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Interview: "Overcoming Global Economic Crisis"

Iwai, Katsushito

1. What is the essence of the contribution for which you received the largest prize?

To me all the prizes I have received are equally meaningful but publicly, Medal with Purple Ribbon from the Japanese government is perhaps the most significant. It is given for my contributions to economic theory in general. There are four major works I have done in economic theory -- (1) Disequilibrium Dynamics, (2) Theory of Money, (3) Evolutionary Economics, and (4) Theory of Corporation. Their specific contents differ widely, but they are all theoretical endeavors to construct alternative foundations to the neoclassical orthodoxy in economics and other social sciences.

My work on disequilibrium dynamics demonstrates that the laissez-faire market mechanism is intrinsically unstable by constructing a macro dynamic model that explicitly incorporates decentralized price-formation process and monetary nature of market exchanges. My bootstrap theory of money shows that everybody accepts money as money simply because everybody else accepts money as money. It thus implies that, once everybody begins to fear that not everybody accepts money as money, money ceases to circulate as money and the economy collapses into a mere barter system. My modeling of evolutionary economic process exhibits that profits in excess of normal rate never vanish from the economy because what the economy approaches in the long-run is not a neoclassical equilibrium of uniform technology but at best a statistical equilibrium of technological disequilibria. Finally, my theory of corporation provides a new characterization of business corporation as an entity consisting of two-tier ownership relations -- the shareholders own the corporation as a thing that is tradable in share markets, and the corporation as a legal person owns the corporate assets in turn. It is able to explain why in spite of the rapid globalization of Anglo-American corporate governance that dictates corporate managers to seek the shareholders' returns as the sole objective, Japanese corporations still place more emphasis on the survival and growth of their organization as going concern.

2. What are the impacts of this contribution?

My contributions to economic theory are still heterodox, and I have no intention to claim their wide impacts outside of Japan. But the on-going "once in a hundred years" global economic crisis has clearly pronounced the failure of the neoclassical orthodoxy that has championed, in the last 40 years, the self-regulating nature of *laissez-faire* market economy.

3. What are the applications of your contribution that may change the everyday life?

Let me quote from the last paragraph of John Maynard Keynes' *General Theory of Employment, Interest and Money* (1936). "[T]he ideas of economists and political philosophers, both when they are right and when they are wrong, are more powerful than is

commonly understood. Indeed the world is ruled by little else. Practical men, who believe themselves to be quite exempt from any intellectual influences, are usually the slaves of some defunct economist. Madmen in authority, who hear voices in the air, are distilling their frenzy from some academic scribbler of a few years back."

4. *Can you shed more light on the last answer?*

If works of an economist or a social scientist in general can change the people's everyday life, it is mainly through their influences on the mental framework though which people look at the society and understand the way it works.

5. *Can you tell us, what are the issues that we have to teach our kids, so they become creative when they finish studies?*

I may have misunderstood the point of your question, but for a social scientist like me, it is very important to teach students that social sciences are "sciences" that are as scientific as physical and biological sciences. It is because there are in this world not only physical entities and biological entities but also "social entities" like language, law and money. For instance, money is a mere sheet of paper or a small disc of metal that has no or little intrinsic utility as a thing, and we humans are not genetically programmed to accept it as a valuable thing. Yet, when we find a piece of Euro bill or Euro coin on a street, we stop walking as if we stumble upon a stone and we feel happy as if we see a cute little kitten. To understand why such a physical and biological non-entity can nevertheless function as a full-fledged entity in a human society is scientifically as challenging as solving Schroedinger equation or decoding human genomes.

6. *What are the major things to keep in mind, when you form a team for a scientific experiment, or similar?*

Since I have not done any scientific experiment, I do not have any suggestion to make on this subject.

7. *What are the people to avoid, when trying to generate a break-through achievement?*

A necessary condition for a person to become creative is not to be afraid of straying away from the main trends of scientific community. This is, unfortunately, not a sufficient condition for any break-through.

8. *What is your opinion about the impact of math?*

There is no doubt that sciences, even social sciences, have increasingly become mathematical. Many of my works in economic theory have indeed employed various branches of mathematics extensively. However, mathematical equations in economics and other social sciences are not the representations of laws of nature as in physics and genetics but merely tools to organize our thinking of particular problems amidst hugely complex social phenomena. I am afraid that too much reliance on mathematics in contemporary economic theory has led many economists to lose sight of this humble role of mathematics in social sciences.

9. *When targeting a major breakthrough, how sensitive one has to be about the direct interests of tax-payers?*

Individually each scientist should not directly take consideration of the interests of tax-payers in his or her pursuit of scientific breakthrough.

All that is required is to do a good work. In any mature democratic society it is only by way of a democratic budgetary process that the tax-payers' interests should influence scientific works.

10. *What is the major driving force that motivates a person like you to continue to create and generate results after he-she receives such a big prize?*

First, a feeling of awe towards the world we live in which is so complex that we have understood so little of it; second, a sense of responsibility to contribute to make it a little better place tomorrow.

11. *For small nations like Serbian, what is your advice, which road to take, when it comes to science?*

There should be a global division of labor not only in production of economic goods but also in production of scientific knowledge. Try to concentrate on a few selected fields so that you can marshal a sizable number of scientific talents to form a critical mass in each of them.

12. *What road to take, when it comes to its general future development plans?*

The recent global economic crisis have told us an important lesson that in order to survive and flourish in the 21st century every nation has to find a delicate balance between the openness and the closeness. Too much openness would make the nation vulnerable to global shocks and too much closeness would leave the nation stagnant in its economic, social and intellectual development. There is no globally optimal solution to this problem, and each nation has to discover its local optimum by itself.

What Will Become of the Corporation? –A Comparative Perspective[1]

Iwai, Katsushito

Abstract - *In spite of ever-expanding financial markets and ever-advancing communication networks, there still remains a wide difference in corporate structures and corporate governance among advanced capitalistic economies, notably between America and Japan. American corporations tend to view the returns to shareholders as their sole objective, while Japanese corporations place more emphasis on the survival and growth of their organization as a going concern. The first purpose of this talk is to show how the legal personality of "corporation (or joint stock company)" is capable of generating these seemingly contradictory models within the same institutional framework of capitalism. The second purpose of this talk is to suggest that, despite the growing pervasiveness of the American corporate model, the Japanese model may offer a viable alternative in an age of post-industrialization where the major source of corporate profits is shifting from physical assets (which the shareholders" money can buy) to organization- specific human assets (which it cannot).*

Key words - *comparative corporate governance, corporate personality, human assets, Japanese economy, joint-stock company, post-industrial capitalism, theories of firm.*

1. Two Corporate Systems.

Important Management Goal %	U.S.A.	Japan	Europe
Rate of Return on Investment	**78.1**	35.6	64.2
Capital Gains of Shareholders	**63.0**	**2.7**	10.6
Expansion of Market Share	53.4	**50.6**	61.8
Product Portfolio	28.8	11.5	26.0
Maximizing Sales Volume	15.1	27.9	17.9
Ratio of New Products	11.0	**60.8**	14.6
Corporate Social Image	6.8	18.6	18.7
Retention of Employees	1.4	3.8	6.5
Employees' Benefits	0.0	7.7	0.8

Source:1988 White Paper on Corporations (Keizai Doyu Kai: Tokyo, Japan, 1988)

The above table reports the results of a 1988 survey that asked corporate managers in America, Japan and Europe to pick out the three most important goals of their management policies. One can see from the entries at the first column that answers given by American corporate managers were consistent with the traditional assumption in economics that the whole purpose of the corporate firm is to maximize the returns to its shareholders. They ranked ROI (the rate of return on investment) at the top (78.1) and capital gains of shareholders second (63.0). In stark contrast to American counterparts, the Japanese corporate managers placed capital gains of shareholders at the very bottom of their ranking (2.7). True that they did rank ROI the third, but the points it gets are not so high (35.5). Instead, they put the ratio of new products and new operations at the top (60.8) and ranked market share second (50.6). These goals are more or less related to the survival and growth of the corporation as a business organization. The answers given by European corporate managers, however, were somewhat murky, due to the diversity of the countries in this category.

This study was conducted more than 20 years ago, and the outlook of the corporate managers, especially those in Japan, have changed since then. But, more recent studies have also shown that there still exists a wide difference between American and Japanese corporate systems. (See [11, 16, 24].) While the major objective of American corporate managers is the maximization of the returns to shareholders, the chief concern of a large number of Japanese corporate managers is the survival and growth of the corporation as an organizational entity comprising of employees and other stakeholders.

However, in spite of this wide difference in attitudes towards the purpose of the corporation, both America and Japan are full-fledged capitalistic economies with similar corporate laws. Indeed, the current Japanese corporate law can be regarded as an amalgam of German law and American law. There thus emerges a theoretical puzzle I now have to solve: How can the same institutional framework of capitalism allow these seemingly contradictory systems of corporation to coexist in this world?

This talk's main theme is that it is the very legal concept of "corporation" (or "joint stock

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*The author is Professor of Economics at The University of Tokyo.

[1] This talk draws heavily from the following work of mine on the theory of corporation: [11, 12, 13, 14].

company") that is responsible for the coexistence of two seemingly contradictory forms of capitalism.

2. What is Corporation?

Suppose you are an owner of a small grocery shop around a corner. Whenever you feel hungry, you can pick up an apple on the shelf and eat it right away. That apple is your property, and the only thing you have to worry about is the wrath of your spouse -- your co-owner. I have chosen a grocery shop as a real-life example of the classical firm in any textbook of economics. As Fig. 1 shows, it consists of a single ownership relationship between an owner (or a group of owners in the case of a partnership firm), and assets such as apples and oranges on the shelf of the grocery store. However, as soon as a firm is "incorporated" and become a "corporation (or a joint stock company)," its ownership structure undergoes a fundamental change.

<Fig. 1>
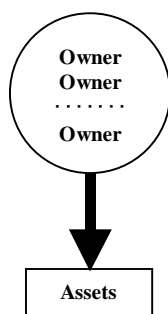
Then, what is "corporation"? Toyota is a corporation and NIS is a corporation, and both are business (or for-profit) corporations. University of Belgrade and University of Tokyo are also corporations, though not a business corporation.

Suppose you are a shareholder of a business corporation, for instance, a big supermarket chain. You feel hungry and found one of its stores on your way. If you enter the store, grab an apple from its shelf and eat it right away, what will happen to you? You will be arrested as a thief! Why? It is because a corporate shareholder is not the legal owner of the corporate assets. Who, then, is the owner of those corporate assets? The corporation as a "legal person" is. Then, what is a legal person? The law treats a corporation as a subject of property right capable of owning real property, entering into contracts, suing and being sued, all in its own name, separate and distinct from

its shareholders.[1] A corporation is, in other words, a "thing" that is treated legally as a "person." And it is the corporation as a legal person that is the owner of the corporate assets.

Who, then, are corporate shareholders? The answer is, owners of the corporation. Corporate shareholders are the holders of corporate share -- a bundle of the financial and participatory rights in the corporation that can be bought and sold freely as an object of property right. Indeed, to hold a corporate share is to own a share of the corporation as a thing (an asset) separate and distinct from the underlying corporate assets. It is the corporation as a "thing" that the corporate shareholders own.

This observation will lead us to the most crucial characterization of the business corporation. In contrast to a single ownership firm or a partnership firm, a corporate firm is composed of not one but TWO ownership relations: the shareholders own the corporation, and the corporation in turn owns the corporate assets, as is shown in Fig.2.

Indeed, in this two-tier ownership structure the person/thing duality of corporation is used in an ingenious manner. In regard to things (corporate assets), a corporation acts legally as a person, as a subject of property right; and in regard to persons (shareholders), a corporation is acted on legally as a thing, as an object of property right.[2]

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[1] §3.02 of American Bar Association's *Revised Model Business Corporation Act* states that "unless its articles of incorporation provide otherwise, every corporation ... has the same power as an individual to do things necessary or convenient to carry out its business and affairs, including without limitation power…." §1-1-3 of Japanese Corporate Law (Company Act) simply states: "A corporation (company) shall be a legal person (juridical person)."

[2] Our theory of corporation could never be complete without having "managers" (directors and officers) incorporated in it. Even if the corporation has a full-fledged personality in law, it is in reality a mere abstract entity that is incapable of performing any act except through the act of real human beings. In fact, it is a mandatory requirement in corporate law that the corporation must have a board of directors who hold the formal power to act in the name of the corporation. Because of space limitation, however, I leave the detailed discussion on the roles of managers to [11, 12].

<Fig.2>
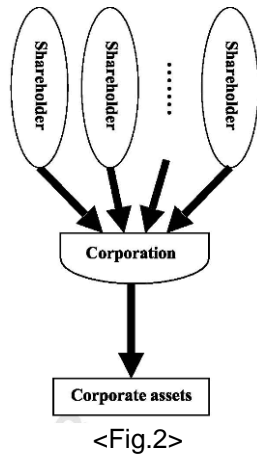
3. The Corporate Personality Controversy and the Comparative Corporate System

For many centuries, legal scholars and legal philosophers have debated heatedly as to what constitutes the "essence" of the corporate personality. This is called the "corporate personality controversy" – one of the most celebrated controversies in legal theory and legal philosophy. In this age-old controversy, two competing legal theories have emerged, each advancing opposing answers. They are "corporate nominalism" and "corporate realism." The corporate nominalism asserts that the corporation is a contractual association of individuals, whose legal personality is no more than an abbreviated way of writing their names together. The corporate realism, in opposition, claims that the corporation is a full-fledged entity whose legal personality is no more than an external expression of its real personality in the society. (There is a huge body of writings on this controversy. Some of the best-known works available in English are [18, 7, 5, 25]. For a comprehensive review of various theories of corporate personality before 1930, see [10]. In [12] I have given an extensive discussion on this controversy.)

The corporate personality controversy is not the thing in the past. The rivalry between corporate nominalism and corporate realism has continued up until now. On the one hand, the contractual theory of the firm, whether it is an agency-theory version or a transactions costs economics version, is a direct descendent of corporate nominalism. (See, e.g., [4, 1, 17, 8, 27].) On the other hand, the so-called evolutionary theory of the firm or knowledge-base view of the firm or core-competence view of the firm can be interpreted as a modern representative of corporate realism. (See, e.g., [3, 20, 21, 22, 26].) The former regards the "private corporations" as "simply legal fictions which serve as a nexus for a set of contracting relationships among Individuals." ([17], p. 310.) The latter posits corporate firms as "organizations that know how to do things, ... while individual members come and go." ([28], p. 136.) The corporate personality controversy is far from a relic of the past.

It is not hard to see that the age-old controversy between corporate nominalism and corporate realism and the more recent rivalry between the contractual theory of the firm and the evolutionary theory of the firm more or less correspond to the difference between the American corporate system and the Japanese corporate system.

What I would like to do now is to "end" this controversy once and for all.   It is, however, not by declaring victory for one side or the other. It is rather by declaring victory for both sides by means of elucidating two legal mechanisms, through which the legal concept of the corporation is capable of generating two seemingly contradictory corporate structures ----- one approximating corporate realism and the other approximating corporate nominalism.

Indeed, if we only look at the downstairs of the two-tier ownership structure depicted in Fig. 2, the corporation appears as a person owning and managing corporate assets, and we draw near to the position of corporate realists and that of the Japanese corporate system. If we look only at the upstairs, the corporation appears as a thing owned and controlled by shareholders, and we draw near to the position of corporate nominalists and that of American corporate system.

We can go further. What I am going to demonstrate is that there are even ways to eliminate either thingness or personality from the corporation, thereby turning it into a full "person" or a mere "thing", respectively.

4. How to Make a "Realistic" Corporation

Let me begin with a way to eliminate thingness from corporation. We know that as a legal person a corporation can own things and that as a legal thing a corporation can be owned by persons. This implies that a corporation as a person can in principle own itself as a thing. Indeed, nothing prevents us from imagining a corporation that becomes its own controlling shareholder by holding a

majority block of its own shares under its own name, as is shown in Fig. 3. If this were indeed possible, that corporation would be free from any control by real human beings (natural persons) and become a self-determining subject. It would thus acquire a full personality in the province of law.

<Fig.4>

<Fig.3>
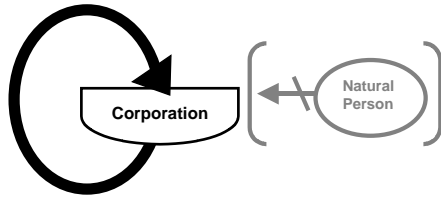
One might dismiss all this as idle speculation. Some countries prohibit a corporation from repurchasing its own outstanding shares. And, in many other countries that allow share repurchases, the repurchased shares usually lose their voting rights in shareholders meetings.[3] In the real economy, therefore, it appears impossible for the corporation to become its own owner.

There is, however, an important leeway to this. Imagine a situation where two corporations, A and B, hold a majority of each other's shares. The corporation A as a person owns the corporation B as a thing, and the corporation B as a person in turn owns the 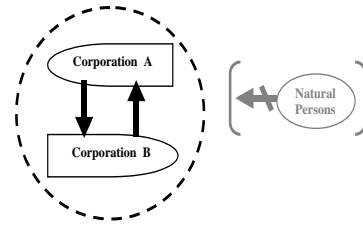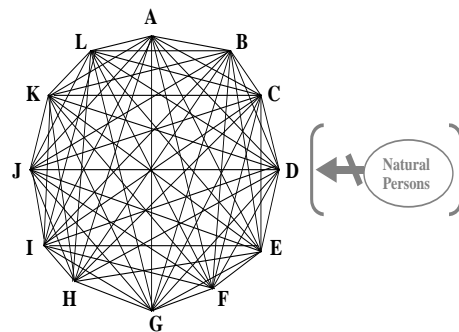corporation A as a thing. As is shown in Fig. 4, even though each corporation does not own itself directly, it does indirectly through the intermediacy of the other corporation. One might still object to the practical possibility of this leeway by pointing out that some countries impose legal limits on the extent of cross-shareholdings between corporations.[4]

Yet, it is possible to circumvent even these limits. Suppose that twelve corporations get together and that each holds 5 percent of each of the other's shares. Then, simple arithmetic $((12 - 1) \times 5\% = 55\%)$ tells us that a majority block of each corporation's shares could be effectively sealed off from real human-beings, without violating legal restrictions on cross-shareholding in any of advanced capitalistic countries. These twelve corporations would indeed become their own owners at least as a group, as is depicted in Fig. 5. It is therefore practically impossible to prevent corporations from becoming their own owners, if they so wish. We have now reached the paradigm of corporate realism -- by extensive cross-shareholdings corporations can get rid of their thingness and become self-determining subjects in the system of law.

<Fig.5>

5. How to Make a "Nominalistic" Corporation.

The way to eliminate the personality from a corporation is much simpler: it is to have someone own more than fifty percent of its shares. That someone then acquires an absolute control over the corporation. The corporation is deprived of its subjectivity and turned into a mere object of property right. Legally speaking, the corporation is still the sole owner of the corporate assets, but in

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[3] U. S. has been the most liberal legal rule on share repurchases. Great Britain had made it illegal to acquire its own shares until 1980, but since then the repurchase was allowed under certain conditions. The repurchase had also been illegal in Germany but the ban was lifted in 1998. In France the repurchase had not been illegal but subject to strict procedural rules until 1998. The rules were then much simplified. In fact, most European countries now have similar regulations on open market share repurchases, due to a European directive. Japan used to prohibit share repurchases until 1994, but several law reforms have since liberalized its procedures substantially.

[4] Japanese law forbids a bank to own more than 5 % of the shares of any domestic corporation. In the case of U. S. banks are allowed to own up to 5% of the voting stocks of any non-banking corporation only indirectly through bank holding corporations.

practice it is the dominant shareholder who can exercise the ultimate control over these assets. We are certainly in the world of the corporate nominalists here.

This is of course a common sense. But I now argue that the so-called corporate raiders are daily putting this legal mechanism into practice in the real economy.

That a business corporation consists of two-tier ownership relations implies that it contains in it two kinds of "things" — the corporate assets and the corporation itself. This fact immediately implies that there are also two kinds of values residing in a business corporation. They are, respectively, the value of corporate assets and the value of the corporation as a thing. The former can be defined as the present discounted value of the future profit stream that would accrue from the most efficient use of these assets. This can also be called the "fundamental" value of the corporation. The latter can be identified as the total share price of the corporation in the stock market. And the business of corporate raiders is to exploit the potential difference between these two values by buying corporations whose stock market values are lower than the fundamental value of the underlying assets. In the process, they do become dominant shareholders and turn the target corporation into a purely "nominalistic" corporation.

Corporate raiders thus help to realize the idea of corporate nominalism in this world. It is indeed claimed that even if they are not daily raiding corporations, the mere perception that they may at any time enter the scene works as an effective threat to incumbent managers, steering them away from management policies that may fail to realize the corporate assets' fundamental value. If this is indeed the case, the stock market is said to function as the "market for corporate control." (For the notion of the market for corporate control, see [19].)

6. The Indeterminacy Principle in Corporate Law

I have thus shown that the corporate law is endowed with two legal mechanisms – one turning a person-cum-thing corporation into a full person, and the other turning a person-cum-thing corporation into a mere thing. Indeed, each society can choose any position along a long spectrum that runs from a purely "realistic" to a purely "nominalistic" structure, on the basis of or at least under the influence of economic efficiency, political interests, ideological forces, cultural traditions, historical evolution and other extra-legal factors. My contention is that in the

long history of their capitalistic development the Japanese economy and the American economy have chosen from this long legal menu the position close to the "realistic" end and the position close to the "nominalistic" end, as their dominant corporate structure, respectively.

One of the distinguished features of the post-WWII Japanese economy was the extensive cross-shareholdings among large corporations. Indeed, it used to have six major corporate groups (Mitsubishi, Mitsui, Sumitomo, Daiichi-Kan-Gin, Fuji, and Sanwa), each of which was clustered around a main bank, extended over the whole industry, and connected through mutual holdings of shares and mutual exchanges of directors. The percentage of cross-shareholdings reached as high as 32.9% of the total shareholdings of publicly-held corporations in 1990. In contrast, the stock market in America is known to have served as the "market for corporate control" far more effectively than that in Japan.

I believe I have resolved the paradox I stated at the outset of this talk. Because I have now shown that in spite of their seemingly irreconcilable differences, Japanese corporate capitalism and American shareholder capitalism are but two extreme forms of the genus Capitalism.

7. The Future of the Corporate System in the Post-Industrial Capitalism

It is no secret that the traditional Japanese-style management has completed its historical mission. The stock market and property market bubbles burst in the late 1980s. The financial markets were belatedly but rapidly liberalized in the 1990s. And the wave of globalization began to expose Japanese corporations to mega-competition in the world markets. All these movements have weakened the traditional ties between major banks and industrial corporations and loosened the tight network of corporate cross-shareholdings. In fact, the percentage of cross-shareholdings declined to 12.0% in 2006, and the six major corporate groups are now consolidated into three (Mitsubishi-Tokyo, Mitsui-Sumitomo, and Mizuho).

Does this mean that the long-run tide of the corporate system is in the "nominalistic" direction? My answer is, however, a "no." Indeed, I am also discerning another tide that is moving in the opposite direction in the United States, Europe, Japan and other advanced

capitalistic economies. It is a tide brought about by the transition from the stage of "industrial" capitalism to the stage of "post-industrial" capitalism. There is now a strong shift in the major source of profits for business corporations from physical assets to organization-specific human assets. What is critical to the long-run competitiveness of business corporations is no longer the scale-and-scope economies of production facilities and distributional networks, but ideas, know-how, coordinating skills, forecasting capabilities, strategic prowess, strong leadership, etc. of managers, researchers, engineers, and other knowledge-oriented employees working inside of organizations.[5] There is a growing body of literature suggesting that the capital values of human assets and other "intangibles" have shown a phenomenal rise in recent years in the U. S. and other advanced capitalist economies. (See, for instance, [2], [5], [9].)

The single most important characteristic of human assets is its inalienability. Money can buy factories, machines, offices, land, and other physical assets. Money can also buy software, licenses, patents, copyrights, trademarks, brand names, and other non-physical but non-human assets. Money, however, cannot directly buy ideas, know-how, skills, capabilities, prowess, leadership, and other human assets because they are all some forms of knowledge stored inside of human brains. As long as there is free will in human, it is impossible to dictate from outside how such knowledge should be employed and accumulated in their brains. The only thing money can do is to provide a variety of incentive schemes that would encourage the employees to effectively utilize the existing

knowledge and to willingly develop it toward a new knowledge within their organization. Examples of such schemes are performance bonuses, promotion systems, pension plans, flexible working conditions, intellectual autonomy, comfortable and stimulating environments, etc.

In the old era of industrial capitalism, the shareholders were able to hold an upper-hand in the balance of power within a business corporation, because a large sum of money was required to construct and maintain production facilities and distribution networks that were critical to the firm's competitive advantage. Now, in this new era of post-industrial capitalism, the physical assets have surrendered its central position to the knowledge-based human assets (i.e., ideas generated by our brains) that money can no longer buy and control. The balance of power within a business corporation is clearly tilting away from suppliers of money towards suppliers of knowledge-based human assets, that is, from shareholders to knowledge-oriented employees. Indeed, the tighter shareholders' control will breed the worries of hold-ups on the part of employees and impede their efforts to invest in organization-specific human assets the business corporation badly needs for its survival and growth.

I have, however, no intention to argue that one form of corporation is better than the other. I have indeed shown that both "nominalistic" corporations and "realistic" corporations are legally, philosophically, and economically possible forms of corporations. My belief is merely that too much shift to the nominalistic direction may be counterproductive to the value creation of the corporation and ultimately the wealth creation of the economy as a whole in this new era of post-industrial capitalism, where luckily our brains, yours and mine, are more important than shareholders' money.

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[5] It is the exhaustion of the 'industrial reserve army' -- the surplus population deposited in rural areas and supported by communal networks -- that is the ultimate cause of this massive phase-transition of capitalistic system from 'industrial' to 'post-industrial.' The consequent rise in real wages has reduced the profit margins of the existing production facilities and distribution networks so that capitalist enterprises are able to reap profits only by undertaking what Schumpeter [23] called "innovations." By innovations Schumpeter designated a broad range of events which includes "the introduction of new commodities..., the technological change in the production of commodities already in use, the opening-up of new markets or of new sources of supply, Taylorization of work, improved handling of material, the setting-up of new business organizations … -- in short, any 'doing things differently' in the realm of economic life." Obviously, in order to do things differently, capitalist enterprises need ideas, know-how, coordinating skills, forecasting capabilities, strategic prowess, strong leadership, etc. of real human beings.

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11

ICT Project Management in Companies in Restructuring – Example of NIS

Petrović, M., Goran; and Despotović, S., Marijana

Abstract—*Implementation of ERP is a demanding process which can create large costs for the company in case of failure. Realization of such project in companies in restructuring is even more complex task because of changing of organization structure and redesign of business processes. The aim of this paper is to present the implementation process of SAP at Naftna Industrija Srbije.*

Index Terms—*SAP, project management, risks, organizational changes, ERP*

1. INTRODUCTION

roject management is a complex task. PIntroduction of new information systems or modernization of the old ones could be a great financial investment for the company. Generally, the bigger the company is, greater are the investment and mismanagement, and a bad risk assessment could lead to failure in project implementation and losses (financial, organizational, in time). ICT IT software projects often 'fail' but the failure usually is not caused by technical reasons. More often, they fail because of reasons related to the management issues. Main reason of ERP`s failure is implementation itself. Analysis of success or failure factors show that primarily it is the implementation's effect on organization, the workplace and the individuals at work which yields a positive or negative result.

The companies have great, often unrealistic expectations from the new information systems. It is often anticipated that ICT project will correct the failings of badly organized company. However, the bigger the company is, the greater is the possibility for the project to fail. This is the reason why ICT projects are sometimes the subjects of litigation, since the investments are big and the results could be worse than expected [1]. The project team, the suppliers, the customers and other stakeholders can all be a source of failure.

However, the most common reasons for project failure are rooted in the project management process itself [2], and the aligning of IT with organizational cultures. That is why it is very important to pay special attention to management of organizational changes and risk management.

Organizational Change Management (OCM) is one of the key factors for the project success. Mismanagement or the lack of change management poses a great risk for project realization. Therefore the interactivity of these two categories excludes independent analysis and observation [3]. Change of the corporative culture is the biggest challenge when compared to changes in business processes, organizational structure and elementary IT systems. The advantages of the introduction of modern technologies into business cannot be disputed and, at the first glance, they are completely understood and accepted by all employees. However, although the innovations improve and make savings in the business process, they generally always face some resistance. Each change of established (learned) way of doing business causes the silent resistance and obstruction from one part of the employees. Change causes the stir and the fears of losing the influence, power or even a job surface. The bigger the change is the greater are the fears (resistance).

Risk Management represents the effort of the management, information system designers and employees in charge of IS implementation to eliminate or minimize potential loss during this process with the use of certain methodologies. Systematic identification, analysis and approach to the risks contribute significantly to successful realization of the project. On the other hand, bad risk management or even complete lack of it can affect the different segments of company's business activity. Planning and activities connected to risk management should be an integral part of organization process management. ERP producers usually have well developed methodologies of risk management, but these solutions are general and should be adjusted for each particular use.

2. CHARACTERISTICS OF MYNIS PROJECT

MyNIS Project is implementation of SAP at Naftna Industrija Srbije (NIS). SAP is an ERP software product that integrates different functions in a business providing rich functionality in each of included business areas [4]. A big burden for successful project realization was a simultaneous commencement of the several complex processes:

- Company restructuring
- Reengineering of business processes
- Preparations for the privatization
- ERP implementation (mySAP project)

ERP software architecture should connect information flow between producer, logistics, finances and human resources within the company. ERP is a client/server based application i.e. ERP modules interact among themselves using centralized data basis and in that way create unique business surrounding [5]. The essence of ERP system is that the data are entered only once, in that way becoming available to all integrated modules without need to enter again particular application segments. If the company does not have stable organizational scheme and well defined document and business activities flow, then the implementation of ERP solution can be a problematic task. Disarray in company organization causes often changes in project demands as well as the development of the wrong software functions, which are «Top 10» software project risks that increase chances for failure [6]. NIS and SAP project team faced these problems at the very beginning of myNIS project.

Structure of NIS ICT Departments

The initial situation of the different business divisions of NIS can be characterized from an IT perspective as followed:

- IT Organization
  - No relationship between IT departments of different business divisions
  - IT departments act autonomously with different report lines
- IT Processes
  - Decentralized and not standardized
  - No IT Governance Model exists
- IT Landscape
  - Isolated applications and architecture
  - No network exists so far for linking the IT applications of the different business divisions

The implementation of SAP as an integrated software solution for all business divisions of NIS requires the transition of the existing IT departments into a new IT organizational model. This transition results in organizational changes and process changes for the IT.

To run integrated SAP systems by support of decentralized ICT Departments is inefficient and risk prone, so the main goal is to build new IT system [7].
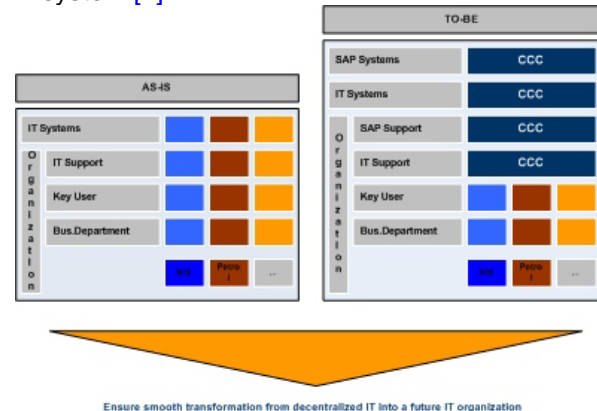
**Figure 1: Transition of ICT department.**

The overall **mission** of the NIS CCC *(Customer Competence Centre)* is to align the ICT activities to the business goals of NIS entities so that information technology enables NIS to build up competitive advantage and to boost the core business of NIS in a fast and secure manner.

Therefore the **strategy** for the NIS CCC is set up as follows:

1. The NIS CCC is a NIS internal service supplier, which supports and consults all NIS business entities in questions concerning the daily use and the future development of systems and applications.

Together with NIS business entities the NIS CCC wants to provide availability and stability of business critical systems and to ensure a controlled and continuous development according to the specific needs of NIS business.

2. Besides that the NIS CCC takes over the function to set up standards, guidelines and process harmonization for all ICT related activities.
3. The NIS CCC is the interface to the NIS business entities and to external partners like software and hardware vendors, service providers and consulting partners.
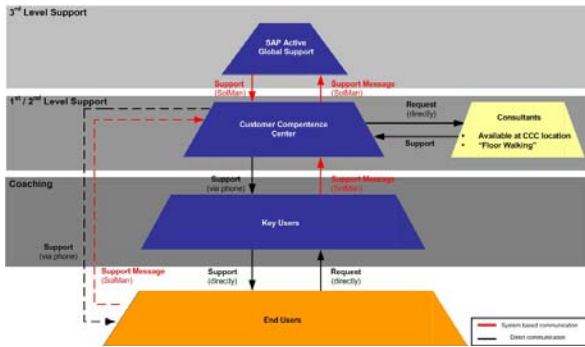
Figure 2: Go-Live Support Concept

Change management objectives

Change Management is the bridge from 'old' to 'new' and is one of the main success factors in SAP projects [8]. The NIS managers and employees affected by changes usually react with resistance. There can be various reasons for this, including a fear of too much transparency ("glass workplace"), or a fear of being made redundant, losing power or qualifications, or insecurities about working with the new technology. During the myNIS Project, Change Management (CM) focused to the following:

**Objective 1:** Create acceptance of the Aims for the myNIS Project

-   The Change Manager supports, in order to convey knowledge to the end user, to make them able to understand their impact while they get changed.

Objective 2: Create willingness, build up trust, and decrease resistance

-   By pointing out the benefit the Change Management Team (Change Manager, Change Management Core Team, and local Change Agents) wants to create acceptance

Objective 3: Create ability

-   Work Out a common understanding of the system by coaching and training the end users.
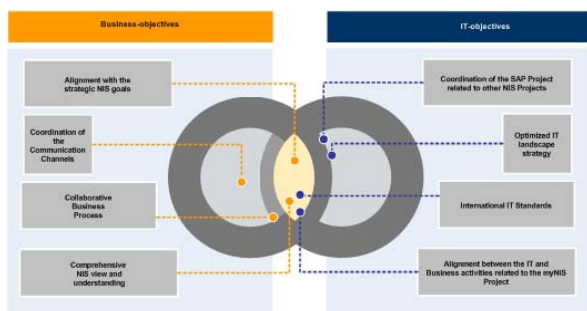
Figure 3: Change Management tasks [9]

There are numerous reasons for resisting change, some of these include:

-   fear of loss of personal choice, information, power
-   lack of awareness, competencies
-   insufficient knowledge and / or information about the change
-   lack of skills and / or abilities to operate in the new environment
-   employees are unwilling to change
-   political, social, strategic reasons

Risk management

The findings presented are based on three primary sources of information; the project information sheet, on site interviews with various key project stakeholders and project document study. The risk exposure for each review topic assessed is summarized in the following table:

Table 1: myNIS Project Review Dashboard

TOPIC AREA OF REVIEW RISK EXPOSURE LEVEL	Risk Exposure Level
Project Management	
Integration Management	**High Risk**
Scope Management	Medium Risk
Time Management	Medium Risk
Cost Management	Medium Risk
Communications Management	Medium Risk
Human Resource Management	**High Risk**
Quality Management	No Risk
Risk Management	*Low Risk*
Procurement Management	*Low Risk*
Functional and Technical Topics	
Business Organization and Process	Medium Risk
Organizational Change Management	*Low Risk*
End User Training and Documentation	No Risk
Technical – Systems Management	Medium Risk

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Risks determined by analysis were stored in the risk data base. The influence of each identified risk was defined and the recommendation for their management was given.

Research results

After the Phase 1 (*Finance & Controlling, Basic Elements, Master Data, Human Resources Basics*) of the myNIS Project was finished, a survey among the key participants on the SAP and NIS side was conducted, using interview and questionnaire. The objective was to learn systematically from the experience in order to improve the effectiveness of the myNIS project [11].

Table 2: Phase 1 - Top answers

75 %	An efficient Governance was missing in terms of risk awareness, operative meetings, direct communication lines
69 %	Lessons Learned are a good idea
63 %	There was a good relationship and good cooperation between the teams
31 %	Sufficient SAP overview training was missing, to learn to be a key user and get confidence and self confidence of users
31 %	Too many role assignments within the project and other tasks in daily business
25 %	NIS counterparts displayed a total commitment to the project

Participants also agreed that the most troublesome issue was lack of the management support to the Project.

3. CONCLUSION

Beside the technical problems a great challenge for the project managers are the problems connected to the effects of organization transformation, because ERP introduction is not only implementation of the new software but it also comprises change in corporative culture and business activities through new or innovated business processes, change in model of organization as well as lines of reporting and communication. These problems are additionally increased when the company is in the process of restructuring during which a new organizational scheme is defined and business processes are redesigned. Due to inadequate organizational scheme of the company, in several cases NIS ICT department had a role of generator of the transformation instead of only being the support for the business activities.

A big burden for successful project realization was a simultaneous commencement of the several complex processes:

- Company restructuring
- Reengineering of business processes
- Preparations for the privatization
- ERP implementation (mySAP project)

Combination of these factors led to frequent team changes and the need to train new team members and to introduce them to the processes. Such situation generates delays in project realization and other problems.

Methodology and process structure applied in the myNIS project were done according to modified ASAP methodology. Key aspect of the implementation mySAP Business Suite solution in NIS is the integration of fairly autonomous entities of NIS into one, vertically integrated business system that led to need for the change in company's organization model and the need for consolidation and harmonization of business processes. This was not provisioned in the initial project content and consequently could not have the focus.

As a conclusion, it could be said that myNIS project has its shortcomings and that there were the problems due to unsolved system questions during the Phase 1. The greater part of these problems was solved thank to the competence and devotion of the project participants. This again confirms the presumption that people are the most important and the most influential resource of every project.

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The Economic Models for the ATM Network Implementation

Ranković, A., Marko; and Vasković, R., Vojkan

Abstract — *In order to create or expand the Automated Teller Machine (ATM) network infrastructure, the bank has two options: to create or expand the network by using its own resources or to outsource the network implementation and expansion to the banking processor. This paper describes the foundations of the shared ATM network and economic models for the banking ATM network establishing. Two models have been developed: the Economic model for the bank's ATM network outsourcing services and the Economic model for the shared ATM network services. The structure of the costs has been presented as well as comparative analysis of these two models. This paper is highlighting the need for rationalization of the invested funds in ATM infrastructure development. This is especially significant for rural and less developed regions, in the countries were lack of these services is obvious. Small number of users makes individual banks uninterested for the ATM network development, but shared networks are justifying the invested funds. Making closer these services to the users, digital divisions are decreasing.*

Index Terms— *ATM, shared network, economic model, costs, savings*

1. INTRODUCTION

When the banks and banking business facing the global market turmoil, they are not eager to invest into the business development and therefore they're not eager to invest into the ATM infrastructure neither. In order to expand their ATM networks, the banks need to invest significant amount of funds. The financial crisis shows that the banks, not only, are not ready to invest, but the banks have became financial institutions which need investments injections. However, despite the problems with which the financial institutions are facing, the banks need to have continuous presence on the market and to expand that presence further and to offer more convenient service to its clients. One of the important bank's links to the clients is the part of the bank' alternative distribution channels – the ATM network.

In order to gain benefits from the ATM network, the bank needs to build infrastructure of the ATM network continuously and to invest continuously into the ATM network management. The costs of the ATM network management are numerous and therefore very complex and they are presenting a significant investment to the bank, either if they are considered as one-time costs or monthly costs.

Networks of the ATM devices are deployed by the banks only or in cooperation with processing companies. Deployment of the ATM devices requires engagement of the significant resources from the bank side, both financial as well as human resources. Deployment and maintenance of such network is usually outsourced by the banks, in order to avoid huge computing centers and specialized experts needed for the network maintenance. Network maintenance is comprehensive job and it can be payable only if there is many ATM devices in the network, which is not the case while speaking about small banks. From the other side, processing companies have resources and equipment for deploying and maintenance of the ATM networks, bigger then those which are owned by the banks. All these elements created prerequisites for relationship established between banks and processing companies, with idea that each party should do what it do best. This relationship represented common ground for the shared ATM networks enterprise

2. SHARED ATM NETWORKS

Shared Networks of the ATM devices are deployed by the banks only or in cooperation with processing companies. Deployment of the ATM devices requires engagement of the significant resources from the bank side, both financial as well as human resources. Deployment and maintenance of such network is usually outsourced by the banks, in order to avoid, huge computing centers and specialized experts needed for the network maintenance. Network maintenance is comprehensive job and it can be payable only if there is many ATM devices in the network, which is not the case while speaking about small banks. From the other side, processing companies have resources and equipment for deploying and maintenance of the ATM networks, bigger then those which are

owned by the banks. All these elements created prerequisites for relationship established between banks and processing companies, with idea that each party should do what it do best. This relationship represented common ground for the shared ATM networks enterprise.

The shared ATM network is based on the concept of spreading and expansion of these devices, by involving the third party- specialized companies (banking processors). The shared ATM network is not a substitute for the existing banking ATM network, but on the contrary, it represents the expansion of that network.

There are several reasons why the banks should invest in the infrastructure of the shared ATM network. The most important reasons are the following:
1. Reducing of the cost per transaction (transaction initiated in the ATM device are cheaper then those initiated at the banks premises, via teller)
2. Expanding bank's presence on the market
3. Increasing the client's satisfaction
4. Profit gain, based on the charges for initiation of transactions to the non-bank ATM users
5. Reducing time needed for the turnover of funds.
6. Expanding geographical presence of the bank in the regions where the bank is not usually present
7. Marketing advantages gained through expanded market presence.

The main reasons why processor should invest in the shared ATM network infrastructure are:
1. Expanding presence on the market of the ATM devices
2. Profit gain, based on the transactions fees initiated on ATMs devices of the shared ATM network.

3. ATM SHARED NETWORK PARTICIPANTS

Classification based on the participation in the shared network is as following:
1. Owner of the shared ATM network – processor
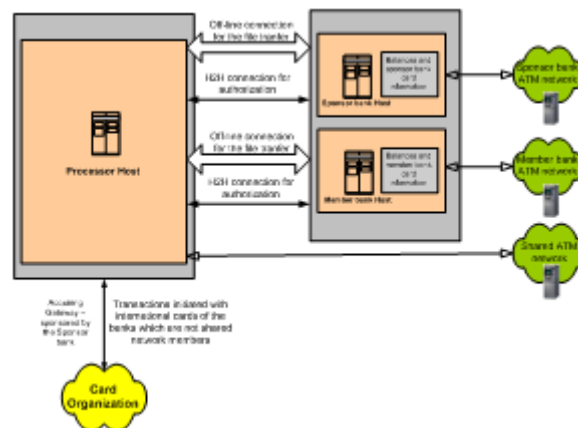2. Sponsor Bank
3. Member bank

Figure 1. Architecture of the ATM network

It is important to highlight that the bank can be the owner of the ATM network and the member bank which is sharing the ATM network with other member banks at the same time.

4. MODEL I: THE ECONOMIC MODEL FOR THE BANK'S ATM NETWORK OUTSOURCING SERVICES

The Economic model for the bank's ATM network outsourcing services is describing the level of funds, on one-time and monthly basis, which need to be invested in the ATM network infrastructure, in order to expand the network. The starting presumption of this model is that the bank is the main and only investor to the expansion of the ATM network. This model describes the structure of the costs and the cost-related activities which need to be undertaken in order to create or expand the ATM network.

The costs in the Economic model for the bank's ATM network outsourcing services have been separated to the two levels: one-time costs and monthly costs.

One-time costs

One-time costs are the costs which are occurring once. In this model these costs are very significant, because they are including the purchase of the ATM, which is the largest investment needed for the expansion of the ATM network.

One-time costs and their structure are presented with the equations below:

$$C_{UK} = \sum_{i=1}^{m}\sum_{j=1}^{n} C_{OT} = C_S + C_{SS} + C_{PC} + C_I + C_{PIF}$$
$$: \quad C_I = \left[C_{SP} + C_{IPC} + C_{IC} \right]$$

i =1-n   :- number of the ATMs on the corresponding locations

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j =1–m :- number of the ATM locations
k=1-t   : -number of transactions

Cuk – overall one-time costs
Cpif=(Cp+Cfc)/f - Crediting purchase finance model
Cot- One-time infrastructure costs
Cpif- ATM purchase and financing costs
Cp- ATM purchase costs
Cs- ATM storage costs
Css- ATM site selection costs
Cpc- ATM procurement costs (Procurement department related costs)
Ci- ATM installation costs (Csp- ATM site preparation costs + Cipc- ATM site infrastructure preparation costs + Cic- ATM installation costs)
Cfc- ATM financing model costs
f- financing period
 Implication.

Monthly costs

Monthly costs are the costs which are occurring on the monthly basis. Individually, these costs are not hot too high, but since there are many types of the monthly costs, summarized they are representing significant costs.

The structure of the monthly costs is presented with the equation below:

$$C_{UM} = \sum_{i=1}^{n} T_{mt} = \sum_{i=1}^{n} T_{up} + \sum_{i=1}^{n} T_l + \sum_{i=1}^{n} T_s + \sum_{i=1}^{n} T_o$$

Cmt- Monthly costs
Cum – Overall monthly costs
Tup- Processing services costs
Tl- ATM location costs
Ts- Servicing related costs
To- Insurance related costs

$$T_{up} = C_{of} + \sum_{k=1}^{t} C_{pc}$$

Cof- ATM outsourcing services monthly fee
Cpc- ATM transaction processing fee

$$T_i = \sum_{j=1}^{m} C_{sr} + \sum_{j=1}^{m} C_{mm}$$

Csr- ATM site renting fee
Cmm- ATM site monthly maintenance fee

$$T_s = \sum_{i=1}^{n} C_{tc} + \sum_{i=1}^{n} C_{fc} + \sum_{i=1}^{n} C_{cc}$$

Ctc- ATM telecom connection cost
Ccc- ATM consumables cost
Cfc- ATM cash fill cost

$$T_o = \sum_{i=1}^{n} C_{ci} + \sum_{i=1}^{n} C_{ai}$$

Cci- ATM cash insurance
Cai- ATM insurance

5. MODEL II: THE ECONOMIC MODEL FOR THE SHARED ATM NETWORK SERVICES

The shared ATM network is based on the concept of spreading and expansion of these devices, by involving the third party- specialized companies (banking processors). The shared ATM network is not a substitute for the existing banking ATM network, but on the contrary, it represents the expansion of that network

The Economic model for the shared ATM network services is describing the level of funds, on one-time and monthly basis, which need to be invested in the ATM network infrastructure, in order to expand the network. The starting presumption of this model is that the processor is the main investor to the expansion of the ATM network, as the owner of the ATM devices. This model describes the structure of the costs and the cost-related activities which need to be undertaken in order to create or expand the shared ATM network.

The processor is creating or expanding the shared ATM network, by purchasing, installing and maintaining the network infrastructure and renting these ATMs to the interested parties (banks) as a model of expansion of the ATM network

The costs in the Economic model for the shared ATM network services have been separated to the two types of costs: one-time costs and monthly costs.
 part can be broken in a as many sections and subsections as needed.

One-time costs

One-time costs are the costs which are occurring once. In this model this costs not complex and are not high, because they are including only investment for acquiring gateway opening at the International Card Organization (ICO).

One-time costs are presented with the equations below:

Cot=Cico

Cot- One-time costs
Cico- ICO Acquiring Gateway opening costs

Monthly costs

Monthly costs are the costs which are occurring on the monthly basis. Individually, these costs for this model are not hot too high, and there are not many types of the monthly costs, which are included within overall monthly costs, summarized they are not representing significant costs for the bank.

The structure of the monthly costs is presented with the equation below:

Cmt=Cof+Ctc

Cmt- Monthly costs
Cof- ATM outsourcing services monthly fee
Ctc- ATM transaction fee

Overall monthly costs

$$C_{um} = \sum_{i=1}^{n} C_{mt} = \sum_{i=1}^{n} T_{up}$$

Cum – Overall monthly costs
Tup- Processing services costs

$$T_{up} = C_{of} + \sum_{k=1}^{t} C_{pc}$$

Cof- ATM outsourcing services monthly fee
Cpc- ATM transaction processing fee
t- number of transactions

6. ANALYSIS OF THE SIMULATION RESULTS

During the cost-simulation analysis different scenarios were used, in order to determine cost-flow trend and economic models appliance in a different market situations.

Scenario I – Savings

The main presumptions of the first scenario are that the number of the ATM is variable, which is having growth trend of 20.37% per month and a constant number of transactions per month. If we analyze the levels of monthly costs of Model I and Model II, we can see significantly lower costs when the Model II is applied, especially when observed long-term. Savings on the monthly level, compared to the level of costs were presented on the Diagram 1.

Same as for the monthly savings, accumulated savings for the observed period are increasing. Trend of growth of the accumulated savings, when compared to the monthly costs of the Model I and Model II is presented on the Diagram 2.
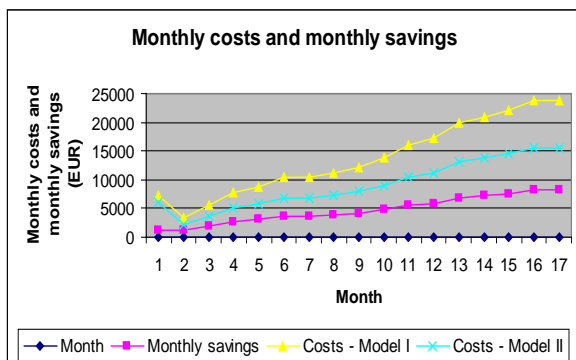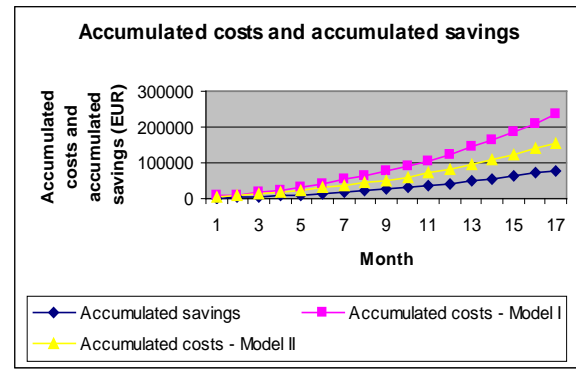

Diagram 1. Monthly savings

Diagram 2. Accumulated costs and savings

Scenario II – Savings

The simulation costs analysis for Model I and Model II, with variable number of the ATMs, which is having growth trend of 20.37% per month and variable number of transactions per month, which is having growth trend of 5% per month has shown that the period when the incomes per ATM are higher than the costs, e.g. when the bank starts to earn money from the ATM network, is twice shorter when the Model II is applied. The costs and savings on the monthly level and their' comparative overview is shown on the Diagram 3.

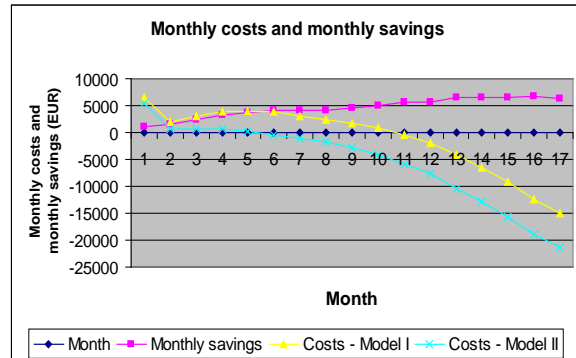The level of the accumulated savings has been shown on the Diagram 4.
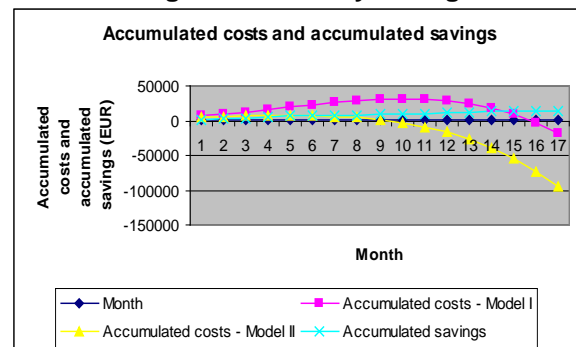

Diagram 3. Monthly savings

Diagram 4. Accumulated costs and savings

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7. CONCLUSION

Based on the simulation costs analysis, when Scenario 1 is applied and the number of the ATMs is changing, as per the monthly growth rate of 20.37% and constant number of transactions, it can be concluded that the appliance of the Model II: Economic model for the shared ATM network services is much more cost-effective for the bank than Model I. The main reason why the Model II monthly costs are lower is that the bank has only ATM renting costs and transaction processing costs. As a result of the lower monthly costs, the Model II accumulated costs are also lower. Appliance of the Model II can bring significant savings both on monthly and accumulated basis. As much as period of simulation is longer, the level of monthly and accumulated savings is higher.

The main reason of the constant, almost linear, growth of the costs, in both models, is the continuous investment into the network, with the constant level of transactions. Since the ATM transaction number is constant, incomes per ATM are constant too. In the Scenario 1 of the cost simulation, the average number of the ATM transactions per month projected on the global level has been used.

If the bank, based on the market researches, determines that the number of transactions for the projected period will be constant, within the average number of transactions, it should use Model II as a model for the ATM network development and expansion.

Based on the simulation costs analysis, when Scenario 2 is applied, when the number of the ATMs is changing, as per the monthly growth rate of 20.37% and number of transactions has monthly growth rate of 5%, it can be concluded that the appliance of the Model II: Economic model for the shared ATM network services is much more cost-effective for the bank than Model I. If the bank, based on the market researches, determines that the number of transactions in the projected period will grow 5% per month, choice of both Model I and Model II is acceptable for the bank, since the level of accumulated savings is relatively low. Advantage of the Model II, is because the investment will be returned sooner that if Model I is applied, because of high initial investments.

It is important to emphasize that usage of the shared ATM networks is having wider social-usability justification. Usage of the shared networks, the same communication channels are used and installed devices are used by more-than-one banking institutions and therefore overall business costs are decreasing and clime of the social responsibility has been produced against the common funds. Individual deployment of the ATM devices by the banks is causing insufficient usage of the invested funds. This is especially relevant to the rural areas and undeveloped parts of the regions, where we can make close services to all users by implementing the concept of the shared networks. The main characteristic of these regions is that the banks don't have interest to develop the ATM networks independently, because the number of users is small. This means that the only way to cover these regions with self-service services on the ATM devices is development and deployment of the shared networks, where sum of the overall users of all banks, members of the shared networks is potentially enough to make the business cost-effective and justified.

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Structure and Functions of Virtual Organization as a Framework for Strategy Design

Ondrej, O., Jaško; Čudanov, J., Mladen; and Miloš V., Jevtić

Abstract—*This paper presents structure and functions of virtual organization as a most important factor for strategy design in turbulent environment. Due to severe political, economic, security and other problems classic framework for strategy design fails in territory of Kosovo and Metohija. Existing solutions, such as acquisitions, merging, formal contracts, create non-flexible tool which has to develop functionalities sometimes almost from the beginning. Proposed solution enabled synergetic use of existing functionalities, which solved the problem. Designed strategy was created on basis of framework made by functions of the virtual organization, which were much more than just sum of functionalities of its parts. Literature analysis, descriptive statistics, comparison and field observation were basic methods used in this research.*

Index Terms—*Broker, ICT, Network Models, Organization, Strategy, Virtual organization*

1. INTRODUCTION

This paper analyses implementation of virtual organization as a framework for strategy design. Due to extreme conditions, strategy of economic development of Serbia cannot be implemented in the territory of Kosovo and Metohija. This requires a new strategy, and most important factor of that strategy is the functionality of a network consisted of institutions, non-governmental organizations and enterprises.

2. PROBLEM DEFINITION

Design and implementation of long-term strategy of economic development of Serbian community in Kosovo and Metohija was extremely specific task, both in methodology and realization. Due to political factors, after the NATO intervention in 1999. Serbian government had practically no formal control or instruments in it's former province. Administration was transferred on UNMIK (United Nations Interim Administration Mission in Kosovo), on 10. June 1999, when the Security Council in resolution 1244 authorized the Secretary-General to establish an interim civilian administration led by the United Nations.

UNMIK has jurisdictions to:
- perform basic civilian administrative functions;
- promote the establishment of substantial autonomy and self-government in Kosovo;
- facilitate a political process to determine Kosovo and Metohija's future status;
- coordinate humanitarian and disaster relief of all international agencies;
- support the reconstruction of key infrastructure;
- maintain civil law and order;
- promote human rights; and
- assure the safe and unimpeded return of all refugees and displaced persons to their homes in Kosovo and Metohija.

Kosovo and Metohija were one of the least developed areas in Serbia, even in the period before the conflict. After military conflict in the year of 1999. Serbia formally lost jurisdiction over this province, but has not lost responsibility for its future economic, political and safety aspects.

National strategy of economic development of Serbia planned achieving of the principles agreed in Lisbon Declaration about regional development and increased investments into least developed areas. But practice has shown that the implementation of most priorities is not possible due to inefficiency of lack of action mechanisms of state institutions in that area. Ministry of industry, Ministry of finance, Tax Office, State Surveyor Office, Courts, State Business Register Agency, Development Fund etc. since year 2000. do not apply its mandate on Kosovo and Metohija, limited by mentioned UN resolution. Although described conditions are evident, state has responsibility for economic aspects, especially population economic standards.

Summarized problems could be described as problems of:
- Unavailability of data, field resources and institutional mechanisms
- Safety of staff and capital
- Non-cooperative or competitive behavior of other present institutions
- Local incompetence – limited abilities of local communities to create it's own strategy and resources needed for entrepreneurship development and employment

- Legal vacuum in jurisdictions over province

State of industry of Serbian communities in Kosovo and Metohija is specific by poverty, slow and late development. The macroeconomic indicators on area with Serbian population is unsatisfactory: population of 130.000 (most living in enclaves), 250.000 exiled and refugees, only 359 of registered enterprises, export share in foreign exchange balance is just 5,9%, basic economy sectors are agriculture and mining, and capacity usage in those sectors is around 10%. Since 1999. GDP is constantly falling and now is less than 400€ per capita, as a result of less and less production activities and international aid.

3. PROBLEM SOLVING

Inefficiency of existing state institutions in Kosovo and Metohija created the need for new institutions, not parallel but those that can use or aid the existing ones.

Exonomic Team for Kosovo and Metohija was formed, consisted mostly of experts in thirteen economic and industry areas. Experts coordinate workgroups consisted of staff from Ministries, public enterprises and science institutions. That fully defines Economic team as a broker of wide institutional network, participating in strategy design and implementation.

Economic team started to develop alternative, specific development strategy, regarding primarily possibilities for appliance of proposed actions and instruments in existing formal and security conditions. By working on this task virtual organizations have functioned in two areas: as a model of organization for strategy design team, and as a model for connection and coordination of loose institutional partnerships which will participate in strategy implementation, creating the framework for strategy of economic development.
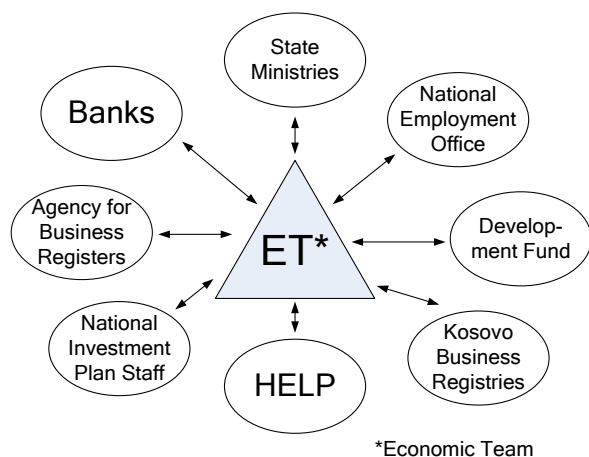
Second dimension has special importance in context of this paper, because by accepting it strategy is aimed only on such priorities, measures and activities that could be implemented in conditions of limited functionality of State (territorial, legal and institutional), or the strategy would be just a declarative document, a list of wishes outside of the practical problems of ways for implementation.

Economic team has took over various roles of network broker, corresponding to classification we can find in works of Avila, Putnik and Cunha [1]. Besides initiating of new collaboration methods, acting as configuration manager, Economic team provides legitimate approach and resources for the network (information, technical, financial), but also provide transfer of goods on institutions and people in Kosovo and Metohija.

This paper presents strategy design approach in field of entrepreneurship – one of the major priorities in development strategies for countries with insufficient economy development.

Although problem sounds specific and politically burdened it has parallels in business environment. Often an enterprise is forced to implement strategy in business environment (often hostile or highly competitive) in which that enterprise has no control of action mechanisms. Such problem can be solved by using the framework provided by virtual organization. Such solution can be more efficient and effective, create more knowledge, create atmosphere of mutual collaboration and ease existing conflicts, and are always faster than usual solutions, such as acquisition, merging, too formal contracts or "brute force" approach.

Some of the basic preconditions for virtual corporation development were:
- There was high degree of trust and understanding among core institutions that formed nodes
- Every partner had some value to add to the organization
- Organization was project-oriented
- Rules of collaboration were clearly defined
- Major nodes recognized need for coordination and one node that will take the role of coordinator
- Clear interface towards "non-virtual" clients was defined[2]

*Economic Team

Figure 1 Virtual network of Economic Team

4. PROCESS OF STRATEGY DESIGN BASED ON STRUCTURE AND FUNCTIONALITY OF NETWORK

As an illustration of approach to strategy design based on structure and functionality of network we will describe process and solution we came to during development of strategy segment for support of entrepreneurship and small and medium enterprises. The design was done in five major steps:

1. Identification of institutions for support of enterpreneurship development in the Republic of Serbia
2. Inspection of collaboration model for supporting institutions
3. Inspection of support process
4. Identification of functionality barriers for existing support model
5. Sustainable strategy design

1) With no doubt major role of supporting economic development, especially small and medium enterprises in Serbia belongs to Development Fund, which has role connected with all means of financial aid, under given conditions, to those enterprises which have size, location or belong to sector that is defined as a priority in National Strategy of Economic Development[3]. Ministry of finance is providing financial means by National Investment Plan. State Business Register Agency is registering the enterprises and keeping records about given mortgages. Business banks, besides credit guaranties, provide operative treatment of applications. Tax Office controls and charges tax obligations. Ministry of Agriculture is giving financial and other means of support to agricultural and rural development. National Employment Office implements programs of employment improvement. Non-governmental organizations give support to development by utilizing humanitarian aid and donations etc.

Such structure resembles information system with poor user interface. The functionality of other layers is diminished by lack of usability in the processes of data input and retrieval. Final users and strategy implementators – existing or future small and medium enterprises sometimes cannot access only one functionality, and then whole complex need or project is imperiled.

2) Number of institutions that have at least part of its authorization in field of small and medium enterprise support indicates relatively high specialization of its functions. This is one more reason to create effective model of collaboration. But, the connections can be found primarily on basis of common client, i.e. existing or future enterprise that needs support. There is no formal institution or standardized procedure of communication. Client is the only mutual connection. In that context efficiency of its collaboration depends on skills of the client to use competences of various institutions and define its application in coherence with principles and rules of those institutions.

3) In aim to support small and medium enterprises and enterpreneurship development Development Fund launches open competitions for loans and grants, defined by priorities of Strategy. Financial means are used for start-up projects and development of existing enterprises. As main selection criteria economic indices, possible export orientation and technological level of the plan are used. Procedure for credit acquirement is complex and involves collaboration of almost all of the institutions mentioned in point 1). It is initiated by the client, who executes most of its steps.

4) Barriers existing in functionality of previous model for support of small and medium enterprises and entrepreneurs in Kosovo and Metohija are mostly connected to conditions candidates have to meet in the process of open competition, to be accepted as valid competitors for financial means. Minimal requirements of the open competition are:

1. Certificate of registration for enterprise, individual business or farm, issued by Serbian institution
2. Financial report about previous business period (for existing enterprises and individual business)
3. Guaranty of business bank or mortgage on immovable estate
4. Open accaount in a business bank registered by Serbian laws

Due to specific situation, most of the Kosovo and Metohija inhabitants are not capable to gather those documents. Some institutions (State Business Register Agency, Cadastre Office, National Employment Office, Tax Office etc.) do not function at all in some parts of Kosovo and Metohija, making it virtually impossible to gather documents for most enclave inhabitants. Cadastre office is displaced outside Kosovo an Metohija, and therefore is not in position to issue mortgage, and all registered enterprises are free from tax payments to Serbia, so there is no obligation for yearly financial reports and no way to control it. State Business Register Agency has no offices in Kosovo and Metohija. Business Banks do not guarantee for credits without mortgage. Ergo, due to limited functionality of state institutions, entrepreneurs or existing enterprises in Kosovo and Metohija cannot enter open competition for state credits or grants.

	ET	CC	MF	DF	NEO	H	B
Program institutionalization	x	x					
Competition criteria definition	x					x	
Competition publishing		x	x				
Application gathering							x
Documentation verification.					x		
Business plan verification				x			
Grading and classification	x	x		x			
Results publishing	x						
Monitoring						x	

ET – Economic Team; CC – Coordination Center; MF – Ministry of Finance; DF - Development Fund; NEO – National Employment Office; H – Help; B – Business banks in Kosovo and Metohija

Table 1. Authority division among key network members

5) In context of described limitations, design for sustainable support strategy has begun. Basic principles were defined: application procedure must be transparent, simple and continuously open; instead of credits, financial stimulus grants will be will be used; investments must be into fixed assets, except buildings; start-up projects have priorities over projects of existing enterprise development; number of new employees is more important than profitability; production and services are key sectors, especially if using local resources; financial stimulus will be uniformly dispersed over entire territory, proportional to number of inhabitants etc.

When the implementation phase was considered, starting point was that no institution should change rules and procedures of its work, regarding the fact that most are regulated by laws and procedures approved from ministry and that responsibilities of public administration is equal no matter if procedures are realized on territory of Kosovo and Metohija or any other part of Serbia. Second, refugees with no personal assets can apply only with business plan, because basic intention is to help to most threatened population. Third, as a certificate for competition appliance documents directly or indirectly issued by local population, or documents issued by international institutions in Kosovo and Metohija will be accepted. Fourth, granted financial stimulus will not be as large as usual, to decrease motivation for abuse. Fifth, sanctions for breaking or abusing the rules of the open competition will be aimed at loosing the right to participate in future grants or financial stimulus organized by the state, not towards financial tolls that will be paid from participants funds. Sixth, appliance for the open competition could be done in institution not belonging to public administration, such as business banks, because of the wider network and operative outposts in Kosovo and Metohija, capable of handling lots of applications. Seventh, monitoring of business plan implementation will be done by non-governmental organizations, which have free access and experience working in the post-war Kosovo and Metohija.

This strategy was presented to the National Council for economic development, because government permission was needed. After strategy was accepted and 4,8 million euros for financial stimulus fund were approved, on 04.11.2006. public call for applications was opened, with help of the governmental office for media relations. During one month 1420 applications have arrived. One of the criteria for successfulness of the program was number of applications. As a comparison, during entire year of 2006. for start-up programs of the Development Fund in the territory of entire Serbia there were 1750 applications. Processing of the applications was done in the following three months by the Development Fund, aided by experts from State Employment Office. Governmental office for media relation will continue to publish results of the future competitions, which are also published on internet site of Economic Team and in the local offices. Contracting and payment will be done via banks in the territory of Kosovo and Metohija. Monitoring, especially control of the correlation of business plan used for application and real situation will be done by HELP – Hilfe zur Selbsthilfe e.V. nad IOM – International Organization for Migration. Monitoring of the entire project will be done by the National Council for economic development, using the resources of the project centre in Ministry of Finance.

Duting entire process, as can be seen in procedure description Economic Team has role of broker, same as in the process of strategy creation. Using the cited classification of broker functions, its functions are both in domain of explicit and implicit effects. Explicit functions are mostly:
  - Initiation of the virtual enterprise,
  - Identification of recources,
  - System integration of resources,
  - System reconfiguration of resources,
  - Monitoring and reliability of resources
  - Control of the resources,
  - Information dissemination,
  - Virtual environment provision between the client/server levels

Implicit mentioned functions include:
  - Interactions with other brokers
  - Resources market / virtual net creation
  - Resources market maintenance
  - Intermediacy and negotiation

- Guarantee confidentiality between client / supplier
- Creation of mechanisms that support transactions risks

5. INFORMATION AND COMMUNICATION SUBSTRATUM OF THE VIRTUAL ORGANIZATION

The collaboration in multidisciplinary projects has been approached as an leadership and team selection issue[4] but the role of information and communication technologies, especially in virtual organization is indispensable. Every author in the field of virtual organization design acknowledges role of information and communication technologies as a factor of virtualization of organizations, but most of them propose different lists. Communication and coordination have been seen as dimensions of organizational structure since Mintzberg[5]. Information technologies offer variables that, when combined with considerations of structure, people, and tasks, can help design more responsive organizations[6], and communication technologies provide the "glue" that keep entire structure altogether. Technological support for the virtual organization can be seen through communication and collaboration among the dispersed business partners, e.g. groupware technologies, e-mail, videoconferencing, screen sharing and similar uses, support for standard transactions such as EDI and EFT, shared database access[7] and knowledge sharing. Wider list of communication technologies would include cellular services, videoconferencing, voice mail, facsimile, information kiosks, automated payment systems, web based electronic commerce, P2P sharing[8]. The list of information and communication technologies and tools that have no implication in virtual organizations is virtually empty. Cooperation behavior significantly and systematically depends not only on the contents of the linguistic coded messages but also on the used communication medium[9].

Important pragmatic remark is to restrain such technologies to be tool, not the goal of virtual organizations. If all the tasks have been done by using latest technologies, major part of partners would have been eliminated, because large portion of enterprises in Kosovo and Metohija has just a basic internet usage. For example, videoconferencing has various benefits, it gives some human touch to the transaction process and adds significant value to the customer[10], whatever type the transaction is, is as useful to employ the favourable features of face-to-face communication as a 'real' conference (obviously, it is important that people can see one another

and talk with each other simultaneously, but it is not that important to be near each other in a physical sense)[11]. Nevertheless, customers in Kosovo and Metohija have no basic value that could be enriched – they cannot acces basic information in any form or participate in the processes by any means. Therefore, videoconferencing has been done just as a pilot project, coordinating top experts and stakeholders during close deadlines.

Intranet data sharing provided useful channel for real-time collaborative work on documents. Since work division was basically done by major fields of the strategy, there was not much requirement for synchronous collaborative work on one part of strategy, but experts often had to check in the real time what were advancements in other fields. Internet file sharing, again not a high technology proved extremely effective, and was done literally with no additional costs, by usage of free services, which eased the suppress on budged. Full usage of this concept was enabled in inter-institutional collaboration, where data, information and knowledge could have defined levels of access, basically defined in the following fashion:
- End users could access synthetic data and formal announcements, advice and information,
- Institutional members could access analyzed data, all announcements, recommendations, documents, literature etc.
- Experts from the institutions and those working on strategy formulation could access all data, information and knowledge, even those basically confidential
- Experts from the Economic team which acted as network broker and selected institutional experts had access to all data, information and knowledge, and mandate to change and update documents of their expertize.

Instant messaging services provided synchronous coordination mechanism for core of the team. During the working hours experts working on strategy could inform each other on urgent issues. Group was relatively large, and had more than 10 participants on most tasks. It is over usual span of control, especially in high-knowledge demanding tasks. However, participants had no complaint and were even satisfied on size of the group, which confirms findings of Abdul-Hamid and Howard that students participating in online-delivered courses have increased satisfaction with increased size of group[12] and suggests repetition of experiment in different conditions.

Usage of e-mail for communication was standard, and took major portion of communication. Although asynchronous it provided functional and effective connection for all nodes in network, even those with poor information and communication infrastructure, powerful enough to send core information to outposts in Kosovo and Metohija and retrieve data when needed. More than 500 unique mails were composed at common central nodes monthly, enabling quick response from people and institutions outside intranet.

Serbian Government provided other standard equipment for the Economic team. Various institutions are also included in the research network. All usual social science equipment and economic resources were injected into network by Serbian Government over economic team. Team physically used computer network and library of Serbian Government during strategy design. That provided all necessary circumstances for applying techniques such as brainstorming, workshops and group decision making and problem solving.

6. CONCLUSION

Most of the organization and technical solutions result as a development of knowledge and skills, but its appliance is at most result of the increasing and new requirements or problems that could be solved. This paper analyses virtual organization through list of the conditions that aided to its emerging, and also a list of benefits that are possible in elimination of non-functional aspects of classic organization models, at first in public administration sector.

Example of Kosovo and Metohija, as a region of great political, security, but also economic importance is one more proof for the conclusion that virtual organization is efficient solution in complex ad difficult conditions. Economic Team as a network broker aided the design of new strategy for entrepreneurship support, based on existing resources and functions done by the state institutions, which were disabled by field conditions and formal procedures. Designed strategy was based on trust toward clients and support for the most jeopardized. It is aimed at production revival, and local resources usage, implicit cooperation of institutions that support economic development, transparency of the support procedure as a guarantee for corruption elimination.

Unfavorable conditions have disabled credit support on Kosovo and Metohija since 1998. Realization of this strategy is a validation that improvement is possible when projections are negative, not only because lack of efforts of will, but regarding factual limitations.

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Methodology for Creating Adaptive Online Courses Using Business Intelligence

Despotović, S., Marijana; Bogdanović, M., Zorica; and Barać, M., Dušan

Abstract — *This paper describes methodology for creating adaptive e-learning courses based on learning styles using business intelligence techniques and tools. Building effective e-learning framework depends on finding adequate means for discovering users' interests, preferences, motivations and needs. Data mining and its techniques are discussed as the most appropriate and sophisticated tools for fast discovering students learning styles and classification into groups. Each group attended adapted online course. Evaluation of the system showed that students achieved better results with higher level of satisfaction when attending courses adapted upon learning styles. Experiment was conducted in distance education system of Laboratory for E-Business, Faculty of Organizational Sciences in Belgrade.*

Index Terms — *adaptive e-learning, personalization, clustering students, data mining*

1. INTRODUCTION

The lack of adaptive learning environments or an environment with adaptive features is partly due to the concepts "one-size-fits-all". Very often e-learning courses have a problem of "universal size" as the same static content is presented to all students and objective is getting the learner online and 'into' the technology. A few researches proved that this type of e-learning system organization resulted in failure. Currently, the emphasis is moving toward learner oriented platforms and putting student's expectations, motivation, habits, learning styles, needs, etc. in centre of interest 0.

According to 0, an e-learning system is considered to be adaptive if it is capable of: monitoring the activities of its users; interpreting these on the basis of domain-specific models; inferring user requirements and preferences out of the interpreted activities, appropriately representing these in associated models; and, finally, acting upon the available knowledge on its users and the subject matter at hand, to dynamically facilitate the learning process. Since the system behavior adapts to a person, this kind of adaptation is also called personalization. Thus, adaptive e-learning system can be described as personalized system, which beside contents discovery and assembly, is able to provide adaptive course delivery, adaptive interaction, and adaptive collaboration support 0. Personalized e-learning uses proactive learning strategy, which enable learner to control learning content, pace and scope.

1.1. Business intelligence and data mining

Global trends, dynamic environment and complexity of issue obligate on high degree of effectiveness, adaptability, integration and coordination of all relevant processes in e-learning. In that context, business intelligence can be recognized as fulfillment of demands for additional, undiscovered knowledge that will be used for improving e-learning process. The term Business Intelligence (BI) presents a wide area of applications and technologies for collecting, storing and analyzing data to help making better business decisions. More details about BI could be found in 0.

Data mining is one of the BI techniques and can be defined as the nontrivial extraction of implicit, previously unknown and potentially useful information from large data sets or databases. Therefore, role of data mining as adaptive mechanism in e-learning systems is obvious 0.

By using data mining tools and techniques it is possible to execute intelligent analysis of large quantities of data stored in database. Data mining can be used both as a mean for predicting unknown or future values of the attributes of interest and for describing embedded patterns that will contribute to generating the best possible personalized e-learning models. 0

Although personalized recommendation approaches that use data mining techniques are first proposed and applied in e-commerce for product purchase, there are also several works 0 about the application of different data mining techniques within recommender systems in E-learning.

1.2. *Adaptive hypermedia systems*

For a system to be classified as an adaptive hypermedia system - AHS 0, it must essentially meet three criteria: it should be a hypertext or hypermedia based system, it should have a valid user model, and it should be able to adapt the hypermedia using this model (i.e. the system may appear differently to each user depending on each consecutive user model. It is necessary to define basic aspects of adaptation and adequate models 0:

- What should be adapted – adaptation model
- What are parameters and environment for adaptation – user model and context model
- What is the best way for performing adaptation – instruction model and adaptation model

AHS build model of the goals, preferences and knowledge of each learner and uses this model throughout the interaction with the user in order to adapt to the needs of the learner. Popular adaptive techniques applied are adaptive content selection, adaptive navigation and adaptive presentation.

By analogy to 0, suggested solution for architecture of an adaptive e-learning hypermedia system is shown in figure 1.

Proposed model consists of three layers. First layer includes data storages located in *domain* and *context model*. These are networks of connected objects related to e-learning mission, objectives hierarchy, metadata, conceptual design. Whole AHS relied on learning materials repository and *user (learner model)*. Learner model includes data bases about students' preferences and characteristics, behavior and learning knowledge space.
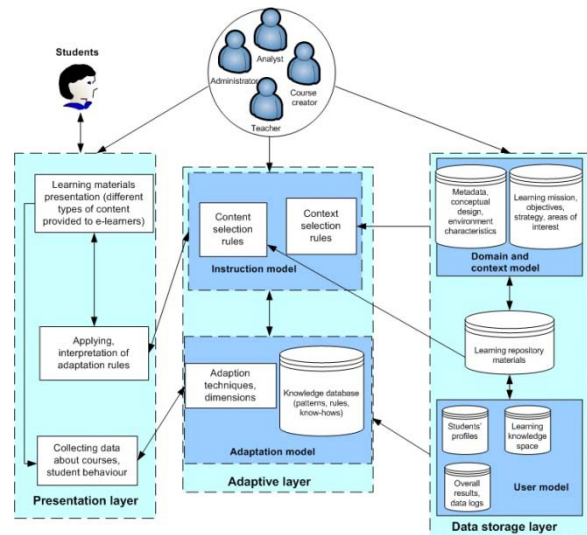

Figure 1. Three-layer architecture of AHS

The instruction (pedagogical) and adaptation models specify the navigational design for an adaptive hypermedia application. Together with the presentation specification they tell *how* the adaptation should be performed, so they describe the dynamics ("flow") of the system. Knowledge base is in the center of middle layer. It possesses variety of applied patterns, rules and "know-how", which in combination with adaptive mechanisms should develop models. Inputs in the adaptation process are sets of students' preferences and profiles. Output of the adaptation is a sequence of content objects personalized to a learner.

Naturally, on the top of the architecture are users. In order to generate effective e-learning systems, students have to be the most important part of the whole paradigm 0. Personalized e-learning implies an active cooperative learning strategy that empowers the learner to be in control of the context and scope of learning experience [9].

Obviously, the best performance in personalization would be achieved if we had information about learner's pre-knowledge, experience, usage of course content, but this issue becomes more complex if that type of data isn't available. Moreover, what if e-learning course has being created before students know nothing about the areas it deals with 0? That problem is examined in the practical example of this paper.

Student modeling is the process whereby an adaptive learning system creates and updates a student model by collecting data from several sources implicitly (observing user's behavior) or explicitly (requesting directly from the user). Traditionally, most of student modeling systems have been limited to maintain assumptions related with student's knowledge (acquired during evaluation activities) not paying too much attention to student's preferences.

1.3. Personalization based on learning styles

Learning is a cognitive activity that differs from student to student. Analyzing adaptability in e-learning system has explicitly pointed out the importance of the modeling learners' cognitive characteristics, particularly, learning styles as the most explored cognitive features.

There are several different learning style models presented in literature; however, Felder-Silverman Learning Styles Model (FSLSM) 0 is often used for providing adaptability regarding learning styles in e-learning environments. Felder-Silverman model describes single student in accordance to four dimensions 0:

- Active and reflexive learning style
- Sensitive and intuitive learning style
- Visual and verbal learning style
- Sequential and global learning style

To build the initial model, the system's authors must firstly establish the rules 0 to match learning styles with the resource's characteristics in order to determine which resources are more appropriate to a particular learning style. In table1 relations between different learning styles and activities in Moodle learning management system are shown. Later in the paper, adaptation of courses is performed in accordance to presented rules

Table 1. Moodle suitability for adaptation

|	Active	Reflexive	Visual	Verbal	Sequential	Global	Sensitive	Intuitive
Forum	Concrete problems	Topics for thinking	No	Yes	Yes	Global topics	Facts, examples	Abstract topics
Chat	Yes	No	No	Yes	Frequent	No	Yes	No
Glossary	Many terms	Concepts	No	Yes	Yes	No	Yes	No
Work-shop	Experiment	Unexplored topics	Yes	Yes	Yes	Yes	Practical examples	Unexplored topics
Survey	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Choice	Yes	Yes	Yes	Yes	Yes	Rarely	Yes	No
Lesson	Problems examples	Provided topics	Illustration	Written, multimedia	Yes	Rarely	Facts, algorithm	Rarely
Comm.	Face-to-face	E-mail	Combined	Combined	Combined	Combined	Combined	Combined

1.4. Researching goals

Primary goal of the research was to project and implement adaptive, personalized distance education system based on students' characteristics, particularly learning styles. Courses, as key part in architecture of an e-learning system, were organized and fully adapted to students' expectations. Whole process of personalization was conducted through several phases. Concrete aims of the research include:

- Developing generic model and architecture of adaptive e-learning system
- Defining main phases and requirements in developing personalized e-education systems
- Performing clustering students upon their learning styles
- Personalization and adaptation of e-learning courses

2. METHODOLOGY FOR COURSE ADAPTATION

In order to improve process of personalization in e-learning systems and make it more effective, it would be very useful to identify main phases and requirements. Steps shown in figure 2 shouldn't be realized separately, but as integrated components of iterative and dynamic process of developing adaptive e-education system.
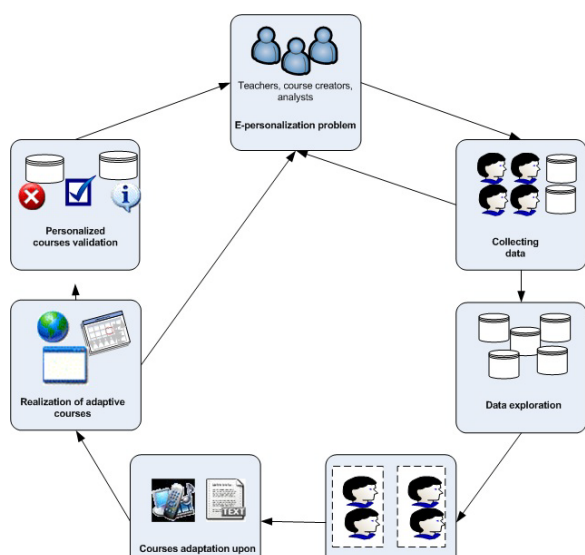
Figure 2. Phases in developing personalized e-education systems

2.1. Participants

For this analysis, data were provided by testing sample of 200 students of undergraduate studies on Faculty of Organizational Sciences, Belgrade. E-learning courses include following areas: Internet technologies, E-business and Computer simulation. In addition, we use a concept of blended learning to carry out whole process of teaching. Moodle[6] LMS has being used for creating and organizing these courses.

2.2. Methods and procedure

Defining e-personalization goals and models

Main goal of this research was to implement an adaptive e-learning system. The substantial part of the research was realized through separating students, who attend our e-learning courses, into different clusters according to their learning styles.

In the beginning it is necessary to define key segments and models[7] in our adaptive hypermedia system 0:

- *Learner model* - collecting personal data (age, sex, etc.), data related to learning styles, as well as relations with domain and context model (year of study, average mark, level of knowledge from similar areas, using Moodle, etc.)

- Domain model - three exams (internet technologies, computer simulation and e-business) on the fourth year of undergraduate studies on our faculty are completely realized

through these courses. In addition, we use a concept of blended learning to carry out whole process of teaching 0

- *Content model* - refers to all content objects in scope of the courses

- *Adaptation model* - this is the position where data mining has key role. Namely, by using intelligent analyses, it is feasible to connect particular concepts and content with student characteristics (i.e. learning styles)

- *Instruction model* – set of activities that should be performed based on information realized from developed data mining model

Collecting data about students
I phase - Questionnaire

Due to restraints, which appeared in the process of personalization, not only within the scope of the courses, but also within distance education system we created a questionnaire according to FSLSM. In purpose of coordinating and supporting this uneasiness with personalization problem, it was decided to create questions in such way that they represent four dimensions of learning styles.

This was the most adequate model for adapting personalization to specific conditions. Survey consisted of 30 questions that dealt with some general topics (average grade, year of study) and the others were about motivation for learning, preferred style of communication, way of presenting content, organizing available time, team working.

II phase - Testing

In order to obtain more objective data about students' learning styles, we organized introductory course with all types of activities, resources and materials. Course was organized without any kind of adaptation. In order to complete the course, students had to pass a test that was constructed to evaluate knowledge acquired from different types of materials and activities. Test results were to be used for discovering learning styles of students.

2.3. Exploring collected data about students

All data collected in two described phases were integrated in single Excel table in such way that each question from questionnaire and from test represented one column. Rows were represented through sets of single student's answers. Although denormalized, this table was suitable for further analysis and data mining. After integration, data were transformed and reduced. Number of options in answers were transformed and reduced to three, and missing data were changed with mean values.

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[6] Moodle is one of the most used web-oriented LMS. More information on http://www.moodle.org

[7] Components are defined according to the proposed architecture in figure 1

Clustering students using Data Mining Client for Excel

Clustering, as a data mining technique, was applied for building data mining model on the integrated data set prepared in previous phase. Clustering algorithm finds natural groupings among data related to sets of input attributes, so that attributes inside one group (cluster) have fairly the same values, but among groups (clusters) notable differences exist 0. It could be asserted that essential aim of clustering is discovering hidden values and variables, which precisely arrange data. Clustering was carried out using Data mining client for Excel 2007 and SQL Server Analyses services[8].

Some questions were made in order to lead process of creating data mining structures in right way:
- *What number of clusters is the most appropriate?*
- *What are main characteristics within clusters and differences between them?*
- *Which input variable, i.e. learning style, has dominant influence in grouping of the students?*
- *Is created mining model convenient for further forecast?*
- *Which content should be delivered to students from single clusters?*

Experiment was carried out for two and three clusters. By processing and mining available data it was identified that results were almost of the same accuracy, regardless whether students were divided into two or three clusters, what is explained later in the paper. However, in second case, outcomes were more consistent, logical and of higher quality. Therefore, outputs and conclusions related to the case of three groups will be presented here.

Courses adaptation according to defined groups (clusters)

Using results of this research, changes and adaptations have been made in scope of our e-learning courses. Students have been separated into three groups. The ways adaptation was performed are described in the next chapter.

Adaptive courses realization

This phase was realized through supervising students' behavior during the courses. Courses were carried upon activities, scope and schedule proposed in previous phase.

Personalized courses validation

Final phase in developing adaptive e-learning course includes testing courses effectiveness,

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[8] Microsoft clustering algorithm based on K-mean

how created personalized models work and comparison with non-adaptive course. Further analysis and validation is discussed in next chapter.

3. RESULTS AND DISCUSION

In this chapter gained results from the phases were explained. First part of results is related to clustering students. For each cluster the most important characteristics and related learning styles are presented in table 2.

Table 2. Clusters and related learning styles

Cluster	Characteristics	Identified learning style
Cluster1	Multimedia materials	Visual
	Going through obligations sequentially	Sequential
	Team work	Active
Cluster2	Students choose topics	Intuitive
	Practical work	Active
	No strict deadlines	Global
Cluster3	Written materials	Verbal
	Going through obligations sequentially	Sequential
	Team work	Active

Distribution of students by clusters is shown in Figure 3. Most of the students were classified into cluster 2, which represents combination of intuitive, active and global learning style.

Figure 4 shows that aptitude about the presentation of teaching materials is of the highest importance for students' classification. Also, it is important who determines topics for essays and deadline for finishing exam obligations, professors or students themselves.
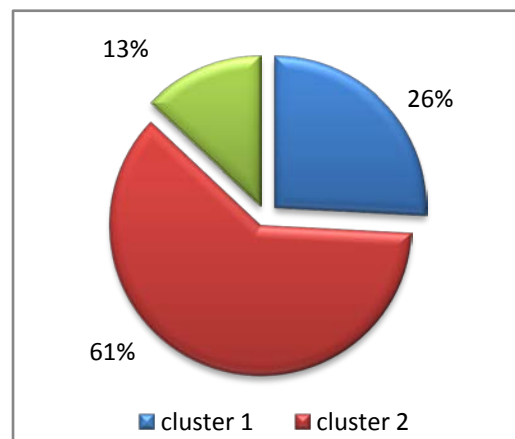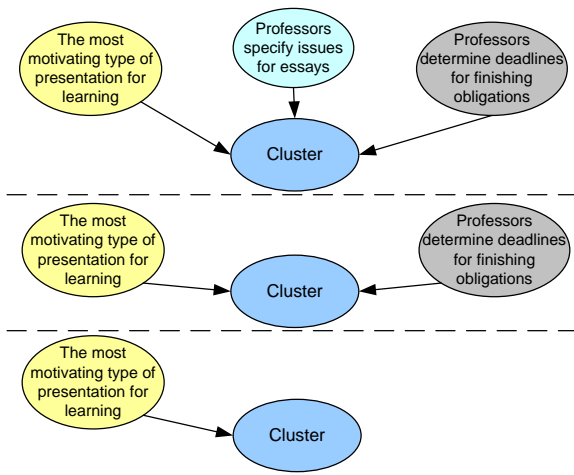


Figure 3. Distribution of students by clusters

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After data mining model is created, it is necessary to validate it. The method of comparison used here is called mining accuracy lift chart 0. Results are sorted and plotted in the graph together with ideal model, which presents theoretical model with accuracy of 100%.

Figure 4. Dependency network

If the state of the predictable column, i.e. forecasted class in this case, is specified, than the quality of model could be analyzed. The X-axis of the chart represents percentage of the test dataset that is used to compare the predictions. The Y-axis of the chart represents percentage of values that are predicted to be in specified state, i.e. Cluster 1. The most important is that it is significantly above the blue line in the chart, which represents "random guess line". Green line, which indicates the "ideal model", shows that it would "catch" 100% of predicted population (Cluster 1) by using about 50% percentage of available data in the model with three classes. Classifying model would catch 100% of students arranged in Cluster 1 by using approximately 80% of total data.
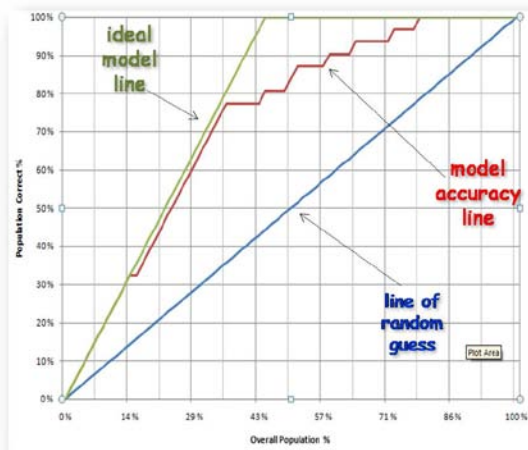
Figure 5. Model validation - lift chart

Adaptation was performed upon gained results in clustering. There were some similar characteristics for all students, like working in teams or passing exams sequentially. Indicated demands have been fulfilled for all of them by making some possibilities globally available.

Although percentages of these characteristics were fairly high in every cluster, this decision could raise question about what happened with students who didn't have same expectation. They were given possibility to choose whether they wanted to use set of global characteristics or to adjust mentioned options by themselves.

Due to the fact that the main goal was to do some fine-tuning of the courses, final adaptations based on proposed generic model and discussed relationships between learning styles and different types of presentation were reflected in:

- *Course level adaptation* - students in Group 1 and 2 were let to determine time-limits for finishing exam obligation, but students in Group 3 have been provided with the certain terms for exams.
- *Teaching materials* - Picture, video, graphs, animation and hypertext materials were delivered to Group 1, but text and audio materials were given to Group 3. Group 2 has been provided with combination of multimedia and written materials.
- *Examination* - Students in Groups 2 and 3 had projects instead of essays. In Group 1 learners could choose between practical and theoretical tasks. Homework, quizzes and oral exams were obliged for all students.
- *Activities* - Generally, almost all activities were available for students. The only difference was the way how these activities were organized (Table 3).

In the figures 6 and 7 examples of different type of materials (text and multimedia) are presented.

Table 3. Course organization and clusters

|			Cluster 1	Cluster 2	Cluster 3
Type of presentation			Multimedia materials	Combined	Text materials
Course activities	Assessment	Choosing topics	Teacher	Student	Teacher
		Type of activity	Project / Case study / Survey	All types	Essay
		Final exam	Test with multimedia questions	No	Oral examination
		Deadline	Strictly specified by teacher	Not defined	Strictly specified by teacher
	Moodle activity		Video lessons, workshops	Wiki, Glossary, Lessons	Text lessons
Communication			Face-to face, Video conference	Forum, chat, Face-to face	Forum, chat, Face-to face

Figure 6. An example of text materials
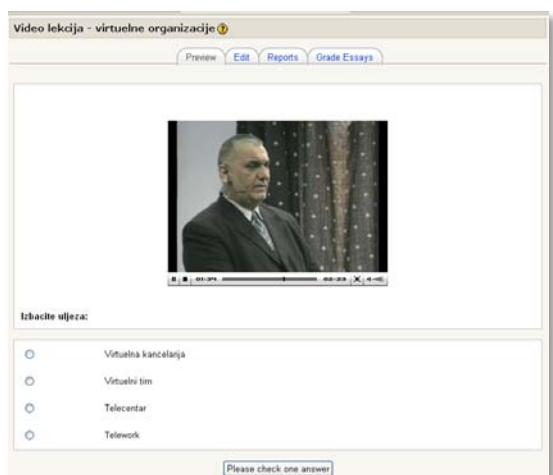
Figure 7. An example of multimedia materials

Figures 8 and 9 show percentage of students who passed or failed exam in e-business organized through non-adaptive and adaptive online course. Percentage of students who passed exam is 11% higher in case of adaptive e-learning environment (figure 10).
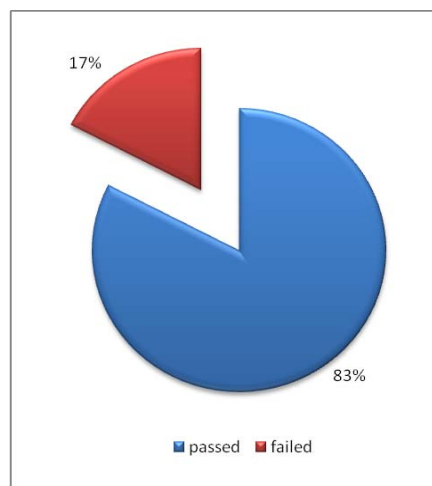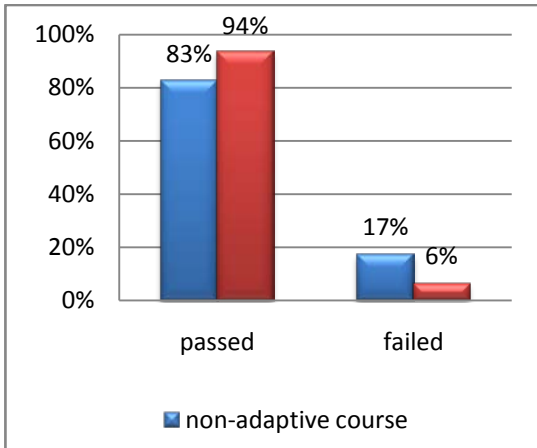

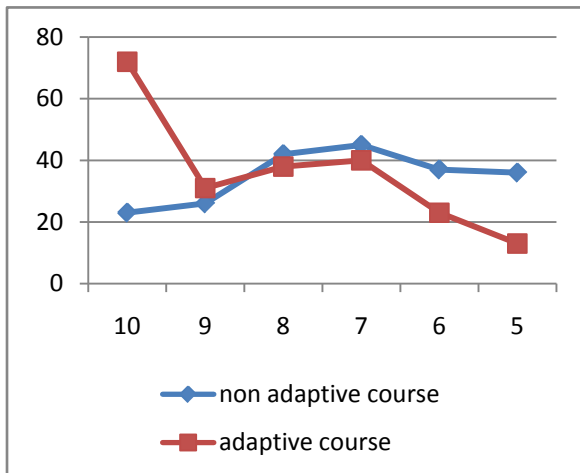**Figure 8. Non adaptive course results**
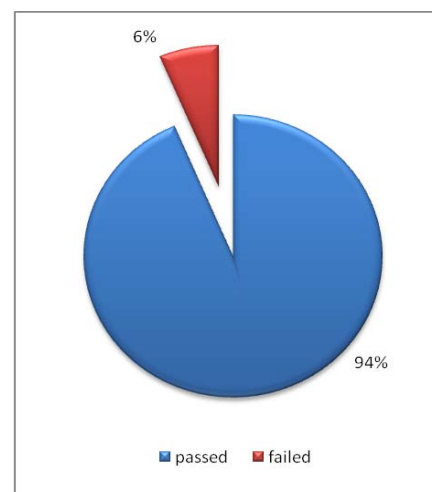

Figure 9. Adaptive course results

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Figure 10. Comparative analysis of students' passing exams in non-adaptive and adaptive course

Comparing students' marks on non-adaptive and adaptive course, it could be realized that when applying adaptive way of organizing courses and learning, higher number of students got higher marks. In the case of non-adaptive course, students' grades are distributed near to normal distribution. On the contrary, in adaptive course there are quite a big number of students with the highest mark (10).


Figure 11. Grade comparison in non-adaptive and adaptive course

Since the most important for classification of students into clusters was type of presentation, we asked students if presentation of teaching materials within adapted courses was appropriate to their learning style. Only 4% of students replied that the type of presentation was not adjusted to their learning style (Figure 12.)
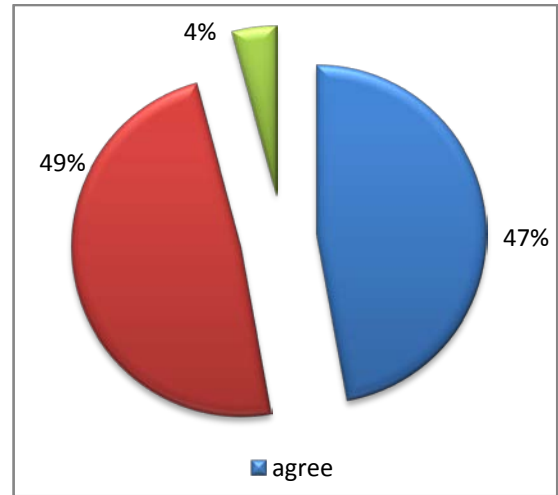
Figure 12. Suitability of teaching materials and type of presentation

When asked if adaptive course suited their learning style most students agreed that is does, while only 5% of students said that adaptive course did not fit their learning style.
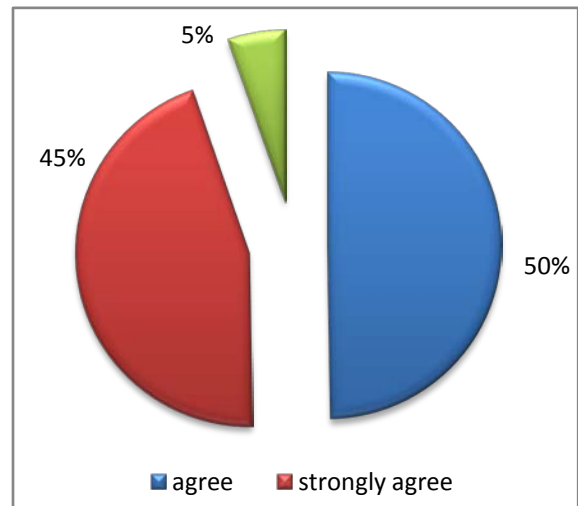
Figure 13. Suitability of adaptive course to students learning style

4. CONCLUSION

E-learning systems generate an exponentially increasing amount of data, and much of this information has the potential to become new knowledge to improve all instances of e-learning. New concepts in academic analytics imply a higher degree of standardization and uniformity in adaptation process and request real time analyzing of collected data. Simultaneously, by following the idea of "eLearning 2.0" 0, e-education systems should fulfill demands for blended learning, open access, connectivity, putting students in the centre.

In this paper the following has been done:

- Generic model and architecture of adaptive e-learning system were proposed

- Main phases and requirements in developing personalized e-education systems were identified

- Data mining model was created upon students' learning styles

- E-learning courses have been adapted and evaluated

Research will be expanded by providing some more data about students' characteristics and by improving courses according to new data. Finally, it would be very useful to develop a real-time feedback loop between intelligent analysis and the adaptive e-learning system.

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