



BABES – BOLYAI UNIVERSITY

CLUJ NAPOCA

The Faculty of History and Philosophy

DOCTORAL THESIS

**SECURITY OF INFORMATION SYSTEMS AND STRATEGIC
MANAGEMENT IN A EUROPEAN CONTEXT**

Case study: The Health Care System in Romania

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The subject matter that I propose to be fathomed in the framework of doctoral research is „Security of Information Systems And Strategic Management In A European Context. Case Study: The Health Care System in Romania”.

The increase of world trade and the emergence of globalization (drifting towards flexible systems of interoperability) created changes unimaginable a century ago from the point of view of interaction between societies in their entirety, regarding the exchange of informations, but also at a group level of individuals (organisations – national and multinational companies).

From the point of view of business, the companies adopted in the last 20 years the principle : “Think globally, act locally”, but very few of them approached profoundly the aspect of the information flow and its security. This approach shows clearly the importance of the local culture (with everything it implies: attitudes, mentalities, protocol, work style etc.) in the deployment of a secure and coherent information society.

From the perspective of public services, with large social implications, where security, confidentiality and access to personal data represents a critical area, health care services as well as information systems which are fundamental to the strategic management in the national health care systems are a subject matter of an utmost interest, but not often addressed.

Being especially interested in this as yet insufficiently explored field – the security of information systems in the strategic management in health care, considering as a foundation for research and examples the strategic management in public health care units as hospitals, I also rest upon my own experience in this field, earned in over twelve years as general manager in a company which performs services in health care starting with 1992. The company is the biggest provider of medical, non-pharmaceutical goods and services on the Romanian market - MEDICAROM GROUP. I also have a six years of experience as assessing expert of The European Commission – Directorate for the Information Society – for FP7 (Frame Programme 7) projects - eHealth and, last but not least, an extensive experience in developing and coordinating several European projects in the field of medical IT (examples: European project e-Ten „Health Optimum”¹, with five countries, Italy, Spain, Denmark, Sweden and Romania and a budget of 23 million Euro, the project Eureka ”Retemes”²) with all the multidisciplinary and study

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See <http://www.healthoptimum.info/page.jsp?idLingua=1> [accessed: 10.08.2012.]

interactions which develop based on the analysis tools pertaining to the field of information security, adjusted and developed for the necessities and the characteristics of each area of study.

During the years dedicated to this field, following the changes in economy, politics, society and technology, I discovered that strategic management determines more and more and in a more subtle way not only the performances of the organisation, but also the performances of individuals, groups and partners, as well as the relations between them in both directions. Therefore, to promote secure information systems, built upon accurate information which is coherent, real, at the right moment and most important, secure, becomes a basic element of the organisation, the group and the individual, as well as a major objective of the strategies in order to competitively manage it.

The policies of security became more important and comprehensive, but so did the risks, such as attacks on information systems.

A defining example in supporting security policies have the STEP factors (Social, Technological, Economic, Political influences) as well as the mentalities of the personal and organisational perspectives. The ones and the others are more and more entangled in a globalized system, while the prosperity of the nation-states, organisations and individuals increasingly depends on this system (example: private data – such as EHR “Electronic Health Record”- including the entire medical history of a person, can be transferred by a mouse click on the other side of the world). Nevertheless, the technological revolution has negative aspects too, specifically, it can give to the authors of cybernetic attacks the power to destabilize systems which appear as solid as a rock.

The technological, political, cultural and social discrepancies determine in some areas the need of a specific interaction approach, especially in the security area. For example, the differences between the European states which are old members of the Union and those who are newcomers are striking, if we assess this perspective through the statistical data of the past 10 years.

Characteristic of the approach throughout the paper was the area of Romania in the field of the achieved research. At a company level (be it with whole state-owned, mixed or private

See <http://www.eurekanetwork.org/project/-/id/4053> -RETEMES develops new methods and industrial experiences to enable the European medical industry to test their IT-based systems more effectively, with new reliability test methods based on TTCN-3. [accessed: 10.08.2012.]

capital) or at personal level, as well as at the level of public institutions or public local and central authorities, the protection of information is an up-to-date subject of critical importance, both from the perspective of the economic and social safety, due to the fact that Romania is also a member of NATO and European Structures as well.

Therefore, we can say that to speak about the security of information as a concept, but also about its deployment in practice, is to speak above all else in terms of strategic national interest, beyond the interest of any other institutional or political entity.

Starting from these considerations of a theoretical and practical nature, during my research activities on the subject of the security of the information systems, I came to the conclusion of the necessity to assess the tools used in the field of study, as well as the results derived from the data analysis, also through techniques which are specific to a certain field – the medical field – in order to have a clear applicability of the paper, beyond "thinking in the Lab". The purpose of such a scientific endeavour was to analyze the existence of certain relations of correspondence, conditioning and/or correlation between the results in these types of research of the aforementioned field (including motivations pertaining to the validation and the advancement of the tools of research into the security of information systems in the strategic management), as well as to achieve an architecture of the logical system for the management of the information security, based on an interlocking approach of the public health field. Considering these aspects, the subject matter of research, „**The Security Of Information Systems And The Strategic Management In A European Context. Case Study: The Health Care System in Romania**”, opens a direction of further research in the field of public health care and the data used in this system.

Preliminary documentation

The subject of research proves to be oriented towards a very sensitive area (*critical mission*), the area of information security. This is a relatively new field: the security of information systems. The technology of information in the medical field is in a germinal stage of development, characterized by searching, advancement, maturation and being acknowledged by other already established fields in the security of information (national security, for example). Because of this fact, during the stage of documentation for the subject, I consulted public polls done especially in the medical field, governmental statistics relevant for the subject, central

written media (especially from health care, respectively medical TIC). The documentation work also included reading fundamental writings on subjects like: security of informations, processing personal data and their free circulation, evolution of data security in information systems, management of information systems in hospitals, strategic management, analysis of public documents from the archives of The Ministry for Health Care, security of informations and mass-media, public polls, the management process and modern strategies, public space and interoperability of systems etc.

In the same time, I was aware of this subject being present in the public debate, in mass-media, therefore following with great interest the appearance of other research as well as the relevant debate on the subject proposed by me (especially the debates organized and the scientific works which are related with security of informations and strategic management, in conferences, congresses and seminars organized during the documentation period).

THE RESEARCH – ELABORATING THE PLAN OF THE PAPER

Scientific Observation

This was a stage of methodical observation of data gathered through documentation and evaluation, in the framework of analyzing the phenomenon which is the subject of research. This stage was crucial from the point of view of the hypotheses which are basic to my personal contribution in the investigating endeavour and the completion of models.

In this stage appeared the **case study**. This is made from a practical perspective.

Drafting of the scientific hypotheses

The relation of causality – was an important aspect in identifying the input variables and understanding the inter-functional relations.

As an approach technique I used *induction* = the general conclusions of the group of cases studied are generated by a study on a small but representative number. In my doctoral dissertation I tackled a small number of cases of management styles and their interaction in the area of making information safe, in order to reach conclusions regarding a whole concept of modern strategic management of the type „*think globally, act locally*”³.

Measurement through indicators – It is well known that any objective of research must be conceived in terms of SMART (Secure, Measurable, Achievable, Realistic, Time-related) and with these terms we associate indicators through which we can analyze the dimension of the phenomenon being researched.

The construct of the indicators intended to raise the level of objectivity in assessing the services of health care information, in correlation with the deployment of the policies for the security of information. Through the indicators I tried to reduce the risk of erroneous interpretation of the data gathered (these can be found in Annex 3).

I envisaged several categories or types of indicators applicable to the criteria of evaluation of the status of the mentioned services in the analyzed organisations:

- of the type „yes” / „no” or the type „present / „absent” ,
- of frequency, applicable for research on a sample and usually relating to a process,
- of volume

or, from a different point of view (of the measured system), I had:

- indicators of activity,
- of resources,
- of process ,
- of result / impact.

The indicators were expressed in absolute values or as a numerical proportion (rate), and they are simple and composite. I applied the indicators upon various dimensions of evaluation of the researched system. Some indicators can be found in the documents of the health care units from the point of view of evaluating performance or the degree of conformity to the standards of authorization (DSP)/ certification (RENAR, ISO, OHSAS) / accreditation (CoNAS).

Inclusively, the evaluation of conformity to a standard/reference/criterion/indicator starts from the aggregation and analysis of data gathered while interacting directly with the organisation and the statistical processing. As a consequence, objective information were able to allow the issuing of a judgment and a conclusion in regard to being able to achieve or not the desideratum named standard/valid regulation/reference.

During the research I strictly pursued the achievement of current requirements for the use of some specific indicators, especially those intended for hospitals organisations with in Romania, having the following characteristics:

I. Indicators constructed in a simple way

I took into consideration the fact that the indicators used should be useful by themselves. The relevance of the indicators comes from their coherence and credibility, which they confirm as a way of measuring a certain phenomenon.

II. Real Indicators

The validity is confirmed by the fact that the indicators in discussion measure the phenomenon which is associated to them, giving correlative and interdependent informations in the field of interest. The indicators well-constructed and relevant contribute to efficiently identifying the probable dysfunctions which can appear.

Given the fact that variability is a part of measurable systems, even more so of the health care system where there are multiple answers to one action (for example, an individual answer to a certain procedure or process), I considered building an “apparatus” of indicators starting from collecting data fundamental to my research, which would allow to maintain their validity even in the case of huge variability of the phenomena under study.

III. Specific Indicators

The indicators modified their value only when the phenomenon under study itself underwent modifications. In general, when there are variability of the phenomenon/system, the indicators modified their value in the same way.

Verifying the hypotheses and laying the foundation for the scientific conclusions

- Natural observation: based on daily experience
- Scientific observation: based on methods of scientific research with the purpose of theoretical conceptualization
- Scientific experiment: starting from the scientific concept in order to reproduce it in the practical area.

Objectives of research

In the present research, ***the general objectives*** were meant to underline the particularities of the security of information systems, their dynamic, as well as formulating explanations regarding the relations with other phenomena of strategic management (interoperability of operational flows and processes, dynamic of the evolution of information in internal and external

environment, classification of data etc.). I analyzed the way in which the phenomenon of the dynamic of information systems security correlate with other phenomena of contemporary management. The conclusions resulted from research provide perspectives of further development based on an information strategy in contemporary management as well as relations of interoperability established between the actors from the system of reference. Last but not least, they will permit to draft predictions regarding the deployment in practice (in the public space) of these systems. In this context, taking into consideration the influences of the European policies in health care, assisted by the technology of information and communications, we can speak about developing an action strategy tuned to UE directions. This way the subject of research remains open for further thoroughness with regard to the assessment of the effects of various actions carried on in the field of information security and measurement of their effects, in terms of technological, social and economic change.

As *specific objectives* I had in mind to fathom the existing knowledge on the functioning of the security mechanisms for information systems in strategic management in health care, focusing on the confidentiality of data and their security from a new perspective, namely that of ethics (in the process of using information of a personal nature - medical/sanitary). The observation of the new directions in building information systems (the basic element being the medical information inside various groups of „actors” – managers of health care units/authorities, specialists in the medical field, doctors, pharmacists, biologists etc, specialists in IT, patients) allowed me to detect the effects of this process as well as the influence over the information security policies in strategic management, from the point of view of a field which operates continuously and dynamically: the health care field.

The universe of research

The proposed universe of research represents, practically, a segment of the process of integration of the contemporary Romanian society in European policies, from the point of view of strategic management based on coherent and performant systems of information security. The motivation comes naturally: here it is an approach from a new point of view, critical and rarely mentioned – the health care strategic management and the security of medical data. The analysis of an extended population segment, which can be described on several coordinates (of the type geographical - rural/urban, age-related – children/adults/old age, social-professional - managers/specialists, doctors/patients, sex-related – men/women) allowed me to examine the

phenomena starting from various basic characteristics of the population segment chosen, in order to support the axiomatic ideas of data confidentiality (demographic, economic, social, political, cultural etc.).

Theoretical framework of research

The action of communicating, conveying and receiving messages, of interacting and entering in relationships with others represent a transfer of information which can be perceived depending on the context of communication and the interests of the receiver. An important aspect of this flow is represented by the handling and the „storage” of information (archives). Therefore, an efficient communication involves the analysis and understanding of the environment, because the manager is surrounded daily by a multitude of information. He will choose from the mass of information received only those which meet his necessities and which comply with the social culture to which he belongs. There is also a hypothesis that not all information get to various actors in the system, and those which get there are filtered through the point of view of each person's own „mental translation of the external reality”⁴. As a consequence, depending on the level of perception, they decide the further flow of information – and here the information system (TIC) plays an essential role in passing on, handling, corrupting or not the information, doing archives, but also the safety to have a back-up (disaster recovery) in case of damage.

In order to create and maintain a coherent and interoperable data base for a modern management, the organisations communicate both internally and externally. The management of external communication is an extremely complex process because it requires the existence of a collective receiver, named through the notion of organisation publics. By *public* it is understood „any group (or individual) who has any implication in an organisation. Therefore, the public would include neighbors, clients, employees of the organisation, the competing firms as well as the governmental institutions playing a role in issuing regulations. The publics and the organisations are interdependent: the actions of the public have an impact on the organisation and the other way around”⁵. The importance of knowing these groups is big, because it

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Nicolae Frigioiu, *Imaginea publică a liderilor și instituțiilor politice*, București, Edit. Comunicare.ro, 2004, p.10.

represents the base of the act of communication through which the information is „disseminated”. The individuals who belong to a public are seen as a homogenous group and therefore it is considered that most of them will receive the messages with the same tendency. The messages passed on to a certain category of public should take into consideration the characteristics, the degree of interest, the availability to communicate and the degree of trust and message security.

In the existent sources (theories and concepts), as well as in the practical activities of ensuring data security, the most frequently used are the notions of reliability, coherence, security, protection, threat, confidentiality, vulnerability, integrity, risk (danger).

From the aforementioned notions, we will take two terms, in the structure of the most frequent binomial: *danger – security*. Taking into consideration the antithesis between the two notions, we can propose to interpret these terms as follows: **security**, having the meaning of minimizing the vulnerability of the system's elements, while **danger** is a potential trespassing of security.

The notion of security includes ensuring the data confidentiality, protecting information from modification, falsification, cancelation.

Unities of analysis and registration

For this research the unity of analysis is the group, circumscribed depending on the activity environment, occupations, status and operating area (the one who works with the information or the one who owns the information). In the study included in this doctoral thesis it has been selected a health care unit with beds, in a city with over 60.000 inhabitants, which is representative as an organisation, as resources, for the health care system in Romania: a municipal hospital (named in the paper, for confidentiality reasons, hospital B). This public hospital is multi-specialty care unit and has a medium dimension in terms of number of beds (under 500 beds), belonging to the local public authority.

Research as such

In the study of the dynamic of information systems security from the point of view of strategic management, I chose a research strategy which included analyses of quantitative and qualitative information. These are based on the study of certain types of documents: reports and statistics, from national and international data bases), work cards, procedures and reports (documents with public character of the health care units or institutions in the medical field). At the same time, important information sources were the internet, virtual libraries, social networks, specialty sites.

I also had access to different types of information from **periodical primary documents** (magazines, newspapers, publications) and **non-periodical/traditional** (books, official publications of various national and international forums and institutions, congresses, conferences, symposiums).

A special relevance for the subject under discussion had the public polls carried out in Romania in the last four years. The results obtained after analysing periodical and non-periodical primary documents will be correlated with the results of the polls in order to estimate if there are relations between these sources and the information from the virtual space.

Methodology of work

The methodology used involved, in the first place, to create a system of indicators which represent „the structural elements of information systems which define, singularize and in the same time allow their investigation”⁶. In order to efficiently use the indicators in an analysis, they need to be relevant on a long term, to have relevance for the organisation/institution/system under study, to be quantifiable positively and negatively, to be possible to decompose in sub-indicators and to cover a distinct segment of the field being analysed. Therefore, the system of indicators was used depending on the information system of the organisation/institution investigated. This has been achieved from the point of view of data security, which meant a pre-designed strategy depending on the purposes and objectives targeted.

An important direction of the research achieved was to identify and analyse the favorable premises for the development of an innovative system of strategic management based on a secure

and safe informational structure, in order to be aligned with the requirements of the European Union.

The analysis of the current situation of the health care management systems, and further, of informational systems in health care units in Romania showed the incipient stage of these concerns. Nevertheless, I consider that despite the problems generated by insufficient financing or even sub-financing, to ensure the quality of the medical and managerial information, as well as its security, must be a continuous concern of the health care system in Romania in general and particularly for the managers of health care units. We can say that the changes which took place at an economic, social and political level in Romania after 1990 were reflected also in the health care system, and it becomes evident that a reform is necessary, both because of the weak performance in the public health care system and because of the profound modifications, structurally and institutionally in a health care unit.

For all these reasons, I believe that the subject of the doctoral thesis „Security Of Information Systems And Strategic Management In A European Context. Case Study: The Health Care System in Romania” is really purposeful, fresh and of a great applicability in practice.

Scientific conclusions

The final stage of scientific research materialized in substantiating conclusions and proposing directions of improvement of data security systems and policies in health care units in Romania. The purposefulness of scientific research was harmonized with the system of scientific premises which were at the base of the concept. Criticism and observations are normal for some aspects of practice with various theoretical approaches. It should be mentioned that some criticism represent the author's perspective and will be present in the doctoral dissertation.

THE STRUCTURE OF THE THESIS

The first chapter refers to strategic management in the context of the present globalization. It is presented a summary of the theoretical elements of specialty as well as fundamental notions in the field, taking into consideration the organisation and the organisational behaviour, as a paradigm of business management in the context of contemporary economic phenomena. Operational and structural needs of an informational system were identified, taking into consideration the field and limits of the trichotomy

Management – Data – Information security.

Chapter two approaches the European governance as a component of harmonization at a local, regional and national level of the economic strategy and the information exchange in a virtual space, having a more or less controlled and controllable access.

Another area approached in chapter two, closely depending on the European governance theme, is represented by economic globalization and going from an abstract, even scholastic perspective to that of the existing multicultural and organizational reality.

Last but not least, I considered important, in order to understand the real situation in the investigated field, to achieve an analysis of the area of national governance from the point of view of European level and requirements, from the perspective of using new technologies to support a better management of specific activities of central and local authorities, especially in the field of the health care system. The aspects of this analysis take into consideration the new concept of „eGovernance”, concept which covers the whole range of interest in local, national and European governance, respectively: administration, education-research-development, health care, culture, inclusion based on new information and communication technology – the data infrastructure, wide band, digital services. Taking into consideration the social and economic differences between European countries members of UE and non-members, as well as the technological gap between countries recently entered and the rest of the European Union members, evaluating this perspective through statistical figures of the past 10 years, we can say that, regarding the security of information as a concept, the deployment of systems dedicated to this area represents above all a strategic national and European interest, beyond the interest of any other institutional or political entity.

Chapter three presents a formal type approach to represent the management processes of information security in our contemporary society. The architecture of data security policies based on a holistic approach of information security management (including the current stage of knowledge in the fields covered by international specific regulations) was taken into consideration. These aspects are extremely important in representing management processes and the requirements of the information solution, generated by the constraints of a viable system of data security. The direction of investigation in the area of health care services was also due to the fact that this field is of paramount relevance regarding the evolution of society as well as individuals, both from the technological point of view and the point of view of organizational

attitudes and behaviours.

Chapter four refers to the investigative endeavour: the consequences of data security in the development of strategic management, taking into consideration the current context of European integration and globalization, from the perspective of health care services. The case study which was chosen, approaching the context and issues of the health care system in Romania, represents the premises of development of an area of analysis for information security policies at a local and national level, an area that is superficially and insufficiently approached in the framework of the present health care management. The analysis achieved took into consideration the information requirements in the present context of integration, on one hand, and the movement of people, information, risks, on the other hand. Using data gathered from the system under analysis (qualitative and quantitative research), as well as from studying the current regulations and requirements in the national health care system, the thesis proposes a conceptual configuration of the information system able to manage the process and the flow of data from the perspective of the safety of the medical data existent in an a hospital information system. The practical study was achieved in a public hospital, municipal, of medium dimension – under 500 beds, belonging to the local public authority and having in place an information system (HIS – Hospital Information System) for the management of patients data and health care unit activities (of the type ERP – enterprise resources planning), named throughout the study, out of confidentiality reasons, Hospital B.

Therefore we can say that the last chapter intended to „close” the analysis of the cycle of tackling strategic management, aligned to a European context, through the information systems, approaching a critical area: the area of data safety and security in health care.

The thesis is concluded by formulating conclusions and further recommendations for a possible continuation of the research in the same field, which is the health care system, at the level of a hospital unit but also at the level of state policies.

Taking into consideration the need of active involvement of those who can and should contribute to ensuring the protection of information, especially information considered critical (for example: processing personal data) or classified (for example: military information), from a proper management of data by every keeper, strictly following valid regulations, to security education – a new component of the concept of European security culture, we consider that the subject matter is extremely timely because of the way in which the security of information

systems was approached, taking into consideration the correlations and influences between strategic management and health care. All these led to formulating new methodologies and action strategies to evaluate the risks and deploy viable security policies. On the other hand, the subject offered the possibility of validation (from a practical perspective) and improvement of the working instruments of information systems and management analysis. Thus we came to the conclusion that when discussing about building an integrated and interoperable information system (representing the architecture of the system, the design and analysis of the system, the clarification of the effects achieved -data, processes, procedures, flows- in the process of handling management activities), the deployment is considered finalized only when it is „accepted” in the risk area: information security.

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