IT – CAUSE AND RECOVERY TOOL IN THE ECONOMIC CRISIS CONTEXT

Popescu Laura, Zurbagiu Bogdan[*]

Abstract

The present paper aims to identify some of the weaknesses in the IT area that have contributed to the current financial crisis. At the same time, the crisis impact over the IT&C industry is analysed. Some case studies are introduced: credit risk evaluation software applications with low performance are one of the main causes for the collapse in the loan market, while investments in software applications for virtual campuses have the potential to contribute to the recovery as they reduce costs. Therefore, the IT&C is presented from two opposite perspectives: a factor that contributed to the on-going economic turmoil and an important tool in the recovery process.

In the economic recovery plan designed by the European Union, an important place is dedicated to the investments in IT&C networks, in the Research & Development area or in the development of the global commerce as companies can make profit from every opportunity that appears on the market.

Under these circumstances, the authors design a set of performance metrics that are meant to quantify the efficiency of software applications. The concluion is that the existence of performant information systems with high quality metrics and user-friendly interfaces undoubtly leads to an improvement in the economic pressure factors that characterize the crisis.

Keywords: economic crisis, IT, virtual campuses, credit risk evaluation applications, metrics

JEL Classification: E50, D81, D83, G32

Introduction

There is no doubt that the society deals with what Media considers to be „the greatest financial crisis of past generations". According to [Cagle, (2009)] the birth of the crisis is located in 2007, when the mortgage loan field has strongly declined. The current situation has been encouraged by the existence of prices that are higher than the true value of the good on the housing market. This tendency has been sustained by the banks' policy of granting a massive amount of loans. The increased number of clients that defaulted on reimbursing their credits has determined a massive reduction in the amount of liquidities of financial institutions around the world. The main consequence is the abrupt decline of prices on the housing market. The current status could have been avoided by implementing performant informatic systems. The replacement of simplistic evaluation models with software applications that

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implement expert systems, neural networks and performant statistical models for risk analysis and the development of user-friendly applications are solutions for overcoming the recession.

In an era when people talk about their knowledge, and researchers have developed theories based on organized knowledge management, virtual campuses existence is absolutely necessary. One of the most important areas in which collaborative systems have been succesfuly applied is education.

1. The informatic system – one of the causes of the economic crisis

The main cause of the economic crisis (the defaulted credits) can also be identified in the Romanian banking system. The indicators computed by The National Bank of Romania (BNR) refer to the number of loans that have been granted but proved to be unsuccessful and to the gross value of granted credits related to the total amount of deposits. The researchers indicate an unpreceding increase in the amount of defaulted credits in december 2008 (their weight in the total value of granted credit was 35%) compared to the value of the same indicator for december 2007, when the percentage was 22%. At the same time, the total value of granted loans represent 122% from the value of deposits, but the metric has decreased by 2.71 percentage points when compared to its level in december 2008. An analysis of the Romanian credit risk evaluation models applied for three of the most important Romanian banks (The Romanian Commercial Bank, Piraeus Bank and The Romanian Development Bank) proves the fact that the applied models and technologies lack performance and efficiency. [Diosteanu, (2009)]

Another informatic cause that has encouraged the on-going economic turmoil is the lack of collaborative informatic systems that are able to facilitate the interoperability in different types of companies or in the financial system. Although service oriented standards have been designed (*Business Plan Modeling Notation*), institutions lack the implementation of an open system that is able to design all the business flows based on finding, automatic building and extracting useful information from the web services' semantic.

2. IT&C - simptoms induced by recession

Under the current economic turmoil, companies have been obliged to redefine their activities. The IT processes are among the first aspects to be taken into consideration. The IT strategies for the recession period consist of: maintaining the IT tehnologies and projects that are strictly needed by the clients and the members of the organization, the improvement of the infrastructure only if this aspects proves to be helpful, the consolidation of the IT security, the proactive monitorization of the IT services (it is better to foresee than to repair), the consolidation of the *back-up* and *diaster recovery* mechanisms, redefining the *business intelligence* applications in orderto create user-friendly systems that are able to satisfy both users and clients. Some of the long-term projects, complex CRM implementation projects or projects that aim to replce the database management systems have been postponed and their budgets

have decreased for the short term. Companies are trying to identify cheaper alternatives for the CRM solutions. At the same time, investing in the tehnologies that are meant to virtualize some of the processes or in software applications that are able to diminish the costs is going to be encouraged. Changes have also affected the IT management: communication has intensified and transparent human resources evaluation applications have been developped.

As it is compulsory to reduce costs, the market is affected by an increased implementation of open source softwares: aproximately 46% of the IT cmpanies have implemented such softwares or were about to test them in 2009, according to an enquiry operated by Forrester Research.

A survival method under the context of the financial crisis consists in the externalization of certain services, phenomenon known as outsourcing. More than 41% of hte IT companies in Europe buy services from the external providers. In the second half of 2008, the outsourcing contracts on the european market have decreased by 25% when compared to the same period in 2007. The main cause of this result is the decrease of the demand for software products in the financial system. Despite these facts, the IT market has not registered remarcable decreases on the stockexchange, because the outsourcing facilitates cost reduction inside companies. The IT Asian market has been the least affected by the crisis as their services are characterized by a high quality accompanied by a reduced price. Therefore, they create an ideal environment for outsourcing [Deutsche Bank Research, (2009)].

3. IT&C – the economic rehabilitation tool

The IT industry is considered to be a strong set of tools that can contribute to the rehabilitation of the economy as it can increase the competitivity and improve both quality of life and the professional skills of all the actors that are involved in the working process. The IT sector can also lead to an increased performance in the public sector (**Figure 1**).

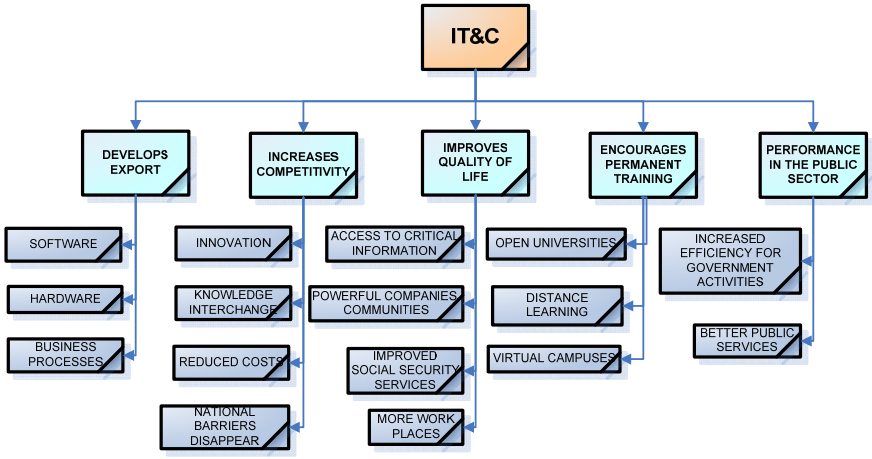


Figure 1. IT&C features – an economic rehabilitation tool

The IT can contribute to *significant increases in export*. Many countries around the world owe important percentages of their exports to the services in the IT industry. For example, India, Ireland and Israel are software exporters, while India, Philippines and Caribbean export business services and processes. The most accountable hardware suppliers are Costa Rica, China, Taiwan and Malaysia.

Another characteristic of the IT industry that is useful for economic development is that it *encourages the increase of competitivity* as it promotes the innovation and it facilitates the knowledge exchange between people. At the same time it reduces the national barriers and the transactional costs.

At the same time, the high quality of the software applications determines *an improvement in the quality of life* and it contributes to the idea of permanent training and continuous learning. Firstly, it defeats distance problems as it creates the opportunity to acces critical information for citizens that are located in areas characterized by less local means of information. Companies and communities develop their powe to communicate through the help of software resources and the educational process is extended by introducing permanent learning programmes and concepts such as open universities, virtual campuses and distance learning. Another strong point consists in the improvement of social security systems as distance consultance becomes available. Taking into account the fact that the unemployment is a one of the most important menaces in the crisis context, this is an area that will combat the increased unemployment rate: 7.8 billion people work in the IT industry in Europe and according to the European Software Association another billion workplaces will be created by the end of 2011.

Another aspect is that the performance is increased in the public sector as many activities are divided in subactivities and the efficiency is improved through highly performant software applications that reduce transactional costs.

There are several emergent technologies that are able to provide an insight over the real status of the market in which they develop their activity and over the innovation potential they have. An investment in the appropriate technology leads to an important decrease in the losses. For example, the employees of a building company are more efficiently redirectioned to the closest place where their intervention is required through the help of the mobile gadgets that have access to the management information. The reporting and all the additional documents is completed through these devices as the employees are not obliged to be physically located at the company's headquarters. Consequently, time losses between two interventions are minimized.

Another example which is worth taking into account is the reorganization of the government system in Baltimore: a new software application was introduced (CitiStat) [Gullino, (2009)]. The aim is to improve public services and to find appropriate answers for the problems of the local community. The main objective is to reduce the criminality by identifying the crimes and positioning them through a GIS system (Geographical Information System).

4. Credit risk evaluation applications – A POTENTIAL CAUSE

The origins of the current crisis, which blocked the blood in the arteries of finance across all markets, are to be found in the financial sector. In March 2008 Bear and Stearns collapsed and the Dow Jones Industrial Average hit its lowest level since 2006. A second notable spike in the banking sector occurred in late summer 2008, which coincided with the bankruptcy of Lehman Brothers in September 2008.

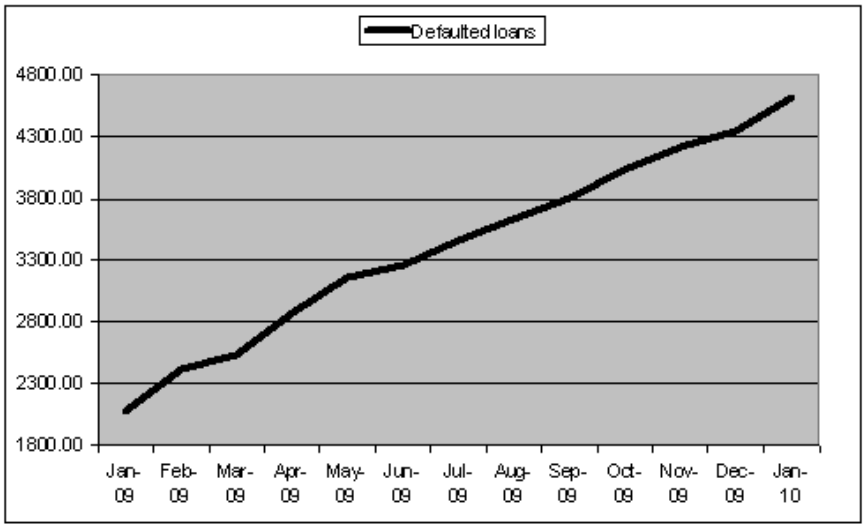
Similar to the recession in 1990-1991, the main driver of the 2008 credit crisis appears to be an increase in subprime mortgage defaults, which was first noted in February 2007. The subprime market is the riskiest segment of the mortgage market, so it is hardly surprising that some borrowers default on their loans. According to [Buraschi, (2009)], the incidences of defaults have been "the catalyst for the crisis". Consequently, one of the main causes has been represented by the difficulty of valuing structured credit products. Most of the banks use very simple risk evaluation application, most of them beeing based on regressions and statistical algorithms. Therefore many of the loans have been granted due to the result computed by a software application that did not use an appropriate model.

As argued by [Brunnermeier, (2009)], a possible trigger was the extent of securitization. For years, the asset-backed securitization markets fueled the explosion in consumer borrowing, allowing lenders to easily spread their risk to other investors like pension funds, hedge funds, and insurers. Securitization not only made the exposure of institutions to credit counter-party risk more opaque, increasing systemic leverage, but it also made these products more difficult to value. Therefore, the lack of a software application that is able to determine the "true" value of the parameters behind the inflated amounts induced by the crisis, has often led to spurious results and wrong decisions.

According to the National Bank of Romania, the trend in the evolution of defaulted credits indicates a progressive growth throughout the months of 2009 (**Graph 1**)

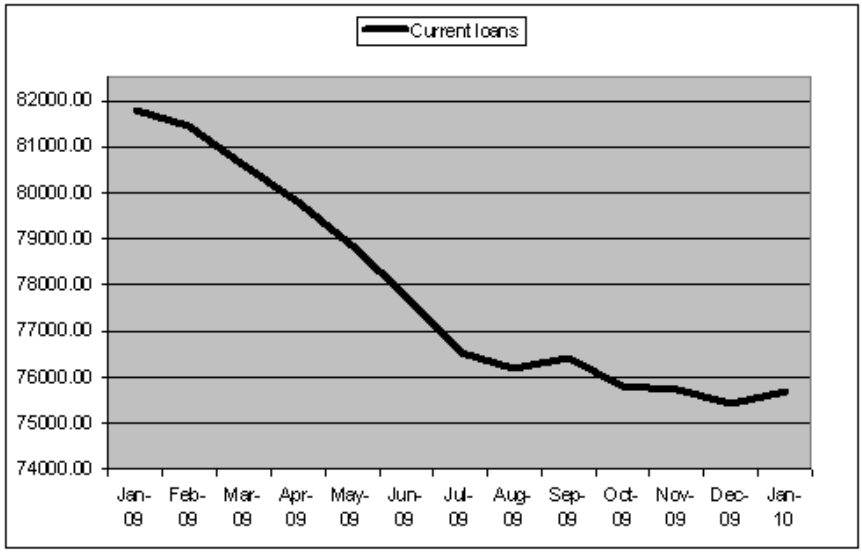
	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09
Total amount of granted loans	83868.17	83861.48	83143.63	82703.05	82011.26	81007.37	79990.67	79829.06	80219.38	79840.85
Current loans	81798.85	81440.32	80603.03	79833.69	78849.58	77749.43	76522.66	76197.32	76408.36	75806.75
Defaulted loans	2069.32	2421.16	2540.60	2869.36	3161.68	3257.94	3468.01	3631.74	3811.01	4034.10

Table 1. The evolution of granted loans over 2009 (millions of RON)

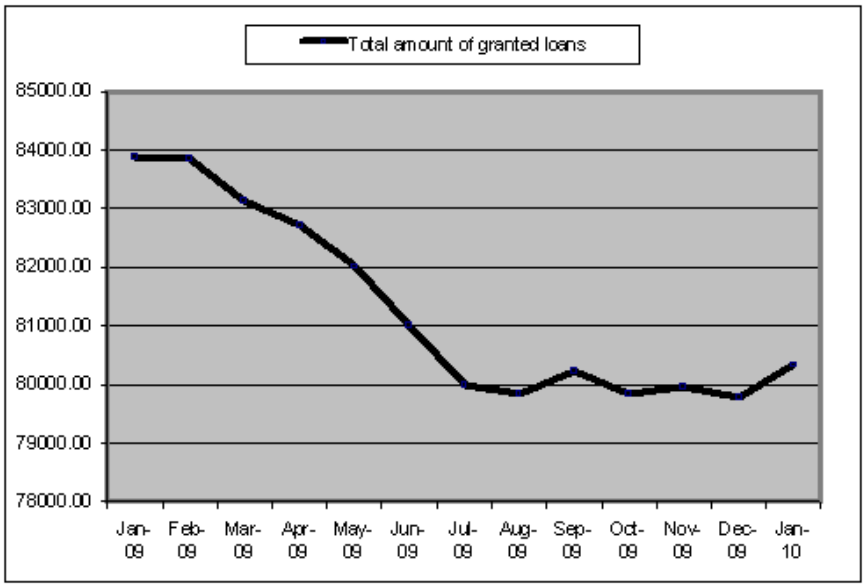


Graph 1. The 2009 evolution of defaulted loans (millions of RON)

The negative impact of this evolution is emphasized by the fact that the total amounts of granted credits and current loans have decreased (**Graph 2**).



Graph 2. The 2009 evolution of current loans (millions of RON)



Graph 3. The 2009 evolution of total amount of granted loans (millions of RON)

The conclusion is that even though credit risk applications have become more restrictive and fewer clients were accepted, their performance and ability to correctly identify default credits and reject them has decreased. Consequently, these software tools are not able to adapt to a crisis environment. Unless factors that include the economic turmoil influence are taken into account and spurious influences are dropped from the values of the model's parameters, these evaluation methods will contribute to inflating the current crisis.

5. Virtual campus investments – a recovery tool

In the context of the second largest economic crisis known to modern human kind, investing in the development of human capital is the wisest long term measure to be taken, ensuring a secure and stable economic groth. In [Bravo, (2008)] it is considered to be "particularly necessary to look in more depth at the joint analysis of the collaborative process and its resulting product".

Virtual campuses provide their members with a virtual community in which knowledge sharing is the governing law. Inside a virtual campus, students perfom specific activitities specially developed to fit each ones level of understanding. In a knowledge based economy, one of the most efficient means to obtain a high degree of skill is the online collaborative system.

Companies are getting more involved than before in the educational process by taking part in the curriculas organization, arranging meetings with the managerial staff of the virtual learning communities, purposing new ways of teaching, offering

specialized consultation, etc., with the purpose of hirring highly educated and creative people that will bring added value.

Nowadays, the biggest asset of a company is the employee. The creative and visionary employee will create new business lines or will develop the existing ones. But in order to create added value, firstly the companies must invest in their current employees but also in the community, from where there new employees may come.

Virtual Campus is an online tool that requires educational programs carried out online, without the necessary physical presence. The term is usually associated with the concept of virtual education, describing education using virtual courses delivered via the Internet. The notion of virtual is, in this case, a course that is not supported in one physical location, but given the alternatives.

According to [Le Beux, (2007)] "modern approaches to teaching and learning… include collaborative learning, problem based learning and the use of computer similations".

The purpose of virtual universities is to provide access to educational materials to those people who can not attend a traditional education system, because the distance or the need for flexibility.

Many virtual universities are accredited and work according to the same standards as those classics, therefore, issued diplomas are recognized worldwide.

Distance learning, at first, assumed the study through correspondence courses offered via television or recorded in audio and video formats.

Distance learning is the principle of making possible learning where a professor specialized professor is missing, in the desired area.

The development of virtual campus is accelerated, along with the wireless networks and, the quality characteristics become strictly related to the security characteristics.

Comparing collaborative training with classical training is found that in the case of collaborative training assimilation of knowledge is made more efficient due process of learning within the teams. Collaborative work can be successful if all members show goodwill and responsibility.

The objective of the virtual campus is the development and diversification of the online education for all the race, held on the e-learning platform of the university, providing logistical support, e-learning monitoring, training the participants and developing student and teacher's guide online.

6. Efficiency metrics for software applications

The previous two chapters of the current paper proved that the efficiency of the informatic system is an important issue to be analysed and quantified. The higher is their performance, the greater will be the recovery chances of a certain entity and of the whole economy.

Therefore, the informatic systems that are designed for the new economy – the digital economy – should be characterized by the following: are portability, a high

degree of accessibility, the ability to answer to the client's needs and the possibility to be accessed from as many locations as possible.

An important metric is the **User Fidelity Rate** (UFR) which is computed as a monthly indicator that is able to quantify the percentage of users that have accessed the on-line application in two successive months. It is computed as a ratio between the number of users that have accessed the application both in month n-1 and in month n and the number of total users that have accessed the application in month n-1 (**Formula 1**). The counter is determined as the cardinality of the dataset that represents the intersection between the set of users that access the application in month n-1 and the set of users that use the application in month n.

$$UFR = \frac{number\_of\_common\_users(month_{n-1}, month_n)}{total\_number\_of\_users(month_n)}$$

Formula 1. The User Fidelity Rate

Another important aspect refers to the application's **Accessibility** (A). This indicator is determined as the ratio between the number of successful accesses and the total number of accesses in a period of time (Formula 2). The definition of a „successful access" depends on the type of application that is evaluated. For example, in the case of a credit risk evaluation application, a successful access refers to the ability of the user to answer all the required questions and determine his credit score. If, for any reason, the user is not able to end his evaluation (the conexion brokes, the application is very difficult to use and he abandons, etc.), his access is considered to be unsuccessful.

$$A = \frac{number\_of\_successful\_access}{total\_number\_of\_accesses}$$

Formula 2. The Accessibility Rate

This metric can be computed for different time periods: daily, weekly, monthly, annualy.

Security metrics are used by virtual campus platform administrator to determine the ideal level of security to be applied. The security level applied in day *t+1* will be determined on the SMITU level of day *t* and will determine the security mechanisms used in the virtual campus platform. The security level applied daily (day *t+1*) in the virtual campus platform will automatically adapt depending on the values of the $SMITU_t$ indicator. The details of the security levels and the measures taken are shown in **Table 2**.

Security level	Values of $SMITU_t$ indicator
SL1	Between 0% and 5%
SL2	Between 5,01% and 10%
SL3	More than 10,01%

Table 2. Security levels associated with different SMITU values

Security level SL1 involves the default security measures, allowing the highest level of accessibility, while SL3 will determine the most strict security measures and in the same time the lowest level of accessibility.

$$SMITU_t = \frac{\sum SMIU_{it}}{TNU_t}$$

Formula 3. Security Metrics Indicator for Total Users

where:

$SMITU_t$ (Security Metrics Indicator for Total Users – **Formula 3**) indicates the average confidence level, showing the average probability that the virtual campus platform is being subject of attacks in day *t*. It calculated by adding the values of $SMIU_{it}$, for user *i* in day *t,* and dividing them to the total number of users.

$SMIU_t$ (Security Metrics Indicator for User) shows the average confidence level when declaring a user as performing unauthorized activities. It is determined by calculating a percentage on the basis of multiple indicators and reflects the level of probability when declaring a user is an unauthorized one that performs different attack activities in day *t*.

TNU_t represent the total number of users that have accessed the virtual campus platform in day *t*.

As shown bellow, the $SMIU_{it}$ indicator (**Formula 4**) is calculated based on multiple specific indicators. Each specific indicator will have assigned a level importance.

$$\mathbf{SMIU_{it} = 0,1 * UIP_{it} + 0,3 * EA_{it} + 0,25 * LC_{it} + 0,35 * CI}$$

Formula 4. SMIU Indicator

where i = user i; t = day t;

UIP_{it} (Unknown IP) – the indicator shows if the user *i* has connected from an unknown IP address. The virtual campus platform will store the activity of each user and the IP's from where is has connected. The indicator will take value 0 if there was no appearance of the event or 1 of the event has taken place at least once.

EA_{it} (Erroneous Authentifications) - this indicator counts the number of erroneous authentifications the user has performed before connecting to the virtual campus platform. The indicator will take value 0 if there was no appearance of the event or 1 of the event has taken place at least once.

LC $_{it}$ (Logical Course) – this indicator shows if the user has connected to one of the virtual campus functionalities and did not use the normal path of reaching the functionality. The indicator will take value 0 if there was no appearance of the event or 1 of the event has taken place at least once.

CI $_{it}$ (Code Input) – this indicator will reflect the number of times the user has input code text in different text areas of the virtual campus platform. The indicator will take value 0 if there was no appearance of the event or 1 of the event has taken place at least once.

Table 3 illustrates the values computed for the SMIU metric in a particular situation. The software application has been accessed by 10.000 users per day. For example, 300 users have performed an activity that has determined a SMIU value of 0.35, while 8000 did not perform any suspect activities.

Occurrences	Value
1000	0.1
500	0.3
200	0.25
300	0.35
8000	0

Table 3. Occurences table for SMIU indicator

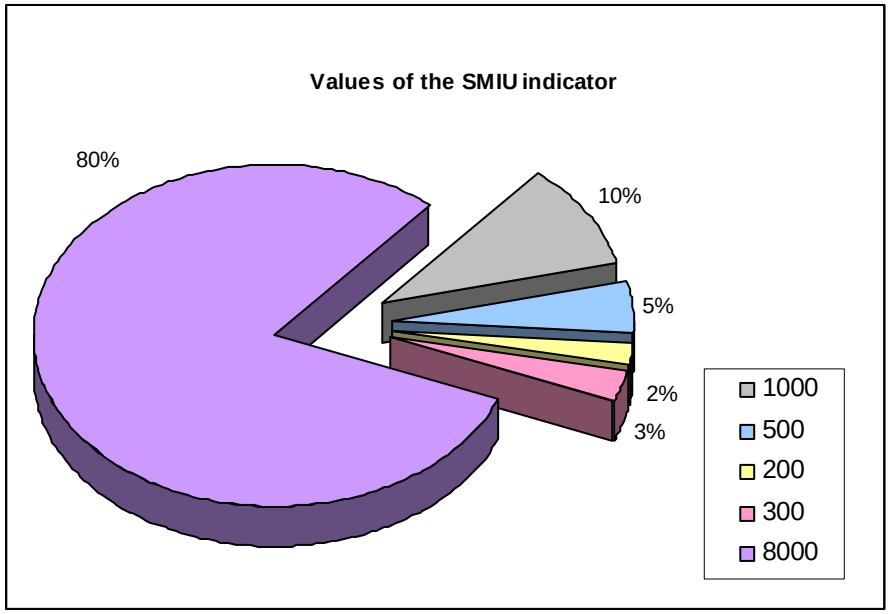


Figure 2. Values of SMIU indicators

An adaptive security measure will ensure a low level SMIU indicator, reflecting a good security status of the software. As long as there will be protected virtual campuses, the distance learning projects will prove their superiority by increasing the efficiency of human resources development and in the same time decreasing the costs.

7. Conclusion

Issues related to the information transparency, application's security and performance are more and more evident and have negative effects that induce a negative influence on the clients and influence their trust in the institutions that use these applications. The importance of investing in strong informatic solutions that aim to develop the digital economy and to encourage the recovery of the world economy after the crisis has been emphasized by UK's prime minister at the Digital Britain Summit. At the same time, [Gates, (2009)] made public his opinion according to which the innovation is the main tool that humanity should use in order to overcome the effects of the recession, and the first area in which it should be applied is software.

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