Theoretical and Applied Economics
Volume XVIII (2011), No. 2(555), pp. 13-32

The Particularities of the Economic Crisis in the Knowledge-Based Society*

Ion IVAN
Bucharest Academy of Economic Studies
ionivan@ase.ro
Marius POPA
Bucharest Academy of Economic Studies
marius.popa@ase.ro
Dragoş PALAGHITA
Bucharest Academy of Economic Studies
mail@dragospalaghita.ro
Bogdan VINTILĂ
Bucharest Academy of Economic Studies
vb@vintilabogdan.ro
Mihai DOINEA
Bucharest Academy of Economic Studies
mihai.doinea@ie.ase.ro

Abstract. *The paper presents the characteristics of the informational society and the requirements for the transition towards the knowledge based society. The informational society and the advantages it brings are described. The concepts of informatics system and informational system are described. Their roles and functions are identified. The functioning principles of the informatics systems are presented. The factors that lead to the evolution from the informational society towards the knowledge based one are identified and analyzed. The main trends in the knowledge based society are identified. For each of these trends we identify the short and long run effects and the implied*

* Ideas in this article were presented at the Symposium „The global crisis and reconstruction of economics?", 5-6 November 2010, Faculty of Economics, Bucharest Academy of Economic Studies.

consumptions of resources. Knowledge is seen in the new society as the main source of competitive advantage. Ways of transmitting knowledge are presented. The efficiency and applicability are discussed. In the knowledge based society the end-users have higher expectations regarding the products and services than before. The paper discusses the factors that lead to the structural re-equilibration in the knowledge based society. Research concepts are developed in the direction of adapting informatics applications to the target group exigencies. The paper details the quality characteristics of computer applications that are tailored to the requirements of the target group and a quality system for such applications is presented. The paper examines the benefits obtained by adapting computer applications to the target group exigencies.

Keywords: economic crisis; knowledge based society; informatics applications; fluctuation; model.

JEL Codes: F41, G01.
REL Code: 10A.

1. Knowledge-based society

Societies appeared as a form of collaborative work between individuals in order to reach goals greater than those individually achievable. Most of the tasks that are executed in a society are not one-man jobs but greater projects that need large teams. This is valid in the animal world, not only for humans. Ant colonies and bee hives are the most common examples one can think of. These work together to ensure the well being of the colony and the persistence of the species. Human society evolved along with the individuals. As people grew smarter, they realized the advantages a society brings to individuals:

- security is given by the fact that all individuals in the society follow the same rules that are created to please all; as a group, the military power of the entity increases considerable and there are fewer threats it must fear; due to the fact that not all individuals obey the laws of the society, entities that punish delinquents are created; those working in these entities must lower the number of delinquents and punish those that already exist;
- easier life is made possible in a society as individuals don't have to do all works necessary for a household; in societies individuals specialize in doing a certain task; with specialization comes a high improvement in the efficiency of work;
- better life is achievable because due to the high efficiency of the specialized workers, it is possible for one individual to benefit of more services and products; individuals have a wide range of products and services to chose from as each individual tries to obtain revenue to invest in products and services he can't produce.

The list is not exhaustive as there are much more advantages.

Human society advanced through ages and modern times involve high productivity, environmental care, knowledge based innovation. The industrial revolution meant a huge increase in productivity made possible by the replacement of humans in the manufacturing process with automated machines. This led to an increase in the quality of life.

The appearance of computers allowed an even more rapid development of the society. Informational society is based on information. The fluxes of information are very large and must be shared by multiple entities. Companies are the base entities that produce products and services in societies. These function according to many internal rules that are obeyed by all employees. Documents are exchanged between employees and these are a proof and a mean for them to realize their tasks. An informational system is represented by all the information, no matter the form it is in, and the paths on which it travels within the company. Each company has an informational system that allows the

managerial team to take decisions easily and assess the company's situation at all times. Informational society has some characteristics:

- clarity in the work process that is given by guidelines and the paths the information goes on; each employee knows what he must do and how to do it; the documents that are used as support for information inside the company prove that an employee fulfilled his tasks; the situation of the company is clear at all times because there are many documents that can be used to determine it;
- precision is another characteristic of the informational society; as all information is clear, there are no doubts about the precision of data (Galin, 2004);
- information is used in the decision making process; the management team has to take good decisions based on clear and precise economic data; the information within the company and also from the environment make it possible; if the management team analyses all the available data and has enough experience, the decision will lead the company further in the economic environment.

The informational society brings advantages related to the efficiency of work, communication and security. As all actions are documented, the path followed by one can be reconstructed and mistakes can be identified. The efficiency is increased as each is specialized and has documented work that he can use to improve. Communication through documents within companies improves the management system and allows the team to take decisions more rapidly. The security within the company is increased as all actions are documented and a malicious person would be easily identified.

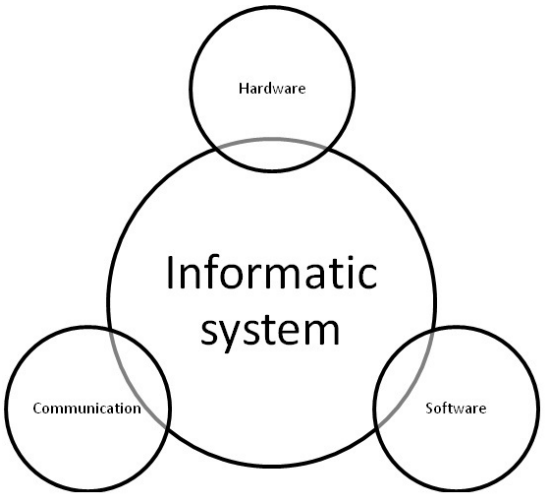

Figure 1. *Informatics system's components*

The informatics system is a set of hardware and software that is support for the informational system. The role of the informatics system is, therefore, to support the informational system. The informatics systems are formed of three components:

- hardware is the physical representation of the system; hardware includes computers, servers, printers, scanners, cameras;
- software is formed of the computer programs and data used by people to solve their problems; software includes operating systems, utilities, antivirus, text editing tools, image editing tools, multimedia players;
- communication possibilities are given by the connection to the Internet; communication possibilities are measured in bandwidth; the need of communication is given by the type of information one wants to send to another; if the information is plain text its size can be reduced using compression tools; audio and video information's size can also be reduced using compression with or without quality loss; information is coded in various forms and thus the communication needs of companies differ.

The informatics systems respect the following functioning principle: input data is insert in the system; input data is validated; input data is processed; results are displayed; results are stored along with input data.

Factors that lead to the evolution from the informational society towards the knowledge based one are:

- a new source of innovation and competitive advantage was needed as the traditional ones were exhausted; the advantages brought by the informatics systems were no longer a source of competitive advantage as all companies implemented such systems;
- high amounts of information have accumulated over time and the owners wanted to have some advantages for owning them; information is extensive and usually no real advantage can be obtained from the raw form; knowledge is therefore a refined form of information that has real value because it brings competitive advantage to the owner;
- the evolution of systems designed for the aid of decision making process and the continuous need of the management for valuable information; as information warehouses grew larger and larger the complexity of decision support systems also increased to be able to exploit to the maximum the available input data.

Knowledge society brought not only innovation through knowledge but also new trends.

Knowledge workers are a new category of labor (Wikipedia, 2010). They are very good people at interpreting data from a specific area (Huang, 2009, pp. 430-438).

Being well prepared can come up with good solutions of problems in a very short time. The training of these individuals allows them to adapt easily to new situations and resolve them quickly and efficiently. The one person with knowledge of working longer, it becomes even more efficient and can solve a wide range of issues while lower. Knowledge workers must be in permanent contact with each other to ensure that the transfer made both explicit and tacit knowledge. By making these knowledge transfers they become better and better in the quick resolution of problems.

The society acknowledges the seriousness of climate issues facing the planet and tries to take measures to remedy the situation. Courses of action are: preventing undesirable effects caused by existing climate changes and improve the existing situation. Primary method of improving the situation which would be applied is reducing emissions.

Virtualization business process involves passing the information flow of business processes of traditional forms of physical support in virtual form without physical support. Documents circulating in companies of any transaction that occurs are now automatically handled by computer systems.

The emergence of global markets is a direct consequence of technological development. The development of global markets is possible because there are no boundaries for access to information. This allows virtual stores to present products in an interactive and users can buy regardless of location, culture or occupation. Limitations imposed by boundaries were often causes of major conflicts in history. When a market becomes saturated, producers are looking for other markets to sell their product. Manufacturers' benefits lowers because of costs incurred by market research, product transport, rent paid for storage facilities, product quality losses incurred during transportation. Virtual markets do not have these disadvantages, the manufacturer presents the product line through a web application. Customers access the application and place orders, products are selected from stock company and the customer order is delivered. This way are avoided many of the costs incurred by a new real market access. Access time is also very low for both producer and customer. Lower cost of production also leads to lower final price and thus to greater customer satisfaction.

Energy conservation is a knowledge-based society ongoing concern of equipment manufacturers. Both industrial equipment manufacturers and electronics manufacturers realize the need for energy conservation and renewable energy orientation (Richard, 2002). Development of hybrid cars, developing technologies to reduce energy consumption in electronics, improved production technologies for renewable energy are areas where you go. Car makers are gradually closing the fuel-intensive models and incorporated into

automotive components leading to lower consumption and better performance. The transition from traditional engines to hybrid engines is achieved for both business models and for the top ones. Hybrid engines use electricity to move the car in normal traffic conditions. If you need high performance engine then it is in operation and the traditional one. In normal traffic conditions traditional engine generates electricity to operate the electric motor. The effectiveness of this combination is very high, fuel consumption recorded was much lower than cars operating exclusively with traditional engines. Reducing energy consumption in electronic equipment is also an ongoing concern. For computers, the largest energy consumers of the system are processors and video cards.

Resource intensive process outsourcing is imposed as a cost reduction measure. Companies increasingly rely on outsourcing more resource-intensive processes to other companies, specialized in that type of process. Outsourcing leads to a saving of resources for the company concerned. The principle of specialization is increasingly applied by market players to reduce costs. Companies fail to perform specialized tasks faster and consume fewer resources. Quality of services provided by specialized companies is also higher than the same service in the domestic version. Outsourcing also brings potential advantage to concentrate efforts on key objectives for the company long term, where most trials are outsourced, the company management has more time to analyze data and make decisions on the direction and future goals.

Developing citizen oriented applications appears as a necessity in society based on knowledge (Ivan, 2009). Development of database technology, multimedia and communications enables development of applications oriented citizen. This new class and applications is central to the citizen, the requirements and needs. These applications are made only after detailed study of the target group. Citizen oriented applications are distributed applications to be available online as permanent and also to enable rapid updates to reflect reality for all users simultaneously. The development of these applications requires changes in the development cycle classic to reflect the needs and demands of users and ensure a high level of quality. Citizens, given their diversity, are considered to be persons without prior training in informatics and so applications must be made so that they may use without problems. Citizen orientation is of high priority for areas in which people use very large applications. E-government, e-vote, pay taxes are areas where almost all citizens are involved and use the applications made available by the administration.

In the new society knowledge is seen as the main source of competitive advantage. Knowledge workers are very valued due to the advantages they

bring to the company. The products and services are innovated and small touches are given to them through knowledge.

Knowledge is tacit and explicit. Explicit knowledge is the one that the owner can express through words, images, figures. Tacit knowledge consists of inexpressible information that only the owner uses and has no means of transmit it directly. Explicit knowledge can be transmitted through courses, trainings, presentations, discussions, workgroups. The degree in which the explicit knowledge was transmitted can be measured through tests. The tacit knowledge can be acquired by one only through deep observation but there is no mean of evaluating the acquiring process or the correctness of acquired knowledge.

2. The stage of development and generalization of citizen oriented informatics applications

Citizen oriented informatics applications are spread mostly in the domains where the interaction with the users is crucial and their number is very large. The domains with the highest interest in the citizen oriented applications are:

- e-government is the interaction process between the state and its citizens; as all the citizens within the state interact with it, the citizen oriented informatics applications are favored by the large number of users; in the interaction process, the communication with the citizens must be clear and simple as not all the state's citizens have the same education; the interaction with the citizens is influenced by the logic and the characteristics of the graphic interface but, even more important, the messages that are delivered to the users; these must use a narrow vocabulary of simple words; the messages must be clear and clearly state what is the source of the problem and what steps the user must follow to solve it; the graphic interface must be light and the navigation through forms must be logical or on the basis of the users' options;
- e-vote is another domain in which a very large part of the population is active; e-voting assumes the execution of the electoral choice using means of electronic data transmission; e-voting must ensure the authenticity of the vote, the anonymity of the voter and the impossibility of a person to vote multiple times; taking into consideration the very large number of mobile devices, these are a good support for the e-voting informatics applications;

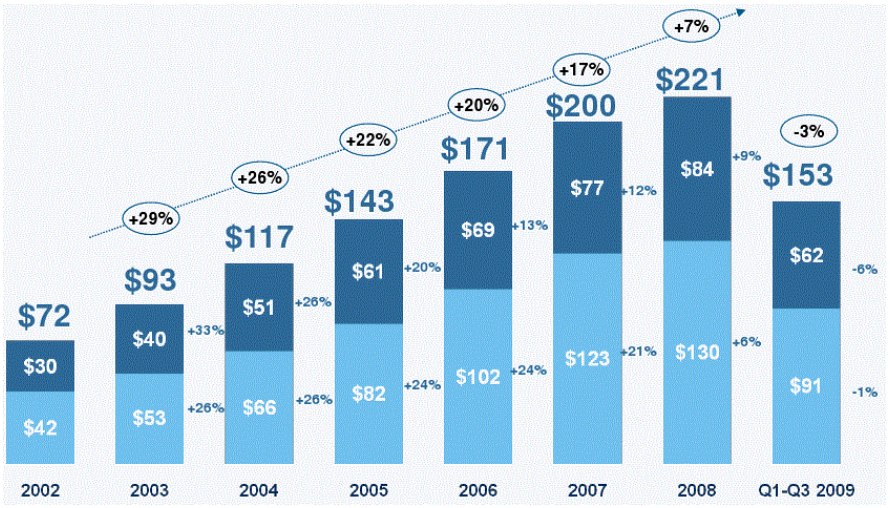

Figure 2. *E-commerce evolution (billion $)*

- e-commerce appeared with the Internet and records growths every year (Figure 2); virtual stores are more and more appealing for the users as they have advantages over the traditional stores:
  - the offer of products is wider; as virtual stores don't have to keep all products in stock they can have a more diversified product offer than the traditional stores;
  - they are accessible regardless the location of the user; the user needs only access to a computer connected to the Internet in order to access the virtual store; this situation is very favorable for the cases when the closest traditional store that sells the product is far away from the customer and this one can't travel;
  - the product prices are smaller as the virtual stores eliminate many of the expenses caused by rents, human resources, stocks, marketing;
- the online biding platforms are more and more popular among those wanting to buy and sell products; the number of users of these platforms and the number of finalized transactions grew very much in the last ten years.

Even if there are many domains that are interested by the citizen oriented informatics applications their generalization is not complete.

3. Security characteristics for informatics applications

In order to adapt IT applications to information security requirements, the target group has an important role as it ensures safety and validity of transactions. Applications suited for knowledge-based society need a high degree of security to be tailored to user requirements.

Security is achieved through the ability to protect systems resources, both logical and physical. Security is a condition of a system resulting from the establishment and maintenance of measures to protect the system. Information security is defined in CSRC (2010) as the ability to protect information and information systems from unauthorized access, use, disclosure, disruption, modification, or destruction in order to ensure confidentiality integrity and availability.

Availability is the process to ensure maintenance of services and operational systems in the event of failure. A distributed system must ensure high availability so that there is no period in which application data is not accessible by users who wish solving problems or need information provided by the computer. To ensure availability requires:

- existence of procedures and policies to ensure transparency in the event of a failure, this is ensured by:
  - redundancy is represented by the existence of information systems and facilities to provide secondary data warehouses that can retrieve all tasks distributed system where it becomes non-operational, secondary data warehouses must be located in other geographical areas not to be subject to the same risks as the main system, but this approach is costly and is applied only to critical systems;
  - clustering systems is a less expensive, being implemented by servers such as Windows Server 2008, Linux and Novell Open Enterprise Server; clustering is the presence of networked systems providing acquisition tasks to other systems if one system is in a failure condition; clustering addition that offers a cheaper solution to achieve scalability and system redundancy guarantees to the complexity of tasks;
  - fault tolerance is the ability of a distributed system to continue operation in case of interruption of the nature of hardware; fault tolerance is obtained by fitting the hardware side components that are designed to take over all tasks principal components when they fail or become unusable; there are many ways to ensure fault tolerance including ensuring continued operational processes by maintaining a constant supply of electricity through the use of UPS equipment and power generators, providing spare parts

requirements by implementing the strategy N+1 as are reflected by the availability of N components in current use and one spare to replace any component that fails;

- risk assessment to counter the undesirable effects caused by quantifying threats present in the operating environment of distributed systems.

The availability of distributed systems is affected by MSDN (2010):

- inadequate testing leading to the omission of usage scenarios that cause destabilization of the system, lack of testing leads to a large number of software defects that contribute to lowering the affordability;
- lack of monitoring and review process leads to:
  - omission implementing some features of the distributed system;
  - failure of policies imposed by the project software development leading to the situation as disastrous for the proper functioning of computer components products distributed system;
  - failure to comply predetermined development of project specifications;
- operating errors that are caused by incorrect use of modules distributed resulting in physical or logical damage to hardware or software involved in these modules;
- coding errors that lead to situations of unavailability through source code access to areas not adequately manage situations arising;
- interaction with third-party distribution system causing damage by providing data in formats not recognized or attempting to access system features distributed in a manner - inappropriate; another aspect of interaction with the third service consists of attempts to access the services of nature private or no distribution system;
- operating conditions characterized by the nature of the environment in which distributed processes are carried out; operating conditions refer to operating systems that is implemented distributed systems, security systems in place to manage humidity, fire prevention and other factors risk of human nature;
- hardware failures are characterized by destruction or failure of certain components that make up the distributed system;
- low security causing unauthorized access to protected software resources of the system or physical access to the physical parts making up the distributed system;
- natural disasters that are specific to geographic locations of distributed system components such as hurricanes, earthquakes, fires or floods.

From an economic perspective availability ensures the online presence of information in the distributed application online. The user gains confidence in the reliability of the application by attaining a high level of availability of the

information presented by the distributed application. Also an important factor associated with a high level of availability is ensuring continuous usage of services provided without extra cost.

Integrity is the provision of information from tampering or destruction and includes non-repudiation and authenticity. Authenticity is necessary to ensure that data, information and transactions are genuine. Non-repudiation means that nobody can deny or issue a transaction receipt with the possibility of negating it. The authenticity and non-repudiation in electronic commerce are applied by using digital signatures. Integrity is ensured at:

- data level which refers to keeping the integrity of information contained in the database system; in order to complete this objective it is necessary to:
  - determine the logic structure of database entities;
  - identify data types that must be inserted in order to maintain structural homogeneity of the information stored in the database;
  - maintaining a stable form of the database structure in order to keep table relationships and data storage logic;
- information system by developing procedures and functionality that are designed to prevent cyber attacks that target distributed application destabilization, these include:
  - input sanitation to protect the system from code-injection attacks that have destabilizing effects on the database by making unauthorized changes in the tables and entities stored in them;
  - removing areas of source code that have the elements of uncertainty about the exposure of information which improve the chances of the attacker to damage software product.

In terms of economics the integrity feature gives a uniform behavior of operations on data. This is perceived by users as the validity of results obtained from accessing product information. By providing a high degree of integrity of data and of the information system the preservation of existing users is ensured and could potentially increase their numbers.

Confidentiality means preserving authorized restrictions on access and publication, including the means to protect privacy and property rights to personal information. Confidentiality is ensured in distributed applications at:

- data level to protect information stored in the database through user input validation in order to prevent attacks that use code injection; by managing requests to the database by removing harmful content that causes destruction of information in the database;
- user level via secure Internet transmissions between client and web server which hosts the product information; user-level privacy is important from the point of view of the data that the user manages or

inputs in the operation cycle of the software product; this data is represented by access keys, personal data or other data directly addressing the target software application;

- product operation level by reference to situations in which an attacker gains access to information regarding the used database system, web server version which hosts the software application, infrastructure components used for product development; a risk factor which leads to loss of confidentiality is stack exposure due to errors generated by poor product management.

From the economic point of view a high level of confidentiality of personal data is an advantage to users because it provides a guarantee that the software application manages all operations safely and without risk of disclosure.

4. Cost analysis

The economic environment is very complex. Building an economic model that treats all possible situations is impossible. There are many conditions that generate fluctuations that can affect the economic models: very large natural disasters, discovery of new deposits of rare resources, wars, tensed political situations. The structural equilibration is influenced by solving the problems that caused the imbalance in the first place. For solving global problems the collaboration between many states is required. As the users' requirements are greater than before in the knowledge based society, the developed citizen oriented informatics applications must respect them. Ways of adapting the applications assume redesign of the graphic interface, code optimizations, new modules, database optimization, adoption of a distributed model. All modifications done to the applications must lead to increases in productivity for the users and economies of resources in the maintenance process. The developing costs of the informatics applications are very important. Balance must be obtained between the consumption of resources and the delivered results. The cost analysis aims many aspects: performance, development, security, maintenance.

Performance is the extent to which a distributed system uses resources available for carrying out the tasks required by users. Performance is analyzed for the functional and non-functional requirements. Thus to assess the performance level functional requirements are analyzed by the time and accuracy of results obtained by users from the application of algorithms to implement distributed systems to solve a set of predefined problems. It aims to achieve swift calculations necessary to obtain the results required by the user and their reliability. Performance of non-functional requirements is evaluated following the levels of quality characteristics of software processes analyzed

during the effective operation of the distributed system. To quantify the values of quality characteristics it is necessary to determine the optimal levels at which the system operation is to be recorded.

These levels are considered an optimum reference configuration of application performance. To determine the extent to which performance is recorded at these levels there is periodically made a comparative analysis for each feature that will result in some performance indicators measuring percentage recorded in the period under review compared to baseline defined optimal performance.

PERFF indicator is defined as the functional performance and PERFNF represents the non-functional performance of the distributed system.

$$PERFF_i = \frac{TMin_i}{TMax_i}$$

where:

$TMin_i$ - the minimum time required to make transaction i;

$TMax_i$ - the maximum time needed to make the transaction i.

$$PERFNF = \frac{\frac{C_1}{CO_1} + \frac{C_2}{CO_2} + \cdots + \frac{C_{ncp}}{CO_{ncp}}}{ncp}$$

where:

C_j - measured level of quality characteristic *j;*

CO_j - the optimal level of quality characteristic *j;*

ncp - the number of features as recorded in the measurement of performance.

The optimal functioning of the application is set as a basic configuration in the testing process. The use cases define all the application functionalities and determine individual measurements for each. Thus the formula for calculating the performance of the application for configuration *k* is determined using the formula:

$$PERFNF_k = \frac{\frac{C_{k1}}{CO_{k1}} + \frac{C_{k2}}{CO_{k2}} + \cdots + \frac{C_{kncp}}{CO_{kncp}}}{kncp}$$

where:

C_{kj} - the measure of the quality characteristic pattern *k* associated *j;*

CO_{kj} - the optimal level of quality characteristic *j* associated to pattern *k*;

kncp - number of features as recorded in the measurement of the performance associated to pattern *k.*

To optimize performance measuring distributed systems it is necessary to establish a set of common characteristics as MPCC = (CCP $_1$ CCP $_{2,}$ ..., CCP $_{npcc}$) and a number of distinct sets of quality characteristics associated with each configuration MMPDC = (MDPC $_{1,}$ MDPC $_{2,}$ ..., MDPC $_{ncp}$) where $MDPC_k$ =(PDC_1, PDC $_{2,}$ ..., PDC $_{npdck}$); npdck is the number of distinct quality characteristics of pattern k. Figure 3 is an outline of quality characteristics to measure the performance of a distributed system containing a number of different configurations, each having associated a set of ncp quality characteristics.

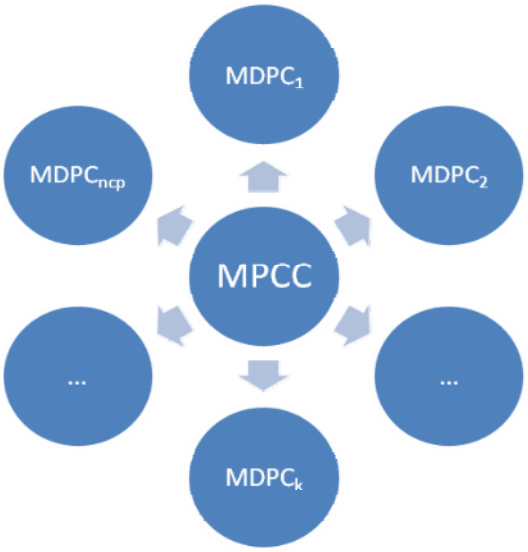

Figure 3. *Performance quality environment*

Ensuring a high level of performance is accompanied by high costs of development that are not justified in practice. To determine the extent to which financial investment in optimizing distributed software is efficient a cost optimization analysis needs to be performed.

Optimizing costs according to Gartner (2010) are practices, skills and behavior adopted by an organization to reduce costs, minimize costs while preserving quality of software systems developed and maintained steady growth potential of the organization. The aim is to optimize organizational costs, the level of team-level software developers and source code.

Optimization of organizational costs has to identify administrative and production areas of the organization which has the highest costs and to intervene by minimizing or eliminating costs:

- of supporting auxiliary operations with no profits;
- with staff that doesn't affect profit generating activities;
- the availability of materials and equipment not necessary for the proper conduct of business processes and software development;
- transport of employees; for this purpose to identify ways to decrease the number of business trips if possible address situations through video-conferences or through the internal computer network;
- with third parties making bids to obtain the best price for materials and equipment needed.

Cost optimization in the development teams must follow a plan to reward developers of software based on recorded performance and also implement a value system matrix value in Table 1.

Table 1

Value matrix

Features	Feature Level				
	Weak	Mediocre	As expected	More than expected	Very good
C_1	X				
C_2			X		
C_3					X
...	...	...	...	...	...
C_{i-1}	X				
C_i			X		
$C_{and\ 1}$		X		X	
...	...	...	...	...	...
C_{n-2}			X		
C_{n-1}	X				
C_n				X	

where the characteristics and expectations are quantified based on experience, responsibilities and dedication of software developers. Based on these characteristics the plan is established and the developer motivation over time is determined. If the individual is ineffective, i.e. has a negative slope of progress, it is necessary to remove him because the costs caused by his work outweigh the benefits to the organization.

Cost optimization of source code quality maintenance requirements imposed by the security solution architects is determined as minimizing the time and funds related to debugging activities. Also, if they are to achieve a high quality source code it is less likely paying for damages and penalties to users for faulty developed computer security systems.

The optimum timing for improving the software system is determined by technological advances made in computer security that lead to fighting the last type of threat.

Figure 4 presents the elements that consolidate the decision making on improving the software system.

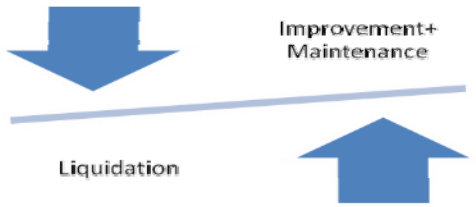

Figure 4. *System factors*

According Uclouvain (2010), a time frame T = (t_1, t_2, t_n) is considered and with each time t there is only one technological improvement. Thus, the cost of technology is represented by a function with parameters:

$(\prod_t, Q_{t,k}, S_{t,k})$

where:

$\prod_t$ - cost of implementing a new security model;

$Q_{t,k}$ - cost of maintenance of the old security system until the end of k > t;

$S_{t,k}$ - liquidation value of the old security system at the end of k > t.

It is considered that as time goes on maintenance cost increases and the liquidation value falls, as follows:

$Q_t < Q_{t+1}$ and $S_t > S_{t+1}$

The cost of replacing security technologies at the time k is given by the following equation:

$$TEC(\prod_t, Q_{t,k}, S_{t,k}) = \prod_t + Q_{t,k} - S_{t,k}$$

The aim is to minimize the cost of such replacement and is calculated for all times k> t according to table 2.

Table 2

Choice of optimal improvement cost

k_1	k_2	...	k_i	...	k_m
$TEC(\prod_t, Q_{t,k}, S_{t,k_1})$	$TEC(\prod_t, Q_{t,k}, S_{t,k_2})$		$TEC(\prod_t, Q_{t,k}, S_{t,k_i})$		$TEC(\prod_t, Q_{t,k}, S_{t,k_m})$

The aim is to find:

$$TEC_{optim} = \min_{i=1..m}\{TEC(\prod_t, Q_{t,k}, S_{t,k_i})\}$$

Cost optimization is an important economic issue in any IT project, especially where it is necessary for software cost optimization without affecting the overall quality of the system in question.

5. The imbalance generated by profit maximization iterative optimization model

The iterative optimization model is represented by developing improvements starting from an initial version V_1, an intermediary version V_i and a final version V_k according to the schema presented in Figure 5.

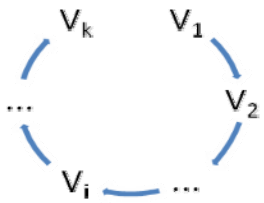

Figure 5. *Iterative optimization model*

In application developed in the knowledge based society, optimization is a continuous process such that with each improved version of the application it is necessary to observe improvements in the informatics application behavior. In Figure 6 the evolution of application versions V_1, V_2, …, V_k is presented along the set of time moments M_1, M_2, …, M_k.

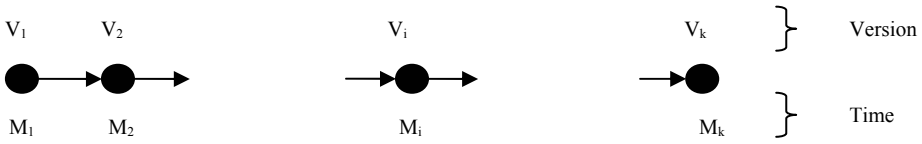

Figure 6. *Application version evolution*

In this way the following relation is respected:

$$V(V_{i+1}) > V(V_i)$$

$$\forall i = 1..n-1$$

where:

$V(V_{i+1})$ – application value at M_{i+1} moment;

$V(V_i)$ – application value at M_i moment.

Imbalances created by using the iterative system are determined by iterative propagation of quality characteristics as those that satisfy the requirements of the target group at the M_1 time frame, however, until the final M_k time frame get deprecated and not properly deal with users' expectations. Imbalance thus generated leads to poor performance of distributed applications and loss of market share to other products that are up to date. If the quality characteristics are monitored at every step of the iterative optimization process and are reviewed to determine their validity then are created the conditions to obtain a version of the application that has a high performance.

In economy, using the iterative optimization model for profit maximization imbalances might occur because, even if, on short term, it seems to function well, in the long run the imbalance is unavoidable. The system's stability is very strong and doesn't allow the immediate manifestation of unfavorable factors. Maximizing profit is not sustainable in the long run as there are domains that work well a short period with less resources, but doesn't last in the long run and lead to the collapse of the system.

An application that didn't suffer adaptations to fulfill the users' requirements compared with an application that has been adapted in this scope has a lower performance level, developing costs are lower as they don't include the adaptations and the maintenance costs are high. The structure of the application is clearer as adaptation includes reorganization of modules and code optimization. The complexity of the modified application is higher as the requirements that are reached are higher. The performance indicator is computed as a report between the application's performance and the performance obtained before the adaptation. The quality characteristics of the adapted applications are the same as for the unmodified applications, the difference being in the very high levels that are obtained. Applications' adaptation brings many benefits: more users, greater users' satisfaction, rapidity, economy of resources.

Conclusions

Knowledge based society highlights the explicit or tacit knowledge people possess. People become real valued containers for the companies because they attract numerous advantages. In knowledge based society the innovation of products and services is made on the basis of knowledge gathered in time. Informational systems are support for the management team of the company. These deliver information on which basis the management team takes quick and correct decisions. The informatics systems are support for the informational systems. These ensure the rapid processing of documents and

their immediate transmission. In knowledge based society appear trends towards the protection of the environment, developing low energy consumption technologies, process virtualization. The citizen oriented informatics applications are of great interest for domains as e-government, e-vote, e-commerce, bidding portals. Security is a very important issue for the informatics applications. As the speed of data transmissions is very high through the Internet any security breach can have disastrous effects. Costs analysis is vital for projects as it shows if they are viable or not. Investing into an unviable project is loss of time and money with no results. While developing citizen oriented applications a balance must be obtained between the resource consumption and the obtained results. Both in economy and the development of informatics applications can appear imbalances when using the iterative system.

Acknowledgements

This article is a result of the project „Doctoral Program and PhD Students in the education research and innovation triangle". This project is co funded by European Social Fund through The Sectorial Operational Programme for Human Resources Development 2007-2013, coordinated by The Bucharest Academy of Economic Studies.

References

Brian, C. (2009). *Ecologic: The Truth and Lies of Green Economics*, E.P. Books, Editura Eden Project Books

CSRC, http://csrc.nist.gov/publications/nistir/NISTIR-7298_Glossary_Key_Infor_Security_Terms.pdf [Online] Accessed Sept 2010

Galin, D. (2004). *Software Quality Assurance From Theory to Implementation,* Addison Wesley

Gartner, http://www.gartner.com/DisplayDocument?doc_cd=166713, Accessed Sept. 2010

Ivan, I., Vintilă, B., Ciurea, C., Doinea, M. „The Modern Development Cycle of Citizen Oriented Applications", *Studies in Informatics and Control*, vol. 18, no. 3, 2009

Huang, J.-J., „The evolutionary perspective of knowledge creation – A mathematical representation", *Knowledge-Based Systems*, vol. 22, no. 6, August 2009, pp. 430-438

MSDN Network, http://msdn.microsoft.com/en-us/library/aa291862(VS.71).aspx, [Online], Accessed Aug 2010

Richard, P.A. (2002). *Energy Management Systems & Direct Digital Control*, 1st ed, Fairmont Press

Uclouvain, http://www.uclouvain.be/cps/ucl/doc/core/documents/coredp2008_69.pdf, Accessed July 2010

Wikipedia. (2010, Feb.) Knowledge worker. [Online]