*, despite the longer business experience. In simplicity, it is difficult once a company is on a specific historical trajectory for a competing system to offer a better product and better price. Writers of IBM SW came up with the dominant operating system, which made dominant the IBM

goodwill (Cerere, 2009). A little initial advantage has been changed into the significant cost differentiation. *Dell* is also successful because of its specializing in cost control, controlling the customer experience and being the first to the market. But where *Apple* more stands out is its perfect marketing and elegant design. The *Apple* “transformative changes” mean that technology has been integrated in a more creative way in different systems and applications, and this reflects the process of learning by doing (Consoli, 2005).

In general, increasing returns to innovation adoption of new technologies are necessary for evolving path dependencies in TM. Once the *higher adoption* appears, lock-in might emerge. Therefore, changing the past dependence for adopting new technologies also implies higher requirements on TM. Thus, a company can be locked in to its technology, while a competitor can be locked out, producing the result “winner takes all”. At the same time past and existing purposeful TM processes, capacities and corporate culture can have a significant impact on new technology integration and adoption. But, TM must be also a more socio-cultural process (Hard and Knie, 2001). And new technology can also become a particular tool to socio-technological integration of an enterprise (especially its internal organization and communication), and thus also the mean for improvement of economic results.

Table 1: Most successful technology companies worldwide

10 most profitable tech companies in 2009 (2008)	2009				2008				2009/2008	
	Global 500 Rank	Best 50 R&D investors	Profit (bil. USD)	Revenues (bil. USD)	Global 500 Rank	R&D investment (bil. USD)	Profit (bil. USD)	Revenues (bil. USD)	Profit accrual (bil. USD)	Revenues accrual (bil. USD)
1. Microsoft (1.)	117.	2.	17,7	60,4	136.	9,0 (2.)	14,1	51,1	3,6	9,3
2. IBM (2.)	45.	15.	12,3	103,6	46.	6,0 (11.)	10,4	98,8	1,9	4,8
3. HP (4.)	32.	39.	8,3	118,4	41.	3,5 (26.)	7,3	104,3	1	14,1
4. Cisco (3.)	191.	21.	8	39,5	218.	5,2 (14.)	7,3	34,9	0,7	4,6
5. Oracle (6.)	408.	-	5,5	22	462.	2,8 (36.)	4,3	18,0	1,2	4
6. Intel (5.)	202.	17.	5,3	37,6	188.	5,7 (13.)	7,0	38,3	-1,7	-0,7
7. Corning (12.)	-	-	5,3	5,9	-	0,7 (132.)	2,2	5,9	3,1	0
8. Apple (8.)	253.	-	4,8	32,5	337.	1,1 (77.)	3,5	24,1	1,3	8,4
9. Qualcomm (9.)	-.	-	3,2	11,1	-	2,2 (38.)	3,3	8,9	-0,1	2,2
10. Dell (10.)	115.	-	2,5	61,1	106.	0,7 (122.)	2,9	61,1	-0,4	0

Source: (Fortune, 2009 and 2010; JRC, 2009.)

3 Selected specifics of most profitable technology companies

The most successful technology companies achieve their outstanding results by creating specific *technology teams* to systematically analyze new market opportunities and trends, technological infrastructures, and to innovate their integrated (written) technology strategies and programs, for better optimization of technology and related processes (Kepczyk, 2004). Among the most developed technological companies are: *Microsoft, IBM, HP, Cisco, Oracle* etc. (Table 1).

The largest increase in profit reported Microsoft, IBM and Corning, just at the time of the most intensive phase of the *Global economic crisis* in 2008 and 2009. The biggest change in revenues reported HP, Microsoft and Apple. Corning reported the biggest change within the ranking of the most profitable technology companies. And according to the ranking the 500 most successful companies of the world, Apple and Oracle experienced the biggest change. *Among the key specifics of the success of these best technology-based companies are:*

- *TM creates preconditions* for a proper application, implementation and realization of strategic objectives of an enterprise through a technological system and constantly monitors technological processes, as if it was the main strategic business asset. For example, before a company begins a technology implementation project with *Intel@AMT* (active management of technology), it must have a clear understanding of own technology capabilities, how they can be utilized within its environment, and it must review the scope of organizational impacts that the implementation will have. Having there identified also „opportunity areas”, this will provide the basis for the technology implementation project and allow embracing the framework for creating technology teams, developing roadmaps for technology improvements, creating infrastructure augmentation, project schedule, and deploying the new technology (Intel, 2007).
- *TM adequately integrates strategic objectives and technological processes*, market requirements and R&D processes, technology innovation capacities and business opportunities, etc. An appropriate technology strategy is also an opportunity for organizational changes and improvement. From integration of technology processes; through customer insights that drive product and brand extensions; to spotting emerging trends that competitors miss; business and technology integration are of tremendous importance for an optimal growth and profit. E.g. with about 3500 strategy professionals, the *IBM technology strategy and change practice* is a part of IBM Global Business Services, one of the world's leading management consulting practices. Working across all major sectors, IBM has the technology expertise across more than a dozen industries: from communications, distribution, financial services, to industrial and public sectors. The IBM technology strategy services offer: establishing an overall IT strategy for a company, helping to establish/evaluate an overall business architecture or SOA (service-oriented architecture), and helping to improve IT processes to deliver higher quality and reduced technology costs to a company (IBM, 2011).
- The main tool that characterizes TM and its relevance to strategic business objectives should be a *well communicated technology strategy*, preferably formulated as the result of Foresight or broader technology cooperation. Technology strategy should form the basis for measuring TM efficiency and effectiveness, also for the alignment of operational plans and programs even in SMEs. Many companies look for partners to help them and their stakeholders to work up and implement more complex technology strategies. For example, *HP* works with thousands of clients (within the Strategic IT Advisory Services) to establish its technology strategy that adequately details the technology and capability requirements. But, HP also delivers more comprehensive technology strategies and transformation plans to their clients. HP widely maps relevant data associated with various technology processes and assigns a value to it that justifies introducing new technologies and changing the existing technology strategy. Clients can engage with HP to plan and implement new technology and realize technology synergy plans (ALTO, 2011).
- *Technological innovation* is often a long term incremental process that *requires a longer-term source of investment*. At the same time, the investment is often more risky than at product innovation. Therefore, a technology innovation process often requires an effective investment strategy and cooperation. As an example can be the *Qualcomm Ventures (QCV)* that was formed in 2000, with the \$500 million fund commitment to make strategic investment in early-stage of high-technology ventures. Since then, QCV has also funded numerous other companies in the wireless sector, and set up several exclusive regional funds to spur development in key strategic markets, including the \$100 million fund in China and the €100 million fund in Europe (QCV, 2011).
- An important factor in success and efficiency of TM operations is the so called Open technology strategy, which implies creation of the functional network with other institutions, not only from the technology industry, but also from R&D, education, finance, marketing sectors, etc. From a *resource based perspective of integrated TM*, a key advantage of such an open alliance or a network is that it enables a firm to use technological resources of cooperation partners. As a result, the partners' resources can be used without the need to transfer or lease them. Open networks thus enable to access to assets that are immobile or very costly to transfer (Markard and Worch, 2009). For example, *Oracle* is an open standards leader. Its IT solutions are based on the open industry standards so that the products could simplify customers' interoperability and security, and decrease the cost of deployment. Within its Open technology strategy, Oracle cooperates with about 100 standards-setting organizations, 320 technology managers, 590 technical working groups, and about 90 policy committees. This approach helps the company avoid vendors' lock-in, enables an open access to technical details and interfaces, lowers barriers to

innovation, and reduces the cost of technology investment (Oracle, 2011).

- Currently, a *significant IT support for TM* can be provided by complex information solutions (SAP, Oracle, Microsoft etc.) and Internet. In this context, it is also necessary to emphasize the need for *adequate protection of technological know-how* and information. For example, for SMEs, *Microsoft* offers *Windows Small Business Server* that is an affordable server solution providing networking, security, databasing, line-of-business support, and remote access, etc. *Windows Small Business Server* offers a server solution with appropriate complexity and increased manageability over traditional enterprise servers. The solution also enables to optimize technology processes and cost by using an intuitive management interface, one that presents relevant system information and matching set of tasks (Microsoft, 2011). Technology companies are concerned that legislation requiring the inclusion of specific intellectual property protection technologies poses serious threats to privacy, technical innovation, open source software development, and the fair use of copyrighted content. But, the widely discussed mandatory technical standards should result in user-unfriendly products and services. Development of such outputs can be a costly long-term process, but it can positively impact companies, consumers and technology industry.
- *Value-added of technological processes* mainly depends on systematic and systemic TM, clear technology vision and strategy, good internal and external relations, on corporate culture that accepts changes and creativity of employees, as well as on flexibility of technological solutions (Boomer, 2006). Many companies establish the so called value-added resellers to deliver their customers "hand-made" technology solutions. E.g. the independent *Apple Value Added Resellers* help associated companies to simplify and enhance their technology processes leading to improved business processes and economic results. Working with the Value Added Resellers, a company can obtain customized integrated multi-platform technology solutions, professional, industry experience, proficiency in Apple and complementary IT products, and additional services, such as: technology planning, system design, or training (Apple, 2011).
- And *effective integrated TM requires not only adequate management skills* (persuasion, good communication especially among engineers, managers and key stakeholders, capacity for flexible decision-making, empathy etc.), as it is at many other business processes, but also professional skills and technological know-how, where their "acquisition" is often a long term process. According to *Gartner*, a manager can save approximately 5 hours of work by 1 hour of technological education, or 20 hours of technological training can provide the manager with about 100 hours of an available capacity (Gartner, 2010).

4 Summary and conclusions

Approximately since the 1980s, TM has become a part of managerial processes and strategies in many companies and

institutions (Pelc, 2002). Decentralization of R&D increased in the same time (Larson, 2007). Since the early 1990s, effective technology innovation has become essential for a success of many companies and projects. Increasingly more successful have become specific technological companies (Apple, Microsoft, IBM, Corning, Google, Intel etc.) that integrate their R&D with systematic marketing analyses, increasingly use venture capital for innovation processes, and create different broad cooperative business models. An important mean for formulating an integrated technology strategy has become an Open innovation approach.

TM has not only become a sum of particular managerial processes and experience, but also a methodological tool and scientific discipline, which requires systematic identification, categorization, and linking technological and related know-how. TM should systematically integrate technology elements, processes, TM levels and capacities in order to achieve partial strategic business objectives through the technology. This integration should lead towards an interdisciplinary team approach to MT at all levels of management, particularly as regards to the relationship of organizational stability and flexibility, process efficiency and product quality, or an increase in an absorption capacity and risks of external collaboration.

A technological activity is a specific process of dynamic interactions between all elements of a technological system, which takes place at a particular technological infrastructure. A general rule is that investment in hard and soft elements of technology should be balanced to some degree, but it is also necessary to keep adapting human elements to this degree and all necessary inputs. Integration of a product technology usually requires higher demands on hard-tech elements synchronization. Organizational integration of technology requires better soft and human-tech elements synchronization. The so-called right social infrastructure should also create an important part of each technological system.

On the level of internationalized companies, we can recognize three levels of TM, which require appropriate integration. Operative TM should ensure implementation of strategic business objectives into a technology and its outcomes. Strategic corporate TM should focus mainly on the proper use of corporate resources and capabilities in connection with a technology system. And global TM should focus mainly on the global use of resources and capacities, but also on a global transfer or sale of technologies. Dynamic technological capabilities can enable TM to form the basis for new capacities in other business areas.

Lack of an integrated approach to TM can prevent many managers to increase their technological efficiency. Companies often have well-developed processes of product innovation, but they have a problem, how to develop and integrate their technologies. Among the best technology-oriented companies are *Microsoft, IBM, HP, Cisco, and Oracle*. The main specificity of the success of technology-oriented businesses is the fact that *TM creates preconditions* for proper utilization, implementation and realization of strategic business objectives through the technology and constantly monitors technological processes, as if it was the main strategic business asset.

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Integracija managementa tehnologije in izbranih specifik v najboljših tehnološko integriranih podjetjih

Tehnološki know-how je pomemben dejavnik, ki je v prvi vrsti odvisen od systemskega, integriranega pristopa k managementu tehnologije, na jasno opredeljeni in vpeljani strategiji tehnologije, pa tudi od celotnih sociološko-okoljskih značilnosti tehnološkega sistema. Glavne naloge integriranega managementa tehnologije so zagotoviti sistematično spremljanje, analizo, planiranje, organiziranje, nadzor, ocenjevanje in učinkovito rabo tehnološkega sistema, da bi se bolje integriral v funkcionalno entiteto in podpiral druge poslovno usmerjene cilje in procese. Članek obravnava opredelitev ključnih delov integracije tehnološkega managementa s posebnim poudarkom na izbranih specifikah najboljših tehnološko integriranih podjetjih na svetu.

Ključne besede: integrirani management tehnologije, integriran tehnološki sistem, tehnološko integrirano podjetje, učinkovitost

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Mnenja zaposlenih o delovnih razmerah, organizaciji dela in motivaciji v elektrodistribucijskem podjetju

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V času sprememb z deregulacijo trga za električno energijo ima pomembno mesto dejavnik zaposlenih kot katalizator delovnih razmer, organizacije dela in motivacije v poslovnih procesih. V prispevku smo analizirali rezultate ankete med zaposlenimi v distribucijskem podjetju z opisnimi statistikami, korelacijsko in regresijsko analizo. Pri poslovnih procesih in pri osebnih dejavnikih so zaposleni visoko ocenili pomen stalnosti zaposlitve s socialno varnostjo, pomen neposrednega vodje in zahtevnost dela (fizična in psihična). Z regresijsko analizo je potrjena hipoteza, da so delovne razmere sodelavcev pozitivno in statistično značilno povezane z organizacijo dela, strokovnim razvojem in odnosi s sodelavci. Organizacija dela je pozitivno in statistično značilno povezana z obveščanjem o dogodkih, soodločanjem, sistemizacijo delovnih mest, strokovnim razvojem, odnosi s sodelavci, ustnim komuniciranjem in negativno povezana s prenašanjem čustvenih obremenitev. Motivacija zaposlenih je pozitivno in statistično značilno povezana z delovnimi razmerami, soodločanjem, sistemizacijo delovnih mest, svobodo, fleksibilnostjo, samoiniciativnostjo, odnosi s sodelavci, ustnim komuniciranjem, možnostjo napredovanja, sposobnostjo načrtovanja organizacije, pomenom neposrednega vodje, prenašanjem čustvenih obremenitev in negativno povezana s plačo.

Ključne besede: zaposleni, organizacija, zadovoljstvo, statistična analiza, regresijska analiza

1 Uvod

Slovensko elektrogospodarstvo se je v zadnjih dveh desetletjih organizacijsko povsem spremenilo. Iz enotnega sistema imenovana Sestavljena organizacija združenega dela Elektrogospodarstvo Slovenije s sedežem v Mariboru, je razpadlo na samostojna podjetja. Z razpadom enotnega sistema organizacije je prišlo do organizacijskih sprememb s spremembo organizacije delovnih procesov in prilagajanj, kar je vplivalo na spremenjene odnose med zaposlenimi in s tem na zadovoljstvo zaposlenih v podjetjih za distribucijo električne energije (Papler in Bojnec, 2011b). Z letom 1990 so začela delovati samostojna javna podjetja za distribucijo električne energije, p.o., ki so bila v naslednjih desetih letih v postopkih delnega olastninjena in so postala delniške družbe z večinsko državno lastnino.

Poleg organizacijskih sprememb in delne privatizacije v elektrodistribucijskih podjetjih se je trg električne energije postopno dereguliral s postopno liberalizacijo cen (Bojnec in Papler, 2005; Papler in Bojnec, 2011a). Liberalizacija trga električne energije z namenom, da se zagotovi konkurenčna in kakovostna ponudba električne energije, je vseevropski proces, ki vodi do sprememb v elektroenergetskem sektorju in

znotraj podjetij, ki za električno energijo uvajajo različne blagovne znamke. Evropski elektroenergetski trg se odpira tudi s čezmejno izmenjavo, glede na zmožnosti in meje tehničnih omejitev omrežij. Razdružitev energetskih sistemov in tržno preoblikovanje je zahtevalo tudi preoblikovanje evropskih združenj tega področja. UCTE (2012) je postala pomembna samo še za prenos v okviru interkonekcije. Za Slovenijo je posebej pomembna regionalna organizacija UCTE za jugovzhodno Evropo SUDEL (2012).

Z deregulacijo trga z električno energijo leta 2001 in s postopnimi prostim oblikovanjem cen električne energije se je v podjetjih za distribucijo električne energije začela vzpostavljati organiziranost podjetij, v smeri prostega delovanja na trgu z vse večjo vlogo konkurenčnosti podjetja in zadovoljstva porabnikov električne energije (Bojnec in Papler, 2011; Papler in Bojnec, 2011). Deregulacija trga, liberalizacija in organizacijske spremembe v elektrodistribucijskih podjetjih so vplivali na spremenjeni pomen managementa na dereguliranem maloprodajnem trgu električne energije v Sloveniji (Papler in Bojnec, 2006) in na prilagajanje v organiziranju in upravljanju prodajnega managementa za potrebe tržne dejavnosti v elektrodistribucijskem podjetju (Papler in Bojnec, 2007a, 2007b, 2010). Sistemske in organizacijske spremembe in spremenjeno upravljanje v elektrodistribucijskih procesih pa

so se odražali tudi v poslovnih procesih in osebnih dejavnikih zaposlenih v elektrodistribucijskih podjetjih.

Predhodne raziskave so pokazale pomen vrednotenja zaposlenih o delovnih razmerah, organizaciji dela in motivaciji, kar je pomembno za obravnavo in razumevanje izbranega področja. Organizacijska klima je eden od največkrat omenjenih, a pogosto tudi najmanj razumljenih pojmov v organizacijskem vedenju in managementu. Organizacijska klima in kultura vplivata na stopnjo zadovoljstva zaposlenih pri delu in na delovnem mestu. V ospredju pridobitnih organizacij so zlasti zahteve po učinkovitosti, racionalnosti in usmerjenosti k strankam, kar pomeni, da je potreben vedno večji poudarek zaposlenih pri uresničevanju teh zahtev. Organizacija je lahko uspešna, če zaposleni ustrezno spodbujajo njene aktivnosti. Bistveno vlogo v organizacijah odigrajo prav zaposleni in njihove zmožnosti. Če zaposleni poznajo in sodelujejo pri postavljanju in uresničevanju ciljev, vizije, strategije in verjamejo v uspeh, so pripravljeni dograjevati svoje znanje, spreminjati lastne in utečene načine razmišljanja ter obnašanja pri delu.

Adizes (1996) meni, da organizacijska klima pomembno vpliva na uspešnost poslovanja in na zadovoljstvo zaposlenih ter na njihovo uspešnost in učinkovitost pri opravljanju nalog. Zato mora vodstvo posebno skrb nameniti ukrepom za stalno povečevanje in vzdrževanje zadovoljstva zaposlenih ter s tem vpliva na večjo uspešnost in učinkovitost zaposlenih in na uspešnost organizacije.

Fuller (1997) in Vrčon-Tratar in Snoj (2002) ugotavljajo, da je organizacijska klima pomemben dejavnik razvijanja konkurenčne prednosti organizacij. Ustrezne temeljne vrednote prispevajo k učinkovitemu uresničevanju ciljev v organizaciji. Posebej osvetljujejo sestavino marketinškega koncepta z naravnostjo k odjemalcem, kot možno razsežnost organizacijske kulture.

Organiziranost je formalna urejenost organizacije, izražena v obliki organizacijskih struktur, le-ta pa predstavlja formalno razčlenitev in razporeditev delovnih nalog po izvrševalcih in organizacijsko ureditev njihovih medsebojnih odnosov v podjetju (Vrčko in Erjavšek, 1998). Lastniki organizacije dajejo skupno nalogo organizacije v izvedbo vodstvu, ti pa nadalje svoje naloge, dolžnosti ali zadolžitve naložijo podrejenim. Tako se tvorijo razmerja oziroma hierarhija v organizaciji. Vodstvo prenese na podrejene zadolžitve in odgovornosti, hkrati pa tudi vpliv za izvedbo naloge. Pri tem je pomembna organizacijska klima, ki jo Erjavšek (2003) pojmuje kot močno silo, ki določa obnašanje posameznikov in skupin v organizaciji.

Zupan (2001) meni, da je uspeh podjetij močno odvisen od sposobnosti in motiviranosti zaposlenih, da nenehno izboljšujejo delovne procese, proizvode in storitve. Zaposleni imajo znanja in izkušnje ter vedo, kje in kakšne izboljšave so mogoče. Njihovo vključevanje v vseh stopnjah izboljšav lahko zmanjša odpor do morebitnih sprememb in potrebo po usmerjanju pri njihovem uvajanju. Pristopi vključevanja zaposlenih v proces nenehnih izboljšav so lahko bolj ali manj formalizirani ter povezani s timskim delom ali vključevanjem posameznikov.

V procesu uvajanja sprememb je pomembna pravočasna in kakovostna komunikacija z zaposlenimi (Gorišek, 2003). Za graditev zaupanja in partnerskih odnosov ter graditvi skupne

kulture ima pomen tudi voditeljstvo. Le-to v mrežni organizaciji močno upošteva poleg jasnih poslovnih ciljev tudi različne mehke pristope, s katerimi želi polno izkoristiti intelektualni potencial zaposlenih ter doseči njihovo pridruženost podjetju in k želenim ciljem. Vrednote organizacije poudarjajo s svojim zgledom in ustvarjanjem zaupanja in sodelovanja. Posebno pozornost namenjajo talentom in neposrednemu komuniciranju z zaposlenimi v razvijanju kulture, ki je odprta do sprememb, sprejema različnosti in omogoča kreativnosti in inovativnosti.

Mihalič (2007) navaja, da organizacijska klima in klima odličnosti spodbujata in omogočata stalen napredek, razvoj, rast, izboljševanje in spremembe v organizaciji. Organizacijska klima in kultura odličnosti temeljita na odličnih posameznikih, delovnih mestih, oddelkih in organizaciji kot celoti. Proces ustvarjanja odlične korporativne klime in kulture je dolgotrajen in zelo kompleksen. Zahteva večletna prizadevanja s stalnim uvajanjem novosti in nenehnim izboljševanjem že sicer učinkovitih procesov spodbudne organizacijske klime, uspešnih posameznikov, optimalnih postopkov, odličnih mehanizmov in izjemno visok nivo intelektualnega in finančnega kapitala.

Topolšek in Čurin (2012) analizirata povezanost odnosov med zaposlenimi v podjetjih in zadovoljstvom in učinkovitostjo zaposlenih v slovenskih trgovskih podjetjih. Ugotavljata, da učinkoviti odnosi med funkcijama vplivajo na raven notranje integracije med logistično in marketinško funkcijo.

Poglavitna kakovost našega prispevka je izvedba lastne raziskave v elektrodistribucijskem podjetju, kjer se na prvo mesto postavlja razumevanje zaposlenih, odnosni in strukturni ter človeški kapital v povezanosti motivacije s procesnim kapitalom. Pomembno mesto ima dejavnik zaposlenih s posebej poudarjenim pomenom motivacije. Pri izvedbi raziskave so uporabljena različna statistična orodja za potrjevanje domnev. V prispevku so posebej analizirani in predstavljeni rezultati ankete med zaposlenimi o dejavnikih delovnih razmer in organizaciji dela v poslovnem procesu ter o osebnih dejavnikih zaposlenih in motivaciji zaposlenih v poslovnem procesu v elektrodistribucijskem podjetju. Naprej na kratko predstavimo uporabljene podatke in statistične metode analize, s katerimi so obdelani anketni podatki. Temu sledi prikaz rezultatov, pojasnitev rezultatov in ugotovitev. Prispevek zaključuje s sklenimi ugotovitvami.

2 Metodologija in uporabljeni podatki

Za izvedbo raziskave je med zaposlenimi v podjetju za distribucijo električne energije bila izvedena anketa s pisnim anketnim vprašalnikom. Med naključno izbranimi zaposlenimi v podjetju za distribucijo električne energije Elektro Gorenjska, d.d., smo izvedli anketo s pisnim vprašalnikom med januarjem in marcem 2009. Razdeljeno je bilo 100 pisnih anketnih vprašalnikov in vrnjeno je bilo popolno izpolnjenih 72 anket. Anketni vprašalnik je vseboval trditve, katere so anketiranci ocenjevali po Likertovi lestvici z ocenami od 1 (ni pomembno) do 5 (zelo pomembno).

Med socio-demografskimi podatki anketirancev smo posebej vprašali za spol, raven izobrazbe in število let izobra-

ževanja, vključno z osnovno šolo, spol in starost. Po spolu je bilo 79,2 % moških in 20,8 % žensk. Izpolnjevalci ankete po kvalifikacijski strukturi so bili: 2,8 % z 8. stopnjo izobrazbe, 16,7 % s 7. stopnjo, 9,7% s 6. stopnjo in 41,7 % s 5. stopnjo in 29,2 % s 4. stopnjo izobrazbe. Povprečno število izobraževalnih let anketirancev je bilo 12,7 let. Struktura anketirancev glede na starost je bila: do 30 let 12,5 %, 31 do 40 let 30,4 %, od 41-50 let 34,7 %, od 51-60 let 22,2 % in nad 60 let 0 %. Njihova povprečna starost je bila 41,7 let.

Obdelava podatkov je bila izvedena na programski opremi SPSS (Norušis, 2002), verzija 12.0. Kot raziskovalne metode analize anketnih so bile uporabljane metode kvantitativne analize z uporabo opisnih statistik, korelacijske analize in regresijske analize podatkov (Easterby-Smith, Thorpe in Lowe, 2005). Eden od temeljnih parametrov, ki ga uporabljamo v korelacijski analizi je korelacijski koeficient. S korelacijsko analizo proučujemo (pojasnjujemo) stopnjo parcialne linearne povezanosti med analiziranimi spremenljivkami. Korelacijski koeficient lahko zavzame vrednost med -1 in 1. Predznak nam pove smer linearne odvisnosti med spremenljivkama. Absolutna vrednost korelacijskega koeficienta pa izraža stopnjo linearne odvisnosti med analiziranimi paroma spremenljivk. Kadar imamo podatke o naključnih spremenljivkah, od katerih nobene ne izberemo vnaprej, ne moremo govoriti o

medsebojni odvisnosti, temveč le o medsebojni povezanosti. Namen regresijske analize je določiti matematično specifikacijo med odvisno in eno ali več neodvisnih spremenljivk. V primeru regresijske analize uporabimo multiplo regresijo, kjer je odvisna spremenljivka pojasnjena z dvema ali več neodvisnimi ali pojasnjevalnimi spremenljivkami (Kachigan, 1991). Z multiplo regresijsko analizo ugotavljamo obliko povezanosti in statistično značilnost povezanosti med odvisno spremenljivko in posameznimi pojasnjevalnimi spremenljivkami. Na ta način testiramo spodaj postavljene hipoteze s pomočjo regresijske analize, in sicer empirično želimo proučiti dejavnike, ki vplivajo na delovne razmere zaposlenih in osebne dejavnike zaposlenih, ki so pomembni pri uspešnem poslovanju elektrodistribucijskega podjetja. Izhajajoč iz predhodnega raziskovanja (Bojnec in Papler, 2011; Papler in Bojnec, 2011b) prispevek posebej testira hipoteze o dejavniki delovnih razmer, organizaciji dela in motivaciji zaposlenih v elektrodistribucijskem podjetju. Postavili smo naslednje tri raziskovalne hipoteze, ki jih v nadaljevanju empirično testiramo s pomočjo uporabe regresijske analize:

Hipoteza 1 (H1): Delovne razmere zaposlenih v procesih v podjetju so odvisne od dejavnikov organizacije dela, strokovnega razvoja in odnosov s sodelavci.

Preglednica 1: Relativna frekvenčna porazdelitev odgovorov (v %) glede dejavnikov delovnih razmer zaposlenih in organizacijo dela v poslovnem procesu

Spremenljivka	Oznaka / Ocena	1	2	3	4	5
Ocena delovnih razmer procesa	Delovne razmere	1,4	5,6	25	59,7	8,0
Ocena možnosti napredovanja v procesu	Možnost napredovanja	12,5	27,8	43,1	15,3	1,4
Ocena obveščenosti o dogodkih v podjetju	Obveščenost v podjetju	6,9	20,8	47,2	20,8	4,2
Ocena plače in drugih materialnih ugodnosti procesa	Plača	5,6	27,8	43,1	22,2	1,4
Ocena odnosov s sodelavci v procesu	Odnosi s sodelavci	1,4	5,6	23,6	47,2	22,2
Ocena ustvarjalnosti dela v procesu	Ustvarjalnost	2,8	15,3	34,7	43,1	4,2
Ocena metode sedanje sistemizacije delovnih mest procesa	Sistemizacija delovnih mest	15,3	25,0	44,4	15,3	0
Ocena organizacije dela v procesu	Organizacija dela	4,2	23,6	43,1	26,4	2,8
Ocena fleksibilnosti (prilagodljivosti) v spremenjenih okoliščinah za učinkovito obvladovanje novih, nepredvidljivih in stresnih situacij v procesu	Fleksibilnost	2,8	12,5	47,2	30,6	6,9
Ocena samoiniciativnosti, dajanja pobud, samo motiviranja, učenja in razvijanja svojih potencialov v procesu	Samoiniciativnost	4,2	13,9	30,6	44,4	6,9
Ocena zanimivosti dela v procesu	Zanimivost dela	1,4	2,8	25,0	52,8	18,1
Ocena zahtevnosti dela (fizično in psihično)	Zahtevnost dela	0	0	30,6	58,3	11,1

Legenda: Ocene v glavi tabele pomenijo: 5 – zelo pomemben, 4 – pomemben, 3 – srednje pomemben, 2 – delno se strinjam, 1 – povsem nepomemben.

H2: Organizacija dela ima skupne točke v obveščanju o dogodkih, soodločanju, sistemizaciji delovnih mest, strokovnem razvoju zaposlenih, odnosih s sodelavci, ustnem komuniciranju in prenašanju čustvenih obremenitev.

H3: Motivacija je značilno odvisna od delovnih razmer zaposlenih v procesih v podjetju, soodločanja, sistemizacije delovnih mest, svobode zaposlenih, fleksibilnosti, samoiniciativnosti, odnosov s sodelavci, ustnega komuniciranja, možnosti napredovanja, sposobnosti načrtovanja organizacije, neposrednega vodje, plače in prenašanja čustvenih obremenitev.

3 Rezultati opisnih statistik in korelacijske analize

3.1 Delovne razmere zaposlenih in organizacija dela v poslovnem procesu

S področja dejavnikov delovnih razmer zaposlenih in organizacije dela v poslovnem procesu so bile vključene spremenljivke: delovna razmerja, možnost napredovanja, obveščенost v podjetju, plača, odnosi s sodelavci, ustvarjalnost, sistemizacija delovnih mest, organizacija dela, fleksibilnost in samoiniciativnost. Zanesljivost tega dela anketnega vprašalnika je bila testirana z Cronbachovim indeksom, ki znaša 0,828, kar potrjuje zanesljivost anketnega vprašalnika.

Preglednica 1 prikazuje relativno frekvenčno porazdelitev odgovorov na zastavljena vprašanja o dejavnikih delovnih razmer zaposlenih in o organizaciji dela v poslovnem procesu z uporabo Likertove lestvice od 1 povsem nepomembno do 5 zelo pomembno. Največ nadpovprečno visokih ocen so prejele spremenljivke za delovne razmere, zahtevnost dela, zanimivost dela, odnosi s sodelavci in fleksibilnost. Plačo okrog

ena tretjina anketirancev ocenjuje kot slabo in skoraj večina daje temu srednji pomen. Visok je tudi delež anketirancev, ki slabo ocenjuje obveščенost v podjetju, medtem ko večina daje temu srednji pomen. Pomemben delež anketirancev kot slabo ocenjuje organizacijo dela v podjetju in sistemizacijo delovnih mest ter prav tako možnost napredovanja.

Najbolj razpršeni so odgovori s standardnim odklonom nad 0,9 pri vprašanjih za samoiniciativnost, možnosti napredovanja, obveščенost v podjetju in sistemizacija delovnih mest. Sledijo odnosi s sodelavci in organizacija dela, ustvarjalnost, plača, fleksibilnost, delovne razmere in zanimivost dela. Najmanj pa so razpršeni odgovori za vprašanje glede zahtevnosti dela s standardnim odklonom 0,6.

Preglednica 2 podrobneje prikazuje opisne statistike za dejavnike delovnih razmer zaposlenih in organizacijo dela v poslovnem procesu. Najvišje povprečne ocene imajo naslednje spremenljivke: odnosi s sodelavci, zanimivost dela, zahtevnost dela (fizično in psihično) z vidika zaposlenih in delovne razmere. Srednje povprečne vrednosti imajo spremenljivke: samoiniciativnost, fleksibilnost, ustvarjalnost in organizacija dela. Najnižje povprečne vrednosti imajo spremenljivke: obveščенost v podjetju, plača, možnost napredovanja in sistemizacija delovnih mest. Ker gre za izražena mnenja zaposlenih o njihovih delovnih razmerah in organizaciji dela v poslovnem procesu, ki so pogosto izven njihove neposredne pristojnosti, gre za informacije, ki so pomembne za vršni management v upravljanju organizacije, ki je neposredno odgovoren in s svojim upravljanem in odločitvami pomembno vpliva na ustvarjanje delovnih razmer in organizacije dela za številne zaposlene v poslovnem procesu. Zato je participacija zaposlenih zaposleni s svojimi izraženimi mnenji tisti minimum, ki je pomembne za soustvarjanje boljših delovnih razmer zaposlenih in organizacijo dela v poslovnem procesu, v katerem tudi neposredno sodelujejo.

Preglednica 2: Opisne statistike za dejavnike delovnih razmer zaposlenih in organizacijo dela v poslovnem procesu

Spremenljivka	Mediana	Modus	Povprečna vrednost	Standardni odklon	Standardna napaka	Varianca	Rang
Delovne razmere	4,0	4,0	3,68	0,77	0,09	0,59	4.
Možnost napredovanja	3,0	3,0	2,65	0,94	0,11	0,88	11.
Obveščенost v podjetju	3,0	3,0	2,94	0,93	0,11	0,87	9.
Plača	3,0	3,0	2,86	0,88	0,10	0,77	10.
Odnosi s sodelavci	4,0	4,0	3,83	0,89	0,10	0,79	1.
Ustvarjalnost	3,0	4,0	3,31	0,88	0,10	0,78	7.
Sistemizacija delovnih mest	4,0	4,0	2,60	0,93	0,11	0,86	12.
Organizacija dela	3,0	3,0	3,00	0,89	0,10	0,79	8.
Fleksibilnost	3,0	3,0	3,26	0,87	0,10	0,76	6.
Samoiniciativnost	4,0	4,0	3,36	0,95	0,11	0,91	5.
Zanimivost dela	4,0	4,0	3,83	0,81	0,09	0,65	2.
Zahtevnost dela	4,0	4,0	3,81	0,62	0,07	0,38	3.

Legenda: Mediana, modus, povprečna vrednost, standardni odklon, standardna napaka ocene in varianca so izračunani iz ocen odgovorov: 5 – zelo pomemben, 4 – pomemben, 3 – srednje pomemben, 2 – delno se strinjam in 1 – povsem nepomemben.

V nadaljevanju smo izvedli korelacijsko analizo glede povezanosti med pari spremenljivk za dejavnike delovnih razmer zaposlenih in organizacijo dela v poslovnem procesu. Oblikujemo korelacijsko matriko in z njeno pomočjo ocenimo, kako močne so odvisnosti med pari spremenljivk posameznih dejavnikov delovnih razmer zaposlenih in organizacijo dela v poslovnem procesu. Na podlagi korelacijske matrike ugotovimo korelacije med pari analiziranih spremenljivk. Ugotovimo, da je parcialna korelacijska povezanost med posameznimi analiziranimi spremenljivkami relativno zmerna. Največja je korelacijska povezanost z vrednostjo korelacijskega koeficient nad 0,5 je ugotovljena za povezave med naslednjimi pari spremenljivk spremenljivkami: plača in sistemizacija delovnih mest, organizacija dela in obveščanje o dogodkih, ustvarjalnost in samoiniciativnost, fleksibilnost in samoiniciativnost in odnosi s sodelavci in samoiniciativnost ter blizu, vendar pod 0,5, za povezanost med spremenljivkama odnosi s sodelavci in fleksibilnost, odnosi s sodelavci in ustvarjalnost, ustvarjalnost in fleksibilnost, organizacija dela in sistemizacija delovnih mest in organizacija dela in delovne razmere. Vrednost korelacijskega koeficienta nad 0,4 je za naslednje pare spremenljivk: odnosi s sodelavci in delovne razmere, organizacija dela in plača, možnost napredovanja in obveščanje o dogodkih ter delovne razmere in obveščanje o dogodkih.

3.2 Osebnih dejavniki zaposlenih in motivacije zaposlenih v poslovnem procesu

S področja osebnih dejavnikov zaposlenih in motivacije zaposlenih v poslovnem procesu so bile vključene spremenljivke: stalnost zaposlitve in socialna varnost, strokovni razvoj, svoboda in samostojnost pri delu, motivacija, ugled dela, soodločanje, neposredni vodja, zahtevnost dela, ustno komuniciranje, sposobnost načrtovanja in organizacije in prenašanje čustvenih obremenitev. Zanesljivost tega dela anketnega vprašalnika je bila testirana z Cronbachovim indeksom α , ki znaša 0,851, kar potrjuje zanesljivost anketnega vprašalnika.

Preglednica 3 prikazuje relativno frekvenčno porazdelitev odgovorov na zastavljena vprašanja o osebnih dejavnikih zaposlenih in motivaciji zaposlenih v poslovnem procesu z uporabo Likertove lestvice od 1 povsem nepomembno do 5 zelo pomembno. Največ nadpovprečno visokih ocen so prejele spremenljivke za stalnost zaposlitve in socialno varnost, ustno komuniciranje, svoboda in samostojnost pri delu in ugled dela. Razpršena je porazdelitev ocen za spremenljivko za sposobnost načrtovanja in organizacije, vendar polovica odgovorov s srednjo vrednostjo 3. Relativno visok delež anketiranih zaposlenih je najslabše ocenilo soodločanje zaposlenih pri delu in poslovanju in pri motivaciji.

Preglednica 3: Relativna frekvenčna porazdelitev odgovorov (v %) glede osebnih dejavnikov zaposlenih in motivacije zaposlenih v poslovnem procesu

Spremenljivka	Oznaka / Ocena	1	2	3	4	5
Ocena stalnosti zaposlitve (socialna varnost)	Stalnost zaposlitve in socialna varnost	1,4	1,4	15,3	55,6	26,4
Ocena možnosti strokovnega razvoja zaposlenih	Strokovni razvoj	5,6	9,7	33,3	45,8	5,6
Ocena svobode in samostojnosti pri delu	Svoboda in samostojnost pri delu	4,2	4,2	31,9	51,4	8,3
Ocena motivacijskih faktorjev pri delu (pohvala, priznanje, dodatna stimulacija za dobro delo, zavestnost, prijaznost)	Motivacija	6,9	20,8	45,8	22,2	4,2
Ocena ugleda dela z vidika zaposlenih	Ugled dela	4,2	5,6	43,1	41,7	5,6
Ocena soodločanja zaposlenih pri delu in poslovanju	Soodločanje	8,3	20,8	45,8	22,2	2,8
Ocena neposrednega vodje z vidika zaposlenih	Neposredni vodja	1,4	6,9	13,9	47,2	30,6
Ocena zahtevnosti dela (fizično in psihično)	Zahtevnost dela	0	0	30,6	58,3	11,1
Ocena ustnega komuniciranja, zmožnosti tekočega, razumljivosti govornega izražanja	Ustno komuniciranje	2,8	2,8	33,3	55,6	5,6
Ocena sposobnosti zaposlenih za načrtovanje in organizacijo službe z vidika metodike, strukture in delovnih operacij	Sposobnost načrtovanja in organizacije	2,8	20,8	50,0	23,6	2,8
Ocena zaposlenih z vidika prenašanja čustvenih obremenitev, ko prihaja do pritiskov, težav, ovir, v stresnih situacijah, kakršni sta časovni pritisk in negotovost	Prenašanje čustvenih obremenitev	9,7	11,1	55,6	18,1	5,6

Legenda: Ocene v glavi tabele pomenijo: 5 – zelo pomemben, 4 – pomemben, 3 – srednje pomemben, 2 – delno se strinjam in 1 – povsem nepomemben.

Preglednica 4: Opisne statistike za osebne dejavnike zaposlenih in motivacije zaposlenih v poslovnem procesu

<i>Spremenljivka</i>	<i>Mediana</i>	<i>Modus</i>	<i>Srednja ocena</i>	<i>Standardni odklon</i>	<i>Standardna napaka</i>	<i>Varianca</i>	<i>Rang</i>
Stalnost zaposlitve – socialna varnost	4,0	4,0	4,04	0,78	0,09	0,60	1.
Strokovni razvoj	4,0	4,0	3,36	0,94	0,11	0,88	7.
Svoboda in samostojnost pri delu	4,0	4,0	3,56	0,87	0,10	0,76	5.
Motivacija	3,0	3,0	2,96	0,94	0,11	0,89	10.
Ugled dela	3,0	3,0	3,39	0,85	0,10	0,72	6.
Soodločanje	3,0	3,0	2,90	0,94	0,11	0,88	11.
Neposredni vodja	4,0	4,0	3,99	0,93	0,11	0,86	2.
Zahtevnost dela	4,0	4,0	3,81	0,62	0,07	0,38	3.
Ustno komuniciranje	4,0	4,0	3,58	0,77	0,09	0,59	4.
Sposobnost načrtovanja in organizacije	3,0	3,0	3,03	0,82	0,10	0,68	8.
Prenašanje čustvenih obremenitev	3,0	3,0	2,99	0,96	0,11	0,92	9.

Legenda: Mediana, modus, povprečna vrednost, standardni odklon, standardna napaka ocene in varianca so izračunani iz ocen odgovorov: 5 – zelo pomemben, 4 – pomemben, 3 – srednje pomemben, 2 – delno se strinjam in 1 – povsem nepomemben.

Najbolj razpršeni odgovori (standardni odklon nad 0,9) na zastavljena vprašanja o osebnih dejavnih zaposlenih in motivaciji zaposlenih v poslovnem procesu so na naslednja vprašanja oziroma analizirane spremenljivke: prenašanje čustvenih obremenitev, motivacija, strokovni razvoj, soodločanje in vloga in pomen neposrednega vodja. Temu sledi razpršitev naslednjih analiziranih spremenljivk: svoboda in samostojnost pri delu, ugled dela in sposobnost načrtovanja organizacije. Najmanj pa so razpršeni odgovori anketiranih zaposlenih na vprašanja o stalnosti zaposlitve in s tem socialne varnosti, o pomenu ustnega komuniciranja in zahtevnosti dela, ki ga zaposleni opravljajo.

Preglednica 4 podrobneje prikazuje opisne statistike na zastavljena vprašanja o osebnih dejavnih zaposlenih in motivaciji zaposlenih v poslovnem procesu. Najvišje povprečne ocene imajo naslednje spremenljivke: stalnost zaposlitve in na ta način zagotovljena socialna varnost, vloga in pomen neposrednega vodja in zahtevnost dela (fizično in psihično), ki ga zaposleni opravlja. Srednje povprečne vrednosti imajo spremenljivke: ustno komuniciranje, zmožnost tekočega, jasnega in razumljivega govornega izražanja; svoboda in samostojnost pri delu; ugled dela; strokovni razvoj zaposlenih; sposobnost načrtovanja in organizacija dela. Najnižje povprečne vrednosti imajo spremenljivke: prenašanje čustvenih obremenitev, motivacija (pohvala, priznanje, dodatna stimulacija za dobro delo, zavestnost in prijaznost) zaposlenih in soodločanje zaposlenih pri delu in poslovanju. Ker gre za izražena mnenja zaposlenih, so rezultati pomembni za upravljanje s človeškimi viri in za izboljšanje delovnih razmer zaposlenih, ki se lahko odrazi v izboljšanih spodbudah za še uspešnejše poslovanje podjetja.

Korelacijska analiza s korelacijsko matriko za pare spremenljivk osebnih dejavnikov zaposlenih in motivacije zaposlenih v poslovnem procesu kaže, da je največja korelacijska

povezanost s parcialnim korelacijskim koeficientom, ki je večji od 0,5, med spremenljivkami: motivacija in soodločanje poslovanja, ustno komuniciranje in načrt organizacije službe, motivacija in prenašanje čustvene občutljivosti, svoboda in motivacija, svoboda in prenašanje čustvenih občutljivosti, motivacija in načrt organizacije službe, ugled dela in soodločanje poslovanja, načrt organizacije službe in prenašanje čustvenih občutljivosti ter blizu 0,5 za pare spremenljivk za soodločanje poslovanja in načrt organizacije službe, soodločanje poslovanja in prenašanje čustvenih občutljivosti, motivacija in ustno komuniciranje. Parcialni korelacijski koeficient je večji kot 0,4 za naslednji pare spremenljivk: svoboda in neposredni vodja, ustno komuniciranje in prenašanje čustvenih občutljivosti, soodločanje poslovanja in ustno komuniciranje, svoboda in načrt organizacije poslovanja, ugled dela in načrt organizacije poslovanja, svoboda in soodločanje poslovanja, soodločanje poslovanja in neposredni vodja, stalnost zaposlitve s socialno varnostjo in ugled dela. Pozitivna in vsaj srednje močna povezanost med pari spremenljivk kaže, da je večina osebnih dejavnikov zaposlenih in motivacije zaposlenih v poslovnem procesu vsaj rahlo, če ne intenzivno povezana. Pozitivni razvoj pri enem dejavniku prav tako pozitivno vpliva na pozitivno mnenje in razvojem pri drugem osebnem dejavniku zaposlenih in za njihovo motivacijo v poslovnem procesu.

4 Rezultati testiranja hipotez z regresijsko analizo

Za testiranje hipoteze so kot osnova za regresijsko analizo uporabljeni z anketiranjem pridobljeni podatki. Preglednica 5 prikazuje rezultate regresijske analize za dejavnike delovnih razmer zaposlenih in motivacije zaposlenih v poslovnem procesu, s katero smo

Preglednica 5: Regresijska analiza dejavnikov delovnih razmer zaposlenih v poslovnem procesu

Odvisna spremenljivka	Konstanta	Organizacija dela	Strokovni razvoj	Odnosi s sodelavci	AdjR ²	F
Delovne razmere zaposlenih v poslovnem procesu	1,573 (4,156)	0,188 (1,790)	0,207 (2,060)	0,221 (2,331)	0,303	11,285

V oklepaju je *t*-statistika.

preverjali H1. Iz rezultatov regresijske analize izhaja, da so delovne razmere zaposlenih pozitivno in statistično značilno povezane s spremenljivkami organizacija dela, strokovni razvoj in odnosi s sodelavci. S tem smo potrdili H1, saj se druge testirane pojasnjevalne spremenljivke niso pokazale statistično značilne.

Preglednici 6 prikazuje rezultate regresijske analize za dejavnike organizacije dela v povezavi z dejavniki delovnih razmer v poslovnem procesu in v povezavi z osebnimi dejavniki zaposlenih in motivacijo zaposlenih v poslovnem procesu, s katero smo preverjali H2. Iz rezultatov regresijske analize izhaja, da je organizacija dela pozitivno in statistično značilno povezana s pojasnjevalnimi spremenljivkami obveščanje o dogodkih, soodločanje, sistemizacija delovnih mest, strokovni razvoj, odnosi s sodelavci in ustno komuniciranje, vendar pa

negativno povezana s prenašanjem čustvenih obremenitev. S tem smo potrdili H2, saj se druge testirane pojasnjevalne spremenljivke niso pokazale statistično značilne.

Preglednica 7 prikazuje rezultate regresijske analize za dejavnike motivacije zaposlenih v povezavi z dejavniki delovnih razmer v poslovnem procesu in v povezavi z osebnimi dejavniki zaposlenih v poslovnem procesu, s katero smo preverjali H3. Iz rezultatov regresijske analize izhaja, da je motivacija zaposlenih pozitivno in statistično značilno povezana s spremenljivkami delovne razmere, soodločanje, sistemizacija delovnih mest, svobode, fleksibilnosti, samoiniciativnosti, odnosov s sodelavci, ustnim komuniciranjem, možnostjo napredovanja, sposobnostjo načrtovanja organizacije, neposrednega vodje in prenašanjem čustvenih obremenitev, vendar pa negativno povezana s plačo. S tem smo potrdili H3.

Preglednica 6: Regresijska analiza za organizacijo dela v poslovnem procesu

Odvisna spremenljivka	Konstanta	Obveščanje o dogodkih	Soodločanje	Sistemizacija	Strokovni razvoj	Zanimivost dela	Prenašanje čustvenih obremenitev	AdjR ²	F
Organizacija dela	-0,656 (-1,568)	0,457 (6,314)	0,175 (1,842)	0,136 (1,702)	0,240 (2,860)	0,135 (1,692)	-0,174 (-2,243)	0,655	20,227
Organizacija dela	0,083 (0,284)	0,471 (6,106)	0,227 (2,543)		0,260 (2,996)			0,630	25,131
Organizacija dela	-0,413 (-1,066)	0,453 (5,934)	0,218 (2,492)		0,252 (2,951)	0,157 (1,896)		0,616	29,517
Organizacija dela	0,247 (0,819)	0,473 (6,227)	0,275 (2,987)		0,290 (3,326)		-0,138 (-1,746)	0,613	29,160
Organizacija dela	-0,033 (-0,110)	0,499 (6,735)		0,223 (2,877)	0,293 (3,733)			0,611	38,202
	Konstanta	Obveščanje o dogodkih	Sistemizacija	Strokovni razvoj	Odnosi s sodelavci	Ustno komuniciranje	AdjR ²	F	
Organizacija dela	-0,371	0,482	0,235	0,242	0,138		0,622	30,201	
Organizacija dela	(-1,052)	(6,539)	(3,065)	(2,916)	(1,713)				
	-0,392	0,491	0,204	0,252		0,158	0,622	30,163	
	(-1,087)	(6,702)	(2,655)	(3,113)		(1,697)			

V oklepaju je *t*-statistika.

Preglednica 6: Regresijska analiza za motivacijo zaposlenih v poslovnem procesu

<i>Odvisna spremenljivka</i>	<i>Konstanta</i>	<i>Delovne razmere</i>	<i>Soodločanje</i>	<i>Sistemizacija</i>	<i>Odnosi s sodelavci</i>	<i>Ustno komuniciranje</i>	<i>Možnost napredovanja</i>	<i>Plača</i>	<i>AdjR²</i>	<i>F</i>
Motivacija (-0,076)	-0,032	-0,273	0,436	0,370	0,219	0,259	0,317	-0,293	0,650	19,808
	(-2,631)	(4,425)	(3,484)	(2,456)	(2,523)	(4,050)	(2,957)			
Motivacija (-0,327)	-0,142	-0,297	0,383	0,207	0,206	0,252	0,323		0,619	20,201
	(-2,754)	(3,810)	(2,315)	(2,217)	(2,347)	(3,954)				
	<i>Konstanta</i>	<i>Soodločanje</i>		<i>Sistemizacija</i>	<i>Odnosi s sodelavci</i>	<i>Ustno komuniciranje</i>	<i>Možnost napredovanja</i>	<i>Plača</i>	<i>AdjR²</i>	<i>F</i>
Motivacija (-1,035)	-0,425	0,390		0,393	0,157	0,219	0,285	-0,320	0,618	20,123
	(3,853)	(3,548)		(1,754)	(2,066)	(3,526)	(-2,720)			
	<i>Konstanta</i>	<i>Soodločanje</i>	<i>Sistemizacija</i>	<i>Prenašanje čustvenih obremenitev</i>	<i>Neposredni vodja</i>	<i>Možnost napredovanja</i>	<i>Plača</i>	<i>AdjR²</i>	<i>F</i>	
Motivacija (0,203)	0,064	0,371	0,340	0,270		0,302	-0,235	0,624	24,558	
	(3,609)	(3,145)	(3,306)		(3,788)	(-2,014)				
Motivacija (-1,575)	-0,603	0,233	0,247	0,286	0,158	0,287		0,622	24,319	
	(2,215)	(2,758)	(3,508)	(1,900)	(3,563)					
Motivacija (-0,490)	-0,149	0,307	0,211	0,289		0,304		0,607	28,389	
	(3,070)	(2,370)	(3,481)		(3,727)					
	<i>Konstanta</i>	<i>Soodločanje</i>	<i>Sistemizacija</i>	<i>Samoinicativnost</i>	<i>Ustno komuniciranje</i>	<i>Možnost napredovanja</i>	<i>Svoboda</i>	<i>AdjR²</i>	<i>F</i>	
Motivacija	-0,069	0,375	0,179	0,224		0,271		0,579	25,380	
	(-0,215)	(3,812)	(1,932)	(2,616)		(3,196)				
Motivacija	-0,690	0,295	0,230		0,270		0,236	0,602	22,521	
	(-1,701)	(2,908)	(2,523)		(1,972)		(2,425)			
Motivacija	-0,325	0,365	0,192		0,259	0,301	0,236	0,574	24,869	
	(-0,833)	(3,609)	(2,060)		(2,439)	(3,546)	(2,425)			
	<i>Konstanta</i>	<i>Soodločanje</i>	<i>Sistemizacija</i>			<i>Možnost napredovanja</i>	<i>Sposobnost načrtovanja organizacije</i>	<i>AdjR²</i>	<i>F</i>	
Motivacija	-0,034	0,365	0,190			0,283	0,227	0,567	24,212	
	(-0,102)	(3,539)	(2,022)			(3,302)	(2,190)			
	<i>Konstanta</i>	<i>Soodločanje</i>	<i>Sistemizacija</i>			<i>Možnost napredovanja</i>	<i>Fleksibilnost</i>	<i>AdjR²</i>	<i>F</i>	
Motivacija (-0,086)	-0,028	0,352	0,183			0,284	0,226	0,567	24,284	
	(3,351)	(1,940)	(3,310)			(2,219)				

V oklepaju je t-statistika.

5 Sklep

Prispevek je prikazal povprečne vrednosti odgovorov na zastavljena vprašanja zaposlenim o delovnih razmerah zaposlenih in organizacijo dela v poslovnem procesu ter o osebnih dejavnikih zaposlenih in motivaciji zaposlenih v poslovnem procesu v elektrodistribucijskem podjetju. Ugotovitve so pomembne za zaposlene v podjetju in zlasti za vršni management v pri upravljanju podjetja in sprejemanju odločitev, ki so pomembne za zaposlene in tudi za uspešnost poslovanja podjetja. Analiza je potrdila močno pozitivno povezanost med posameznimi spremenljivkami, kar kaže na sinergijske učinke v njihovem medsebojnem delovanju.

Z regresijsko analizo smo potrdili vse tri postavljene hipoteze, in sicer, da so delovne razmere med sodelavci v podjetju pozitivno povezane z organizacijo dela, strokovnim razvojem in odnosi med sodelavci. Organizacija dela v poslovnem procesu je pozitivno povezana z obveščanjem o dogodkih v podjetju, soodločanjem pri sprejemanju odločitev, sistemizacijo delovnih mest, strokovnim razvojem, odnosi med sodelavci in primernim ustnim komuniciranjem, vendar pa negativno povezana s prenašanjem čustvenih obremenitev. Motivacija zaposlenih v poslovnem procesu je pozitivno povezana z delovnimi razmerami, možnostjo soodločanja, sistemizacijo delovnih mest, svobodo v poslovnem procesu, fleksibilnostjo, samoiniciativnostjo, odnosi s sodelavci, ustnim komuniciranjem, možnostjo napredovanja, sposobnostjo načrtovanja organizacije, od odnosov z neposrednim vodjem in prenašanjem čustvenih obremenitev, vendar pa negativno povezana s plačo.

Sklenemo lahko, da v času liberalizacije trga z električno energijo ima pomembno mesto človeški in socialni kapital zaposlenih kot osebni dejavniki zaposlenih in kot katalizator delovnih razmer, organizacije dela in motivacije v poslovnih procesih in med zaposlenimi v elektro distribucijskem podjetju. Zato bi veljalo večjo pozornost nameniti vlaganjem v človeški kapital za dvig sposobnosti zaposlenih za načrtovanje in organizacijo službe z vidika metodike, strukture in delovnih operacij, ki so potrebni v zaostrenih tržnih in vse bolj konkurenčnih pogojih z izboljšanje motivacijske klime in uvedbo novih pristopov za motiviranje in soupravljanje v organizaciji.

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valnem področju prejel „nagrado Srečko Kosovel“ Univerze na Primorskem. Aprila 2008 je prejel priznanje „energetski menedžer“ za prvonagrajeni „sonaravni projekt 2008“ partnerskega razvojno izobraževalnega modela pri izgradnji sončne elektrarne Strahinj. Maja 2009 je prejel „Trimovo raziskovalno nagrado“ za magistrsko delo Primerjava razvojnih učinkov obnovljivih virov energije, oktobra 2009 pa

državno nagrado za trajnostni razvoj družbe. Aprila 2010 je prejel posebno priznanje za razvoj in promocijo okolju prijazne proizvodnje električne energije Ministrstva za gospodarstvo in Centra za energetske učinkovitost Inštituta Jožefa Štefana na 12. Dnevih energetikov. Objavil je večje število samostojnih prispevkov, vključno samostojno monografijo.

Opinions employees on factors of work processes, work organisation and motivation in electro distribution enterprise

During the structural changes with the electricity market deregulation important role plays employees as catalyst of work relations, work organisation and motivation in business processes. The paper analyses surveys results, which were conducted between employees in electricity distribution enterprises with summary statistics, correlation and regression analysis. In business processes and among personal factors the employees are highly evaluated the importance of continuity of employment with social security, importance of direct head, and work requirements (physical and psychical). With regression analysis is confirmed hypothesis that work conditions of employees are positively associated with work organisation, professional development, and relations between employees. Work organisation is positively associated with mutual exchange of information, systematisation of work places, professional development, relations between employees, and mouth-to-mouth communication, while negatively associated with transfer of emotional pressures. Motivation of employees is positively associated with working conditions, self-participatory decision making, systematisation of work places, freedom, flexibility, self-initiatives, relations between employees, mouth-to-mouth communication, opportunities for carrier promotion, ability of programming of development of organisation, importance of direct head, and transfer of emotional pressures, while negatively associated with wages.

Key words: employees, organisation, satisfaction, statistical analysis, regression analysis

Vpliv zunanjih in notranjih dejavnikov na individualno uspešnost prodajalca – primer družbe Relax Turizem

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Družba Relax Turizem je ena izmed sedmih hčerinskih družb poslovnega sistema Relax. Družba je razvila sistem lastnih poslovnih enot, v katerih se odvija prodaja turističnih storitev na mestu nakupa. Lastna prodajna mreža obsega 20 mest nakupa s 30 prodajalci. Odločitev o razvoju lastne prodajne mreže je temeljila na predpostavki, da sta lahko obseg in kakovost prodaje v lastnih poslovnih enotah večja zaradi boljše usposobljenih prodajalcev. Glede na to je bil predmet raziskave uspešnost prodajalcev na mestu nakupa, pri čemer je bila ta opredeljena s kriterijem povprečnega doseganja dnevnega prometa. Namen raziskave je bil identificirati odločilne lastnosti uspešnega prodajalca, ki bodo osnova za izdelavo programa usposabljanja za uspešnejšo prodajo na mestu nakupa. Izhajajoč iz predpostavke, da na uspešnost prodajalcev vplivajo različni elementi, je bil cilj raziskave ugotoviti stopnjo vplivnosti posameznih elementov oz. njihovih sklopov na uspešnost prodaje. Rezultati raziskave, izvedene v vseh poslovalnicah družbe Relax Turizem, so pokazali močno stopnjo povezanosti uspešnosti prodaje zlasti s tremi elementi: spremljanjem komuniciranja s potencialnimi kupci, verbalnim komuniciranjem prodajalca ob vstopu kupca in spremljanjem doseganja osebne plana.

Glavne besede: kupci, uspešnost, osebni plan, prodajalec, Relax Turizem, verbalna komunikacija

1 Uvod

O uspešnosti organizacije Zupanova (2001) pravi, da je odvisna od kadrovskega potenciala in od tega, kako le-tega podjetja prenesejo v rezultate dela. Vendar se pri tem postavlja pomembno vprašanje, komu pripisati uspešnost (Bettger, 1995) in kako jo meriti. Mnogi teoretiki zatrjujejo, da je mogoče uspešnost meriti na veliko načinov, izbrati je treba le ustrezne kriterije (Gilbert, idr., 1985). Izbor kriterijev je navadno zelo obsežen in merjenje je lahko zelo zapleteno, zaradi česar se v praksi uveljavlja merjenje uspešnosti z določanjem merljivih ciljev, saj je primerjava postavljenih ciljev in doseženih rezultatov dokaj preprosto merilo uspešnosti (Lipičnik, 1998). Pomemben vidik organizacijske in individualne uspešnosti v storitvenih dejavnostih je kakovost storitve (Sfiligoj, 1990). Njo ocenjujejo porabniki, njihovo zadovoljstvo ali razočaranje pa je trenutek resnice, v katerem storitveno podjetje spozna svoje prednosti in pomanjkljivosti (Androljšek in Seljak, 2005).

Zelo pogosto se v turistični dejavnosti pojavlja izraz, da gre za prodajo nevidnega (Arsene, 2012; Beckwith, 1997, 2003, 2005). Kupec, ki kupi turistični aranžma, v bistvu ne ve, kaj je kupil, saj se je odločil na osnovi fotografij, objavljenih v katalogu, in priporočila prodajalca, kar pomeni, da

mora obstajati velika mera zaupanja v prodajalca. Tukaj bi lahko govorili o kredibilnosti prodajalca, njegovi poštenosti in priljubljenosti v okolju. Uspeh v storitvenem marketingu je v veliki meri odvisen od priljubljenosti in poštenosti, kajti storitev je v bistvu obljuba, ki jo prodajalec v storitveni dejavnosti prodaja (Beckwith, 2003; 2005).

Ljudje smo zelo kompleksna in zapletena bitja, ki jih v različnih obdobjih življenja motivirajo različne stvari. Po vsej verjetnosti gre za različne individualne scenarije uresničevanja osebnih teženj in pričakovanj vsakega posameznika, zato je smotno ugotoviti motive, potrebe, želje, ambicije, in če je le mogoče, tudi poslanstvo vsakega posameznika. Le tako lahko organizacija ustvari pogoje za uresničevanje svoje politike z namenom, da se bodo lahko zaposleni zasedrali in postali njena največja konkurenčna prednost. Iluzorno bi bilo pričakovati, da bi nam to uspelo pri vseh zaposlenih, vsekakor pa moramo stremeti za tem, da bomo to dosegli pri večini zaposlenih na kritičnih točkah delovnega procesa. V družbi Relax Turizem je takšna kritična točka prodaja na mestu nakupa, kjer se odloča o obsegu in kakovosti prodanih proizvodov oz. storitev. Gre za neposreden stik s kupci, ki obiskujejo agencijo, bodisi zaradi blagovne znamke bodisi zaradi kakovosti komuniciranja na ravni družbe oz. na ravni posameznega mesta nakupa, ali pa so obiskali agencijo, ker jih je poklical prodajalec.

Uspešnost posameznika je za vsako sodobno organizacijo bistvenega pomena, saj uspešnost posameznikov pomeni uspešnost celotne organizacije. Ker smo se pri raziskavi usmerili na proučevanje ravno tega vidika, smo za predmet raziskave izbrali prodajalce, saj so prav oni tisti, ki lahko največ prispevajo k doseganju ciljev svoje poslovne enote in s tem tudi k doseganju skupnih ciljev na ravni družbe (Gilbert idr., 1985). Glede na pomen individualne uspešnosti smo oblikovali raziskovalni problem, pri tem smo izhajali iz predpostavke, da prodajalci na mestu nakupa niso dovolj učinkoviti.

2 Lastnosti in način dela uspešnih prodajalcev

Tracy (1997) je opredelil sedem dejavnikov uspešne prodaje, pri čemer je poudaril, da izboljšanje ene prodajne funkcije izboljša uspešnost za faktor 1,10, izboljšanje vseh sedmih prodajnih funkcij pa za faktor 1,95 – torej skoraj dvakratno izboljšanje prodajnih rezultatov. Med sedem dejavnikov uspešne prodaje je uvrstil: pozitivno miselno naravnost, dobro zdravje in videz, poznavanje produktov, neprestano iskanje možnih strank, sposobnost za predstavitve, obravnavanje ugovorov in večine osebnega menedžmenta.

Eno najpomembnejših načel, ki je bilo odkrito na področju človekovega dela, je zmagovalna naravnost, kar pomeni, da se majhne razlike v sposobnostih lahko odražajo v velikih razlikah pri rezultatih. Če se človek pri odločilnih delih le malo izboljša, lahko to bistveno vpliva na prodajne rezultate. Pozitivna miselna naravnost je trdno povezana s prodajnim uspehom na vsakem področju, saj je kakovost mišljenja določa kakovost življenja (Tracy, 1997). Dober prodajalec mora torej misliti pozitivno, biti vitalen in mora imeti rad svoj poklic, hkrati pa se zavedati, da pasivno obnašanje ne prinese rezultatov (Schwable, 1993). Kreativnost, iznajdljivost in izkušnost so lastnosti, ki jih potrebuje dober prodajalec, k temu je za uspeh v prodaji treba dodati še lepo urejen prostor, kakovostne izdelke in ugodne cene (Brezovec, 2000).

Stranke so pogosto občutljive na prodajalčeva sporočila, ki jih posreduje s svojim videzom in obnašanjem. Stranka si ustvari vtis v prvih štirih sekundah, prvi vtis pa je tisti, ki vpliva na vsa nadaljnja dejanja (Bednarczuk, 1990). V trenutku, ko stranka pride v stik s prodajalcem, ta napravi nanjo vtis in od tega trenutka dalje stranka išče informacije in dokaze, s katerimi naj bi potrdila svoj prvi vtis. Kar 95% prvega vtisa, ki ga naredimo na potencialno stranko, ustvari obleka, saj je obleka tista, ki pokriva 95% telesa (LeBoeuf, 2000). Vsak prodajalec naj bi se torej zavedal, da je obleka tista, ki pri prodaji škoduje ali pomaga, in da stranke raje kupujejo pri prodajalcih, ki so podobni njim (Bansch, 1993).

Poleg tega uspešni prodajalci pri svojem delu uporabljajo načrt svojih dejavnosti, ki omogoča uspešno prodajo različnih izdelkov v različnih okoliščinah (Becker, 1983). Načrt prodajnega procesa je po besedah Ziglarja (2000) vsebuje štiri korake. Prvi korak je analiza, drugi zavedanje, tretji rešitev in zadnji zadovoljstvo. Samo načrt prodaje pa za najuspešnejše prodajalce ni dovolj, kajti za vrhunške rezultate je potrebna tudi zmagovalna naravnost in obvladovanje vrhunskih prodajnih strategij (Zigler, 2000).

3 Raziskava o vplivu dejavnikov na individualno uspešnost prodajalcev

3.1 Raziskovalni namen, cilji in predpostavke

Namen raziskovanja je bil identificirati odločilne dejavnike individualne uspešnosti prodajalcev v družbi Relax Turizem. Oblikovali smo pet raziskovalnih predpostavk, v katerih smo predpostavljali, da obstaja pozitivna povezanost med:

1. posameznim elementom z ocenjevalne liste o uspešnosti prodajalca in povprečno doseženim prometom prodajalca na delovni dan;
2. zbranimi točkami v sklopu temeljnih nalog z ocenjevalne liste o uspešnosti prodajalca in povprečno doseženim prometom prodajalca na delovni dan;
3. zbranimi točkami v sklopu posedovanih dejavnikov z ocenjevalne liste o uspešnosti prodajalca in povprečno doseženim prometom prodajalca na delovni dan;
4. zbranimi točkami v sklopu posedovanih veščin z ocenjevalne liste o uspešnosti prodajalca in povprečno doseženim prometom prodajalca na delovni dan;
5. vsemi zbranimi točkami pri vseh treh sklopih z ocenjevalne liste o uspešnosti prodajalca in povprečno doseženim prometom prodajalca na delovni dan.

Glavni cilj raziskovanja je bila določitev stopnje vplivnosti:

1. vsakega posameznega elementa z ocenjevalne liste uspešnosti prodajalca na njegovo individualno uspešnost;
2. vsakega posameznega sklopa elementov z ocenjevalne liste uspešnosti prodajalca (temeljne naloge, dejavniki uspešnega prodajalca in večine uspešnega prodajalca) na uspešnost prodajalca;
3. vseh treh sklopov z ocenjevalne liste uspešnosti prodajalca na individualno uspešnost prodajalca.

3.2 Raziskovalni vzorec, postopek zbiranja podatkov in kriteriji uspešnosti

Vzorec raziskave je zajel vse redno zaposlene prodajalce za polni delovni čas na mestu nakupa v družbi Relax Turizem, ki jih je bilo v času raziskave 30 (100% vzorec). Kriteriji uspešnosti prodajalcev so bili določeni po opredelitvi osebnega letnega načrta prometa prodajalca, zaposlenega za polni delovni čas in se merijo s povprečno doseženim prometom prodajalca na delovni dan. Kriteriji so bili sprejeti in oblikovani na sestanku posloводства, in sicer je:

- neuspešen prodajalec tisti, ki dosega povprečno do 2.500 evrov prometa na delovni dan;
- delno uspešen prodajalec tisti, ki dosega povprečno od 2.500 do 3.499 evrov prometa na delovni dan;
- uspešen prodajalec tisti, ki dosega povprečno 3.500 evrov in več prometa na delovni dan.

Izvedba ocenjevanja je potekala v času glavne sezone, od 1. 7. 2009 do 30. 9. 2009. Ocenjevalke so bile tri izvršne direktorice, usposobljene za presojo in ocenjevanje delovnih

procesov po določenih standardov ISO. Ocenjevalke so na podlagi vrste dejavnikov iz ocenjevalnih list ocenile vsakega prodajalca z ocenami od 0 do 5. Izračunane povprečne vrednosti so bile osnova za nadaljnje izračune, še zlasti za spremljanje posameznikovega napredovanja v uspešnosti.

3.3 Metode raziskovanja

Za ugotavljanje vpliva posameznih elementov na uspešnost prodajalcev pri prodaji smo uporabili več raziskovalnih metod.

Za opisovanje posameznih dejstev smo uporabili deskriptivno metodo in metodo zbiranja internih podatkov, za primerjavo med teoretičnimi izhodišči in stanjem v praksi pa komparativno metodo. Za potrditev predpostavk smo uporabili metodo opazovanja z ocenjevanjem, ki je bila izvedena na osnovi izdelanega instrumenta – ocenjevalne liste. Za doseg postavljenih ciljev po določitvi stopnje vplivnosti posameznih vplivnih elementov in sklopov elementov na uspešnost prodajalcev pri prodaji smo izračunali Pearsonov koeficient in koeficient kontingence.

Tabela 1: Elementi sklop »Osnovne naloge« s kriteriji merjenja uspešnosti in mersko lestvico

Sklop/Element	Ocena prodajalca 0	Ocena prodajalca 5	Kriterij merjenja uspešnosti
Osnovne naloge			
• spremljanje osebnega plana	prodajalec nima nastavljenih mape za spremljanje doseganja svojega osebnega plana in tega tudi ne pozna	prodajalec ima nastavljeno mapo za spremljanje skupnega doseganja plana in do potankosti pozna svoj osebni plan, katerega celo presega za 15%	delež doseganja osebnega plana
• spremljanje komuniciranja s potencialnimi kupci	prodajalec nima nastavljenih mape za spremljanje komuniciranja s potencialnimi kupci	prodajalec je tedensko beležil povprečno 220 kontaktov s potencialnimi kupci	število tedensko zabeleženih potencialnih kupcev
• spremljanje komuniciranja s kupci po končanem dopustu	prodajalec nima mape za spremljanje tovrstnega komuniciranja	prodajalec je tedensko komuniciral s povprečno 30 kupci	število kontaktiranih kupcev po končanem dopustu
arhiviranje in poznavanje sporočil	prodajalec nima nastavljenih mape sporočil	prodajalec ima nastavljeno mapo in od 5 sporočil pozna vseh pet	nastavitev mape in poznavanje vsebine sporočil
• ažuriranje in uporaba orodij za uspešno prodajo	prodajalec nima nastavljenih zahtevane mape orodij za uspešno prodajo	prodajalec ima nastavljeno zahtevano mapo in orodja kontinuirano tudi razvija	urejenost mape, v kateri so naslednja orodja: spremljanje odzivnosti medijev, stanje zasedenosti zakupov polno za prazno, logistika avtobusov in letal, stanje zasedenosti fiksnih zakupov itd.
• priprave na dnevno prodajo	prodajalec nima nastavljenih mape za dnevno prodajo	prodajalec ima vzorno urejeno mapo s kreativnimi pripravami, ki so zgled drugim	vsebinska urejenost mape, ki mora vsebovati: seznam proizvodov za zahtevne in manj zahtevne kupce z lastnim, avtobusnim ali letalskim prevozom; seznam posebno zanimivih cenejših in najdražjih namestitvev; lastna prodajna orodja, npr. seznam hotelov, ki so prijazni otrokom ali v bližini mest
• obvladovanje in razvijanje metodologije prodaje	prodajalec nima nastavljenih mape za obvladovanje in razvijanje metodologije prodaje	prodajalec obvlada vse štiri korake prodajnega postopka	poznavanje metodologije prodaje: prodajni intervju s kupcem individualnih aranžmajev (ločeno za počitnice in potovanja), prodajni intervju za zaključene skupine in orodje »ne smem pozabiti«

Vir: Arhiv Relaxa (2009).

3.4 Oblikovanje raziskovalnega instrumenta

Na osnovi preteklih internih raziskav in izkušenj smo v družbi Relax Turizem prišli do spoznanja, da na uspešnost prodaje

prodajalcev na mestu nakupa vpliva več dejavnikov, ki so bili osnova za oblikovanje ocenjevalne liste uspešnosti prodajalca. Dejavnike smo razvrstili v tri sklope. V prvem so osnovne naloge prodajalca. Drugi sklop elementov so dejavniki uspe-

Tabela 2: Elementi sklop »Urejenost prodajalca« s kriteriji merjenja uspešnosti in mersko lestvico

Sklop/Element	Ocena prodajalca 0	Ocena prodajalca 5	Kriterij merjenja uspešnosti
Urejenost prodajalca			
• zunanja urejenost prodajalca – prvi vtis	prodajalec nima niti priponke niti uniforme	prodajalec je v uniformi, ima priponko, urejeno pričesko, obraz, nohte in je prijetnega vonja	nošenje uniforme, priponke in drugimi elementi zunanje urejenosti
• neverbalna komunikacija prodajalca ob vstopu kupca – prvi vtis	prodajalec sploh ni zaznal kupca ob vstopu v prostor	prodajalec je kupca sprejel z navdušenjem, neverbalna komunikacija je bila brezhibna.	gestika in mimika prodajalca v danem trenutku
• verbalna komunikacija prodajalca ob vstopu kupca – prvi vtis	prodajalec kupca ob vstopu v prostor sploh ni zaznal (ga ni pozdravil)	prodajalec je kupca ob vstopu prijazno nagovoril in mu izrazil svoje navdušenje	ustreznost prve govorne komunikacije prodajalca ob vstopu kupca
• splošno zemljepisno znanje	prodajalec ne zna na zemljevidu pokazati niti držav niti mest in krajev, ki so objavljeni v Relaxovih katalogih	prodajalec zna pokazati vse zahtevane kontinente, države in kraje ter zna razložiti različna podnebja	poznavanje držav, mest in celin, ki so v Relaxovih katalogih
• poznavanje Relaxovih turističnih proizvodov	prodajalec sploh ni opravil testa	prodajalec je dosegel maksimalno število točk (100%)	ocena testiranja poznavanja Relaxovih proizvodov, izražena v%
• spremljanje konkurence	prodajalec ne pozna niti konkurenčne ponudbe svojega soseda	prodajalec pozna ponudbo več kot petih turističnih agencij v Sloveniji	število prodajalcu poznanih konkurenčnih ponudnikov turističnih proizvodov na slovenskem trgu
• prodaja prek drugih rezervacijskih sistemov	prodajalec sploh ne uporablja drugih informacijskih sistemov	prodajalec proda tedensko vsaj 10 turističnih proizvodov iz drugih rezervacijskih sistemov	število prodanih turističnih proizvodov preko drugih rezervacijskih sistemov
• pozitivna miselna naravnost	prodajalec ves čas slabe volje, ki je na relaciji do kupcev ne more prikriti	prodajalec je izrazito pozitivno naravn, ki motivira tudi sodelavce	prodajalčev optimizem, pesimizem, slaba volja
• samoiniciativnost	prodajalec v tekočem letu ni pridobil niti ene zaključene skupine	prodajalec je v tekočem letu pridobil vsaj 15 novih zaključenih skupin	število novopridobljenih zaključenih skupin
• prijaznost	prodajalec do kupcev ni niti formalno prijazen	prodajalec je do vseh kupcev iskreno prijazen, je nasmejan in tudi težave rešuje z dobro voljo	prisotna subjektivna ocena ocenjevalcev
• pozitivne osebnostne lastnosti	prodajalec poseduje manj kot 4 naštete pozitivne osebnostne lastnosti	prodajalec ima najmanj 12 naštetih pozitivnih osebnostnih lastnosti	števila posedovanih pozitivnih osebnostnih lastnosti prodajalca
• ažuriranje dokumentov	prodajalec se ne vključuje v urejanje skupne dokumentacije	prodajalec samoiniciativno in ažurno ureja skupno dokumentacijo	pripravljenost vključevanja posameznika v urejanje skupne dokumentacije

Vir: Arhiv Relaxa (2009).

šnega prodajalca, ki se delijo na njegovo zunanjo in notranjo urejenost, saj kupec doživlja prodajalca z vsemi čutili, čustvi in s svojim intelektom od trenutka, ko ga zagleda, vse do trenutka, ko zapusti mesto nakupa. Tretji sklop predstavljajo večine uspešnega prodajalca, ki so praviloma pridobljene z usposabljanjem. Za vsak element smo določili kriterije merjenja uspešnosti prodajalca in šeststopenjsko mersko lestvico. V nadaljevanju povzemamo elemente vseh treh sklopov, tabele 1-3 pa povzemajo kriterije merjenja uspešnosti in mersko lestvico za vse tri sklope.

1. sklop: Osnovne naloge prodajalca

Spremljanje skupnega doseganja osebnega plana. Brez jasnih in merljivih ciljev ni mogoče določiti strategije (poti) in tudi ne taktike (načina uresničevanja strategije). To pomeni, da je spremljanje postavljenih ciljev enako pomembno kot postavljanje le-teh. Vsak prodajalec ima izdelan svoj letni osebni plan, temu mora slediti in vsak trenutek vedeti, koliko osebnega plana ima realiziranega. Prednost osebnih planov je v merjenju uspešnosti vsakega posameznega prodajalca, ne pa skupine prodajalcev na mestu nakupa, pri čemer bi se lahko za rezultati uspešnih posameznikov skrivali neuspešni prodajalci.

Spremljanje komuniciranja s potencialnimi kupci. Na potencialnega kupca lahko vplivamo s številnimi dejavniki, ki izhajajo iz zunanje in notranje urejenosti organizacije, mesta nakupa (oglasna tabla, A-tabla, izložbeno okno) in prodajalca.

Spremljanje komuniciranja s kupci po končanem dopustu. Z opravljanjem te naloge postaja prodajalec kupcu serviser za preživljanje prostega časa. Takšna vzajemnost pripelje do partnerskega odnosa med prodajalcem in kupcem.

Arhiviranje in poznavanje sporočil. Brez spremljanja in arhiviranja sporočil, ki jih dobiva iz marketinga, bookinga, računovodstva, prodajalec ne more biti seznanjen s trenutno situacijo. To pomeni, da pri svojem opravljanju prodaje dela napake, saj kupcem posreduje napačne ali zastarele informacije.

Ažuriranje in uporaba orodij za uspešno prodajo. Brez uporabe in ažuriranja orodij, ki jih pripravljajo ustrezne službe, ni mogoče dosegati zastavljenih ciljev. Ta temeljna naloga nam pove vse o pozicioniranju prodajalca, ki je lahko v preteklosti (ne uporablja orodij) ali v sedanjosti (pozna orodja, jih ažurira in celo razvija nova).

Priprave na dnevno prodajo. Vsak prodajalec, ki želi doseči svoj osebni plan, se mora vsak dan pripraviti na prodajo. Vedeti mora, kje so proste kapacitete hotelov 2*, 3*, 4* ali 5*, prav tako mora biti seznanjen, kje in na katerih relacijah so prosti sedeži na avtobusih, letalih ali ladjah.

Obladovanje in razvijanje metodologije prodaje. Metodologijo prodaje uvrščamo med intelektualna orodja, saj gre za temeljno večino prodajalca, ki jo mora vsakodnevno dopolnjevati in razvijati.

2. sklop: Urejenost prodajalca

Zunanja urejenost prodajalca – prvi vtis. Prvi stik s kupcem vzpostavi prodajalec v trenutku, ko ta odpre vrata. Glede na oddaljenost do pulta ocenjuje kupec prodajalca v zaporedju: drža, obleka (obvezna uniforma za vse redno zaposlene), pričeska, obraz, priponka, roke, parfum, dah iz ust.

Neverbalna komunikacija prodajalca ob vstopu kupca – prvi vtis. Na splošno kupec sprva ocenjuje bonton in vrednote, nato pa se osredotoči na: proksemiko (položaj in gibanje ljudi v prostoru), gestiko (kretanje rok, nog, glave) in na mimiko obraza (pogled v oči, nasmeh, začudenje).

Verbalna komunikacija prodajalca ob vstopu kupca – prvi vtis. Govor je bistveni element uspešne prodaje, saj kupec najprej zazna morebitno govorno napako, nato barvo glasu, prijaznost, živahnost oz. monotonijo glasu.

Na osnovi dolgoletnih izkušenj in analiz smo ugotovili, da je za uspešno prodajo pomembno: znanje, pozitivna miselna naravnost, samoiniciativnost, pozitivne osebne lastnosti in pozicioniranje v sedanjosti. Na osnovi tega vedenja smo v ocenjevalno listo uspešnosti prodajalca vključili še nekatere

Tabela 3: Elementi sklop »Veščine uspešnega prodajalca« s kriteriji merjenja uspešnosti in mersko lestvico

Sklop/Element	Ocena prodajalca 0	Ocena prodajalca 5	Kriterij merjenja uspešnosti
Veščine uspešnega prodajalca			
samoorganiziranost	prodajalec ni orientiran v času, saj si v terminski plan ne zapisuje svojih bodočih aktivnosti	prodajalec načrtuje za leto vnaprej in se za vsako aktivnost usklajuje ter jo vselej zapiše	prodajalčev terminski plan z vpisanimi aktivnostmi
načrtovanje prihodnosti	prodajalec nima osebnega strateškega načrta	prodajalec ima napisan osebni strateški načrt, ki ga ustrezno dopolnjuje	osebni strateški načrt prodajalca, njegovo poznavanje in dopolnjevanje
razvoj novih in vzdrževanje obstoječih intelektualnih orodij	prodajalec nima mape za arhiviranje orodij	prodajalec vzdržuje nastavljeni mapo z devetimi orodji, izdelani pa ima še dve svoji	število intelektualnih orodij, ki jih posameznik vzdržuje ali pa jih ima samo vložene v mapi

Vir: Arhiv Relaxa (2009).

dodatne dejavnike notranje urejenosti, in sicer splošno zemljepisno znanje, poznavanje Relaxovih turističnih proizvodov, spremljanje konkurence, prodaja prek drugih rezervacijskih sistemov, pozitivna miselna naravnost, samoiniciativnost, prijaznost, pozitivne osebnostne lastnosti (neprepirljivost, nezamerljivost, drži obljubo, delavnost, doslednost, ustrežljivost, odkritost, poštenost, komunikativnost, stalna pozitivna miselna naravnost, samozavest) in ažuriranje dokumentov.

3. sklop: Veščine uspešnega prodajalca

Samoorganiziranost. Ta je pogoj za vsako zahtevno funkcijo, še posebno pa za dobrega prodajalca, saj le-ta brez samoorganiziranosti ne izpolnjuje pogoja orientiranosti v času, prostoru in vsebini. Preprosto gre za to, da prične prodajalec uporabljati terminski koledar, v katerega si zapiše vsak dogodek za leto vnaprej, vpisuje pa tudi vse sprotne aktivnosti, vezane na posamezen termin.

Načrtovanje prihodnosti. Prodajalec ne more biti uspešen, niti ne more meriti svoje uspešnosti, če si ne postavi merljivih ciljev in se ne giblje proti njim. Dober prodajalec mora živeti za prihodnost, zato mora imeti izdelan osebni strateški načrt, ki je usklajen s temeljnimi usmeritvami družbe in mesta nakupa.

Razvoj novih in vzdrževanje obstoječih intelektualnih orodij. Prodajalec mora biti kreativen, če želi biti uspešen. Kreativnost posameznika pa se do neke mere lahko izraža tudi v uporabi, vzdrževanju in razvijanju novih intelektualnih orodij, na osnovi katerih spreminja sebe in okolje.

4 Rezultati raziskave

V nadaljevanju smo preverjali povezanost vsakega elementa z uspešnostjo prodajalca. Izračunane vrednosti korelacij med individualno uspešnostjo in posameznimi elementi ter sklopi elementov iz ocenjevalne liste uspešnosti prodajalca so pri

Tabela 4: Rezultati vplivnosti posameznih elementov z ocenjevalne liste uspešnosti prodajalca na njihovo individualno uspešnost

Št. dej.	VPLIVNI ELEMENT	Pearsonov koeficient korelacije (r)	POVEZANOST
Temeljne naloge			
1	spremljanje skupnega doseganja plana	0,80	močna
2	spremljanje komuniciranja s potencialnimi kupci	0,88	močna
3	spremljanje komuniciranja s kupci po dopustu	0,58	zmerna
4	arhiviranje in poznavanje sporočil	0,32	šibka
5	ažuriranje in uporaba orodij za uspešno prodajo	0,40	šibka
6	priprave na dnevno prodajo	0,55	zmerna
7	obvladovanje in razvijanje metodologije prodaje	0,41	zmerna
Dejavniki uspešnega prodajalca			
8	zunanja urejenost prodajalca	0,56	zmerna
9	neverbalna komunikacija ob vstopu kupca	0,59	zmerna
10	verbalno komuniciranje ob vstopu kupca	0,82	močna
11	splošno zemljepisno znanje	0,41	zmerna
12	poznavanje Relaxovih turističnih proizvodov	0,38	šibka
13	spremljanje konkurence	0,65	zmerna
14	prodaja preko drugih rezervacijskih sistemov	0,00	ni povezanosti
15	pozitivna miselna naravnost	0,50	zmerna
16	koristna samoiniciativnost	0,47	zmerna
17	prijaznost	0,50	zmerna
18	pozitivne osebnostne lastnosti	0,55	zmerna
19	ažuriranje dokumentov	0,59	zmerna
Veščine uspešnega prodajalca			
20	samoorganiziranost	0,28	šibka
21	načrtovanje prihodnosti	0,41	zmerna
22	razvoj novih in vzdrževanje obstoječih intelektualnih orodij	0,66	zmerna

Tabela 5: Rezultati izračuna povezanosti posameznih sklopov elementov uspešnosti prodajalcev in individualne uspešnosti

ZAP. ŠT. SKLOPA	SKLOP ELEMENTOV	IZRAČUNANA VREDNOST KORELACIJE	POVEZANOST
1	temeljne naloge uspešnega prodajalca	0,23	šibka
2	dejavniki uspešnega prodajalca	0,41	zmerna
3	veščine uspešnega prodajalca	0,34	šibka

vseh elementih pokazale medsebojno povezanost. Moč povezanosti spremenljivk smo razvrstili glede na moč koeficientov, in sicer je prva spremenljivka linearno povezana z drugo spremenljivko ob 5% stopnji značilnosti, pri čemer od vrednosti 0,00 do vključno vrednosti 0,20 ni povezanosti, od vrednosti 0,20 do vključno vrednosti 0,40 šibka stopnja povezanosti, od vrednosti 0,40 do vključno vrednosti 0,70 zmerna stopnja povezanosti, od vrednosti 0,70 do vključno vrednosti 1,00 močna stopnja povezanosti (BenStat, 2012).

Trije elementi so z individualno uspešnostjo močno povezani, štirinajst povezav je zmernih, štiri so šibke, v enem primeru pa povezave sploh ni (tabela 4).

V nadaljevanju smo na osnovi izračunanega koeficienta kontingence za vse tri sklope preverjali uvodoma postavljene predpostavke o medsebojni povezanosti posameznih spremenljivk (tabela 5).

Prva predpostavka temelji na podmeni, da obstaja pozitivna korelacija med vsakim posameznim elementom z ocenjevalne liste uspešnosti prodajalca in povprečno doseženim prometom prodajalca na delovni dan. Rezultati raziskave so pokazali, da le pri enem izmed elementov ni bila izračunana pozitivna korelacija. Gre za element prodaje preko drugih rezervacijskih sistemov iz sklopa dejavniki uspešnega prodajalca, pri katerem je bil izračunan koeficient 0,00. Vse druge korelacije so bile sicer različnih jakosti, vendar pozitivne. Na osnovi pridobljenih rezultatov raziskave lahko ugotovimo, da se prva predpostavka le delno potrdi, saj se del predpostavk ujema z rezultati, obstaja pa element, pri katerem povezanost z uspešnostjo ni bila ugotovljena.

Druga predpostavka je temeljila na trditvi, da obstaja pozitivna korelacija med zbranimi točkami v sklopu temeljnih nalog z ocenjevalne liste uspešnosti prodajalca in povprečno doseženim prometom prodajalca na delovni dan. Predpostavka se potrdi, saj izračunani koeficient kontingence (0,23) kaže na sicer šibko, toda pozitivno povezanost.

Tretja predpostavka je temeljila na trditvi, da obstaja pozitivna korelacija med zbranimi točkami v sklopu posedovanih dejavnikov z ocenjevalne liste uspešnosti prodajalca in povprečno doseženim prometom prodajalca na delovni dan. Izračunan koeficient kontingence je bil 0,41 in kaže na zmerno povezanost, kar pomeni, da se predpostavka potrdi.

Četrta predpostavka je temeljila na trditvi, da obstaja pozitivna korelacija med zbranimi točkami v sklopu posedovanih veščin z ocenjevalne liste uspešnosti prodajalca in povprečno doseženim prometom prodajalca na delovni dan. Izračunani koeficient kontingence je bil 0,34, kar kaže na pozitivno in šibko povezanost, zaradi česar potrjujemo tudi to predpostavko.

Peta predpostavka je izhajala iz trditve, da obstaja pozitivna korelacija med zbranimi točkami pri vseh treh sklopih z

ocenjevalne liste uspešnosti prodajalca in povprečno doseženim prometom prodajalca na delovni dan. Koeficient kontingence je bil izračunan v višini $r = 0,47$, kar kaže na šibko do zmerno povezanost. Peta predpostavka se potrdi.

6 Sklep

Z določitvijo stopnje vplivnosti posameznih elementov na uspešnost prodajalcev smo dobili odgovor na postavljeno raziskovalno vprašanje, kateri elementi vplivajo na uspešnost prodajalcev pri prodaji. Na uspešnost prodaje vplivajo vsi tisti elementi, pri katerih je bila ugotovljena pozitivna korelacija.

Rezultati raziskave so pokazali močno stopnjo povezanosti pri treh elementih, od katerih sta dva iz sklopa o temeljnih nalogah in eden iz sklopa o dejavniki uspešnega prodajalca. Ti vplivni elementi so:

- spremljanje komuniciranja s potencialnimi kupci ($r = 0,88$);
- verbalno komuniciranje prodajalca ob vstopu kupca ($r = 0,82$);
- spremljanje skupnega doseganja plana ($r = 0,80$).

Spremljanje komuniciranja s potencialnimi kupci je izredno pomemben element, za katerega je bila izračunana največja stopnja povezanosti. Močna stopnja povezanosti verbalne komunikacije prodajalca ob vstopu kupca in individualne uspešnosti prodajalca kaže na izredno velik pomen prvega vtisa, ki ga prodajalec naredi na kupca. Tukaj se potrjujejo dognanja iz teorije, da je prvi vtis najpomembnejši. Močna stopnja povezanosti med spremljanjem skupnega doseganja osebnega plana in uspešnostjo nam pove, da je orientiranost posameznika v doseganje ciljev ključnega pomena.

Raziskava o vplivu posameznih elementov na uspešnost prodajalcev je pokazala, da z izjemo enega primera (prodaja prek drugih rezervacijskih sistemov) obstaja pozitivna korelacija med vsemi drugimi elementi z ocenjevalne liste in individualno uspešnostjo prodajalcev. Pri tem podatku je treba poudariti, da smo v družbi Relax Turizem uvedli druge rezervacijske sisteme (ORS, CATZ, TRAFIC) nekaj mesecev pred raziskavo, kar pomeni, da je treba računati na določeno uvajalno obdobje. Predpostavljamo, da je to razlog, zakaj ni povezanosti tega elementa z individualno uspešnostjo.

Raziskava je pokazala pozitivno korelacijo tudi med posameznimi sklopi vplivnih elementov z ocenjevalne liste uspešnosti prodajalca in uspešnostjo prodajalcev. Za sklop temeljne naloge je bila ugotovljena šibka povezanost ($r = 0,23$), za sklop dejavniki uspešnega prodajalca pa je bila ugotovljena zmerna povezanost ($r = 0,42$). Za tretji sklop, ki smo ga poimenovali veščine uspešnega prodajalca, je bila prav tako ugotovljena

šibka povezanost ($r = 0,34$), ki pa je višja od povezanosti v prvem sklopu.

pozitivna korelacija je bila ugotovljena tudi med vsemi tremi sklopi elementov z ocenjevalne liste uspešnosti prodajalca in individualno uspešnostjo prodajalca ($r = 0,47$), kar pomeni, da so uspešni tisti prodajalci, ki obvladajo več elementov z navedene ocenjevalne liste.

Na osnovi dobljenih rezultatov bi bilo smotrno oblikovati ustrezno intelektualno orodje, ki bi bilo osnova za še bolj temeljito izobraževanje in usposabljanje prodajalcev na mestu nakupa s ciljem povečati uspešnost njihove prodaje.

Orodje naj bi zajelo vse vplivne elemente z ocenjevalne liste uspešnosti prodajalca, pri katerih je bila ugotovljena pozitivna korelacija. Vključiti je smiselno tudi edini element, pri katerem pozitivna korelacija ni bila izračunana, tj. prodajo preko drugih rezervacijskih sistemov, saj je ta za nadaljnji razvoj družbe bistvenega pomena.

Zaradi izredno močne stopnje povezanosti komuniciranja s potencialnimi kupci in individualno uspešnostjo prodajalcev bi bilo priporočljivo v orodje vključiti dodatni element, ki bi se nanašala na pridobivanje tistih potencialnih kupcev, ki imajo veliko prostega časa in na klic prodajalca zasedejo zadnja mesta na letalu, avtobusu itd.

Da bi orodje imelo širšo uporabno vrednost, bi bilo smotrno vanj vključiti še druge elemente, ki neposredno ali posredno vplivajo na uspešnost prodaje, npr. urejenost mesta nakupa, ki je prav gotovo eden pomembnejših vidikov vpliva na uspešnost prodaje.

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Influence of External and Internal Factors on the Salesperson Individual Performance – a Case of Relax Tourism Company

Relax Turizem is one of seven subsidiaries of the Relax business group. The company developed a system of their own business units where touristic services are sold at the place of purchase. The company's sales network consists of 20 places of purchase with 30 salespersons. The decision to develop their own sales network was based on the presumption that the number and the quality of sales in their own sales units would be higher due to better qualified sellers. According to that, the research subject was the performance of salespersons at the place of purchase, whereas the performance was defined by the criterion of the average realization of the daily turnover. The purpose of the research was to identify the deciding characteristics of the effective salesperson that will be the basis for developing a training program for promoting more efficient sales at the place of purchase. Considering the assumption that salespersons' performance is influenced by different elements, the goal of the research was to establish the influence level of individual elements or element sets on sales performance. The results of the research that was conducted in all units of the Relax Turizem company showed a strong level of correlation between sales performance and three elements in particular: monitoring the communication with potential buyers, salesperson's verbal communication at the time of buyer's entrance and monitoring of personal plan realization.

Keywords: buyers, performance, personal plan, salesperson, Relax Turizem, verbal communication

Uporaba metode FMEA za analizo odpovedi železniške proge

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V prispevku je opisana metoda analize načinov odpovedi in njihovih učinkov FMEA (ang. Failure Modes and Effects Analysis). Predstavljene so štiri faze te metode. Metoda je aplicirana na železniško progo, ki je pomemben del železniškega prometnega sistema. Izvedba posamezne faze je ponazorjena na primeru tirnice sistema 49E1, ki je vgrajena v železniški tir odprte proge v Slovenskih železnicah. Pokazali smo, kako na osnovi podatkov o delovanju proge določimo kvantitativno oceno za kritičnost posameznih načinov odpovedi elementov železniške proge.

Ključne besede: FMEA, železniški prometni sistem, železniška proga, način odpovedi, vzrok, učinek, kritičnost

1 Uvod

Pri analizi zanesljivosti kompleksnih tehničnih sistemov so zelo učinkovite metode, ki temeljijo na študiju načinov odpovedi njihovih elementov. Kompleksnejši kot je sistem, večja je potreba po natančnem in sistematičnem pristopu pri identifikaciji in klasifikaciji načinov in učinkov odpovedi. Rezultati študija načinov odpovedi omogočajo odkrivanje tistih mest v sistemu, ki so s stališča zanesljivosti kritična, in planiranje ustreznih vzdrževalnih postopkov ter ukrepov za izboljšanje zanesljivosti. Izsledki v literaturi kažejo, da se je na tem področju uveljavila metoda FMEA (ang. Failure Modes and Effects Analysis; glej npr. Pham, 1998; Kmenta, Fitch in Ishii, 1999; Braglia, 2000; Price in Taylor, 2002; Xu, 2002; Pillay in Wang, 2003; Stamatis, 2003; Hu in Yu, 2009; Walker idr. 2009; Fraracci, 2010).

Primer kompleksnega sistema je železniški prometni sistem (v nadaljevanju ŽPS), čigar osnovna funkcija je varen in urejen prevoz potnikov in tovora iz ene lokacije na drugo na podlagi veljavnega voznega reda. Pomembno vlogo pri izvajanju osnovne funkcije ŽPS igra železniška proga. Odpoved železniške proge namreč lahko povzroči odpoved celotnega ŽPS, kar negativno vpliva na razpoložljivost sistema in ogroža varnost v železniškem prometu.

V članku bomo opisali metodo FMEA, ki jo bomo aplicirali na železniško progo. Izvedbo posamezne faze FMEA bomo prikazali na primeru tirnice sistema 49E1, ki je vgrajena v železniški tir odprte proge v Slovenskih železnicah.

2 Teoretične osnove

2.1 Definicije osnovnih pojmov

Definicije osnovnih pojmov so povzete po Hudoklin in Rozman (2004) in Villemeur (1992).

Nerazpoložljivost sistema pomeni nezmožnost sistema za izvajanje njegove osnovne funkcije. Glavni vzrok za nerazpoložljivost predstavljajo odpovedi sistema in njegovih elementov.

Odpoved sistema oziroma elementa sistema pomeni prenehanje njegove sposobnosti, da zadovoljivo opravlja zahtevano funkcijo. Odpovedi lahko klasificiramo glede na različne kriterije kot npr.:

- hitrost nastajanja (nenadne ali postopne odpovedi),
- stopnja (delne ali popolne odpovedi),
- obdobje v življenjski dobi sistema/elementa sistema (odpovedi v zgodnjem obdobju življenjskega cikla, slučajne odpovedi v obdobju normalnega delovanja ali odpovedi v obdobju staranja),
- odvisnost (primarne ali sekundarne).

V praksi se pogosto uporablja delitev odpovedi na katastrofalne (nenadna in popolna odpoved) in degradacijske odpovedi (postopna in delna odpoved).

Način odpovedi opredelimo kot obliko, v kateri se odpoved pokaže.

Vzrok načina odpovedi opredelimo kot okoliščine, ki so ta način odpovedi povzročile.

Učinek načina odpovedi opredelimo kot skupek vseh možnih posledic posameznega načina odpovedi.

Kritičnost načina odpovedi opredelimo s kombinacijo verjetnosti za nastanek posameznega načina odpovedi in pomembnosti njegovega učinka.

2.2 Metoda FMEA

Pri študiju odpovedi kompleksnih sistemov učinkovito uporabimo metodo FMEA. Uporaba metode FMEA predstavlja prvi korak v procesu priprave in izvajanja programa vzdrževanja sistema na podlagi njegove zanesljivosti (ang. Reliability Centered Maintenance; Moubrey, 1997). Poznavanje elementov, ki jih vključuje FMEA, predstavlja osnovo za planiranje korektivnih ukrepov za izboljšanje razpoložljivosti celotnega sistema (Villemeur, 1992).

Metoda FMEA je induktivna metoda, ki obsega štiri faze (glej npr. Hudoklin in Brezavšček, 1994):

- opredelitev sistema, elementov sistema in njihovih funkcij,
- identifikacija načinov odpovedi elementov sistema in njihovih vzrokov,
- študij učinkov različnih načinov odpovedi elementov sistema na različnih nivojih v zgradbi sistema,
- zaključki in priporočila.

V nadaljevanju bomo posamezne faze metode FMEA podrobneje opisali.

1. faza FMEA:

V okviru prve faze je potrebno natančno opredeliti sam sistem in njegove elemente. Priporočljivo je, da izdelamo ustrezno hierarhično strukturo. Število nivojev v tej strukturi je odvisno od kompleksnosti sistema. Na vseh nivojih v hierarhični strukturi je potrebno definirati funkcije sistema in posameznih elementov. Izdelati je potrebno tudi ustrezne

funkcionalne in logične diagrame, ki ponazarjajo medsebojne povezave elementov sistema.

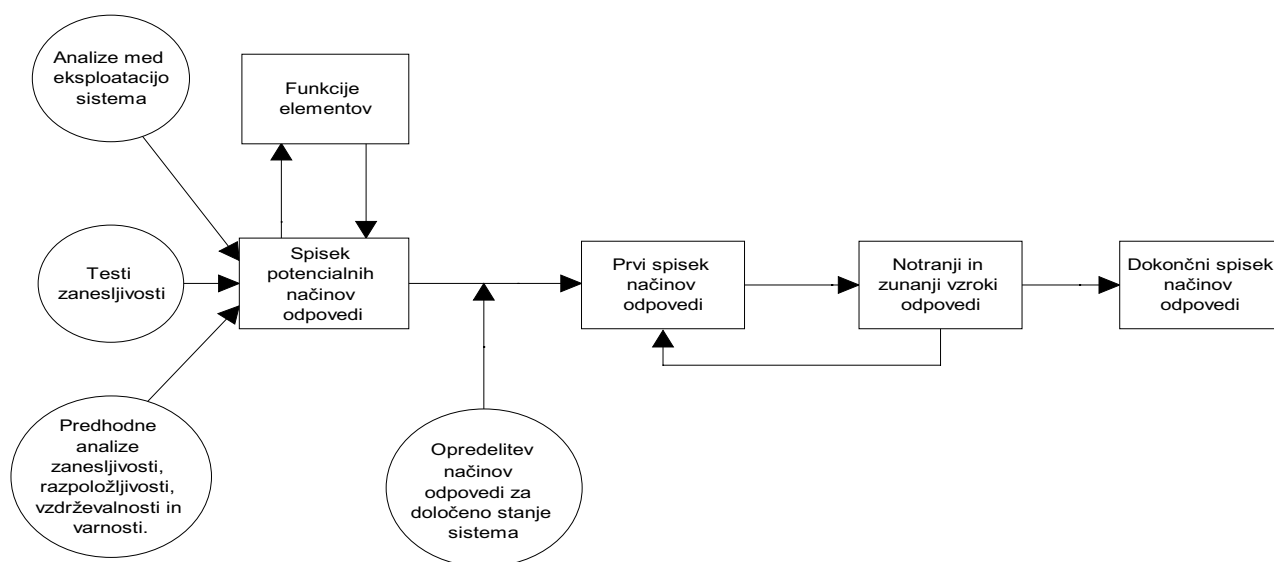
Opredeliti je potrebno pogoje eksploatacije sistema in njegovih elementov, kar predstavlja osnovo za opredelitev različnih stanj sistema in njegovih elementov. V FMEA vključimo le tiste elemente sistema, katerih odpovedi lahko neposredno ali posredno privedejo do stanj, ki pomenijo delno ali popolno odpoved sistema. Pravimo, da so ti elementi za nastanek določene odpovedi pomembni. Če se izkaže, da kateri od elementov sistema ni pomemben, ga iz nadaljnje analize izločimo.

2. faza FMEA:

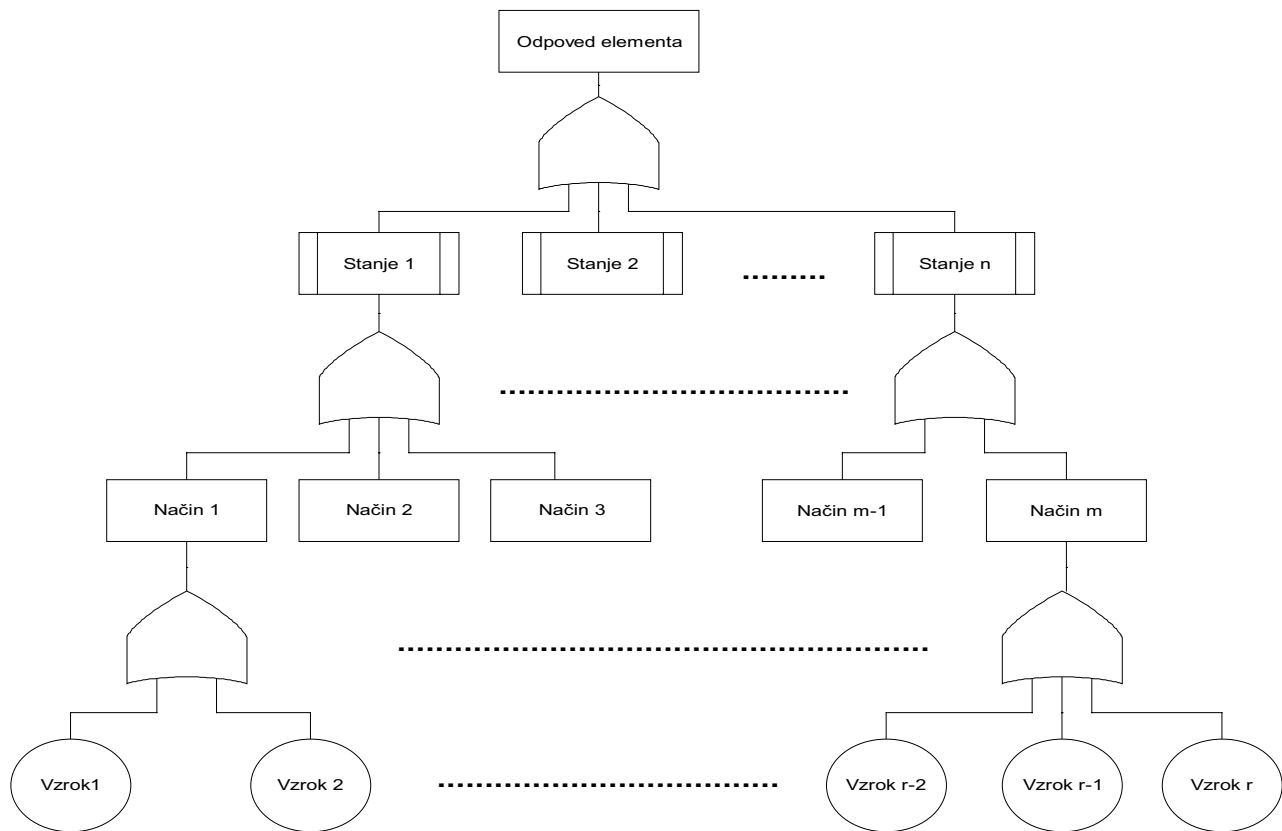
V okviru druge faze metode FMEA je potrebno za vsak element sistema, ki je bil v prvi fazi opredeljen kot pomemben za odpoved sistema v določenem stanju, ugotoviti možne načine odpovedi. Postopek identifikacije načinov odpovedi je prikazan na sliki 1.

Na podlagi podatkov iz eksploatacije sistema, testov zanesljivosti ali predhodnih analiz je potrebno izdelati spisek potencialnih načinov odpovedi elementov sistema v določenem stanju, kar predstavlja osnovo za nadaljnjo analizo. Istočasno je potrebno ugotoviti tudi vzroke posameznih potencialnih načinov odpovedi, ki jih bomo potrebovali za ocenjevanje verjetnosti nastanka odpovedi, odkrivanje sekundarnih odpovedi in planiranje korektivnih ukrepov.

Ločevanje med načinom in vzrokom odpovedi ni vedno enostavno. Pri tem nam je lahko v pomoč tudi deduktivna metoda drevesa odpovedi (glej npr. Hudoklin in Rozman, 2004). Drevo odpovedi je poseben primer logičnega diagrama kombinacije dogodkov, ki vodijo v glavni dogodek. Glavni dogodek je na vrhu drevesa odpovedi in običajno predstavlja neželeni dogodek za obravnavani sistem (Sinnamon in Andrews, 1997; Rosenberg, 1996). Primer drevesa odpovedi za analizo načinov odpovedi in njihovih vzrokov je prikazan na sliki 2.



Slika 1: Postopek identifikacije načinov odpovedi in njihovih vzrokov (Hudoklin in Brezavšček, 1994)



Slika 2: Drevo odpovedi za analizo načinov odpovedi in njihovih vzrokov

3. faza FMEA:

Vsakega izmed načinov odpovedi elementa sistema ovrednotimo glede na njegove učinke. Učinke načinov odpovedi ugotavljamo na vseh nivojih hierarhične strukture sistema. Na posameznem nivoju hierarhične strukture lahko določen način odpovedi ne povzroči nobenih učinkov, lahko povzroči omejeno delovanje, lahko pa povzroči prekinjeno delovanje tega dela sistema. Postopek ocenjevanja učinkov načina odpovedi pričnemo na tistem nivoju v hierarhični zgradbi sistema, kjer se opazovani element nahaja, in nadaljujemo na višjih nivojih vse do nivoja celotnega sistema.

Potrebno je določiti tudi pomembnost posameznega načina odpovedi. Podobno kot učinek načina odpovedi ugotavljamo njegovo pomembnost lokalno, na nivoju opazovanega elementa sistema, in na vseh višjih nivojih do nivoja celotnega sistema (glej npr. Dutuit in Rauzy, 2001; Caror in Sanz, 2000). Pomembnost posameznega načina odpovedi lahko ocenimo kvalitativno tako, da uporabimo več razredov kot npr.: majhen, znaten, kritičen, katastrofalen.

Poleg pomembnosti posameznega načina odpovedi določimo tudi verjetnost njegovega nastanka, ki jo v primeru kvalitativnega ocenjevanja lahko klasificiramo npr. kot: zelo majhno, majhno, srednjo ali veliko.

V praksi je koristno opredeliti tudi kritičnost načina odpovedi, ki je določena s kombinacijo njegove pomembnosti in verjetnosti za nastanek. Način odpovedi določenega elementa

sistema, katerega verjetnost nastanka je zelo velika, ima lahko zanemarljiv učinek na funkcijo sistema, njegova kritičnost je torej majhna. Kak drug način odpovedi elementa je zelo malo verjeten, vendar lahko povzroči popolno izgubo funkcije sistema in škodo na sistemu. Pomembnost tega načina odpovedi je torej velika, kritičnost pa razmeroma majhna.

Kritičnost načina odpovedi lahko ovrednotimo tudi kvantitativno. V ta namen moramo določiti ocene za naslednje parametre za elemente sistema:

λ - pogostost odpovedi,

α - delež pogostosti posameznega načina odpovedi v celotni pogostosti odpovedi,

β - verjetnost učinka posameznega načina odpovedi,

t - čas delovanja.

Pogostost odpovedi elementa sistema določimo na osnovi preskusov zanesljivosti ali iz podatkov o uporabi elementa sistema.

Delež pogostosti kakega načina odpovedi v celotni pogostosti odpovedi pomeni verjetnost, da bo element sistema odpovedal na ta način. Ocenimo ga na osnovi podatkov o uporabi elementa sistema.

Verjetnost učinka določenega načina odpovedi je pogojna verjetnost, da se učinek realizira pri pogoju, da je element sistema odpovedal na določen način. Verjetnost učinka načina odpovedi ocenimo na osnovi podatkov o uporabi elementa sistema in analitikove presoje.

Čas delovanja elementa sistema v urah ali ciklih izhaja iz definicije sistema in ga prav tako ocenimo na osnovi podatkov o uporabi elementa sistema.

Upošteva ocene za λ , α , β , t izračunamo oceno za kritičnost določenega načina odpovedi elementa po enačbi:

$$C_n = \lambda \cdot \alpha \cdot \beta \cdot t \quad (1)$$

4. faza FMEA:

V četrti fazi metode FMEA oblikujemo priporočila za povečanje učinkovitosti sistema, ki naj upoštevajo naslednje prioritete:

- odpraviti vzroke za posamezne načine odpovedi,
- zmanjšati verjetnost, da pride do uresničitve načina odpovedi,
- zmanjšati učinek načina odpovedi,
- povečati verjetnost, da bo potencialna odpoved elementa sistema pravočasno odkrita.

2.3 Omejitve pri uporabi metode FMEA

Pri izvajanju metode FMEA v praksi se pokažejo določene omejitve te metode, kot so:

- kvantitativno določanje ocene za kritičnost posameznega načina odpovedi je pogosto oteženo, ker je večina vhodnih parametrov izražena kvalitativno;
- veliko elementov sistemov se po določenem času uporabe nahaja v številnih različnih stanjih, kar je težko kvantificirati;
- medsebojne odvisnosti med različnimi načini odpovedi in njihovimi učinki na sistem na različnih nivojih hierarhične strukture sistema je težko upoštevati.

Opisane pomanjkljivosti metode FMEA lahko v fazi razvoja novih izdelkov odpravimo z uporabo metodologije, ki

temelji na teoriji mehke logike oziroma teoriji mehkih množic. Razlogi za uporabo mehke logike pri izvajanju FMEA so predvsem naslednji:

- vse informacije, povezane z izvajanjem FMEA, so pridobljene in shranjene v naravnem jeziku;
- uporaba mehke logike omogoča uporabo nenatančnih podatkov, zato omogoča obravnavo različnih stanj elementov sistema ter drugih, v FMEA vključenih kvalitativnih informacij;
- uporaba mehke logike pri izvajanju FMEA omogoča kombiniranje kvalitativnih ocen ekspertov glede medsebojnih povezav načinov odpovedi in njihovih vzrokov.

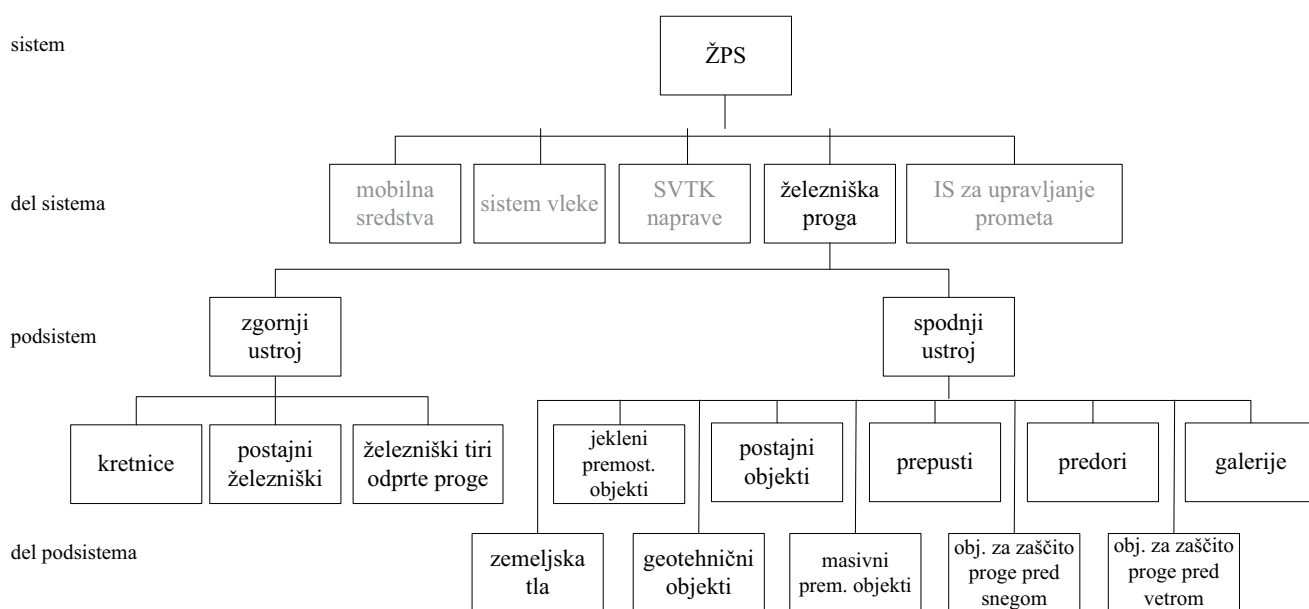
3 Aplikacija metode FMEA na železniško progo

V nadaljevanju bomo prikazali primer uporabe metode FMEA pri analizi odpovedi železniške proge in njenih elementov. Ponazorili bomo izvedbo vseh štirih, v poglavju 2.2 opisanih, faz metode FMEA. Za ilustracijo posamezne faze bomo uporabili primer tirnice sistema 49E1, ki je vgrajena v železniški tir odprte proge v Slovenskih železnicah.

1. faza FMEA:

V prvi fazi je potrebno opredeliti sistem, njegove elemente in funkcije. Osnovna funkcija železniške proge je nudenje transportne poti za izvajanje osnovne funkcije ŽPS. Železniška proga kot del ŽPS je kompleksen sistem, ki ga lahko ponazorimo s hierarhično strukturo na sliki 3.

Železniška proga predstavlja del ŽPS, zgornji in spodnji ustroj pa predstavljata podsisteme ŽPS. Elementi na zadnjem nivoju v hierarhični strukturi na sliki 3 predstavljajo dele podsistemov, ki jih nadalje razdelimo na tri nivoje: nivo funkcionalnih enot, nivo sklopov in nivo komponent. V določenih



Slika 3: Hierarhična struktura sistema železniške proge kot dela ŽPS

primerih (npr. v primeru manjše kompleksnosti) je nivo sklopa lahko izpuščen.

Za potrebe metode FMEA smo izdelali šifrant elementov železniške proge, kjer je vsak element enolično opredeljen z desetmestno šifro, katere struktura temelji na hierarhični strukturi iz slike 3. Prvi dve mesti določata podsistem, drugi dve del pod sistema, naslednji dve funkcionalno enoto, še naslednji dve sklop in zadnji dve mesti komponento železniške proge.

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01	03	03	00	01
oznaka podsistema (zgornji ustroj)	oznaka dela pod sistema (železniški tiri odprte proge)	nivo funkcionalne enote	nivo sklopa (oznaka 00 pomeni, da je nivo sklopa izpuščen)	nivo komponente

V šifrantu elementov železniške proge opredelimo tudi vrsto posameznega elementa in način njegovega delovanja, kar predstavlja osnovo za opredelitev različnih stanj elementov železniške proge.

Na vseh nivojih v hierarhični zgradbi železniške proge definiramo funkcije posameznih elementov. Izdelamo tudi funkcionalne in logične diagrame, proučimo medsebojne odvisnosti in opredelimo vezavo elementov s stališča zanesljivosti.

2. faza FMEA:

Na podlagi podatkov iz eksploatacije železniških prog ter na osnovi predhodnih analiz izdelamo spisek potencialnih načinov odpovedi elementov železniških prog pri čemer uporabimo deduktivno metodo drevesa odpovedi. Pri tem upoštevamo predhodno opredeljene funkcije elementov železniške proge in tista stanja elementov, za katera je smiselno izvajati FMEA metodo. Na primer, za tirnico sistema 49E1, vgrajeno v železniški tir odprte proge, upoštevamo v analizi FMEA naslednja štiri stanja tirnice:

- tirnica zavarjena v neprekinjeno zavarjeni tir (NZZ) - železniška vozila ne vozijo preko tirnice,
- tirnica zavarjena v NZT - med vožnjo železniških vozil preko tirnice,
- tirnica vgrajena v stikovani tir - železniška vozila ne vozijo preko tirnice,
- tirnica vgrajena v stikovani tir - med vožnjo železniških vozil preko tirnice.

Sočasno s pripravo spiska potencialnih načinov odpovedi opredelimo tudi njihove vzroke. Zaradi lažjega ločevanja med načinom in vzrokom odpovedi razdelimo možne načine odpovedi na odpovedi v zgradbi elementa, mehanske odpovedi in električne odpovedi, vzroke načinov odpovedi pa na vzroke znotraj elementa in vzroke zunaj elementa železniške

proge. Rezultat izvedene druge faze FMEA so izdelani šifranti možnih načinov odpovedi in njihovih vzrokov za elemente železniške proge. Izsek iz šifranta potencialnih načinov odpovedi elementov železniške proge prikazuje tabela 1, izsek iz šifranta njihovih vzrokov pa je podan v tabeli 2.

Tabela 1: Izsek iz šifranta potencialnih načinov odpovedi elementov železniške proge

Šifra načina odpovedi	NAČIN ODPOVEDI ELEMENTA ŽELEZNIŠKE PROGE
100	ODPOVEDI V ZGRADBI ELEMENTA
101	Zlom
102	Zlom vara
103	Zlom sestavnega dela
104	Počenost
105	Razrahljanost ločljive zveze (klasičnega spoja)
...	...
199	Ostalo
200	MEHANSKE ODPOVEDI
201	Vdor vode
202	Vdor olja hidravličnega sistema
203	Iztekanje olja iz hidravličnega sistema
204	Zamašenost
205	Erozijsko delovanje vode
...	...
299	Ostalo
300	ELEKTRIČNE ODPOVEDI
301	Prekinitev vrvi (zvezne, ozemljilne)
302	Prekinitev tokokroga
303	Kratek stik (preboj)
304	Prekoračitev dopustne upornosti
305	Sprememba električnih lastnosti materialov
...	...
399	Ostalo

Tabela 2: Izsek iz šifranta vzrokov potencialnih načinov odpovedi elementov železniške proge

Šifra vzroka načina odpovedi	VZROK NAČINA ODPOVEDI ELEMENTA ŽELEZNIŠKE PROGE
100	VZROKI ZNOTRAJ ELEMENTA
101	Nepravilna konstrukcija elementa
102	Nepravilna izdelava elementa
103	Nepravilna montaža elementa
...	...
	Odpoved drugega elementa
150	Previsoka temperatura okolice
151	Nepravilen tlak
152	Slabo tesnjenje
...	...

170	Nepravilna uporaba kretnice
171	Neplanska eksploatacija elementa
172	Nepravilno posluževanje elementa
	Nepravilen poseg v element
...	...
199	Ostalo
200	VZROKI IZVEN ELEMENTA
201	Visoka temperatura
202	Nizka temperatura
203	Visoka vlažnost
...	...
299	Ostalo

3. faza FMEA

V okviru te faze proučimo, kakšen je učinek posameznega načina odpovedi na posameznih nivojih v hierarhični zgrabi železniške proge. Z določanjem učinkov načinov odpovedi pričnemo na tistem nivoju hierarhične strukture, na katerem se opazovani element nahaja in nadaljujemo do najvišjega nivoja tj. nivoja celotne železniške proge. Pri opredeljevanju učinka načina odpovedi elementov železniške proge uporabljamo naslednje vrednosti:

številka 0 pomeni, da določeni način odpovedi na danem nivoju v hierarhični strukturi ne učinkuje;

številka 1 pomeni, da način odpovedi povzroči na danem nivoju v hierarhični strukturi omejeno delovanje;

številka 2 pomeni, da način odpovedi povzroči na danem nivoju v hierarhični strukturi prekinjeno delovanje.

Glede na to, da smo železniško progo popisali s 6 nivojsko hierarhično strukturo, ovrednotimo učinek načina odpovedi s šestmestnim zaporedjem števil 0, 1 in 2, pri čemer upoštevamo, da je lahko učinek načina odpovedi na določenem nivoju največ iste stopnje kot učinek načina odpovedi na nižjem nivoju. Če smo v hierarhični strukturi nivo sklopa izpustili, to ustrezno upoštevamo tudi pri določanju učinkov načinov odpovedi.

Za primer vzemimo način odpovedi "zlom tirnice" sistema 49E1 železniškega tira odprte proge. Denimo, da smo učinku tega načina odpovedi pripisali šifro 2-2111, kar lahko ponazorimo tudi takole:

komponenta	sklop	funkcionalna enota	del pod-sistema	pod-sistem	del sistema
2	-	2	1	1	1

Šifra učinka načina odpovedi v tem primeru pomeni, da zlom tirnice povzroči prekinjeno delovanje komponente, prekinjeno delovanje funkcionalne enote, omejeno delovanje dela pod-sistema, omejeno delovanje pod-sistema, in omejeno delovanje železniške proge kot celote. Iz pričujoče šifre učinka zloma tirnice je razvidno, da je v primeru tirnice sistema 49E1 nivo sklopa v hierarhični strukturi izpuščen.

Poleg učinka posameznega načina odpovedi določimo tudi njegovo pomembnost, verjetnost nastanka in kritičnost. Slednje bomo zopet ilustrirali na primeru tirnice sistema 49E1 in izbranega načina odpovedi "zlom tirnice". Določili bomo

kvantitativno oceno za kritičnosti zloma tirnice. Izračun bomo izvedli le za stanje 2, ko je tirnica zavarjena v NZT - med vožnjo železniških vozil preko tirnice in stanje 4, ko je tirnica vgrajena v stikovani tir - med vožnjo železniških vozil preko tirnice. To sta namreč stanji, v katerih nastane največ zlomov tirnic. V analizi upoštevamo katastrofalne in degradacijske odpovedi tirnice sistema 49E1, vgrajene v železniški tir enotirne železniške proge št. 70 Jesenice-Sežana v obdobju enega leta (t.j. od 01.06.2009 do 01.06.2010). Dolžina obravnavane proge je 129,8 km, vsebuje pa 13 medpostajnih odsekov. Konstrukcija železniškega tira odprte proge je naslednja: 65 % dolžine proge vsebuje NZT, 35 % dolžine proge pa stikovani tir. Železniški tir odprte proge na medpostajnem odseku sestavljata dve tirnici sistema 49E1.

Kritičnost zloma tirnice bomo izračunali po enačbi (1), pri čemer moramo na podlagi podatkov o delovanju tirnice v izbranem obdobju opazovanja oceniti parametre λ , α , β in t .

Pri izračunu pogostosti odpovedi tirnice predpostavimo, da je tirnica v obdobju normalnega delovanja, zato lahko uporabimo enačbo

$$\lambda = \frac{r}{T_{kum}} \quad (2)$$

kjer pomeni:

r - število vseh odpovedi tirnice v obravnavanih stanjih, ki so povzročile odpoved železniške proge,

T_{kum} - kumulativni čas delovanja tirnice v opazovanem obdobju.

V obdobju opazovanja je bilo na odsekih odprte proge, kjer so tirnice zavarjene v NZT, evidentiranih 33 zlomov tirnic in 21 drugih odpovedi tirnic (zlom zvara, počena tirnica, razpokana tirnica, odpadel del tirnice, napake v strukturi). Na odsekih, kjer je tir stikovani, je bilo v istem obdobju evidentiranih 26 zlomov tirnic in 17 drugih odpovedi tirnic (počena tirnica, razpokana tirnica, odpadel del tirnice, napake v strukturi).

Pri izračunu kumulativnega časa delovanja tirnice v opazovanem obdobju upoštevamo povprečni čas vožnje vlakov na obravnavani progi v 24 urah, ki ga izračunamo na podlagi dejanskega grafikona vožnje vlakov v obdobju opazovanja. Ugotovljeno je bilo, da so vlaki opravili na vseh medpostajnih odsekih 101,08 ur vožnje vlakov (ur vv) v 24 urah, kar pomeni povprečno 7,7 ur vv na medpostajnem odseku na dan.

V železniški tir odprte proge so vgrajene tirnice dolžine 90 m, v stikovani tir pa tirnice dolžine 44 m. Iz prej povedanega sledi, da je na obravnavani progi vgrajenih v NZT odprte proge 1863 tirnic dolžine 90 m, v stikovani tir odprte proge pa 2052 tirnic dolžine 44 m.

Kumulativni čas delovanja tirnic dolžine 90 m je torej enak:

$$T_{kum}^{NZT} = 1863 \cdot \frac{7,7}{dan} \text{ ur vv} \cdot 365 \text{ dni} \cdot 3 = 15.707.884,5 \text{ ur vv}$$

Kumulativni čas delovanja tirnic dolžine 44 m pa je:

$$T_{kum}^{STIK} = 2052 \cdot \frac{7,7}{dan} \text{ ur vv} \cdot 365 \cdot 3 = 17.301.438 \text{ ur vv}$$

Z uporabo enačbe (2) izračunamo oceno za pogostost odpovedi tirnice v opazovanem obdobju. Pri tem upoštevamo skupno število odpovedi v posameznem stanju kakor tudi število zlomov tirnic v vsakem stanju. Dobimo naslednje rezultate:

$$\lambda_{NZZ} = \frac{r_{NZZ}}{T_{kum}^{NZZ}} = \frac{54}{15.707.884,5 \text{ ur vv}} = 3,4 \cdot 10^{-6} \text{ ur vv}^{-1}$$

$$\lambda_{NZZ}^{zlom} = \frac{r_{NZZ}^{zlom}}{T_{kum}^{NZZ}} = \frac{33}{15.707.884,5 \text{ ur vv}} = 2,1 \cdot 10^{-6} \text{ ur vv}^{-1}$$

$$\lambda_{STIK} = \frac{r_{STIK}}{T_{kum}^{STIK}} = \frac{43}{17.301.438 \text{ ur vv}} = 2,5 \cdot 10^{-6} \text{ ur vv}^{-1}$$

$$\lambda_{STIK}^{zlom} = \frac{r_{STIK}^{zlom}}{T_{kum}^{STIK}} = \frac{26}{17.301.438 \text{ ur vv}} = 1,5 \cdot 10^{-6} \text{ ur vv}^{-1}$$

Za vsako stanje izračunamo delež α pogostosti zloma tirnice v celotni pogostosti odpovedi tirnice:

$$\alpha_{NZZ} = \frac{\lambda_{NZZ}^{zlom}}{\lambda_{NZZ}} = \frac{2,1 \cdot 10^{-6} \text{ ur vv}^{-1}}{3,4 \cdot 10^{-6} \text{ ur vv}^{-1}} = 0,76$$

$$\alpha_{STIK} = \frac{\lambda_{STIK}^{zlom}}{\lambda_{STIK}} = \frac{1,5 \cdot 10^{-6} \text{ ur vv}^{-1}}{2,5 \cdot 10^{-6} \text{ ur vv}^{-1}} = 0,60$$

Verjetnost učinka zloma tirnice smo za posamezno stanje ocenili na podlagi podatkov o delovanju tirnice v izbranem obdobju takole:

$$\beta_{NZZ} = 0,30$$

$$\beta_{STIK} = 0,25$$

Čas delovanja tirnice t v urah vožnje vlakov v opazovanem obdobju je enak:

$$t = 7,7 \cdot 365 \cdot 3 \text{ ur vv} = 8432 \text{ ur vv}$$

Upošteva se dobljene ocene parametrov λ , α , β in t izračunano po enačbi (1) oceno za kritičnost zloma tirnice v posameznem stanju:

$$C_{101}^{NZZ} = \lambda_{NZZ} \cdot \alpha_{NZZ} \cdot \beta_{NZZ} \cdot t = 3,4 \cdot 10^{-6} \text{ ur vv}^{-1} \cdot 0,76 \cdot$$

$$\cdot 0,30 \cdot 8432 \text{ ur vv} = 0,00653$$

$$C_{101}^{STIK} = \lambda_{STIK} \cdot \alpha_{STIK} \cdot \beta_{STIK} \cdot t = 2,5 \cdot 10^{-6} \text{ ur vv}^{-1} \cdot 0,60 \cdot$$

$$0,25 \cdot 8432 \text{ ur vv} = 0,003162$$

Dobljeni rezultati kažejo, da je kritičnost zloma tirnice, zavarjene v NZZ, večja od kritičnosti tirnice, vgrajene v stikovani tir. Slednji rezultat je glede na vrsto konstrukcije obeh tirov popolnoma logičen.

4. faza FMEA:

Rezultati izvedbe FMEA za vse prepoznane načine odpovedi elementov železniške proge omogočajo prepoznavanje pomembnosti in kritičnosti posameznih načinov odpovedi, analizo njihovih vzrokov ter primerjavo pomembnosti in kritičnosti enakih elementov na različnih železniških progah. Na ta način identificiramo tiste elemente železniške proge, ki neposredno vplivajo na razpoložljivost železniške proge. Za take elemente je potrebno opredeliti preventivne in korektivne ukrepe za odpravo vzrokov odpovedi. Take elemente je potrebno med delovanjem še posebej spremljati in zanje opredeliti ustrezno strategijo vzdrževanja.

Rezultate vseh štirih faz metode FMEA lahko strnemo v posebni tabeli, ki je za primer tirnice sistema 49E1 v stanju 2 prikazana na sliki 4.

ANALIZA NAČINOV ODPOVEDI, NJIHOVIH VZROKOV, UČINKOV IN KRITIČNOSTI

Stanje 2: Tirnica zavarjena v NZZ-železniška vozila vozijo preko tirnice

Naziv dela sistema: Železniška proga št. 70 Jesenice-Sežana

Element: Tirnica sistema 49E1 železniškega tira odprte proge

Datum: 20.08.2010

Analiziral: Miran Abram

Stran 1/4

Identifikacijski podatki o komponenti				Funkcije in stanja komponente		Potencialni načini odpovedi komponente					
Šifra komponente	Naziv komponente	Vrsta komponente	Način delovanja	Funkcije	Stanja	Odpoved v zgradbi komp.	Šif. n. odp.	Mehanska odpoved	Šif.n. odp.	Električna odpoved	Šif.n. Odp.
0103030001	Tirnica v tirničnem traku želez. tira odprte proge	Mehanska	Med vožnjo	1. Prevzem stat. in din. obremen. železniških vozil. 2. Prisilno vodenje železniških vozil v določeni smeri. 3. Prevzem obremenitev zaradi temperaturnih sprememb, def. tira in geometrije tira. 4. Sestavni element tirne rešetke	2 - Zavarjena v NZZ - med vožnjo želez. vozil preko tirnice	Zlom Zlom zvara Počenost Razpokanost Valovitost Odpadlost dela Ostale napake v strukturi mat. tir. po klasifikaciji UIC - kodex 712 E	101 102 104 127 130 129 199	Čezmerna obraba Neenakom. obraba Zbitost	106 107 125		

ANALIZA NAČINOV ODPOVEDI, NJIHOVIH VZROKOV, UČINKOV IN KRITIČNOSTI

Stanje 2: Tirnica zavarjena v NZT-železniška vozila vozijo preko tirnice

Stran 2/4

Naziv dela sistema: Železniška proga št. 70 Jesenice-Sežana

Element: Tirnica sistema 49E1 železniškega tira odprte proge

Datum: 20.08.2010

Analiziral: Miran Abram

Šifra načina odpov.	Uporabljena metoda			Potencialni vzroki načinov odpovedi				Pomembnost načina odpovedi na nivoju					
	Analiza delovanja	Testi Zanesljiv.	Predhodne analize	Znotraj sistema	Šif. vzr.	Izven sistema	Šif. vzr.	Komponente	Sklopa	Funkcionalne enote	Dela podсистема	Podсистема	Dela sistema
101 Zlom tirnice	x		x	Nepravilnosti v strukt.		Nepravilno sproščanje		2	-	2	2	1(2)	1(2)
				materiala	111	napetosti po vgraj. v							
				Utrujenost materiala	108	NZT	112						
				Prekoračene dopustne		Prenizke temperatura							
				notranje napet. zaradi		okolice	113						
				vgradnje v NZT	110	Odpoved železniških							
				Prekoračene dopustne		pragov	114						
				notranje napet. zaradi		Vibracije zaradi							
prometne obremenitve	119	popuščanja veznega in											
Prekoračene dopustne		pritrilnega pribora	115										
notranje napet. zaradi		Vertikalne in horizont.											
prometne obremenitve		deformacije tira	116										
in vgradnje v NZT	120	Nepredpisano urejena											
Prekoračena obraba		gramozna greda želez.											
tirnice	118	tira	117										

ANALIZA NAČINOV ODPOVEDI, NJIHOVIH VZROKOV, UČINKOV IN KRITIČNOSTI

Stanje 2: Tirnica zavarjena v NZT-železniška vozila vozijo preko tirnice

Stran 3/4

Naziv dela sistema: Železniška proga št. 70 Jesenice-Sežana

Element: Tirnica sistema 49E1 železniškega tira odprte proge

Datum: 20.08.2010

Analiziral: Miran Abram

Šifra načina odpov.	Uporabljena metoda			Potencialni vzroki načinov odpovedi				Kritičnost načina odpovedi na nivoju					
	Analiza delovanja	Testi Zanesljiv.	Predhodne analize	Znotraj sistema	Šif. vzr.	Izven sistema	Šif. vzr.	Komponente	Sklopa	Funkcionalne enote	Dela podсистема	Podсистема	Dela sistema
101 Zlom tirnice	x		x	Nepravilnosti v strukt.		Nepravilno sproščanje		$C_{101}^{NZT} = 0,0065$					
				materiala	111	napetosti po vgradnji v							
				Utrujenost materiala	108	NZT	112						
				Prekoračene dopustne		Prenizke temperatura							
				notranje napet. zaradi		okolice	113						
				vgradnje v NZT	110	Odpoved železniških							
				Prekoračene dopustne		pragov	114						
				notranje napet. zaradi		Vibracije zaradi							
prometne obremenitve	119	popuščanja veznega in											
Prekoračene dopustne		pritrilnega pribora	115										
notranje napet. zaradi		Vertikalne in horizont.											
prometne obremenitve		deformacije tira	116										
in vgradnje v NZT	120	Nepredpisano urejena											
Prekoračena obraba		gramozna greda želez.											
tirnice	118	tira	117										

Slika 4: FMEA tabela za primer tirnice sistema 49E1 v stanju 2

ANALIZA NAČINOV ODPOVEDI, NJIHOVIH VZROKOV, UČINKOV IN KRITIČNOSTI

Stanje 2: Tirnica zavarjena v NZT-železniška vozila vozijo preko tirnice

Stran 4/4

Naziv dela sistema: Železniška proga št. 70 Jesenice-Sežana

Element: Tirnica sistema 49E1 železniškega tira odprte proge

Datum: 20.08.2010

Analiziral: Miran Abram

Šifra vzr. nač. odpov.	Predvideni ukrepi za odpravo vzrokov odpovedi						Izvedeni ukrepi za odpravo vzrokov odpovedi					
	Preventivni			Korektivni			Preventivni			Korektivni		
	Ukrep	Odgov. oseba	Rok	Ukrep	Odgov. oseba	Rok	Ukrep	Odgov. oseba	Dat.	Ukrep	Odgov. oseba	Dat.
108						
110						
111						
112						
113						
114						
115						
116	Poostren nadzor nad stanjem tira, zamenjava dotrajanih elem. tira, sproščanje notranjih napetosti v tirnici, strojna regulacija tira	VNP TRZU	1 mesec	Poostren nadzor nad stanjem tira, zmanjšanje vzporedne hitrosti vlakov.	TRZU	Takoj
117						
118						
119						
120						

Slika 4: nadaljevanje

4 Zaključek

Metoda FMEA omogoča sistematično analizo odpovedi elementov sistema in njihovih vzrokov. Izvedba FMEA sestoji iz štirih faz: opredelitev sistema, elementov sistema in njihovih funkcij, identifikacija načinov odpovedi elementov sistema in njihovih vzrokov, študij učinkov različnih načinov odpovedi elementov sistema na različnih nivojih v zgradbi sistema ter zaključki in priporočila.

V članku smo predstavili uporabo FMEA na primeru železniške proge, ki je pomemben segment železniškega prometnega sistema. Izvedbo posamezne faze FMEA smo prikazali na primeru tirnice sistema 49E1, ki je vgrajena v železniški tir odprte proge v Slovenskih železnicah. Pomemben rezultat predstavlja določitev kritičnosti posameznega načina odpovedi. Na podlagi dejanskih podatkov o delovanju železniške proge v obdobju enega leta smo uspeli določiti kvantitativno oceno za kritičnost izbranega načina odpovedi. Na podoben način bi lahko izračunali kritičnost načinov odpovedi za vse elemente železniške proge.

Poznavanje kritičnih elementov železniške proge je pomembno, saj predstavlja osnovo za planiranje preventivnih in korektivnih ukrepov za izboljšanje razpoložljivosti železniške proge in s tem povečanje učinkovitosti celotnega železniškega prometnega sistema.

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Using FMEA method for analysing failures of railway line

In the paper, the Failure Modes and Effects Analysis-FMEA is described. Four steps of FMEA are presented. The method is applied to the railway line as an important part of the railway traffic system. Each step of FMEA is performed on the rail type 49E1, built in the railway track of open railway line in Slovenian Railways. It has been shown that field data on the railway lines enable quantitative estimation of failure mode criticality for the railway line elements.

Key words: FMEA, railway traffic system, railway line, failure mode, cause, effect, criticality

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TERMO d.d. - Industrija termičnih izolacij

Trata 32, 4220 ŠKOFJA LOKA

TERMoeLEKTRARNA TOPLARNA Ljubljana d.o.o.

Toplarniška 19, 1000 LJUBLJANA

TOVARNA KLOBUKOV ŠEŠIR d.d.

Kidričeva 57, 4220 ŠKOFJA LOKA

TRIMO Inženiring in proizvodnja montažnih objektov d.d.

Prijateljstva 12, 8210 TREBNJE

UNITAS - Tovarna armatur d.d.

Celovška cesta 224, 1107 LJUBLJANA

USTANOVA SLOVENSKA ZNANSTVENA FUNDACIJA

Štefanova 15, 1000 LJUBLJANA

ZAVAROVALNICA TRIGLAV, d.d.

Miklošičeva cesta 19, 1000 LJUBLJANA

ZVEZA RAČUNOVODIJ, FINANČNIKOV IN REVIZORJEV SLOVENIJE

Dunajska cesta 106, 1000 LJUBLJANA

ŽIVILA KRANJ - Trgovina in gostinstvo d.d.

Cesta na Okroglo 3, 4202 NAKLO

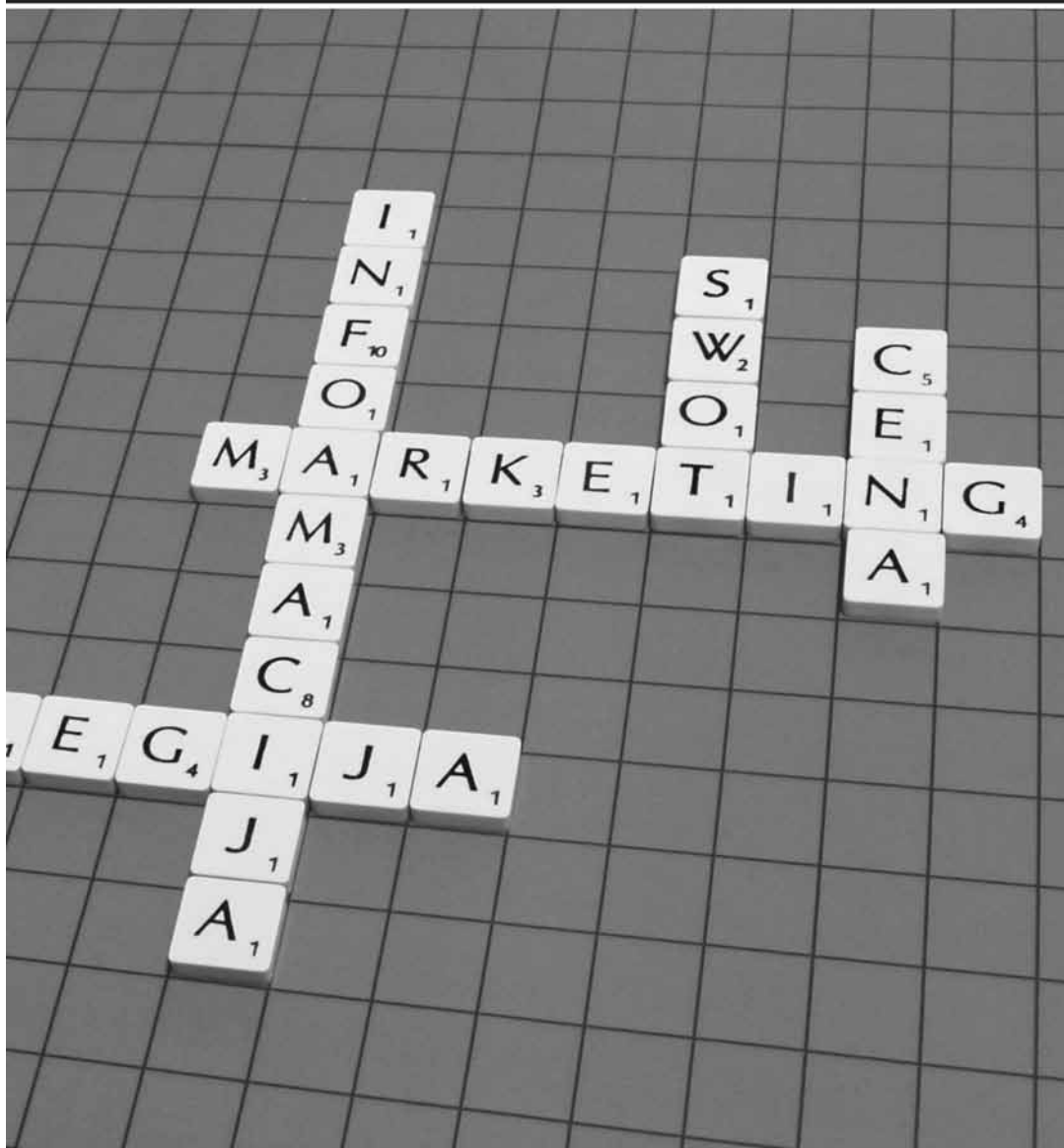
ŽITO GORENJKI d.d.

Rožna dolina 8, 4248 LESCE



Univerza v Mariboru

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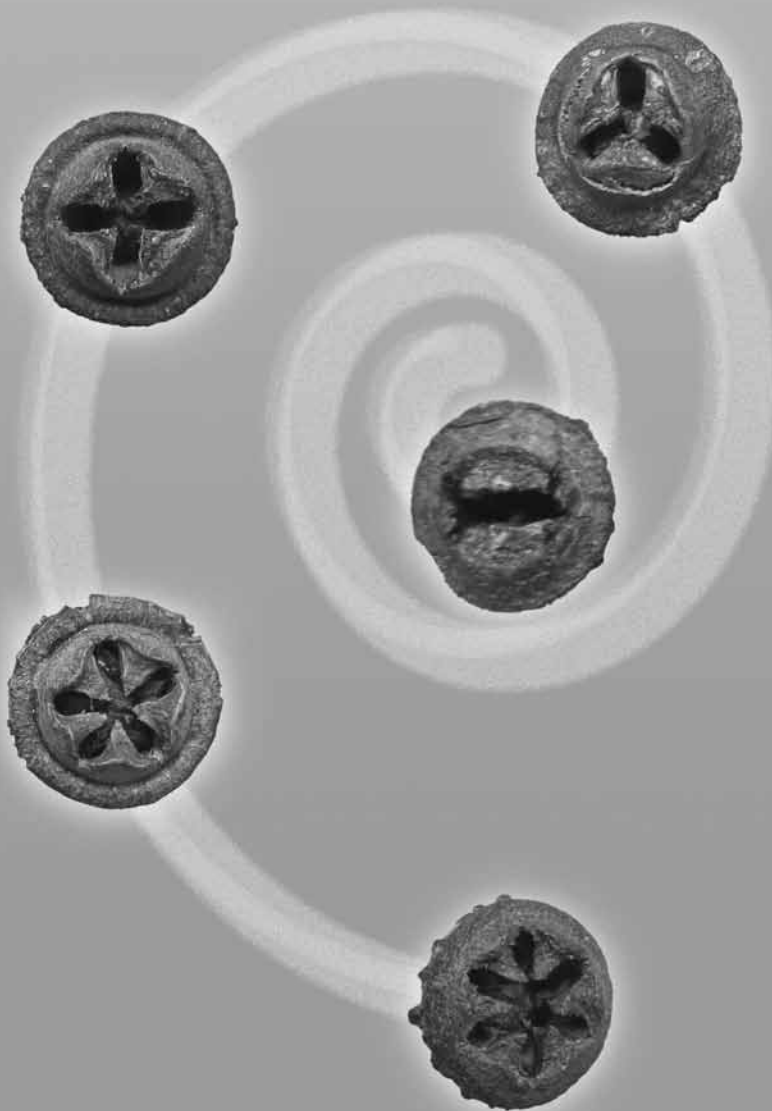
Marketing
Goran Vukovič, Bruno Završnik

Založba  Moderna organizacija




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*T*eorija sistemov – zbirka nalog

Andrej Škraba

Založba  Moderna organizacija