

Knowledge mapping and other visualization methods perspective usage capabilities for purposeful activities in Latvia

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ABSTRACT

The purpose of this article is to give analyse and survey of the status quo of visual interpretation techniques and knowledge mapping usage in the world and their perspective and the need to use such techniques in Latvia. Given the use of extensive practical experience of western countries, these methods and tools may be effectively used in targeted areas of activity, such as life management, knowledge and cooperation organisation, business, education improvement, brainstorming, government, as well as local government sectors in Latvia. It will provide a clear interpretation and purposeful application of the knowledge and methods of cooperation, and the ease of use of practical actions in the field of industries, including the mainstreaming of 'human security with SWOT (strengths, weakness, opportunities, threats) analysis and systems thinking. There will be opportunities to use clear concepts discussions and compare different options using the card, to effectively address various problems, for example, human security curriculum in schools, household and business planning, etc. that is necessary to introduce in Latvia.

Key Words: knowledge maps, systems thinking, purposeful activities, effective learning, SWOT analysis

1. INTRODUCTION

Knowledge maps such as mind maps and concept maps in western countries over the last decade has shown increasing prevalence in wide range of private and business sectors. As their founders may be considered British psychologist Tony Buzan, who has already developed this theory since 1980 (Buzan, 1980), Novak, J., & Cañas A. (2008). This theory defines mind maps and concept maps as quite simple instruments for problem solving support, based on graphical representation of concepts and their binding links as spidergram or diagram used for training, planning, decision-making and operational cooperation of partners in solving different tasks. Most of these tasks can be solved on a piece of paper, but much more effectively, they can be carried out using personal devices. Although mind maps usage is also possible without PC applications, the prevalence of these options greatly expands. For example, some application areas are shown in the Figure 1 taken from Frey, C. (2010).

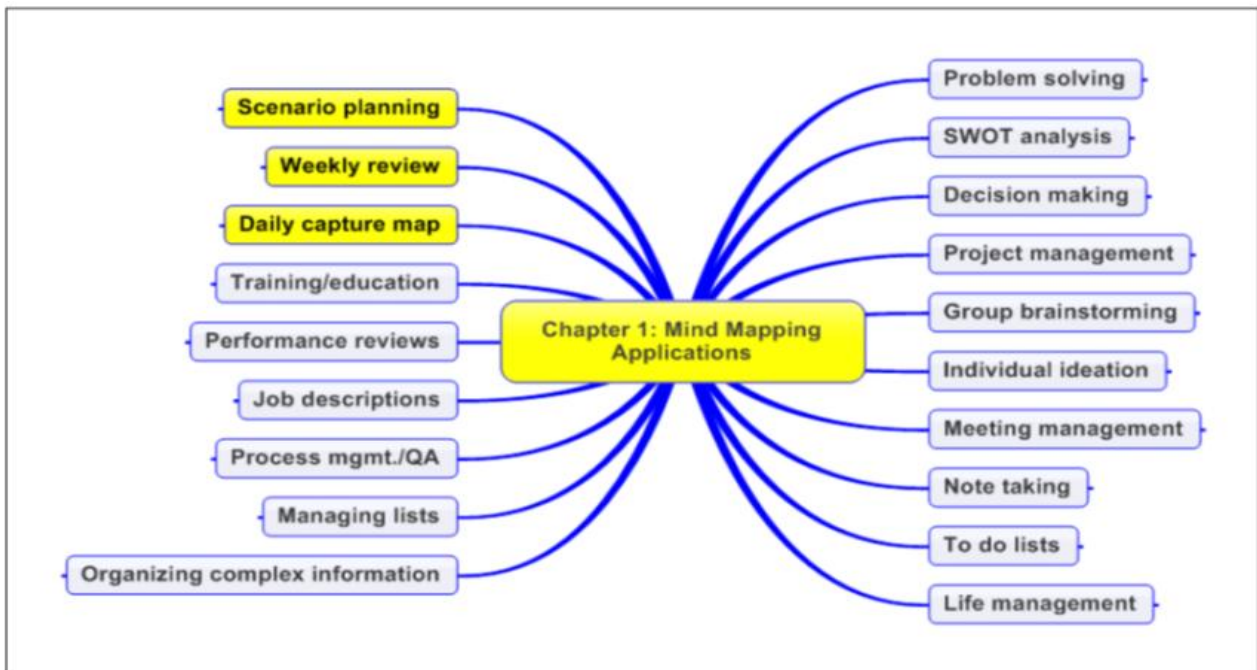


Figure 1. *Some areas of mind mapping applications. Frey, C. (2010)*

Over the past ten years personal devices (smartphones, tablets, personal computers) usage significantly soared among the general population in Latvia, as well as in other countries with increased visual information display options. It is therefore becoming increasingly actual question of their efficient usage not only for entertainment purposes, but also for wide range practical tasks solving. For example, effective learning or targeted planning both in personal and business environment. As advantages of visual and graphical information presentation methods using could be mentioned its agility – the person is able to understand it intuitively and as a result – increase effectiveness in making decisions. Therefore, they are extensively used in wide range of sectors, for example such as traffic signs, which are necessary for quick decision-making.

Personal and mobile devices usage in the actual state has become a problem in the way they can enhance the capacity of the human mind. To this end, more and more are used in methods and technologies based on the use of mind maps theory. Currently, studies and tools developed by the introduction of these applications are booming. In its development and analysis there are involved many scientists and engineers, but this product penetration rates in Latvian are still insufficient and the current issues are undervalued (Ernuiza, Kalnina and Kazaine (2014)). Nevertheless taking into account the necessity to improve the education, business, and communities to improve opportunities for cooperation, the introduction of these methods has very urgent need in Latvia.

It can be considered that the use of mentioned methods and tools is very useful to any person including students, businesspersons, local and parliamentary staff. These technologies work well for any person with any level of competence for growth and efficient acquisition of teaching material and project planning and long-term development strategies and management. The aim of this article is to analyze existing methods and tools, available options in western countries and make recommendations to encourage the rapid implementation of these methods and tools in wide areas of activities in Latvia.

2. METHODOLOGY

During the development of knowledge maps theory as well as other graphical information presentation methods and techniques for situations assessment and decision-making improvement and their applications in western countries they are widely expanded. Apart from mind maps, there

are detached such branches as the concept maps and argument maps (Davies, M. 2010) whose applications as a part of knowledge-mapping software are particularly important in the education sector. Lately, they are particularly used in distance education, where the communication options of teachers and students usually are limited. It should be emphasized that the applications of these tools are always such that an individual must be actively and purposefully involved in planning, decision-making and using of the corresponding information processes. Next to those of knowledge processing methods for specific purposes are also used in many other methods and tools, which are often combined offering certain business applications

The comparative analysis of above-mentioned mapping means quite comprehensively is carried out in the studies conducted by Davies, M. (2010). He shows basic characteristic features of mind maps, concept maps and argument maps and their advantages and disadvantages in the branches of specific disciplines.

Table 1. Summary of the differences between knowledge-mapping software (Davies, M. (2010))

	Purpose	Structure	Level of abstraction	Nodes	Linking devices	Linking words
Mind maps	Associations between ideas, topics or things	Non-linear, organic, radial	High generality	Pictures, words, diagrams	Lines, line thicknesses, colours, shading	Associative words ("Use" and "colours" and "links")
Concept maps	Relations between concepts	Hierarchical, tree-like	Medium generality	Boxes	Arrows	Relational phrases ("in relation to", "is composed of", etc.)
Argument maps	Inferences between claims (conclusions) and support (premises)	Hierarchical, tree-like	Low generality	Boxes and lines	Lines, colours, shading	Inferential linking words ("because", "not", "however")

2.1. Mind mapping

The important role in the usage of the mind maps played by the researches of the English psychologist T. Buzan (1980), who supported the use of the utility. The mind map is a diagram used to present words, ideas, tasks or other items connected to the central key word. In English, it is sometimes called a „spidergram“. These maps are used to generate, to visualize, to structure or classify ideas, tasks or sub-tasks, to organize the information, to make decisions and, e.g., to make publications. They also can be used during the so-called „brain storming“ sessions to organize and structure the ideas. It is important to underline that in contrast to the traditional studying programs the graphical depiction of the relationship between learning themes gives better opportunity to understand the subject's structure that is especially important if one is using modern technologies in the learning process. Thereafter data can be stored as a part of someone's personal knowledge in the flash drive or in the „cloud“ and used while being contacted with a teacher or while being tested.

The components of mind maps can be supplemented by the Internet addresses where the additional information is given. First, during this studying process that can be called very elastic the basic subjects' concepts, the structure of the system and the further learning methods are acquired. Literary it can be compared with a tree trunk. Later the student's research work or the results of the project work can be compared with the tree branches and leaves. The advantages of mind mapping include its "free-form" and unconstrained structure. In accordance with Davies, M. (2010) there is no limits on the ideas and links that can be made, and there is no necessity to retain an ideal structure or format. Mind mapping thus promotes creative thinking, and encourages "brainstorming". A disadvantage of mind mapping is that the types of links being made are limited to simple associations. Absence of clear links between ideas is a constraint. Mind maps have been said to be idiosyncratic in terms of their design, often hard for others to read; representing only hierarchical relationships (in radial form); inconsistent in terms of level of detail; and often too

complex and missing the “big picture” (Eppler 2006; Zeilik, 1997). Mind mapping is also limited in dealing with more complex relationships. For example, mind mapping might be useful to brainstorm the things that are critical for students to recall in an exam (or a presentation, as in the example provided). However, it is hard to see it being useful for a purpose that requires an understanding of how one concept is essential to understanding another. Topics that are more complex require more than an associational tool – they require relational analysis. The tool of concept mapping has been developed to address these limitations of mind mapping.

Table 2. Advantages and disadvantages of hand-drawn and mapping software usage

	Advantages	Disadvantages
Hand- drawn Mind Maps	<ul style="list-style-type: none"> A. No Cost B. No restrictions on map design and layout C. May create map anytime with pencil and paper D. pencil and paper E. Each map is a unique creation of the user F. E. Collaboration possible if colleagues are together in same place 	<ul style="list-style-type: none"> A. Cannot be digitally stored other than as a scanned document B. Map size is limited C. Preference of user for mind mapping software advantages
Mind Mapping Software	<ul style="list-style-type: none"> A. Ability to link to other information such as hyperlinks and notes B. Ability to modify and filter map easily C. Ability to integrate into other Software D. Ability to create templates easily E. Ability to allow real-time collaboration F. No size limits 	<ul style="list-style-type: none"> A. High cost of none free- source software B. Requires computer access C. Learning curve of using software D. Map design flexibility restricted by software options E. Preference of user to hand-draw map F. Map sharing restricted by format incompatibility

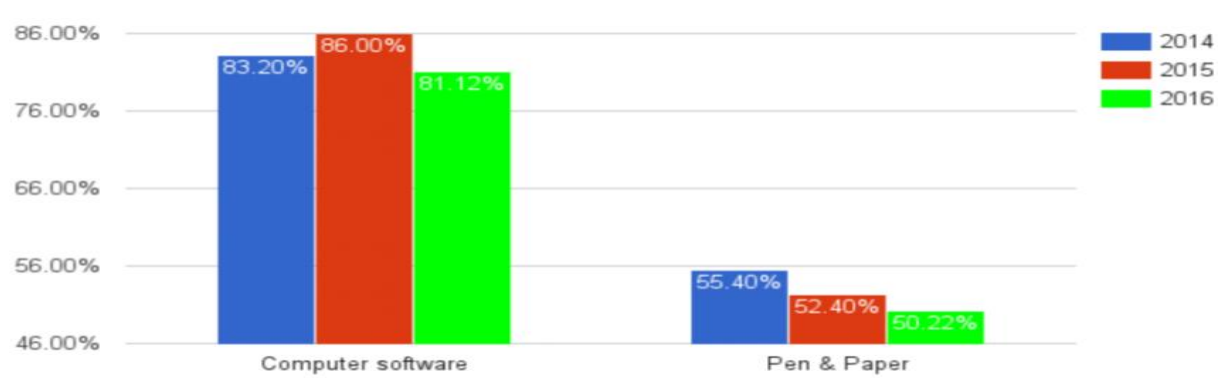


Figure 2. Computer software and hand-drawn usage in mind mapping in past 3 years (Biggerplate (2016))

2.2. Concept mapping

Mind maps are often compared with the concept maps. The difference is that the first one has a tree structure, but the second has relations between the concepts though both are used as the parts of the personal databases.

The concept map according to definition by Novak, J., & Cañas A. (2008) is a diagram showing the relationships between the concepts. Mostly concept maps are used in connection with graphical tools to create them, to organize and depict the knowledge. They consist of the concepts showed in the shape of the circles or rectangles. In the link diagrams, they are interconnected with links representing relations between the concepts. According to the definitions the concept is the generalization created in the man's consciousness or the abstraction reflecting the subject's or the phenomenon's essential features. The words or the phrases in the diagrams represent the meanings of the concepts or the relations between them. The example of the concept maps showing the usage features is shown in the Figure 3.

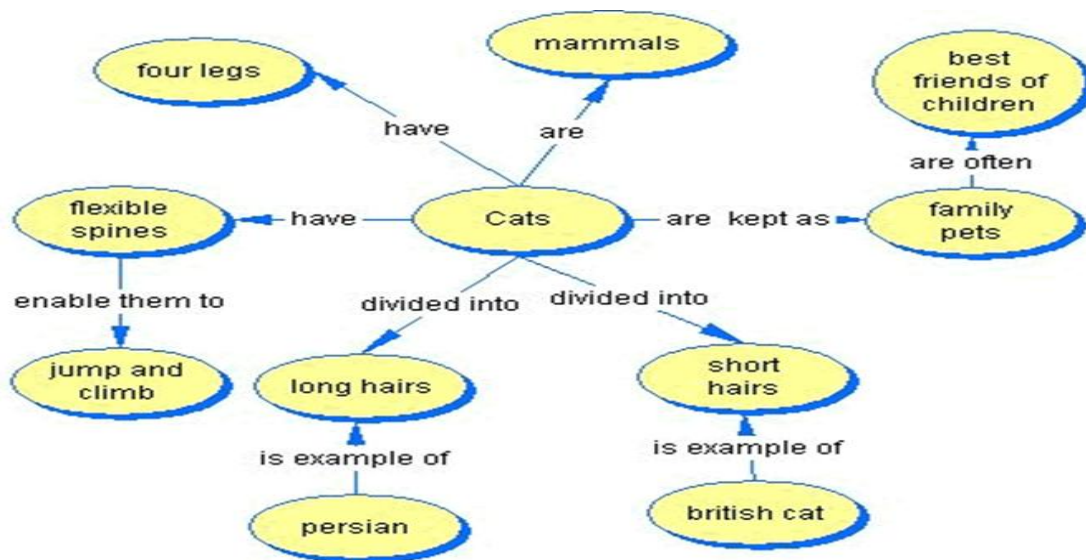


Figure 3. The example that shows characteristic features of the concept map, from ITS Training Services (2014)

2.3. Argument mapping

In accordance with Davies (2010), argument mapping has different purpose entirely from mind maps and concept maps. Argument mapping is concerned with explicating the inferential structure of arguments. Where images and topics are the main feature of associative connections in mind maps, and concepts are the main relationships in concept maps, inferences between whole propositions are the key feature of argument maps. “Arguments” are understood in the philosopher’s sense of statements (“premises”) joined together to result in claims (“conclusions”). Unlike mind mapping and concept mapping, argument mapping could be used in the inferential basis for a claim being defended and not the causal or other associative relationships between the main claim and other claims. The software also allows creating automatically generated description of the argument in text form. In some template argument formats, provided by the software, the mapping program also constructs a prose version of the argument complete with a limited display of linking words. Creating argument maps requires certain resources and technology. The most obvious and accessible technologies are pen and paper or whiteboards, but these quickly reveal their limitations – poor support for complex diagrams and modification of diagrams, as well as failure to constrain, scaffold or guide the user in any way. An important recent development is the growing array of collaborative online argumentation tools such as Debategraph, though good user interfaces

for online argument mapping remain an important challenge (Van Gelder, T. 2010). Argument maps support Critical Thinking by providing a convenient and highly effective way to analyze the exact structure of an argument, showing just those elements that are relevant to making your judgments. While the mapping process itself encourages clearer thinking, a good argument map articulates the reasoning clearly, making it easier to consider the case systematically Twardy, C. R. (2013).

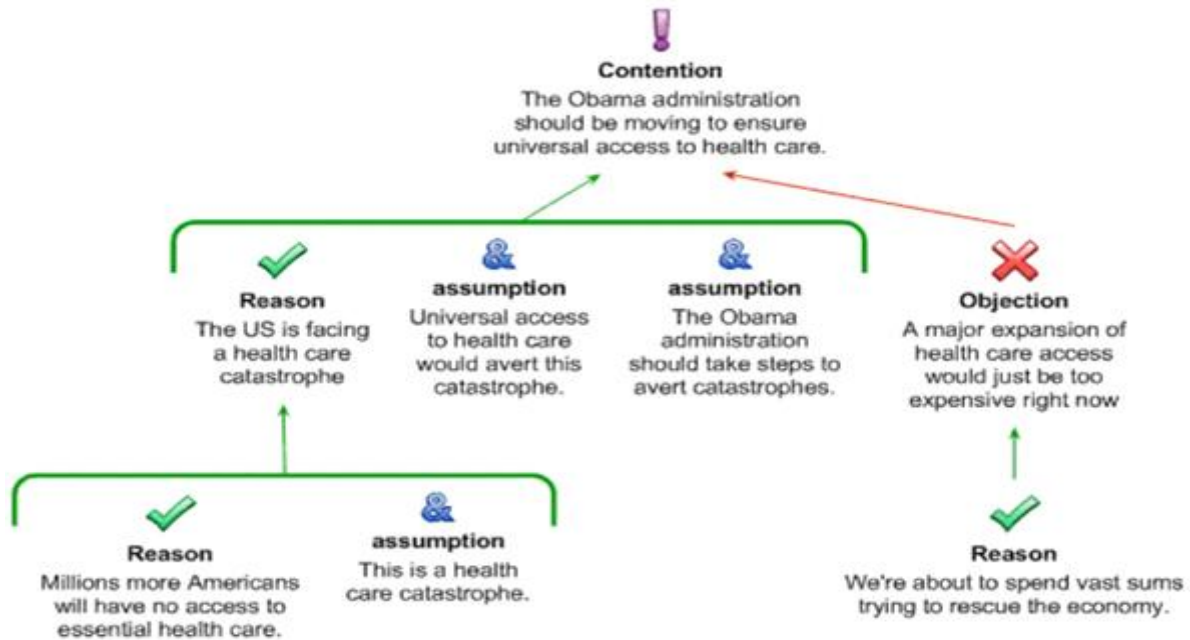


Figure 4. Example of argument map. From Van Gelder, T. (2010).

2.4. Comparison and analysis knowledge mapping and other comprehension and creativity techniques

In this way, Davies (2010) suggested that for education purposes the various mapping tools have complementary functions. Mind mapping is an associational mapping tool; concept mapping provides a way of mapping relationships; argument mapping focuses on maps of inferential structures and logical connections. However, existing technologies already allow enabling a convergence of these mapping tools. All mapping tools function for education is to improve student learning in the ways just mentioned. All of them require the pedagogical advantages of map-making to supplement and drive student learning. What is needed is a way of combining these advantages in an educational tool that provides more flexibility and power than certain existing tools. A schematic plan of how the comparative functions of each of the tools might be integrated is presented in Figure 5.

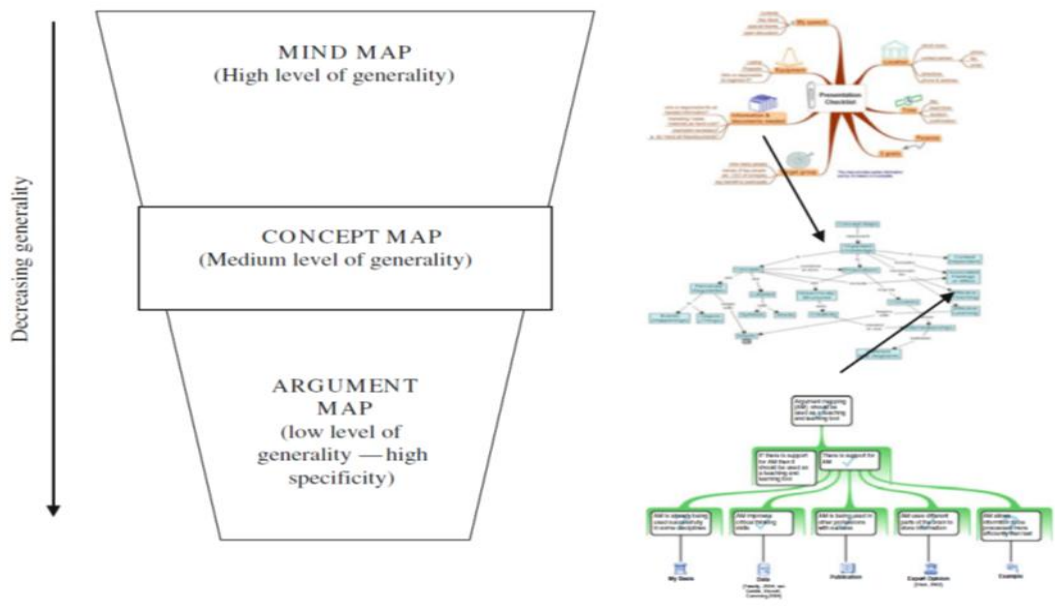


Figure 5. *Proposed convergence of knowledge mapping technologies into a single integrated platform. From Davies (2010)*

Each of these techniques of graphical information presentation has advantages and disadvantages for different branches of application. Therefore it is important to weigh up which of application tools is suitable when you when you want to start using one of the available technologies. The assessment of possible techniques is given in (Enhancing Your Learning and Writing (2012)) as you can see in Table 3.

Table 3. What are they good for? From (Enhancing Your Learning and Writing (2012))

Mind maps	<ul style="list-style-type: none"> - Structured brainstorming of an assignment topic analysis. - Organising literature into themes and issues and seeing the connections between these.
Argument maps	<ul style="list-style-type: none"> - Sorting out a complex web of alternative arguments about an issue, the supporting evidence and counter-arguments and evidence.
Concept maps	<ul style="list-style-type: none"> - Understanding complex, multi-component concepts. - Seeing the connections and hierarchical organisation of a cluster of related concepts.
Tables	<ul style="list-style-type: none"> - Comparing and contrasting theoretical perspectives or approaches to something. - Seeing patterns in data or other information.
Flowcharts	<ul style="list-style-type: none"> - “Chunking” the steps of a long and complex process to make the process more manageable. - Understanding the interactions in a complex system.
Decision trees	<ul style="list-style-type: none"> - Providing a structured approach to problem-solving.

2.5. SWOT and PEST analysis usage

As given in explanation Riccentre (2010) the SWOT (Strengths Weaknesses Opportunities Threats) analysis technique is an extremely useful tool for understanding and reviewing the

company's or person's position prior to making decisions about self-state assessment in the environment or future company direction or the implementation of a new business idea. A SWOT analysis can be completed by an individual or within the organization. As shown in Figure 6 the top row of table is internal and the bottom row is external. As the left column is helpful and the right column is harmful then the purpose of personal activities must be to maximize the issues of strengths and opportunities of left column and minimize the weaknesses and threats of right column the table. See also How to conduct a personal SWOT analysis (2012) and Manktelow (2007).

PEST analysis is a tool to evaluate external factors and more oriented to strategic planning. It is often helpful to complete PEST analysis prior to SWOT analysis, although it may be more useful to complete PEST analysis as part of, or after, a SWOT analysis. SWOT analysis measures a business unit; PEST analysis measures trends and changes in the market. SWOT analysis is a subjective assessment of information about the business that is organized using the SWOT format into a logical order that helps understanding, presentation, discussion and decision-making.

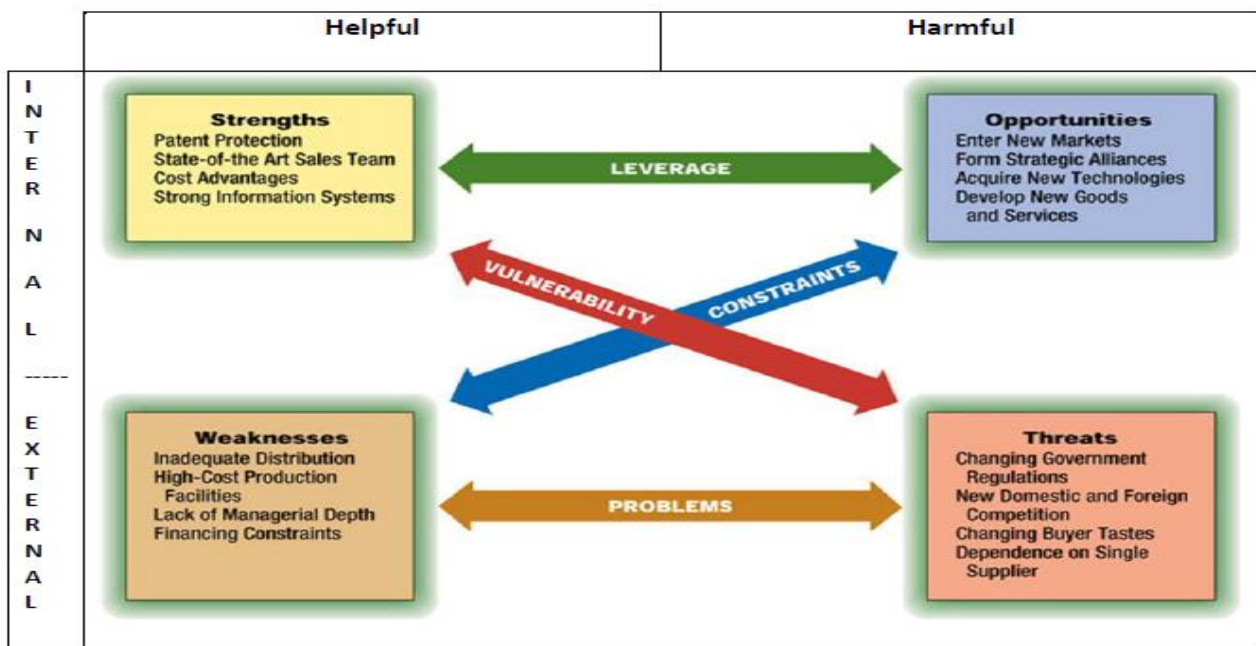


Figure 6. Components of SWOT, from Wenzhong, Z. (2009)

2.6. System thinking approach

Systems thinking provides the ability to observe the deep structure of systems, transcend the simplistic linear cause/effect relationships and apply the language of archetypes across different disciplines Santiago (2011). As recommended “isee systems” (2006) systems thinking usually adds value when situations are:

- Problematic
- Long-standing
- Resistant to change interventions

Systems thinking is often helpful as a planning resource particular in strategic sector. A systems view can help planning for growth, anticipating limits to growth, predicting and avoiding actions that can undermine partnerships, as well as avoiding shooting yourself in the leg (by producing a worse situation than you already have). In general, Systems Thinking rarely helps us find the single correct answer; other problem-solving tools are more efficient in cases where there truly is an answer.

Systems Thinking provides the most value when it highlights the possible choices embedded in complex, divergent problems, and their likely consequences. Do use Systems Thinking to:

- Identify or clarify a problem.
- Increase creative discussion.
- Promote inquiry and challenge pre-conceived ideas.
- Bring out the validity of multiple perspectives.
- Make assumptions explicit.
- Sift out major issues and factors.
- Find the systemic causes of stubborn problems.
- Test the viability of previously proposed solutions.
- Explore short and long-term impacts of alternative or newly proposed solutions or actions.

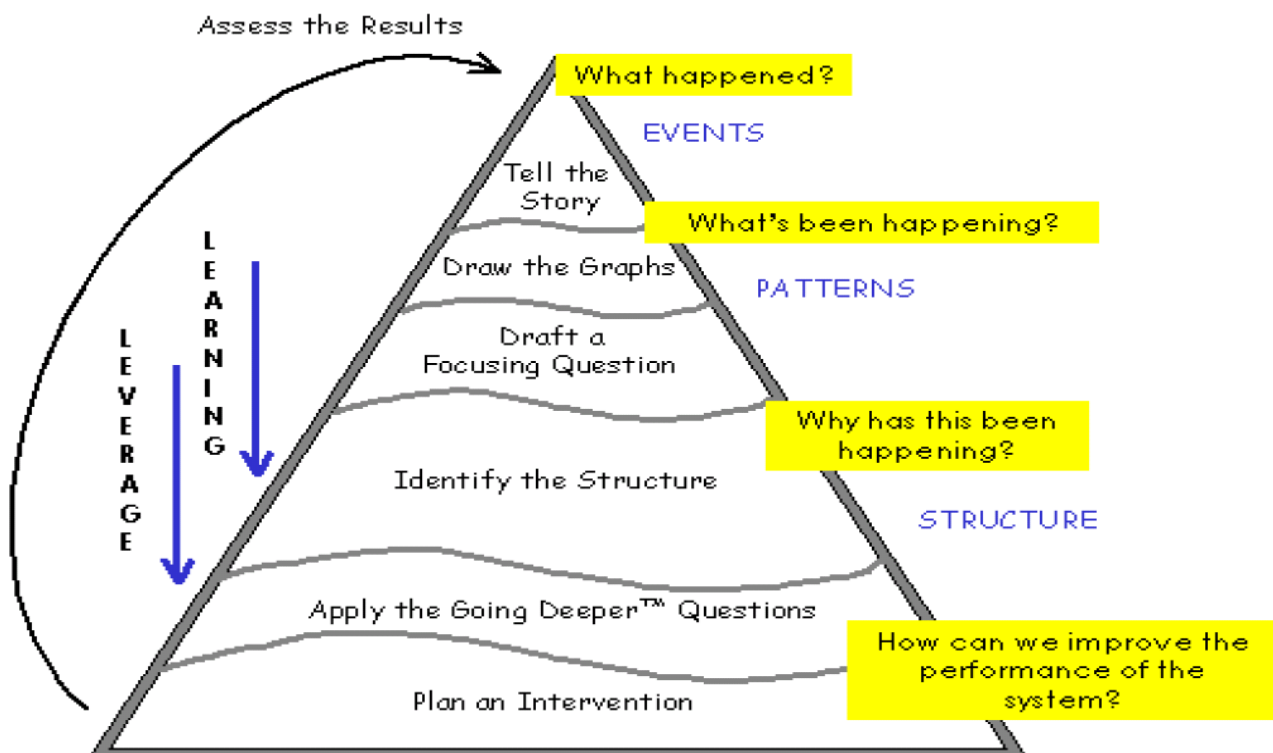


Figure 7. Schema of system thinking approach activities from isee systems (2006)

It should be mentioned that this approach necessary to use for strategic planning everywhere (Goals (2003)) and in particular for development of entrepreneurial skills Aberbrese, (2013) as can be seen in Figure 8.

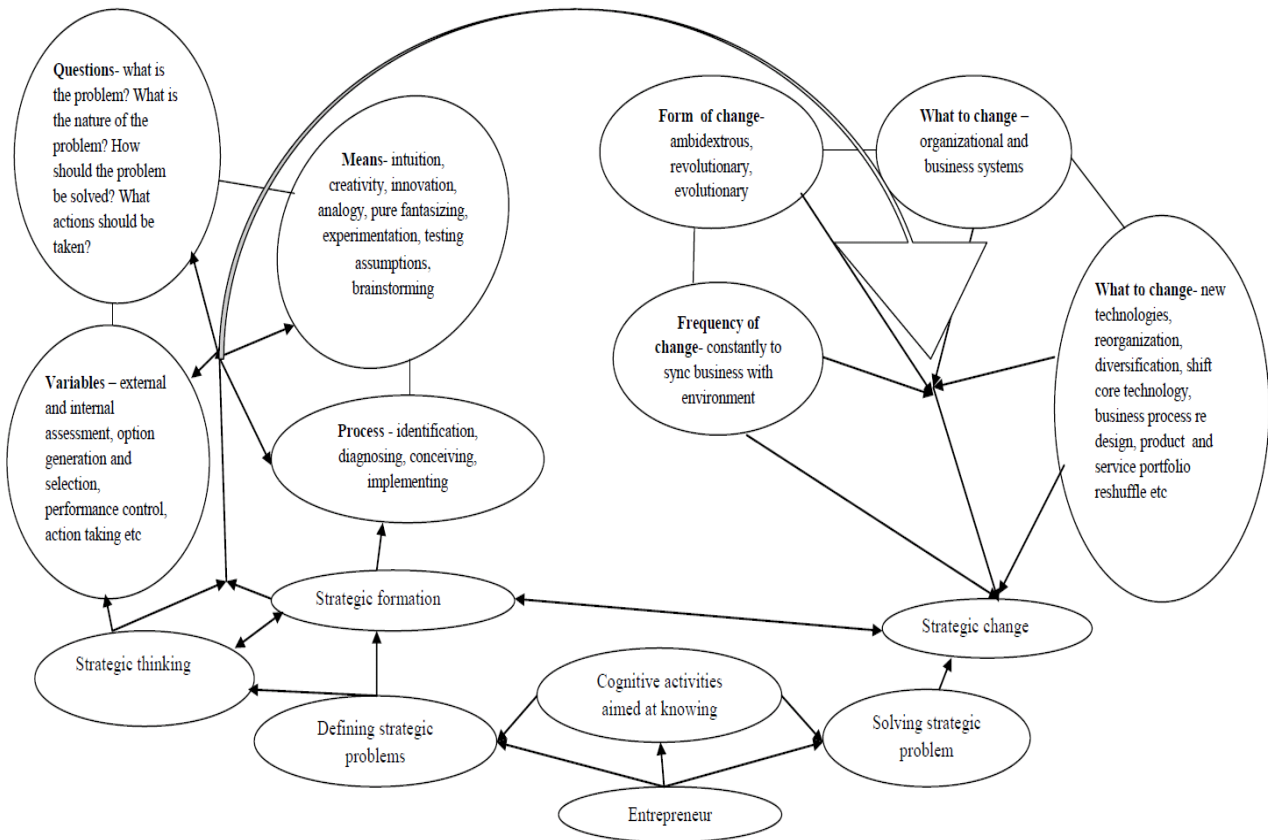


Figure 8. *The Cognition Processes of the Entrepreneur when dealing with a Strategic Problem*
Aberbrese, (2013)

2.7. Top knowledge mapping tools

Over the last years, there has been developed wide range of knowledge mapping tools based on the methods described above. These tools can be applied for practical challenges in the below mentioned sectors. It ought to be noted that many of the tools are intended only for certain device platforms, which can cause incompatibility problems. Therefore, it is appropriate to take into account the cross platform compatibility in order to avoid possible incompatibility problems if different devices. Tools usage is listed in the Table 2 are not among the platform limitation.

Table 2. Cross Platform Tools from the Ultimate Guide to Mind Mapping Software (2015)

Mindjet	Windows, Apple, iPad, iPhone, Android, online
iMindmap	Windows, Apple, iPad, iPhone, Android, online
MindMapper	Windows, iPad, iPhone, Android
XMind	Windows, Apple
MindGenius	Windows, iPad
Mindomo	Windows, Apple, iPad, iPhone, Android, online
TheBrain	Windows, Apple, iPad, iPhone, Android, online
Inspiration	Windows, Apple, iPad
Freeplane	Windows, Apple, iPad, iPhone, Android, online

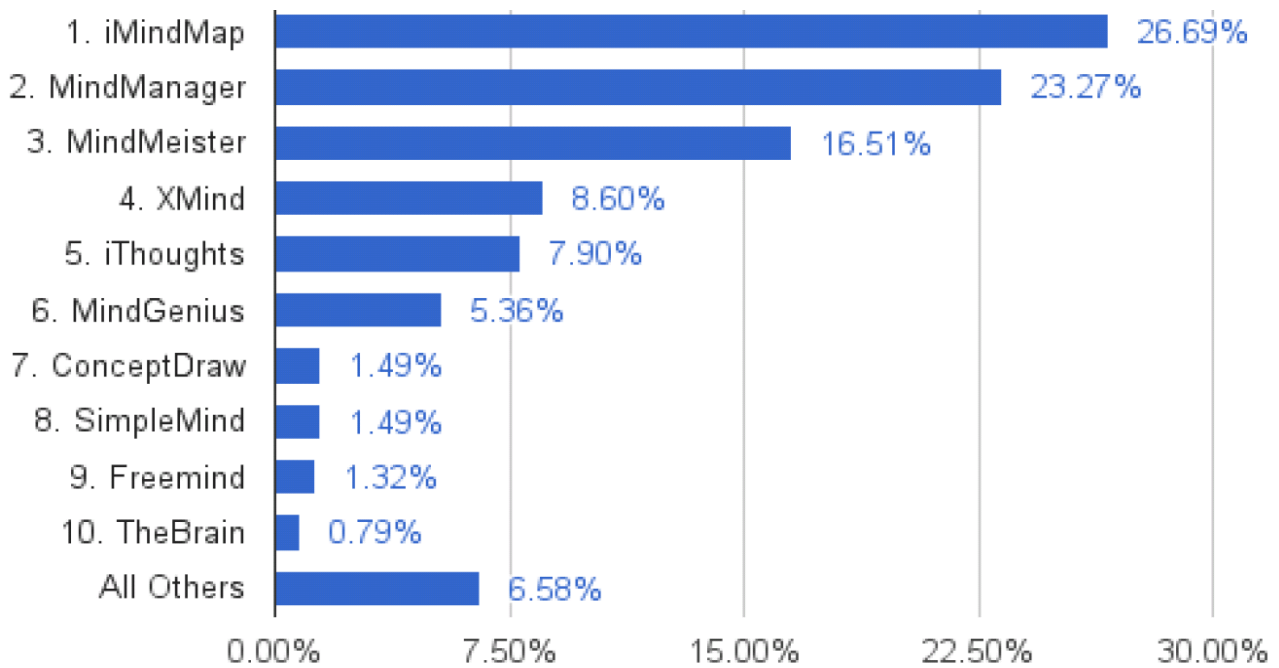


Figure 9. Knowledge mapping software popularity rating (Biggerplate (2016)).

2.8. Usability of visual thinking methods and tools in western countries

Usage of knowledge maps and other graphical techniques is now prevalent in all sectors of human activity and are widely advertised by marketing companies. For example, there exists the portal Biggerplate (2016) that yearly collects information about these tools users in different countries.

There are many human activities sectors of knowledge maps and other graphical techniques usage:

- life management, (Life management (2010)),
- personal graphic organizers (Rowland, (2013)),
- brainstorming,
- strategic planning,
- education, in particular distance learning and learning results assessment,
- adult and self-directed learning (Bryson, (2013)),
- local government management,
- business projects planning and management
- entrepreneurship strategic management (Aberbrese (2013))
- planning and management of the interethnic dialogue,
- human security activities planning and management,
- purposeful web browsing
- software specification development

Life management – is a complex dynamic system, consisting of a several interconnected parts. First, you should find out your main life values, the main goal of your life and the strategy that will help you to attain this goal. That is strategical planning. Of course, your main goal will be complex and compound. For example, if your main goal is happiness, you should find out – what do you need to be happy. The next stage is operational planning: brief review of your plans, plans for year, month, week and day. To manage these plans and control carrying-out you should use time-management techniques (Life management (2010)).

As assert Vidal (2010) experience has shown that it is recommended in a creative process to start with divergent thinking to produce as many ideas or solutions as possible and thereafter to switch to convergent thinking to select the few most promising ideas. Convergent thinking, on the other hand, requires the participants to use skills in reality testing, judgement and evaluation to choose the one or two best options from numerous possibilities. This is usually illustrated in the form of a diamond as shown in Figure 8. Fluency is the production of multiple problems, ideas, alternatives or solutions. It has been shown that more ideas we produce, the more likely we are able to find a useful idea or solution. Picture Stimulation is very popular technique used to provide ideas beyond those that might be obtained using brainstorming. The (5W+H) tool is simple and very useful. The five W's and the H are acronyms for “Who?”, “What?”, “Where?”, “When?”, “Why?” and “How?”. It is a good tool for gathering information systematically about a mess or a problematic situation.

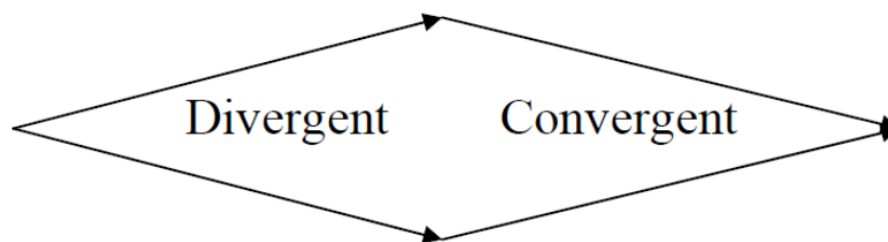


Figure 10. *Divergent and Convergent Processes during creative problem solving Vidal (2010).*

Tucker, Armstrong, Massad (2009) are investigated that a profile of a mind map user from the education sector is one that constructs hand-drawn maps. However, a significant number employ mind-mapping software (such as Inspiration). Users appreciate the ease in which a hand-drawn map may be created at any time or place, but they also see the drawback given today's technology of not having an electronic copy available. An advantage of mind mapping software is the ability to modify maps easily, but the cost is a deterring factor. Users in the education environment indicate that mind maps help them organize their ideas. They use mind maps for brainstorming, problem solving, preparing presentations and conducting research. Biggest part of mind map users from the business and government environment are more like-minded than those from the education sector. They construct hand-drawn maps, but a significant number of users employ software (such as MindManager). Business and government users share the same attitudes with users in education regarding the advantages and disadvantages of using hand-drawn maps. However, those in business and government differ in what they perceive as advantages and disadvantages of mind mapping software. Business users typically utilize mind maps for brainstorming and process improvement.

As concluded Santiago (2011), mind mapping is the most useful during brainstorming, taking notes and developing clinical scenarios. Concept mapping's strength lies in forcing us to organize knowledge hierarchically. Thinking maps are powerful templates allowing the learner to develop metacognitive skills. Argument mapping is a critical thinking tool to formalize premises, counterarguments and conclusions.

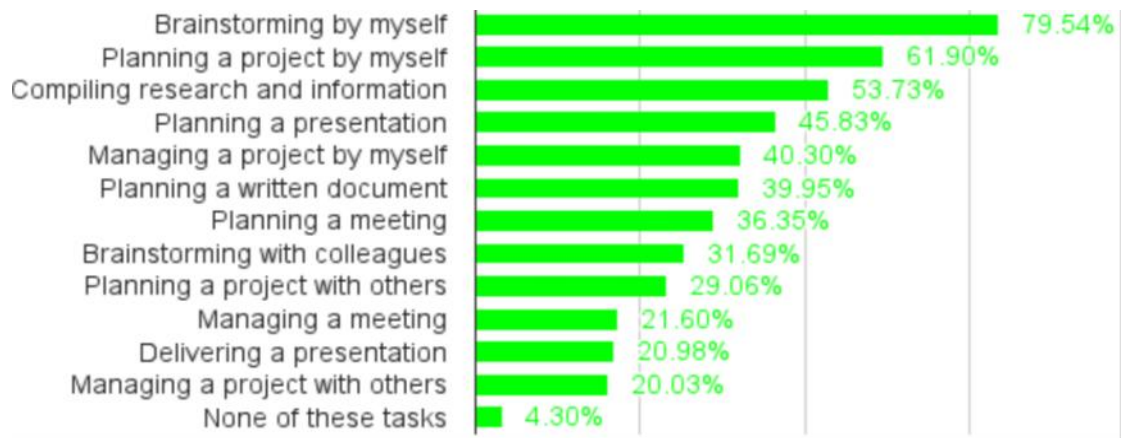


Figure 11. Comparison of knowledge mapping usage for different kind of tasks solving (Biggerplate (2016)).

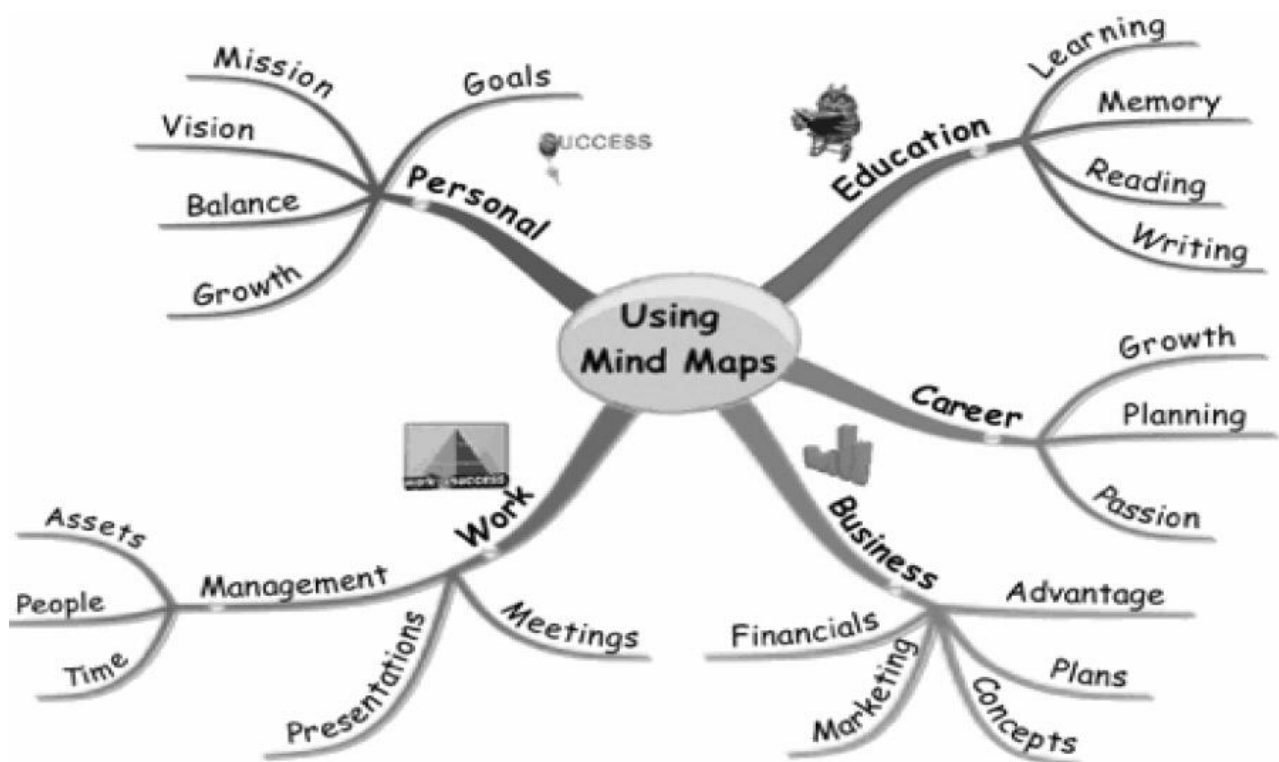


Figure 12. Generalized schema of using knowledge maps from Bryson (2013)

2.9. Knowledge and visual information processing methods development necessity for Latvia

Although knowledge management methods are also used in Latvia by many people, but comparing to Western countries, the users' percentage is significantly lower. This applies especially to the education sector, as well as all the people the opportunity to improve the mainstreaming of 'human security issues. The reason for this is that at the national level has not yet assessed the methods of use and the possibilities to improve the citizens' welfare and public activities for targeted cooperation, which was not possible in the years of the occupation of Latvia. Therefore, there is a need for programmers to increase skills levels and reduce social exclusion of citizens.

As the critical sectors, where in my point of view, the knowledge maps should be used:

- Development of new curriculum about knowledge maps and visual graphic techniques and personal organizers using in Latvia.

- The preparation of teaching staff for the implementation of the present and this object.
- Internet resources preparation for sharing knowledge about knowledge maps and visual graphic techniques.
- Development of new curriculum about human security for schools and citizens. Based on such program, it should be taken into account in the SWOT analysis and of the concept of mainstreaming of 'human security in the areas of the map.
- Implementation of the provisions of the strategic planning of government institutions and municipalities based on systems thinking.

3. RESULTS AND DISCUSSION

This study was carried out in the course of a comprehensive knowledge maps and other graphical planning techniques and their opportunities analysis based mainly on the resources available on the Internet for their research and application in our country taking into account actual needs and putting forward some related proposals. In my view, actual proposals are:

- in education sector:
 - ✓ development of new curriculum about knowledge maps and visual graphic techniques using in Latvian
 - ✓ preparation of teaching staff for the implementation of the present and this object
 - ✓ Development of new curriculum about human security for schools and citizens on the basis of such a programme should be taken into account in the SWOT analysis
 - ✓ internet resources preparation for sharing knowledge about knowledge maps and visual graphic techniques
 - ✓ collaboration with western countries about knowledge maps and visual graphic techniques using
- In government and municipalities sector:
 - ✓ Implementation of the provisions of the strategic planning of government institutions and municipalities on the basis of systemic thinking
 - ✓ internet resources preparation for sharing knowledge about knowledge maps and visual graphic techniques life management
 - ✓ Stimulate between ethnical dialogues
 - ✓ Stimulate life-long education (Bryson, (2013))
- In business sector:
 - ✓ internet resources preparation for sharing knowledge about knowledge maps and visual graphic techniques for business and collaboration
 - ✓ Usage knowledge maps and visual graphic techniques for strategic planning.

During the conducted study there was elaborated an example of mind map of computer network subject for the training distance learning students in Latvian business college. There are developed and proposed some proposals, which could be useful for implementation in practice above-mentioned techniques in Latvia, as shown below.

3.1. Example of the mind map about computer network concepts

The example of the mind map about the knowledge of the main computer network concepts for students is shown in the Figure 13 was made by author for Computer Networks curriculum for Latvian Business College distance learning students. In this example, the mind map is intended for training students and assessment results in such a way that a student must to learn the mind map to

find systematic picture of the basic concepts. For assessing student knowledge, one must be accompanied by examples asked concepts and their relationships.

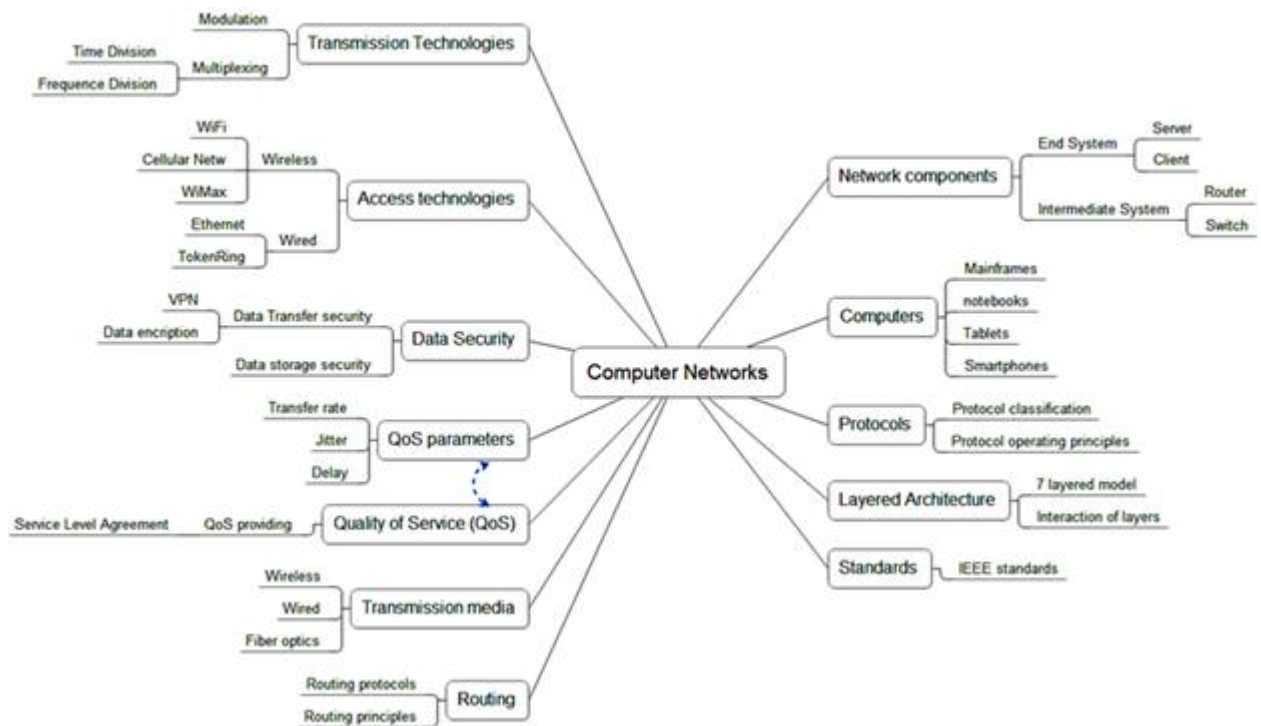


Figure 13. An example of Computer Networks curriculum mind map.

3.2. Proposition for development human security curriculum for comprehensive schools

As one of our education system, big gap may be noted the lack of human security curriculum in comprehensive schools program. There is observed the hesitation to develop and implement human security subjects in schools, which planned several years ago. Its lack contributes such unwanted phenomena of young people as lack understanding of human security, which may be dangerously for anyone to face different situations. The complexity arises from the fact that such a subject should include knowledge of a large number of objects, for example, such as health education, road safety, fire safety, behavior in public places, etc.

As a solution to such subject, development has to make an offer based on a SWOT analysis to incorporate the basis for creative learning and the skills to use it use it in a variety of situations. It should be stressed that the SWOT approach makes it possible to link the threats to its capability assessment, which is very important. This would contribute not only to human security, but also stimulate the growth of any person self-confidence, career mission statement and leadership properties, which is necessary for any personal development (Manktelow (2007)). It should be noted that this subject acquisition does not require the use of any software, but the opportunity to use a possible Internet threats is certainly necessary.

3.3. Proposition for development graphical information presentation methods authority

Although knowledge maps and other graphical information presentation methods for decision-making quality improvement intended mainly for improvement of the quality of education, it should cover all sectors of the economy and social problem solving in the country. Let us look at the vision of marketing, of national reforms that would be needed for their implementation. In order to successfully develop and implement such programs, it is necessary to establish an appropriate authority, for example, in the framework of the Ministry of Education, which would be able to

develop a program, in cooperation with relevant organizations with rich experience in other countries, for example with Scottish Qualifications Authority (2007).

CONCLUSION

We can see that a great success of economic development in a number countries and regions, such as Japan, South Korea (YUN, (2008)) Western Europe and Singapore, have been largely due to knowledge cards and other creative activities stimulating the intensive use. I believe that the result of this work makes it possible to put forward concrete proposals for the development of knowledge, technology implementation plan at national level. I hope that this proposal will find support of the Government of Latvia. I believe that, if you do not want to remain in the stagnation and doldrums, then there is no alternative to this path of development. Therefore, it must become an important part of the national development programs.

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