AN INTELLIGENCE APPROACH TO CITY DEVELOPMENT

Laura Liugailaitė-Radzvickienė[1], Robertas Jucevičius[2]

Kaunas University of Technology, Faculty of Social Sciences, Donelaičio str. 20, LT - 44239 Kaunas, Lithuania
Email: [1]laura.liugailaite-radzvickiene@stud.ktu.lt; [2]robertas.jucevicius@ktu.lt

Abstract. The recent scientific literature about both development of cities and knowledge management is quite broad but the theoretical concept of how the city has to be managed in order to achieve its developmental objectives in the knowledge enriched environment remains not developed yet. The aim of this article is to discuss the concept of intelligence in city development. There are attemts to analyse intelligent cities, but scientific literature is very fragmented in this area and the concept of intelligent city usually is analysed using technological approach. In knowledge economy technological approach to city development is quite limited. While the knowledge management theory is mainly stressing how to make use of inernal knowledge, the intelligence is mainly concerned about how to employ the external knowledge. Therefore intelligent city should be defined as the city with an ability to capture, create, share, acquire and apply knowledge for making successful decisions and appropriate responding to changing environment.

Keywords: intelligence, city, knowledge, social systems, development.

Jel classification: O18, O31, R11, R58

1. Introduction

Much has been written about the impact on societal development by the growing impact of knowledge. The need to base the development processes, their support, and management on intellectual capacity is changing even the understanding the essence of management.

Even if there are many opinions whether knowledge economy is a fact or fad (Cowey 2000) it is a reality. Of course such reality has different faces in different countries or spheres of human life and activity. Knowledge economy is a new economic and even social order in the world. Driven by the rapid technological advances that first brought the information and now knowledge era, the result is one of the biggest changes in the history of mankind. The ability to acquire and use knowledge is increasingly important for national economic development possibly making the difference between prosperity and poverty, both between and within countries. Acquiring and using knowledge requires access to and the ability to use information and communication technologies.

Researchers from different fields of social science are making an attempt to better understand the complexity of the new phenomenon and to develop efficient mechanisms to deal with it (Stacey *et al.* 2000; Komninos 2002; Underwood 2002, etc.).

Development can have many interpretations. Some of them are: development as the use of new techniques, innovations, and increased automation or technical efficiency measures; development in terms of improvements in economic efficiency – greater economies of scale, lower costs per unit, added productivity per worker etc.; development as the formation of new social units – organizations, work groups, enterprises, social and professional groups, and special project undertakings; development as improvement in the social and human condition of individuals at all levels of society (Smith, Kefalas 1983). In our paper we consider the development as the improvement of all aspects of social wellbeing by managing knowledge and implementing intelligence in decision making with purpose to appropriate respond to changing environment.

Knowledge-based economy concept determines knowledge as a key source of growth. Schiuma and Lerro (2008) argue that knowledge resources play an important role in creating regional innovation capabilities. According to them, human, relational, structural, and social capital as the four main knowledge-based categories is building the knowledge-based capital of a region. The definition and explanation of regional competitive advantage need to reach well beyond concern with "hard" productivity to consider several other "softer" dimensions of the regional socio-

economy, and in particular non-economic factors, such as cognitive, social, cultural and institutional factors (Schiuma, Lerro 2008). Xu *et al*. (2010) also highlight the importance of knowledge creation and usage for continuous innovation. According to Amalia and Nugroho (2011), organisations create innovations by finding the best way how to manage their knowledge.

Various aspects of the development of cities and regions were analysed by Ergazakis *et al*. (2006), they offered an unified methodological approach for the development of knowledge cities; Lerro and Schiuma (2009) analysed knowledge dimensions grounding regional development dynamics; Millar and Choi (2010) proposed an integrated approach to understanding knowledge as a global resource for development; Komninos (2002) analysed intelligent cities trough technological perspective. Nevertheless the theoretical concept of how the city has to be managed in order to achieve its developmental objectives in the knowledge enriched environment remains not developed yet. This problem is a key target in this paper. **The aim of the article** is to discuss the concept of intelligence in city development.

The key research method is metaanalysis of the scientific literature and interpretation of realated research findings in the field of business and social intelligence from the city development perspective.

2. Understanding the city: different theoretical concepts and perspectives

In scientific literature there are discussed different aspects of understanding the city. For example, Edvinsson (2006) suggests that the city can be seen as a structural capital surrounding the human capital and connecting the human capital with the structural capital to give a higher value adding for the knowledge worker. According to Carrillo (2004), a generic concept of city can be synthesized as a self-governed human settlement that has been granted a special status by virtue of its relative size, population, merits, or strategic importance. In short, a city is a relatively permanent human settlement of relatively high importance. Bounfour and Edvinsson (*in* Edvinsson 2006) stated that one of the most essential dimensions in the knowledge economy will be the organizational dimensions, or the regime. The city might be seen in this context of a more or less good city regime to support the value creation from and for the knowledge workers (Edvinsson 2006). D'Auria (2001) sees the city as a node of a trans-territorial network of relationships and transactions.

It should be noted that from the rise of the first cities till the present day the concept of the city has become very complex. Sometimes it brings misunderstandings when describing the city. Hillier (1997) argues that today there are two irritating anomalies in the way of seeing cities:

1. *The problem of multifunctionality*: every aspect of the spatial and physical configuration of the city form has to work in many different ways – climatically, economically, socially, aesthetically – with the additional difficulty that form changes only slowly while function changes rapidly;

2. *The part / whole problem or the place / city problem*: most cities with a strong sense of local place are almost unable to make a clear morphological distinction between one place and another; not at the level at which it could inform design.

The problem of multifunctionality rises from the new functions of the city (compared with functions of earlier cities) and from the network paradigm, which suggests to analyse the city (also as D'Auria (2001) it describes) as a node of transterritorial network of relationships and transactions. From this point of view can be clarified and the part / whole problem or the place / city problem. Because today's cities as networks (especial innovative cities) are the part of larger networks and rarely have a clear distinction about what are the boundaries of the city and what are not.

In the field of territorial studies, the network paradigm is used with different meanings, such as (D'Auria 2001):

- *Urban – geography*, which refers to the organisation of settlements (city networks). The city has reached a level of deterritorialisation, it becomes a node of a circuit of relations and has a link with the territory of non traditional nature;

- *Economic – territorial*, which refers to the organisation of productive units (business networks).

Thus today's city could not be described unlike the network paradigm. In knowledge economy there is not enough to treat the city only as the place with defined boundaries. Hillier (1997) also agrees that concepts of space for the treatment of the city are too static and local.

In this paper we suggest that *the city should be treated as a social system*. This allows clarifying an appropriate approach to city development.

According to Marcus (1985), whenever someone or something intervenes, whether an institution, religion, government, or the like, the relationship becomes systematized; a social system is formed. It is needed to highlight that systemic thinking has four main building blocks (Johannessen 1998):

1. *The subsystems and the system must be viewed in context*. That gives direction for stability and structure;

2. *The system in the environment*, not the system separated by a border. That gives direction for identity and norms;

3. *The element-relation connection*. That gives direction for changes in the system;

4. *The reorganisation of the system of relations*. That gives direction for creation processes and innovation in the system.

In this hierarchy there is argued that all social systems should be analysed in particular environment. Luhmann's Totality Paradigm suggests that successfully understanding system performance requires analyzing the system's external relations more than internal relations (Dolan *et al. in* Bridgeforth 2005). These propositions base on the need of knowledge oriented to external circumstances. As will be noted later our suggested intelligence approach is based on the concept of intelligence which appeals to knowledge about external environment. That is the first reason why the city should be treated as the social system.

Snowden (2005) notices in scientific literature a consensus of communities and community interaction that providing a critical mechanism for learning. In knowledge management, the manifestation of that consensus has been through the creation of various communities seen as aggregations of individuals focused on a common interest or function. This author also states that learning communities act as critical mechanisms for the transfer of concrete knowledge. Similar to Snowden, Checkland (*in* Ramage, Shipp 2009) sees the social systems as process of learning. It should be noted, that relationships in the system are organised as network. The network enables a process of learning which is important for capturing, creating, sharing, and acquiring the knowledge. Such knowledge actions are fundamental for enabling intelligence in activities of the city. That is the other reason to treat the city as the social system.

In scientific literature there is also discussed the creation of desirable social systems. For example, Espejo (2000) argues that creation of desirable social system requires more than self-organisation, it requires also the participants' awareness of the processes grounding their purposes and values in social reality and the use of this awareness to steer their recurrent interactions towards the production of a desirable social system. This confirms the need for special knowledge in social systems allowing achieving successful performance: to make successful decisions and appropriate respond to

changing environment. Such kind of knowledge will be discussed in further chapter.

3. The need for intelligence in city development

Socio–economic environment is becoming fundamentally comprised of information; managers, business leaders, or city adminstrators are being overwhelmed by facts and data. Often they are confronted with conflicting information and, instead of acting, they become paralysed. When external data storage capacity and data transmission speed have both increased dramatically over the past decades, the data storage capacity and data transmission speed of human mind have stayed the same. In this situation people are making bad decisions and judgments simply because of inability to cope with data overload. The most advanced organisations understand that the key to success in today's environment lies in spotting a pattern with fewest possible facts before it's too late to respond and before the pattern is so obvious that the competitors catch up. In essence, traditional companies or social institutions can find themselves to be blindsided by more agile organizations led by intelligence-savvy managers. The ability to process this information is the key management skill. Classical tools for information and knowledge management are of little help.

Similar situation could be observed not only on business or organization but also on a state level, especially when we try to get an answer to the question – why do some nations advance and prosper, and what are their perspectives in the future? This becomes obvious when comparing success stories or failures of different cities in any country. In the fields as diverse as anthropology, history, economics, sociology and political science, there have been persistent efforts to understand the main driving forces and their consequences in order to get the answer to this question. But the answer certainly lies somewhere between these sciences. Intellectual capital – knowledge, information, intellectual property, experience and the ability to use them in the most efficient way is probably the most important precondition to succeed in the knowledge age. All this together could be called an *intelligence* of the state, the city or an organization.

According to Castells (2000), knowledge economy is characterised as being informational, global, and networked. Today and increasingly in the future, in a knowledge age where national boundaries are of less importance to business, the transfer of knowledge and expertise, and the creation of a "learning" organisation has become a critical factor to company success and competi-

tiveness (Bender, Fish 2000). Moreover, each social system cannot exist alone; it is a part of other larger systems. Growing social systems become more complex and always meet various external circumstances. Thus they need to *know* how to respond to changing environment: how to capture *external knowledge* and to make appropriate decisions. Knowledge and knowing about external environment are the essence of the concept of intelligence.

Success of the development depends on how well developed and advanced are the most important systems which determine such development. Accordingly there could be different types of intelligence: *political, scientific and technological, educational, economic, business and management intelligence*. Such divide is rather relative, because it is very difficult to extract something "pure" from any social phenomenon.

Knowledge about the policy, intentions or behaviours of governments, national and international interest groups and institutions implies political intelligence. Problems posed by fluctuating financial markets or unstable political conditions create the need for economic intelligence. Keeping track of innovative efforts and new discoveries requires scientific and technological intelligence. Competitor's positioning and knowledge of customers and suppliers by the economic or social actors translates into market or business intelligence. Globalisation processes, coping with social norms and international regulations concerning investment, taxes, etc. require high quality legal intelligence. Emergence of the knowledge and information age, fast development of information technologies, growing mobility of students requires much more dynamic educational intelligence.

In many contexts, identifying and exploiting intelligence is primarily a social, not a technical challenge: social intelligence might mean the acquisition of social skills. How can the cities find out about procedures and informal traditions and roles in the European organizations? What behaviours will favour negotiations? How to avoid mistakes in communication with different cultures? When should you speak and when hold your tongue? Social intelligence is intended to be a vehicle to explore techniques, technology platforms, policy and training tactics, which allow social actors to see things differently, with the multiple visions.

On top of all that there is a sharp competition not only between the businesses but between the cities or even the nations for the resources, both financial and intellectual that could be employed for the development purpose. Without knowledge about such resources and the ways of getting them it is difficult to expect high achievement results.

4. Understanding the intelligence

The concept of *intelligence* is broadly analysed both in social and other sciences. There are various aspects of intelligence discussed in scientific literature. Boole, in his Laws of Thought stated that we can predict the future from the past (which is after all what we want to do) by two means, logic and probability. The difficulty with probability or fuzzy logic is that, as the inference chain lengthens, its conclusions became increasingly uncertain and therefore of little practical use. If logic is therefore the only means available to us, intelligence is presumably skilful application of logic. In this context the length of the inference chain, as well as its accuracy, must be considered. This is in accord with one's experience of playing chess against a better player where his ability to see many moves ahead is very impressive (James 1992).

The basement of the concept of intelligence is knowledge: creation, acquiring, sharing, and the ability to apply by making decisions. According to Wiig, knowledge is a base condition in the organization ensuring its ability to act intelligent; the goal of knowledge management is the creation of intelligent organization (Dalkir 2005). Thus, intelligence also is knowledge, only about the external environment. According to Stankevičiūtė (2002), intelligence is a category of knowledge about events, oriented to external environment. Such knowledge includes: the ability to apply knowledge by responding to the new situation; the quality of mind and the mind; perception; information about various objects, events, and phenomena. Intelligence is the knowing how to predict future events and take actions to prevent them. Intelligence can also be described like optimal usage of resources with purpose to effectively interact with environment (Staškevičiūtė 2009). Choo (1996) proposes the model of knowledge management including three important aspects: sense making, knowledge creation, and decision making. According to this author, organization should know what is there proceeding in its environment, why is it proceeding and what does it mean. Organization should find the way of providing the sense for events by comparing them with former activities and experience. Then organization should create new knowledge and after them, make appropriate decisions.

The concept of intelligence in social sciences is comprehensive analysed by Jucevičienė (1999). Some of her proposed perceptions are:

- *Intelligence in general case:* optimal usage of resources determined by the mental or other potential of subjects (individuals, organizations, states) with purpose to effectively interact with environment;
- *Intelligence as ability:* individuals' and social systems' bio-psychological potentials of usage of resources by interacting effectively with dynamic environment – perceiving and solving emergent problems;
- *Intelligence of activity:* the effective realising of subject's (individual's, organization's, state's) purposes, when resources are used optimally by interacting with dynamic environment;
- *Social intelligence:* the ability of social life's subjects (individuals, groups of people, organizations, states) to communicate effectively by perceiving and solving emergent problems;
- *Intelligence as knowledge, knowing:* in particular way organised information enabling the subject with this knowing to make concrete effective decision.

Thus, there are many perceptions of the concept of intelligence in social sciences. The variety of different perceptions provides some essential aspects of intelligence: *knowledge, optimal usage of resources, effective interacting with environment*. In this article we keep on the viewpoint similar to earlier discussed by Jucevičius (1999): *intelligence is an organised intellectual ability of social system to perceive emerging changes in its environment and to make moves that allow maximising the potential of these changes in attaining its goals.*

5. An intelligence approach to the development

Quite a good indicator of the level of intelligence or at least of the mindset of city managers about the developmet is a strategy. There is a crucial difference between a good and weak strategy.

Many of the less favourable cities do not know exactly where they are going, or where they wish to go and most often – how. They could be characterized by the lack of knowledge about themselves, their friends and their "enemies", about their technological, social, economic environment. Usually they simply do not know what they know and have only more or less structured vision. There is so much vacillation in accepting their' developmental base, because it does not fit with the norms of other successful societies. Relevant information is not always sought or even suppressed. Those paths of development, which are chosen, usually are the fall-outs from the slogans and ideologies of the countries or the regions with

vastly different social and political histories. The ultimate goal in this case can be unattainable.

The search for development tools is most often conducted without clear conception of what the tools are supposed to achieve. Very often it is assumed that tools, which bring prosperity to other regions or the cities, will succeed here too. The disparity in social structures, cultures and values, and ultimate final goals is often ignored. Even when these tools and the economic objectives are compatible, they are not recognized as such by the underdeveloped mentalities, which have deployed them. On the other hand, sometimes the situation is the opposite: 'uniqueness' of local conditions is overestimated and efforts are concentrated on creating 'unique' tools for such city.

Such cities could greatly benefit if they were able to build or strengthen existing intelligence capabilities. This would allow to systematically applying intelligence approaches, which differ from traditional information handling procedures and involve the use of innovative techniques and technologies.

Our previous analysis shows that there are some essential aspects of intelligence (ch. 4). Meanwhile the intelligence approach is a broader category than intelligence itself. According to Dedijer (1993), the intelligence approach sees the world as a shifting variety of social systems, each system – as a communication network with its own "personality" culture, interacting in variety of ways, each exercising its intelligence function as one tool to achieve its goals. Thus, *intelligence approach allows to understand the city as a social system with an ability to capture, create, share, acquire and* the most important aspect – to *apply knowledge for making successful decisions and appropriate responding to changing environment.*

The increasing importance of intelligence in the development process is explained in terms of "information explosion" as well as of the characteristics of information intensive production systems (Jucevičius 1999). In today's economy "know-why" becomes more important than "know-how". Moreover the larger part of social systems has the lack of knowledge not only about the external environment, but even about themselves.

There is consensus in scientific literature about making successful decisions: in knowledge economy there is not enough to capture, create, share, and acquire knowledge. The most important thing is to apply them. That appeals to intelligence approach. In earlier researches Jucevičius (1999) therefore noted the importance of intelligence approach in creating development strategies for underdeveloped countries. It can be perceived that those countries are not always able to apply

needed knowledge and to act after them. The reasons of such inability rise because of insufficient knowledge about the external world and themselves; the increasing non-accessibility of new technologies; increasing non-transparency of information possessed by developed countries; the changing role of the state and organizations in the development processes.

Each social system is acting in particular environment which always influences its actions by creating new challenges. In such point of view it is worth to remember some theories oriented to external environment. For example, the *theory of population ecology*. According to this theory, each environment has a finite number of resources resulting the continual competition. Growing organizations need resources; therefore they have to compete for them. Only the strongest organizations survive because of the natural selection whereas the weakest organizations lose. The cities in the context of this theory when are lacking for resources, for example, natural resources, will then capitulate. But there exist cities without having natural resources and being more successful than other. Furthermore the theory of population ecology argues that all resources are coming from environment. If instead of natural resources we'll take knowledge as the resource it will be also external resource. In resent scientific literature there is acknowledged that social systems can not exist without both categories of knowledge: external and internal. That's why it is important not just to know what is proceeding in external environment but also to know themselves. Only the full set of acquired knowledge determines the ability to use it effectively – prosper possible treats and prevent them. This separates particular cities as more successful from the others.

The other example is *the theory of institutionalization*. It sees the environment as a source of two types of resources: economic (finance, land and machinery) and symbolic (reputation, march and prestige). The objective of organizations also cities and other social systems is to find methods how to gain economic resources and transform them into symbolic (and conversely). This theory is important because it validates the need for searching of new methods to gain and balance the resources. These methods are no other than knowledge reflecting the ability to apply them effectively. This is the main point of using intelligence in social system's actions.

Halal (2002) compared human intelligence with organizational intelligence by using the concept of IQ. By perceiving intelligence of organization as its IQ it becomes easy to understand that social system is acting according to the level of its IQ. Thus, in some cities the level of IQ is higher in some – lower. This point of view clarifies why some cities are able to perform more successful than others. But on the other hand when we treat intelligence as IQ of the organization it becomes naturally the fact that every social system interacts by using intelligence approach. However to validate this fact there is the need for further researches. Despite that the concept of IQ could be used by providing wider practical perception of intelligence approach.

6. Conclusions

Traditional approaches to the developmental issues are becoming of little use in new realities. Emerging knowledge economy and increasing importance of intangible assets such as insight, knowledge and knowing require new approaches for the developemental strategies of nations, regions, cities or even the business companies. Therefore in this article we proposed the intelligence approach to city development.

Intelligence itself can be discribed as an organised intellectual ability of social system to perceive emerging changes in its environment and to make moves that allow maximising the potential of these changes in attaining its goals. This is key difference from the knowledge management concept.

The intelligence of the city has several dimensions and may be political, scientific and technological, educational, economic, business and management intelligence. Every such dimension performs its own function.

The intelligence approach allows to understand the city as a social system with an ability to capture, create, share, acquire and apply knowledge for making successful decisions and appropriate responding to changing environment.

References

Amalia, M.; Nugroho, Y. 2011. An innovation perspective of knowledge management in a multinational subsidiary, *Journal of Knowledge Management* 15(1): 71-87.
http://dx.doi.org/10.1108/13673271111108701

Bender, S.; Fish, A. 2000. The transfer of knowledge and the retention of expertise: the continuing need for global assignments, *Journal of knowledge management* 4(2): 125-137.
http://dx.doi.org/10.1108/13673270010372251

Bridgeforth, B. W. 2005. Toward a General Theory of Social Systems, *International Journal of Sociology and Social Policy* 25(10/11): 54-83.
http://dx.doi.org/10.1108/01443330510791388

Carrillo, F. J. 2004. Capital cities: a taxonomy of capital accounts for knowledge cities, *Journal of knowledge management* 8(5): 28-46. http://dx.doi.org/10.1108/1367327041058738

Castells, M. 2000. *The Information Age: Economy, Society and Culture*. Oxford: Blackwell.

Choo, C. W. 1996. The Knowing Organization: How Organizations use Information to Construct Meaning, Create Knowledge and Make Decisions, *International Journal of Information Management* 16(5): 329-340. http://dx.doi.org/10.1016/0268-4012(96)00020-5

Cowey, M. 2000. Knowledge management – fact or fad?, *New Zealand Management* 47: 54-55.

D'Auria, A. J. 2001. City networks and sustainability. The role of knowledge and of cultural heritage in globalization, *International Jornal of Sustainability in Higher education* 2(5): 38-47.

Dalkir, K. 2005. *Knowledge Management in Theory and Practice.* Elsevier Inc. ISBN: 0-7506-7864-X.

Dedijer, S. 1993. Development and management by intelligence: Japan, in Cronin, B. (Ed.) *Information, development and social intelligence,* Taylor Graham, 304-323.

Edvinsson, L. 2006. Aspects on the city as a knowledge tool, *Journal of Knowledge Management* 10(5): 6-13. http://dx.doi.org/10.1108/13673270610691134

Ergazakis, K.; Mataxiotis, K.; Psarras J.; Askounis, D. 2006. A unified methodological approach for the development of knowledge cities, *Journal of knowledge management* 10(5): 65-78. http://dx.doi.org/10.1108/13673270610691189

Espejo, R. 2000. Self-construction of desirable social systems, *Kybernetes* 29(7-8): 949-963. http://dx.doi.org/10.1108/03684920010342062

Halal, W. E. 2002. Organizational intelligence: a broader framework for understanding knowledge, *On the Horizon* 10(4).

Hillier, B. 1997. Cities as Movement Economics, in Droege, P. (Ed.) *Intelligent Environments: Spatial Aspects of the Information Revolution,* Elsevier Science B. V., 295-345.

James, D. B. 1992. Notes towards the Definition of the Word "Intelligence", *Kybernetes* 21(1), Emerald Backfiles.

Johannessen, J. A. 1998. Organisations as social systems: the search for a systemic theory of organisational innovation processes, *Kybernetes* 27(4)*:* 359-387. http://dx.doi.org/10.1108/03684929810219404

Jucevičienė, P. 1999. Intelligence termino sąvokinė erdvė ir jos atspindžio lietuviškojoje socialinių mok-

slų terminijoje problemos, *Socialiniai mokslai* [Social Sciences] 3(20): 7-21.

Jucevičius, R. 1999. An intelligent approach to management. *Organizacijų vadyba: sisteminiai tyrimai* [Management of Organizations: Systematic Research] 11: 122-134.

Komninos, N. 2002. *Intelligent cities*, London and New York. 115 p.

Lerro, A.; Schiuma, G. 2009. Knowledge – based dynamics of regional development: the case of Basilicata region, *Journal of knowledge management* 13(5): 287-300. http://dx.doi.org/10.1108/13673270910988114

Marcus, A. I. 1985. The City as social system: the Importance of Ideas, *American Quarterly* 37(3): 332-345. http://dx.doi.org/10.2307/2712660

Millar, C. C. J. M. and Choi, Ch. J. (2010). Development and knowledge resources: a conceptual analysis. ISSN: 1367-3270. *Journal of Knowledge Management 14(5):* 759-776.

Ramage, M.; Shipp, K. 2009. *Systems Thinkers*. London: Springer. http://dx.doi.org/10.1007/978-1-84882-525-3

Schiuma, G.; Lerro, A. 2008. Knowledge – based capital in building regional innovation capacity, *Journal of knowledge management* 12(5): 121-136. http://dx.doi.org/10.1108/13673270810902984

Smith, A. W.; Kefalas, A. G. 1983. A five – stage model for developing managers and countries: a social systems approach, *Kybernetes* 12: 235-241. http://dx.doi.org/10.1108/eb005660

Snowden, D. 2005. From atomism to networks in social systems, *The Learning Organization* 12(6): 552-562. http://dx.doi.org/10.1108/09696470510626757

Stacey, R. D.; Griffin, D.; Shaw, P. 2000. *Complexity and Management. Fad or radical challenge to system thinking?* London and N.Y.: Routledge.

Stankevičiūtė, J. 2002. *Organizacijos žinojimo didinimo metodologija.* Doctoral Dissertation. Kaunas: Technologija. 144 p.

Staškevičiūtė, I. 2009. *Inteligentiškos organizacijos vystymas vidinių organizacijos kokybių transformacijų kontekste.* Doctoral Dissertation. Kaunas: Technologija. 140 p.

Underwood, J. D. 2002. *Complexity and Paradox*, Oxford: Capstone.

Xu, J.; Houssin, R.; Caillaud, E.; Gardoni, M. 2010. Macro process of knowledge management for continuous innovation, *Journal of Knowledge Management 14(4):* 573-591. http://dx.doi.org/10.1108/13673271011059536