Critical issues of information systems management in the Greek Public Sector

Euripidis N. Loukis[a],* and Niki Tsouma[b]

[a]*Department of Information & Communication Systems, University of the Aegean, Mytilene, Greece*
[b]*General Secretariat of Information Systems, Ministry of Finance, Athens, Greece*

Abstract. Extensive research has been conducted on the main issues that organizations face concerning Information Systems (IS) management, in order to exploit the capabilities of the rapidly evolving Information and Communications Technologies (ICTs) to the highest possible extent. However, most of this research has been directed towards the private sector. The present study attempts to contribute to the research of the critical issues of IS management in the public sector. Based on 32 interviews with IS Managers of Greek Public Sector organizations using a structured questionnaire, the main issues and challenges that the organizations of the Greek Public Sector face concerning the whole cycle of IS management are investigated. From this investigation it is concluded that the most important IS management issue currently faced is to hire 'New IS Human Resources', followed by the issues of 'Extending Use of Office Automation' and of 'Management and Use of Data Resources'. The results shed light on the profile of the modern IS management function, which has become highly complex and multidimensional, containing many both technical and non-technical management issues, which can be either internal or external to the IS Unit. The results also show the highly horizontal nature of the IS function: its success depends more on issues concerning its cooperation and relationship with the other functions of the organization, than on issues concerning its own functional expertise. From the study of the main expected IS management issues after 3 years, it is concluded that about one third of the main agenda currently faced by IS management is expected to change within three years, confirming the highly dynamic nature of the IS management function. The results of the present study were also compared with the results of previous studies of IS management issues conducted in Greece and in USA. From the comparison were determined both similarities and differences as to the main IS management issues faced. Therefore some of the main IS management issues faced by organizations are universal, while some others are specific to particular sectoral and national contexts.

1. Introduction

It is widely accepted that Information Systems (IS), if properly used and managed, can greatly contribute to the improvement of the efficiency and the effectiveness of both public and private sector organizations, especially when they are accompanied by proper processes redesign and reorganization. The existing experience from the use of various categories of IS in organizations of the public and private sector has shown their great potential, and also the multidimensional categories of capabilities and benefits they can offer [1,16,17,29]. The simplest category of benefits are cost reductions and productivity increases, which can result from the computerization of existing labour intensive processes. More benefits can be achieved by using IS not merely to automate existing processes, but also to reengineer and improve them, and to enrich them with new useful value adding processes and activities that did not exist before [22]. The higher categories of benefits from the IS are associated with the support of important management functions, such as planning, coordinating, controlling and decision making,

---

*Corresponding author: Dr. Euripidis N. Loukis, Agias Barbaras 77, Paleon Faliron 17563, Athens, Greece.

by using Management Information Systems (MIS) and Decision Support Systems (DSS). Very important benefits can also be achieved by using the modern Information and Communications Technologies (ICTs) in order to connect public and private organizations, via Interorganizational Systems based on networks, for supporting the collaboration among them. The highest categories of benefits from the IS are important strategic advantages and radical business transformations which are enabled by IS. The opportunities to achieve the above benefits using IS are expected to increase rapidly in the future, because of the continuous and rapid increase of the capabilities of the ICTs, and also the continuous dramatic decrease of their cost.

Because of all the above important capabilities and opportunities, most organizations of the public and the private sector make huge investments in ICTs, in order to develop big and complex IS supporting their functions. It has been estimated that in the member-states of the European Union the private organizations spend annualy on average about 2% of their turnover on ICTs, although there are big differences among sectors, regions and states, while in USA this percentage is even higher exceeding 2.5%. It has also been estimated that about 50% of capital investment in USA is in ICTs. The investment in ICTs is expected to increase rapidly in the near future, and the worldwide spending on ICTs is estimated to exceed $2.5 trillion in year 2002 [17,25,42].

However most empirical studies have found no statistically significant correlation, and only a few studies have found some small correlation, between ICTs spending on one hand and productivity and other measures of performance on the other [8,9,42]. This remarkable conclusion in the international literature is referred to as the 'Productivity Paradox'. Therefore organizations spending on IS development and operation are not necessarily rewarded with clearly visible productivity and performance increases. One of the reasons for this 'Paradox' is that because ICTs are new and complicated technologies, many public and private organizations do not have the required knowledge and experience to manage them effectively. Like any other asset, IS should be properly managed, in order to offer all the expected benefits and result in significant productivity and performance improvements [42,45]. Also IS development projects are among the riskiest projects, with very high failure rates, and require proper management in order to be successful [49].

Therefore IS management is a very important function for the success of all private and public sector organizations, and is going to become much more important and vital in the future. For this reason an extensive body of knowledge and literature already exists in the area of IS management [1,2,15,35], describing and analysing extensively the main issues and also frameworks, methodologies and techniques for coping with them. From this knowledge and experience it is concluded that IS management in a public or private organization is a very complex and multidimensional function. It includes the management of many technical and non-technical issues, concerning rational IS planning, development, introduction, operation, use, organization, maintenance and evolution. Also IS management is a highly dynamic function; the specific IS management issues faced in an organization and their importance are changing in the course of time, as the ICTs are evolving, and at the same time the IS requirements of organizations are also evolving and increasing quantitatively and qualitatively, because their external environment changes and becomes more demanding. The specific IS management issues faced in an organization and their importance depend highly both on the internal environment within the organization and on its external sectoral, regional and national environment [4,10,14,20,47,48].

For these reasons extensive research has been done in the 90s in order to determine in more detail the specific IS management issues that organizations in various countries or economy sectors were facing, and also their relative importance and their evolution with the course of time. A review of the literature in this area is given in the next section of this paper. However, most of this research has been directed

towards the private sector, and only a few studies have been conducted concerning the IS management issues that the organizations of the public sector face [10]. Therefore more research is necessary in this direction, given the critical role that public sector plays in the economic and social life of all countries, and also the importance of ICTs on public sector productivity and effectiveness.

The necessity and the usefulness of such a research is even higher for the case of Greece. Greece is characterized by a big public sector, which has many chronic problems resulting in low efficiency and effectiveness and also high operating costs. Therefore for many years there is a universal consensus in Greece that public sector needs to be improved and modernized. After the end of World War II one of the most important reports written on the 'Greek Economic Problem' [44] concludes that 'we must not expect any real improvement in the economic situation of the country if we do not deal with the fundamental problem of the inadequacy of its public administration'. Since then many similar conclusions and directions can be found in nearly all the relevant reports and programs, which have been drawn up concerning the economic or administrative development of Greece [27,32–34]. However, although there is a high public interest and pressure for the improvement and the modernization of the Greek public sector, very little progress has been made so far in this direction.

ICTs are generally regarded as a significant factor which can facilitate the modernization of the Greek public sector. For this reason significant IS investments have been made in the late 80s and in the 90s, financed from National and European Union funds, especially from the Integrated Mediterranean Programs [31] and the Community Support Frameworks [33]. However the results of these IS investments were much lower than the initial expectations. Many large public sector IS projects failures are reported in the final reports of the Integrated Mediterranean Programs [3,31]. Also, though the official evaluation of the Operational Programs of the Community Support Framework II (1995–2001) has not been done yet, from the results of relevant studies it is concluded that the outcomes of most of the IS projects of these Operational Programs are far from satisfactory, and that there have been problems and failures in many important IS projects [43]. The general conclusion is that Greek public sector, despite all these big IS investments, exploits to a small only extent the capabilities of modern ICTs [28].

Taking into account the above problems and failures, and also the new huge IS investments, which are going to be made between 2001 and 2006 for the development of IS in the Greek public sector, financed by the Operational Program 'Information Society' [34] (of total budget about 3 billion Euros) of the 3rd European Union Support Framework, it becomes very important to investigate the main issues and challenges that the organizations of the Greek public sector face concerning the whole cycle of IS management. This IS management cycle includes IS planning, development, introduction, operation, use, organization, maintenance and evolution, and generally all the activities undertaken for the exploitation of the capabilities offered by ICTs, for supporting both the time-consuming costly operations, and also the decision making and public-policy planning processes. In this research direction the present study attempts to contribute.

The results of the present study concerning the critical issues of IS management in the Greek public sector are generally interesting and useful to a wide audience: to all researchers, practitioners, professional societies, educational institutions and consulting companies in the areas of both Public Administration and Information Systems, and generally to the entire Public Administration and Information Systems communities. Also the conclusions of this work about Greece, which is a developing country having just become a full member of the European Economic and Monetary Union, are interesting to many other countries, which are developing, but do not belong to the 'avant-garde' of the few highly developed and technologically advanced countries.

In the following Section 2 of this paper is presented a review of the existing literature on critical issues of IS management, while in Section 3 is described the research methodology of the present study. In Section 4 are analysed and discussed the results, and in Section 5 the final conclusions are presented.

2. Literature review

As critical issues of IS management in a public or private organization are defined the most important issues and challenges that the organization faces concerning IS, which deserve the most resources, time and management attention. Extensive research has been conducted worldwide in order to identify and analyse the most critical issues of IS management that organizations face, their relative importance and their evolution in the course of time. The first relevant studies were conducted in USA in the early 80s, and during the 90s the research of IS management critical issues increased significantly and attracted very high interest within both the academic and the professional community worldwide.

Undoubtedly as the most noteworthy of these studies are regarded the ones conducted by the Society for Information Management (SIM) of USA, in cooperation with the MIS Research Center of the University of Minessota and others [5–7,12,37]. These SIM studies, their framework and their methodology, had a significant influence on most of the subsequent relevant studies. The first of these SIM studies was conducted in 1980 [5]. From this study it was concluded that the three most important IS management issues that the respondent organizations expected to face between 1980 and 1985 were 'IS Planning', 'Measuring IS Effectiveness' and 'Telecommunications'. From the same study it was also remarked, and from the subsequent relevant studies it was confirmed, that all top issues were not of the same nature and origin. Therefore in order to facilitate further analysis they should be classified into homogeneous groups. Various classifications have been proposed since then for this purpose.

The main IS management issues can first be classified as 'Technology' issues or 'Management' issues: the 'Technology' issues concern the specification, acquisition, development and operation of various technological components of IS, while the 'Management' issues concern IS strategy, policy, structure, accountability, organization and human resources. Also the same issues can be alternatively classified as 'Internal' issues or 'External' issues: the 'Internal' issues are associated with the internal management of the IS Unit and/or various ICTs, while the 'External' issues are associated with the management of the whole organization or even with its external environment. Another alternative and more detailed classification of IS management issues is into the following four categories: 'Business Relationship' issues (concerning the cooperation and relationship between the IS Unit and the other units of the organization), 'Internal Effectiveness' issues (concerning the measurement and the improvement of the internal effectiveness of the IS Unit), 'Technology Infrastructure' issues and 'Technology Application' issues. The above three classifications of the IS management issues have been confirmed and used in many relevant studies, and are also used in the present study.

In the above first SIM study [5] it was found that 7 out the top 10 IS management issues were 'Management' issues, and only 3 were 'Technical' issues. Also 6 out of the top 10 issues were 'External' ones, and only 4 were 'Internal' issues. Therefore it was concluded that the role of the IS Managers in the early 80s in USA had evolved from initially technical to predominantly managerial, and its orientation had evolved from mainly internal to mainly external, in order to ensure for the high cooperation between the IS Unit and the other units of the organization, required for the development and operation of big and complex IS. This conclusion was in agreement with the 'IT Growth Stages Models' [18,38].

The second SIM study was conducted in 1983 [12]. Again 'IS Planning' was ranked as the most important of the IS management issues that the respondent organizations expected to face between 1983 and 1988, but only 5 out of the top 10 issues of this study were among the top 10 issues of the first study. Also 8 out of the top 10 issues of this second SIM study were 'Management' issues, and only 2 were 'Technology' ones, which means that the importance of the 'Management' issues increased. Generally the critical issues of IS management and their nature are not static. They are subject to significant change

Table 1
The top 10 IS management issues of the fifth SIM study [7]

	IS management issue	M/T	I/E	Group
1	Building a Responsive IT Infrastructure	T	I	TI
2	Business Processes Redesign based on ICTs	M	E	BR
3	Developing and Managing Distributed Systems	T	E	TI
4	Developing an Information Architecture	T	I	TI
5	Telecommunications	T	E	TI
6	Improving Software Development	T	I	IE
7	Effective Use of the Data Resources	M	E	BR
8	IS Human Resources	M	I	IE
9	Aligning the IS Unit within the Organization	M	E	BR
10	IS Strategic Planning	M	E	BR

Notes: – 'M/T' column indicates whether the issue is Management (M) or Technology (T) one; – 'I/E' column indicates whether the issue is Internal (I) or External (E) to IS Unit; – 'Group' column indicates whether the issue is Business Relationship (BR), Internal Effectiveness (IE), Technology Infrastructure (TI) or Technology Application (TA).

over time, as the ICTs are evolving, and at the same time the external economic and legal environment of the organizations evolve as well, resulting in changes of their IS requirements. This conclusion was confirmed from the third SIM study, which was conducted in 1986 [6].

The fourth SIM study was conducted in 1990 [37] and the fifth one in 1994–1995 [7], showing a different trend from the previous ones: an increase of the expected importance of the 'Technology' issues, and especially of the issues concerning 'Technology Infrastructure' (e.g. basic IT Infrastructure, Telecommunications, Distributed Systems, Information Architecture, etc.). In Table 1 we can see the top 10 IS management issues of the above fifth SIM study [7]. We remark that 'Building a Responsive IT Infrastructure' was ranked as the first most important IS management issue and that 5 out of the top 10 issues are 'Technical' issues, having very high ranks. We also remark that 4 out of the top 10 issues are 'Technology Infrastructure' issues, 4 are 'Business Relationship' issues and the remaining 2 are 'Internal Effectiveness' ones.

This 'comeback' of the technological issues in the 90s does not mean that IS managers were reverting back to their previous mainly technical role of the 60s and the 70s [7]. Due to the evolutions of the external environment of the organizations and the continuously increasing demands it posed on them, it became of critical importance in the 90s to implement as quickly as possible a powerful and responsive technology infrastructure. On the contrary the 'Business Relationship' issues, which dominated in the 80s, became less important in the 90s, because organizations had become more aware of the capabilities and the value of the ICTs and more experienced with their practical implementation and usage, therefore the cooperation and the relationship between the IS Unit and the other units of the organization improved and had less problems. Also in the 90s the management of the organizations was focusing more on the rapid IS implementation and less on IS planning and alignment.

Based on the above SIM studies of the IS management critical issues, numerous relevant studies were conducted in USA and in many other developed and developing countries in various geographical regions of the world during the late 80s and the 90s [10,11,13,14,19,21,23,24,26,30,36,39–41,46]. From these studies it was confirmed that IS management issues change significantly in the course of time, making IS management a highly dynamic function. Also based on the results of these studies, a number of interesting secondary international comparative analyses were conducted [20,47,48]. These analyses compare and contrast the findings of studies from many different countries, in order to identify similarities and differences among them, and to determine which of the issues are universal and which are regional.

Table 2
The top 10 IS management issues in Greece [21]

	IS management issue	M/T	I/E	Group	Rank 2000	1997–2000
1	Establish Disaster Recovery Methods	T	I	IE	3	−2
2	Improving IS Security & Control	T	I	IE	1	+1
3	IS Strategic Planning	M	E	BR	6	−3
4	Effective Use of the Data Resources	M	E	BR	5	−1
5	Improving Software Development	T	I	IE	16	−11
6	Telecommunications	T	E	TI	2	+4
7	IS Human Resources	M	I	IE	11	−4
8	Developing an Information Architecture	T	I	TI	10	−2
9	Organizational Location of the IS Unit – Understanding of IS role & contribution	M	E	BR	8	+1
10	Integration of Existing Applications	T	I	TI	7	+3

Notes: – 'M/T' column indicates whether the issue is Management (M) or Technology (T) one; – 'I/E' column indicates whether the issue is Internal (I) or External (E) to IS Unit; – 'Group' column indicates whether the issue is Business Relationship (BR), Internal Effectiveness (IE), Technology Infrastructure (TI) or Technology Application (TA).

An interesting conclusion drawn from these international analyses is that the main IS management issues of the developed countries are to some extent similar [47]. On the contrary many of the IS management issues that the organizations of the developing countries face are different. There are some IS management issues regarded to be important all over the world (referred to as 'universal issues'), however there are many issues regarded as important only in the developing countries and not in the developed ones (referred to as 'developing-country issues'), and also many issues regarded as important only in the developed countries and not in the developing ones (referred to as 'developed-country issues') [30]. Therefore substantial differences are observed internationally in the IS management issues, which are explained by differences mainly in national culture and economic development [48].

Concerning Greece, there have been conducted two main studies of the critical IS management issues in the past by the Athens University of Economics and Business [13,14,21]. The most recent study was conducted in 1997 and was based on the responses of 45 organizations, which were very successful and could be characterized as 'leaders' in their sectors [21]; 24 of them were industrial, 14 were commercial, 6 were in various service sectors and 1 was a public hospital. Therefore in the sample of this study the industry is over-represented and the public sector is under-represented. In Table 2 we can see the main results of this study as to the top 10 most important IS management issues that the respondents were facing at that time (in 1997) and also expected to face after 3 years (in 2000). Some of the critical IS management issues identified in this study for Greece, had been found to have similar ranks, and therefore similar levels of importance, in the corresponding USA studies as well. However some other issues identified for Greece in the above study, had very different levels of importance or did not appear in the corresponding USA studies. Conclusively Greek and USA organizations show some similarities as to the IS management issues they face, however they also show significant differences.

As mentioned above, most of the above research on the IS management critical issues has been directed mainly towards the private sector. Only a few studies have been conducted in order to identify and analyse the main issues that the organizations of the public sector face concerning IS management, alhough the public sector is information-intensive and important user of ICTs. The results of the most representative public sector study [10] conducted in the USA, concerning the IS management issues that public organizations of all public sector levels (federal, state and local) face, are shown in Table 3. An interesting conclusion drawn from this study is that some of the top IS management issues identified for the USA public sector correspond, in a wider sense and very often with a different meaning, to critical

Table 3
The top 10 IS management issues in the public sector of USA [10]

	IS management issue	M/T	I/E	Group
1	Integration of Data Processing, Office Automation & Telecommunications	T	I	TI
2	Comprehensive Planning Integration	M	E	BR
3	Information Requirements Identification	M	E	BR
4	Support End-User Computing	M	E	TA
5	Planning, Implementing & Managing Office Automation	T	I	TA
6	Improving Data Security	T	I	IE
7	Long Term IS Planning	M	E	BR
8	Data Base Management Systems	T	I	TI
9	Distributed Data Processing	T	E	TI
10	Improving Software Maintenance	T	I	IE

Notes: – 'M/T' column indicates whether the issue is Management (M) or Technology (T) one; – 'I/E' column indicates whether the issue is Internal (I) or External (E) to IS Unit; – 'Group' column indicates whether the issue is Business Relationship (BR), Internal Effectiveness (IE), Technology Infrastructure (TI) or Technology Application (TA).

IS management issues of the USA private sector as well. For example the 'Comprehensive Planning Integration', 'Information Requirements Identification' and 'Long Term IS Planning' issues, which as we can see in Table 3 appear in the 2nd, 3rd and 7th positions respectively of the top 10 issues of the USA public sector, correspond to the very important in the USA private sector issue of improving the IS Planning.

However in the same study it is also concluded that there are some notable and pronounced differences between the public and the private sector as to the main IS management issues they face, and that there are some issues unique in the public sector. These unique issues are mainly associated with the lengthy and complex budgeting, procurement, hiring personnel, etc., processes of the public sector, and also with the short-term horizon of politicians. Generally it is concluded that there is a lag in the public sector concerning IS development and usage, in comparison with the private sector. These differences between the public sector and the private sector, concerning IS development and IS management issues, are attributed to some underlying deeper differerences between the two sectors, concerning goals, external environment, internal structure and processes.

3. Research methodology

The present study investigates the critical issues of IS management in the Greek public sector. It is based on 32 structured interviews conducted in early 1999 with IS Managers of Greek public sector organizations, which implemented big IS projects financed by the 2nd European Union Support Framework. The above IS Managers were given a structured questionnaire, which included a list with 37 IS management issues shown in Appendix A. An initial version of this list was synthesized based on previous studies of IS management issues conducted in the USA and Greece, and also on the personal experience of the authors concerning the main problems and issues of IS management that the organizations of the Greek public sector face. This initial list was then reviewed, modified and completed by two highly knowledgeable IS Experts of the Ministry to the Presidency of the Government, which is responsible for the central coordination of the whole Greek Public Sector concerning IS issues, and therefore have a good experience in this area. Finally the above list was pretested for clarity and ease of understanding

Table 4
The top 15 most important current IS management issues in the Greek public sector

	IS management issues	M/T	I/E	Group	2002	2002–1999
1	New IS Human Resources	M	I	IE	6	+5
2	Extending Use of Office Automation	T	I	TA	26	+24
3	Management and Use of Data Resources	M	E	BR	1	−2
4	Developing and Managing EDI	T	E	TI	5	+1
5	Exploitation/Utilization of new ICTs	T	I	TI	2	−3
6	IS Security	T	I	IE	10	+4
7	Building IT Infrastructure	T	I	TI	24	+17
8	IS Strategic Planning	M	E	BR	11	+3
9	IS Human Resources Training	M	I	IE	17	+8
10	Process Redesign based on IS	M	E	BR	7	−3
11	Exploitation/Utilization of modern IS Development Tools	T	I	TA	15	+4
12	Increasing the Compensation of IS Human Resources	M	I	IE	16	+4
13	Management Awareness/Education about IS	M	E	BR	9	−4
14	Utilization of External Data Sources	T	E	TA	13	−1
15	Increasing IS Investment	M	E	BR	8	−7

Notes: – 'M/T' column indicates whether the issue is Management (M) or Technology (T) one; – 'I/E' column indicates whether the issue is Internal (I) or External (E) to IS Unit; – 'Group' column indicates whether the issue is Business Relationship (BR), Internal Effectiveness (IE), Technology Infrastructure (TI) or Technology Application (TA).

by 3 IS employees of the Ministry to the Presidency of Government, and some small additional final modifications were made. It is worth mentioning that the sequence of the above 37 issues was random and different for each respondent.

The respondents were asked to rate, rather than rank, for each issue its current importance at that time (early 1999) and also its expected importance after three years (early 2002), on a 10-point scale, where 10 indicated a very important issue of quite high priority, and 1 indicated an unimportant issue of very low priority. The rating approach was chosen because it is much easier to rate each of the 37 issues independently, than to rank them. Also the above respondents were encouraged to add to the list any additional IS management issue they regarded important for their organization that was not present in the list. Finally there was extensive discussion with the respondents; the respondents were asked to explain their ratings and describe in more detail the most important IS management problems they were facing.

The above ratings given by the respondents for the above 37 IS management issues were processed. For each of these issues were calculated the average rating of its current importance and the average rating of its expected importance after 3 years.

4. Results

4.1. Current IS management issues

In Table 4 we can see the top 15 IS management issues as to the average current rating and therefore as to the current importance. We can see that the most important current IS management issue is to hire 'New IS Human Resources', while it is worth mentioning that in the top 15 issues there are two more issues concerning the IS human resources: 'IS Staff Training' in the 9th position and 'Increasing the Compensation of IS Human Resources' in the 12th position. From the third column of the Table 4 we remark that 8 out of the top 15 issues are 'Management' issues, while the remaining 7 are 'Technology' ones. The most important 'Management' issues are 'New IS Human Resources', 'Management and

Use of Data Resources' and 'IS Strategic Planning', while the most important 'Technology' issues are 'Extending Use of Office Automation', 'Developing and Managing EDI', 'Exploitation/Utilization of new ICTs' and 'IS Security'. From the fourth column of the Table 4 we see that 8 out of the top 15 issues are 'Internal' issues to the IS Unit, while 7 are 'External' ones. Also from the fifth column of the same Table we see that 5 out of the top 15 issues are 'Business Relationships' ones, 4 are 'Internal Effectiveness' issues, 3 are 'Technology Infrastructure' and 3 are 'Technology Application' ones.

The above results shed light on the current profile of the IS management function and of the role of the IS managers in the Greek Public Sector. Qualitatively seen, they confirm the conclusions of previous relevant studies, that the IS management function is a very complex and multidimensional function, dealing with difficult technical and non-technical management issues, and looking both 'inwards' (internal issues to the IS Unit) and 'outwards' (external issues to the IS Unit). Also the results confirm the highly horizontal nature of the IS function: many of its critical issues are 'Business Relationship' ones, concerning the cooperation and relationship between the IS Unit and the other units of the organization, which is necessary in order to exploit the huge capabilities offered by ICTs in the organization to a large extent. Therefore the success of the IS function today depends both on its functional expertise and on its cooperation with the other functions of the organization.

In the sixth column of Table 4 we can see for the top 15 issues their expected ranks after 3 years (in 2002), and in the seventh column we can see the difference rank2002 minus rank1999. A positive difference for an issue means that its importance is expected to decrease in the next 3 years, while a negative difference means that its importance is expected to increase in the next 3 years. We remark that 7 out of the top 10 issues, and 9 out of the top 15 issues, are expected to be less important after 3 years, and therefore to be resolved to some extent. Therefore there is generally an optimism regarding the evolution of the main current IS management issues. The most significant improvements are expected for the issues of 'Extending Use of Office Automation' (+24), 'Building IT Infrastructure' (+17), 'IS Human Resources Training' (+8) and 'New IS Human Resources' (+5), therefore it is believed that these issues will be resolved to a large extent in the next 3 years. On the other side it is expected that some other issues, such as 'Increasing IS Investment' (−7), 'Management Awareness/Education about IS' (−4), etc., will be more important after 3 years.

Also a synthesis was made of the explanations given by the respondents for their ratings and generally of the opinions they expressed about the nature and the details of the IS management issues they were facing. The basic conclusions from this synthesis concerning the top 10 issues are presented in the following paragraphs.

4.1.1. New IS human resources

Nearly all the respondents said that it is of critical importance to hire new IS staff, which is required for monitoring their ongoing and future big IS projects, and also for operating, supporting and managing the new IS that will be developed from these projects. Therefore it is confirmed once more that the shortage of qualified IS staff is the most serious IS management problem of the Greek Public Sector. This problem has been very important for many years since the first introduction of IS in the Greek Public Sector, and has been repeatedly identified and emphasized in numerous relevant studies [3,28,31–34, 43]. However in most public organizations it has not been solved, and has caused them big problems and failures during the 90s concerning the implementation of many important IS projects, financed from the Integrated Mediterranean Programs, the 1st and the 2nd European Union Support Framework or from purely national funds. This shortage of qualified IS staff has become worse due to severe restrictions in public sector appointments, which were decided by the Greek Government during the 90s, in order to decrease budget deficits, and also due to a general shortage of qualified IS staff in the Greek market.

4.1.2. Extending use of office automation

Most of the respondents remarked that many public servants still do not use PCs and basic Office Automation Tools, and do their work on paper, which has a negative impact on their productivity. Therefore it is a high priority issue to plan, implement and generally manage the extension of the use of PCs and Office Automation Tools to all these public servants, as a basic means of increasing the total productivity of public organizations. This issue in the mid 80s was regarded as an important one in both the private and the public sector, and in the first SIM study [5] it was in the 6th position. However it does not not appear in the subsequent studies, which means that it was resolved and a wide use of basic Office Automation was achieved in the late 80s. This issue also appears in the 5th position of the most representative study of the IS management critical issues in the public sector of USA, which was conducted in the early 90s [10]. Taking into account that Office Automation is the basic and simplest form of IS usage, the high rank that this issue has in the Greek Public Sector in the late 90s is an indicator of generally low IS usage.

4.1.3. Management and use of data resources

The public organizations perform 'information intensive' activities: they have many information inputs, which are processed in order to produce many information outputs. Therefore public organizations possess vast data resources, which are continuously growing in size, complexity and value, and are very important for their effectiveness. However, as most of the respondents remarked, these data resources are stored mainly in paper files or in non-integrated isolated electronic files, and remain largely inaccessible and underutilized. For these reasons it is very important for public organizations to develop the required processes, roles, technology and internal culture for managing electronically these data resources in the best possible way, in order to achieve their best exploitation and utilization.

4.1.4. Developing and managing EDI

As mentioned in Section 4.1.3, the public organizations of Greece are characterized by intensive data interchange with their environment, e.g. other Greek public organizations, public organizations of other member-states of the European Union, European Commission, enterprises, citizens, etc. Many of these transactions, such as the ones with the enterprises and citizens, are characterized by big problems, delays, etc., causing discontent and complaints. In order to reduce the cost and increase the speed of all this data interchange it is very important to exploit and utilize the technologies of Electronic Data Interchange (EDI). These technologies have very much improved during the late 90s, and also have moved towards the Internet, therefore their capabilities and interoperability have increased, while their cost has dramatically decreased. The high rank of this issue in the Greek Public Sector shows a positive attitude and interest to develop 'e-Government' capabilities [34], probably influenced by the extensive relevant discussion and developments in many other member-states of the European Union. The e-VAT developed by the Ministry of Finance, and its success and popularity, show clearly the capabilities of these technologies.

4.1.5. Exploitation/utilization of new ICTs

Many of the existing IS in the investigated public organizations are not of modern technologies, but of older ones (e.g. there are many 'legacy' applications developed in 3rd generation languages), therefore their capabilities, interoperability, flexibility and adaptability to new requirements are limited. Many of these older IS should be retired and replaced by new IS based on modern technologies (e.g. on Data Base Management Systems). Also the rapid development of new ICTs (e.g. of the Internet technologies) creates many opportunities for using them in a creative and innovative way, in order to improve significantly their operations, the decision making, the public-policy planning and implementation, and also the transactions with citizens and enterprises.

4.1.6. IS security

Most of the investigated public organizations, even though they have computerized only some of their functions, rely to a large extent on some of their IS, for performing critical activities or even core state functions, and for storing important and sensitive data. In many cases public organizations have severe legal obligations concerning the privacy of the data they collect and store, and especially of the personal data, which must be accessible only to a few authorized public servants and to nobody else. Also the failure of some of their IS can cause severe problems to their operations, to the numerous enterprises and citizens they have transactions with, and generally to many social and economic activities On the other hand the IS security risks continuously increase, because the number and the sophistication of their users increases, these users are more distributed in many networked buildings, which very often are located in many different cities. Also the access of numerous uknown external users to the internal IS of many organizations via Internet creates additional IS security risks. Therefore the respondents regard the security of IS as very important, concerning IS access control, availability, integrity, etc. However most of the respondents recognized that they do not have the required expertise on the rapidly advancing IS security technologies and that they need extensive training in this area.

4.1.7. Building IT infrastructure

Public organizations usually have a number of separate and technologically heterogeneous IS, each of them supporting a different function. Typically some of them have been developed in the past and are of older technology, while some others have been developed recently and are of more modern technology. Therefore it is very important for them to build a modern unified IT infrastructure, which can support and integrate the existing applications, incorporate the advances of the ICTs in the future, and also enable the quick change of the existing applications and the quick development and operation of new ones, so that they can respond quickly to new demands posed by their turbulent environment. On the high importance of this issue agree most of the studies of IS management critical issues, which have been conducted during the 90s. As mentioned in Section 2 in the most recent SIM study in USA [7] 'Building a Responsive IT Infrastructure' was ranked as the first most critical IS management issue.

4.1.8. IS strategic planning

Most of the respondents said that their past IS developments have not been based on a long-range plan. However they believe that their future IS developments should be based on a long-range IS Strategic Plan, determining which IS should be developed, the priorities, the implementation strategy, the necessary resources, etc., and also determining the common technological architecture and characteristics that all these IS should follow. This IS Strategic Plan should be closely associated with the general Strategic-Business Plan of the organization. This issue has been among the most critical IS management issues in nearly many relevant studies during the 80s and the 90s worldwide, which shows its importance and also its difficulty. The practical problems of IS Strategic Planning were also stressed extensively by all respondents. The first problem is the lack of a general Strategic-Business Plan in many public organizations and the frequent changes of their main directions. Politics very often disrupt severely the long-range planning of the public organizations, which has a very negative impact on their IS planning and on their big IS projects. This problem has also been mentioned in many other studies of the IS management issues in the public sector (e.g. [10]). A very useful measure, which has been taken in Greece for reducing these frequent changes, is the obligation by law of all Public Enterprises of Common Benefit (but not of the Ministries) to develop a three years Strategic & Business Plan, which includes the general strategy & directions and the corresponding functional plans (e.g. financial plan, IS plan, etc.). Another

very useful measure is the obligation of Ministries to submit to the Ministry of National Economy and Finance, not one-year budgets, but three-years budgets, justified with corresponding three-years action plans (where all IS development plans should be included). The second problem of IS Strategic Planning is that public organizations do not have the required expertise. For this reason, in order to develop the IS plans required by the European Union for financing IS projects, private consulting companies were used by many public organizations. It would be very interesting to evaluate the contribution of these private consulting companies, as to both the completeness, the adequacy and the quality of the IS plans they developed, and also the relevant expertise they transferred to the public organizations.

4.1.9. IS human resources training

Except the shortage of qualified IS staff, which as mentioned above in Section 4.1.1 is the most serious IS management problem in the Greek Public Sector, the proper development and training of the existing IS staff is also an important issue. Most of the existing IS staff have a good expertise in the older ICTs (e.g. many of them are very good COBOL programmers), but they do not have the required expertise in many critical new ICTs (e.g. in Data Base Management Systems, in Networks, in Internet technologies, in IS security, etc.). This is due to the very rapid development of ICTs and the increased requirements of the public organizations, demanding applications with more, broader and deeper functionalities. Therefore the IS staff today need a much bigger set of ICTs skills than in the past. In order to train the existing IS staff of the public organizations the National Academy of Public Administration organizes many short seminars (typically of 1–2 weeks duration). Also in all IS procurement contracts are included training services. However more training is required, and also more motivation for the existing IS staff to learn the new ICTs.

4.1.10. Process redesign based on IS

The existing experience from using ICTs in private and public organizations has proved that most benefits can be achieved by using IS not merely to automate existing processes, but also to reengineer and improve them, and to enrich them with new useful value adding processes and activities that did not exist before [16,22]. Most respondents believe that it is necessary to redesign the core processes of their organizations, based on the capabilities of modern ICTs, which can become facilitators and enablers of radical innovations. This is very important, since many of these processes are quite lengthy and complex, resulting in high operating costs and at the same time discontent and complaints from the citizens and the enterprises.

4.2. IS management issues after 3 years

In Table 5 we can see the expected top 15 IS management issues after 3 years, sorted according to the average rating of their expected importance after 3 years. We can see that the 'Management and Use of Data Resources' is expected to be the most important IS management issue, followed by the 'Exploitation/Utilization of new ICTs' and the 'Outsourcing of Software Development'. We also remark that among the expected top 15 IS management issues after 3 years there are 4 new issues (27%): 'Outsourcing of Software Development' in the 3rd position, 'IS Support of Organizational Learning and Environmental Scanning' in the 4th position, 'Using IS for Strategic Advantages' in the 12th position and 'Development/Improvement of Telecommunications' in the 14th position. Therefore about one third of the main agenda faced by IS management is expected to change within three years, confirming the highly dynamic nature of the IS management function.

Table 5
The expected top 15 most important IS management issues in the Greek public sector after 3 years

	IS Management Issues	M/T	I/E	Gr	1999	1999–2002
1	Management and Use of Data Resources	M	E	BR	3	+2
2	Exploitation/Utilization of new ICTs	T	I	TI	5	+3
3	Outsourcing of Software Development	M	E	IE	18	+15
4	IS Support of Organizational Learning and Environmental Scanning	M	E	BR	22	+18
5	Developing and Managing EDI	T	E	TI	4	−1
6	New IS Human Resources	M	I	IE	1	−5
7	Process Redesign based on IS	M	E	BR	10	+3
8	Increasing IS Investment	M	E	BR	15	+7
9	Management Awareness/Education about IS	M	E	BR	13	+4
10	IS Security	T	I	IE	6	−4
11	IS Strategic Planning	M	E	BR	8	−3
12	Using IS for Strategic Advantages	M	E	BR	28	+16
13	Utilization of External Data Sources	T	E	TA	14	+1
14	Development / Improvement of Telecommunications	T	E	TI	26	+12
15	Exploitation/Utilization of modern IS Development Tools	T	I	TA	11	−4

Notes: – 'M/T' column indicates whether the issue is Management (M) or Technology (T) one; – 'I/E' column indicates whether the issue is Internal (I) or External (E) to IS Unit; – 'Group' column indicates whether the issue is Business Relationship (BR), Internal Effectiveness (IE), Technology Infrastructure (TI) or Technology Application (TA).

From the third column of the Table 5 we remark that 9 out of the expected top 15 issues after 3 years are 'Management' issues, while the other 6 are 'Technology' ones. From the fourth column we can see that only 4 are 'Internal' issues to the IS Unit, while the other 11 are 'External' ones. Also from the fifth column we see that 7 out of the expected top 15 issues after 3 years are 'Business Relationships' ones, 3 are 'Internal Effectiveness' issues, 3 are 'Technology Infrastructure' and 2 are 'Technology Application' ones.

In comparison with the current top 15 IS management issues (Table 4), we remark that among the above expected top 15 IS management issues after 3 years there are more 'Management' issues, more 'External' issues and more 'Business Relationships' issues than currently. Therefore the profile of the IS management function and of the role of the IS manager in the Greek Public Sector is expected to evolve in the next 3 years and become more management-oriented and more outward-looking. The respondents believe that more cooperation and relationships should be built between the IS Unit and the other units, in order to achieve more sophisticated use of ICTs in the organization, resulting in higher level benefits (according to Farbey's model in [16]), such as support of organizational learning & environmental scanning, strategic advantages, etc.

In the sixth column of the same table we can see for the expected top 15 issues after 3 years their current ranks (in 1999), while in the seventh column we can see the difference rank1999 minus rank2002. A positive difference for an issue means that its importance is expected to increase in the next 3 years, while a negative difference means that its importance is expected to decrease in the next 3 years. We can see that the issues whose importance is expected to increase most in the next 3 years are 'IS Support of Organizational Learning and Environmental Scanning' (+18), 'Using IS for Strategic Advantages' (+16), 'Outsourcing of Software Development' (+15) and 'Development – Improvement of Telecommunications' (+12).

Table 6
Comparison of the results of the present study with the results of previous studies of IS management issues

	IS management issues	Greece-priv		USA-priv		USA-publ	
		rank	diff	rank	diff	rank	diff
1	New IS Human Resources	7	+6	8	+7	22	+21
2	Extending Use of Office Automation	—	—	—	—	5	+3
3	Management and Use of Data Resources	4	+1	7	+4	20	+17
4	Developing and Managing EDI	25	+21	19	+15	—	—
5	Exploitation/Utilization of new ICTs	—	—	—	—	—	—
6	IS Security	2	−4	—	—	6	0
7	Building IT Infrastructure	11	+4	1	−6	—	—
8	IS Strategic Planning	3	−5	10	+2	7	−1
9	IS Human Resources Training	7	−2	8	−1	22	+13
10	Process Redesign based on IS	—	—	2	−8	—	—
11	Exploitation/Utilization of modern IS Development Tools	21	+10	—	—	23	+12
12	Increasing the Compensation of IS Human Resources	7	−5	8	−4	22	+10
13	Management Awareness/Education about IS	—	—	—	—	15	+2
14	Utilization of External Data Sources	—	—	—	—	30	+16
15	Increasing IS Investment	—	—	—	—	—	—

4.3. Comparison with other Studies of IS Management Critical Issues

The results of the present study were compared with the results of the following three previous studies of IS Management Critical Issues:

i) the Study of the IS Management Critical Issues in the private sector of Greece, conducted by the Athens University of Economics and Business [21],

ii) the most recent SIM Study of the IS Management Critical Issues in the private sector of USA [7],

iii) and the Study of the IS Management Critical Issues in the public sector of USA [10].

The above three studies have been reviewed in Section 2.

In Table 6 we can see, for each of the current top 15 most important IS management issues of the present study, its rank in each of the above three studies, and also the difference between this rank and its rank in the present study. In some cases, where an issue appears in two studies with different names and slightly different meanings, the proper mapping was done between them after careful examination of names and meanings.

A first comparison of the top 15 Greek public sector issues of the present study, with the top 15 Greek private sector issues of the above study (i), shows that in both studies the frequencies of the various classifications and groupings of issues are similar: in both studies the top 15 issues contain 8 'Management' +7 'Technology' issues, 8 'Internal' +7 'External' ones, and also 5 'Business Relationship' +3 'Technology Infrastructure' issues. The only difference is that the top 15 public sector issues of the present study contain 4 'Internal Effectiveness' +3 'Technology Application' issues, while the top 15 issues of the private sector contain 6 'Internal Effectiveness' +1 'Technology Application' issue. Therefore the IS management of the Greek private sector puts more emphasis on the internal effectiveness of the IS Unit, but has less problems in applying some useful ICTs, in comparison with the Greek public sector. A detailed comparison of the issues shows that from the top 15 Greek public sector issues of the present study, 7 are among the top 15 issues of the Greek private sector as well (47%), but with different positions, and 2 more issues are among the 25 issues identified totally for the Greek private sector, but in much lower positions, while the remaining 6 are not among the 25 issues of the private sector list (40%). These 6 issues are 'Expansion of Office Automation', 'Exploitation/Utilization of new ICTs',

'Management Awareness/Education about IS', 'Utilization of External Data Sources', 'Increasing IS Investment', which have probably been resolved to some extent in the private sector, and also 'Process Redesign based on IS', which is much more important in the public sector, because of its extremely lengthy and complex processes. Some of the above differences may also be due to time difference: the above private sector study was conducted about 2 years before the present public sector study. From the above comparison it is finally concluded that between the public and the private sector of Greece there are some similarities as to the main IS management issues they face (about half of the main issues are common), but there are also some differences.

By comparing the top 15 Greek public sector issues of the present study, with the top 15 issues of the above SIM study (ii) of the IS Management Critical Issues in the private sector of USA, we can see that in the latter there are more 'External' issues (+2), more 'Business Relationship' issues (+1) and more 'Technology Infrastructure' issues (+1), in comparison with the former. Therefore the IS management in the USA private sector is more 'outwards-looking', in comparison with the public sector of Greece, and also puts more emphasis on the cooperation and the relationships between the IS Unit and the other units, and on the development of technological infrastructure. A detailed comparison of the issues shows that from the top 15 Greek public sector issues of the present study, 7 are among the top 15 issues of the USA private sector as well (47%), 1 more issue is among the 20 issues identified totally for the USA private sector, but in much lower position, while the remaining 7 are not among the 20 issues of the USA private sector list (47%). These 7 issues are 'Expansion of Office Automation', 'Exploitation/Utilization of new ICTs', 'Exploitation/Utilization of modern IS Development Tools', 'Management Awareness/Education about IS', 'Utilization of External Data Sources', 'Increasing IS Investment', which have probably been resolved to some extent in the USA private sector, and also 'IS Security'. The reason for not having the 'IS Security' in the issues of the USA private sector study, and also for many of the other differences between the two studies, is the time difference between them: the USA private sector study was conducted about 4 years before the present public sector study. From the above comparison it is finally concluded that between the Greek public sector and the USA private sector there are some similarities as to the main IS management issues they face (about half of the main issues are common), but there are also important differences. Also it is concluded that the degree of similarity between the Greek public sector and the USA private sector as to the main IS management issues they face is lower than the one between Greek public and private sector.

Finally comparing the top 15 Greek public sector issues of the present study, with the top 15 issues of the above study (iii) of the IS Management Critical Issues in the USA public sector, we can see that in the latter there are more 'External' issues (+1) and more 'Technology Application' (+2) issues, but also less 'Management' issues (−2) less 'Business Relationship' issues (−1) and less 'Internal Effectiveness' issues (−1), in comparison with the former. Therefore the IS management in the public sector of the USA seems to be more technology oriented and less management oriented, in comparison with the public sector of Greece. This difference is mainly due to time difference : the above USA public sector study was conducted about 9 years before the present Greek public sector study. A detailed comparison of the issues shows that from the top 15 Greek public sector issues of the present study, 4 are among the top 15 issues of the USA public sector as well (27%), 6 more issues are among the 37 issues identified totally for the USA public sector, but in much lower positions, while the remaining 5 are not among the 37 issues of the USA private sector list (33%). These 5 issues are 'Developing and Managing EDI', 'Exploitation/Utilization of new ICTs', 'Building IT Infrastructure', 'Process Redesign based on IS', 'Increasing IS Investment'. Many of these differences are also due to the time difference between the two studies. From the above comparison it is finally concluded that between the Greek public sector and

the USA public sector there are less similarities as to the main IS management issues they face (about 30% of the main issues are common), and more differences, probably due to different extent and level of ICTs usage and also the time difference between the two studies.

5. Conclusions

In the present study we investigated the main issues and challenges that the organizations of the Greek Public Sector face concerning the whole cycle of IS management. We concluded that the most important current IS management issue is to hire 'New IS Human Resources', followed by the issues of 'Extending Use of Office Automation' and of 'Management and Use of Data Resources'. It is worth mentioning that among the top 15 most important IS management issues there are two more issues concerning the IS human resources: 'IS Staff Training' and 'Increasing the Compensation of IS Human Resources', showing the criticality and the difficulty of the IS human resources issue for the Greek public organizations. Possible reasons are the chronic shortage of qualified IS staff in the Greek Public Sector, the big requirements for IS staff to monitor the ongoing and future IS projects (e.g. of the 2nd and the 3rd European Union Support Frameworks, etc.) and to operate, support and manage the new IS that will be developed from these projects, the general shortage of qualified IS staff in the Greek market and the public sector compensation system. Taking into account that Office Automation is the basic and simplest form of IS usage, the high rank and importance (2nd position) of this issue in the Greek Public Sector is an indicator of generally low IS usage. Also from the study of the top 15 issues is concluded the need for more management awareness and also for a more strategic approach concerning IS, which should be accompanied by higher investment on IS.

The results of the present study shed light on the current profile of the IS management function and of the role of the IS managers in the Greek Public Sector, which is highly complex and multidimensional, containing many both technical and non-technical management issues, looking both 'inwards' (inside the IS Unit) and 'outwards' (out of the IS Unit, towards the other units, the upper management and the external environment of the organization). The results confirm the highly horizontal nature of the IS function: many of its critical issues are 'Business Relationship' ones, concerning the cooperation and relationship between the IS Unit and the other units of the organization, which is necessary in order to exploit fully the capabilities offered by ICTs and proceed to bigger and more sophisticated applications.

Concerning the near future, the 'Management and Use of Data Resources' is expected to be the most important IS management issue in the Greek Public Sector after 3 years, followed by the 'Exploitation/Utilization of new ICTs' and the 'Outsourcing of Software Development'. Also, from the study of the expected top 15 IS management issues after 3 years, it is concluded that about one third of the main agenda currently faced by IS management is expected to change within three years, confirming the highly dynamic nature of the IS management function. Also it is concluded that many critical current issues are expected to be much less important – and therefore resolved to a large extent – after 3 years, showing a general optimism regarding the evolution of the main current IS management issues.

The results of the present study were compared with the results of three previous studies of IS Management Critical Issues conducted in Greece and in USA. It is finally concluded that between the public sector of Greece on one hand, and the private sector or Greece and also the USA private and public sector on the other, there are similarities as to the main IS management issues they face, but there are also differences. Therefore some of the main IS management issues are universal, while some others are specific to particular sectoral and national contexts. The profile of the IS management function and

the role of the IS manager are not only complex, multi-dimensional and dynamic, but they also highly dependent on the sectoral and national context.

The results of the present study are generally interesting and useful to a wide audience: to researchers, practitioners, professional societies, educational institutions and consulting companies in the areas of both Public Administration and Information Systems, and generally to the entire Public Administration and Information Systems communities. Also the conclusions of this work about Greece – a developing country having just become a full member of the European Economic and Monetary Union – are interesting to many other countries, which are developing, but do not belong to the 'avant-garde' of the few highly developed and technologically advanced countries.

Appendix A. Information systems management issues

- Building the IT Infrastructure.
- Harmonization of the IS Strategic Planning with the general Strategic Planning of the Organization.
- Effective Management and Use of the Data Resources (computerized and non-computerized ones) of the Organization.
- Training existing IS Human Resources.
- New IS Human Resources.
- Using IS for achieving Strategic Advantages.
- Rational and Systematic IS Strategic Planning
- Increasing the Hierarchical Level of the IS Unit
- Processes Redesign based on IS
- Development / Improvement of Telecommunications
- Improving the Quality of the (internally or externally developed) Software
- Management and Coordination of End-User Computing
- Interconnecting existing IS of different Vendors/Technologies
- Objective Measurement of IS Effectiveness and Productivity
- IS Security
- Increasing IS Investment
- Management Awareness and Education about IS
- Exploitation and Utilization of new ICTs
- Exploitation and Utilization of 4th Generation Languages
- Establishment of an IS Development Methodology
- Exploitation and Utilization of Modern IS Development Tools
- Extensing Use of Office Automation
- Development of Management Information Systems (MIS) and Decision Support Systems (DSS), or Extension of Existing IS in these directions, for Supporting Planning and Decision Making
- Increasing the Compensation of IS Human Resources
- Increasing Support to the Users (of the existing Applications or Office Automation)
- Improving IS project management methods
- Exploitation and Utilization of Expert Systems and Artificial Intelligence
- Utilization of External Data Sources
- Increasing the Involvement of the Managers of the other Functions and of the Political Officials in IS Strategic Planning
- Reduction of IS Cost

- Increase of the Productivity of the IS Unit
- IS Support of Organizational Learning and Environmental Scanning
- Operation and Improvement of existing Applications
- Electronic Data Interchange (EDI) with citizen, enterprises, other public organizations, etc.
- Outsourcing of Software Development
- Outsourcing of IS Operations
- Ousourcing of Studies

References

[1] I.O. Angel and S. Smithson, *Information Systems Management: Opportunities and Risks,* Mc-Millan, Basingstoke, 1991.
[2] L.M. Applegate, F.W. McFarlan and J. McKenney, *Corporate Information Systems Management,* Mc-Graw-Hill, 1999.
[3] Athens Technology Center, *Annual Evaluation Report of the Integrated Mediterranean Programs on Information Technology,* Athens, 1994.
[4] C. Avgerou and G. Doukidis, Information systems in Greece: the need for context related research, *European Journal of Information Systems* 2(2) (1993), 69–75.
[5] L. Ball and R. Harris, SMIS Members: A Membership Analysis, *MIS Quarterly* 6(1) (1982), 19–38.
[6] J.C. Brancheau and J.C. Wetherbe, Key Issues in Information Systems Management, *MIS Quarterly* 11(1) (1987), 23–45.
[7] J.C. Brancheau, B.D. Janz and J.C. Wetherbe, Key Issues in Information Systems Management: 1994–1995 SIM Delphi Results, *MIS Quarterly* 20(2) (1996), 23–45.
[8] E. Brynjolfsson, The productivity paradox of information technology: review and assessment, *Communications of the ACM* 36(12) (1993), 67–77.
[9] E. Brynjolfsson and L. Hitt, Paradox lost? Firm-level Evidence on the Returns to Information Systems Spending, *Management Science* 42(4) (1996), 541–558.
[10] S. Caudle, W. Gorr and K. Newcomer, Key Information Systems Management Issues for the Public Sector, *MIS Quarterly* 15(2) (1991), 170–188.
[11] A. Dekleva and J. Jupancic, Key issues in information systems management: a Delphi study in Slovenia, *Information and Management* 31(1) (1996), 1–11.
[12] G. Dickson, J. Leitheiser, J. Wetherbe and M. Nechis, Key Information Systems Issues in the 1980s, *MIS Quarterly* 8(3) (1984), 135–148.
[13] G. Doukidis, S. Smithson and G. Naoum, Information Systems Management in Greece: Issues and Perceptions, *Journal of Strategic Information Systems* 1(2) (1992), 63–75.
[14] G. Doukidis and S. Smithson, *Information Systems in the National Context: The Case of Greece,* Avebury, Aldershot England, Brookfield USA, 1995.
[15] M. Earl, *Management Strategies for Information Technology,* Prentice Hall International, London, 1989.
[16] B. Farbey, F. Land and D. Targett, A taxonomy of information systems applications: the benefits' evaluation ladder, *European Journal of Information Systems* 4 (1995), 41–50.
[17] B. Farbey, F. Land and D. Targett, Moving IS Evaluation forward: learning themes and research issues, *Journal of Strategic Information Systems* (1999), 189–207.
[18] R. Galliers and A. Sutherland, Information Systems Management and Strategy Formulation: The Stages of Growth Model Revisited, *Journal of Information Systems* 1 (1991), 89–114.
[19] R. Galliers, Y. Merali and L. Spearing, Coping with Information Technology – How British Executives Perceive the Key Information Systems Management Issues in the Mid 1990s, *Journal of Information Technology* 9 (1994), 223–238.
[20] P. Gottschalk, Studies of key issues in IS management around the world, *International Journal of Information Management* 20 (2000), 169–180.
[21] Greek ICT Market, *Annual Index for the Greek Information and Communications (ICT) Market,* Teamworks Editions, Athens, 2000.
[22] M. Hammer, *Reengineering Work: don't Automate, Obliterate,* Harvard Business Review, July–August 1990, pp. 104–112.
[23] S. Hayne and C. Pollard, A comparative analysis of critical issues facing Canadian information systems personnel: a national and global perspective, *Information and Management* 38(10) (2000), 38–76.
[24] H.-L. Yang, Key information management issues in Taiwan, *Information and Management* 30 (2000), 73–86.
[25] E. Huerta and P. Sanchez, Evaluation of information technology: strategies in Spanish firms, *European Journal of Information Systems* 8 (1999), 273–283.

[26] H.-W. Chou and S.-B. Jou, MIS key issues in Taiwan's enterprises, *International Journal of Information Management* **19** (1999), 369–387.

[27] G. Lagrond, *Reorganization of Public Administration in Greece,* OECD, Paris, 1965.

[28] E. Loukis and N. Michalopoulos, Information Technology and Organizational Structure of the Greek Public Administration, *International Journal of Public Administration* (Autumn 1993).

[29] H. Lucas, *Information Technology and the Productivity Paradox – Assessing the Value of Investing in IT,* Oxford University Press, 1999.

[30] F. Mata and W. Fuerst, Information systems management issues in Central America: a multinational and comparative study, *Journal of Strategic Information Systems* **6** (1997), 173–202.

[31] Ministry of National Economy, *Final Report of Integrated Mediterranean Programs on Information Technology,* Athens, 1994.

[32] Ministry to the Presidency of the Government, *Program of Administrative Modernization 1993–1995,* Athens, 1993.

[33] Ministry to the Presidency of the Government, *Operational Program 'Klisthenis' for the Modernization of the Greek Public Administration,* European Community Support Framework II, Athens, 1994.

[34] Ministry of National Economy, *Operational Program 'Information Society',* European Union Support Framework III, Athens, 2001.

[35] B. McNurlin and R. Sprague, *Information Systems Management in Practice,* Prentice-Hall International, USA, 1989.

[36] T. Moores, Key issues in the management of information systems: A Hong Kong perspective, *Information and Management* **30** (1996), 301–307.

[37] F. Niederman, J.C. Brancheau and J.C. Wetherbe, Information Systems Management Issues in the 1990s, *MIS Quarterly* **15**(4) (1991), 474–499.

[38] R. Nolan, Managing the Advanced Stages of Computer Technology: Key Research Issues, in: *The Information System Research Challenge,* F. McFarlan, ed., Harvard Business School Press, 1984.

[39] T. Parker and M. Indundun, Managing Information Systems in 1987: The Top Issues for IS Managers in the UK, *Journal of Information Technology* **3**(1) (1988), 34–42.

[40] D.J. Silk, Current Issues in Information Management, *International Journal of Information Management* **9**(2) (1989), 85–89.

[41] D.J. Silk, Current Issues in Information Management – Update, *International Journal of Information Management* **10**(3) (1990), 178–181.

[42] T. Stratopoulos and B. Dehning, Does successful investment in information technology solve the productivity paradox? *Information and Management* **38** (2000), 103–117.

[43] N. Tsouma, *A Study of the Information Technology Actions of the Second European Community Support Framework,* Final Thesis, National Academy of Public Administration, 1997.

[44] K. Varvaressos, Report on the Greek Economic Problem, Washington, DC, 1952.

[45] J. Ward, P. Taylor and P. Bond, Evaluation and Realisation of IS/IT Benefits: An Empirical Study of Current Practice, *European Journal of Information Systems* **4** (1996), 214–225.

[46] R. Watson, Key issues in information systems management: an Australian perspective – 1988, *Australian Computer Journal* **21**(3) (1989), 118–129.

[47] R. Watson and J. Brancheau, Key issues in information management: An international perspective, *Information and Management* **20** (1991), 213–223.

[48] R. Watson, G. Kelly, R. Galliers and J. Brancheau, Key issues in Information Systems Management: An International Perspective, *Journal of Management Information Systems* **13**(4) (1997), 91–115.

[49] L. Willcocks and H. Margetts, Risk Assessment and Information Systems, *European Journal of Information Systems* **3**(2) (1994), 127–138.