DESIGNING A POSTGRADUATE CURRICULUM
IN INFORMATION SYSTEMS: A GREEK CASE [CASE STUDY]

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ABSTRACT

The design of an IS postgraduate curriculum may take as staring point existing model curricula and guidelines. However, the landscape of Information Systems, as well as the needs of the target market continuously changes. Additionally, the idiosyncrasies of the specific local academic and business environments (e.g. existing undergraduates programmes and local market needs), either purposefully or implicitly, pervade the design of curricula or influence their development. As part of the research undertaken to ascertain the content and direction for a new postgraduate curriculum in IS, several activities were

carried out, including a study of existing curricula worldwide, a survey and study of the global and national landscapes of IS curricula, both undergraduate and postgraduate, and of the needs of local IS industry. This paper describes the approach taken and the resulting postgraduate IS curriculum, and highlights how this approach can be used by others and adapted to their needs.

1   INTRODUCTION

The field of information systems is one of the most developing and rapidly changing. The dynamic nature of this field is affected by the continuous changes of market needs and by significant developments in the academic and scientific area. IS departments have to offer studies at both undergraduate and postgraduate levels that cover current market needs, that can easily adapt to future employment environments that will provide IS professionals the ability to develop their careers in a continuously changing field.

The task of designing IS curricula requires knowledge of the status and future trends of related studies as well as the current and future market needs. The current status of the IS academic field is blurred due to a number of factors, such as economic development, and the background and legal status of the institutions. This is reflected in variations in the curricula offered. For example, the content of an IS curriculum can reflect the philosophy of the school or department in which this is located, or the needs of the local IS industry.

In order to design a postgraduate curriculum in IS, specific factors have to be considered, such as the regional market environment, the profile of the candidate postgraduate student and the level of studies that can be offered by the particular academic institution, taking into account the corresponding undergraduate programme(s). Issues such as the educational and the information systems research and development policy of each country and the regional advancement of IS research and education need be studied before embarking on the design of such a curriculum.

This paper describes the approach taken for studying global and Greek landscape of the IS academic field at both undergraduate and postgraduate levels, the industry needs for IS skills in Greece, and existing models and guidelines for IS curricula design. These activities were undertaken in order to elaborate the design of a postgraduate curriculum in IS, for the Department of Information and Communication Systems at the University of the Aegean.

The paper is structured as follows: the next section presents related work, in terms of curriculum models and guidelines and curriculum studies. Section 3 describes in detail the approach taken to design a postgraduate information systems curriculum in Greece, the methods used, and the results obtained. Finally, section four describes the structure and the content of the curriculum and summarises the benefits of the approach and the resulting curriculum structure.

2   RELATED WORK

The growth of the IS field during the last decades and its emerging importance for the operation of organisations has led to many curricula studies pertaining to IS. The variations between those curricula and the difficulty to assess industry needs have created a requirement for the development of a 'common language' among academic institutions and industry that model curricula and curricula studies try to go some way to deal with, by identifying key areas and where these need addressing.

Existing models and guidelines for designing IS curricula are either generic (Davis et al, 1997; Gorgone et al, 2000), or focus on key aspects of IS, such as management (Organizational & End-user Information Systems Curriculum Model (OEIS) (OSRA, 1996)) or Information Resource Management (IRMA/DAMA Curriculum Model for undergraduate studies in Information Resource Management (IRMA-DAMA, 2000)).

As an example of this latter category, the IRMA-DAMA curriculum model prepares the students to understand the concepts of information resource management and make use of technologies, methods and management procedures to collect, analyse and disseminate information throughout organisations in order to remain competitive in the global business world. This curriculum model addresses the needs of undergraduate students currently employed or seeking employment in the Information Resource Management field and of all business students (IRMA-DAMA, 2000).

More genericfocussed efforts for IS curricula design are the IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in IS (Davis et al, 1997), developed by the Association for Computing Machinery (ACM), the Association for Information Systems (AIS) and Association of Information Technology Professionals (AITP), and the MSIS 2000 Model Curriculum and Guidelines for Graduate Degree Programs in Information Systems (Gorgone et al, 2000), developed by the ACM and AIS.

One of the main objectives of these curricula models is to make sure that graduates have the qualifications to operate in a dynamic market environment. The models provide guidelines, a set of courses, source materials, curriculum design objectives, and knowledge elements.

For instance, IS'97 suggests an undergraduate curriculum with coursework organised programmatically in three levels: general courses in IS; specialised information technology and application design; specialised application development, deployment, and project management. Graduates are '…*qualified for entry level information systems positions with a basis for conditioned career growth*'. The model reflects industry requests for emphasis in both technical and organisational skills. Following on from this, the MSIS 2000 model for postgraduate studies pays more attention to managerial issues, including business and IS courses, aiming to provide graduates with qualifications that can enable them to cope with management aspects of IS in an organisation.

These models and guidelines for designing IS curricula are very useful. The advantages from the adoption of a curriculum model include:

- Improving responsiveness between industry needs and studies offered;

- Allowing industry to most effectively assess the expertise level of the graduates;

- Assisting curriculum designers to work according to specific guidelines that can make their work more effective;

- Easing the curricula evaluation process;

However, those curriculum models are based on common structures and degree programmes that are familiar to the organisations that have developed them, as IS'97 report explicitly points out (Davis et al, 1997). Therefore assumptions about the development of the IS academic field and market needs may not be fully applicable to other countries. Furthermore, MSIS 2000 is the only model that refers to the design of postgraduate curricula in IS and has not been really deployed due to its recent publication.

In addition to the work on developing curriculum models, during the last few years, surveys studying the academic status of IS have been developed (Gorgone, 1997; Avgerou et al, 1999) in order to assess several issues regarding the academic field of IS. The analysis of the academic field of IS is a very difficult task due to the various perspectives among academic institutions and different countries.

Within Europe the teaching of IS subjects focuses mainly on IS development, secondly in management and technologies, and less emphasis is given on aspects of impact, ethics and policy. (Avgerou et al, 1999). Additionally, IS postgraduate curricula are located not only in information systems schools and institutes of technology but also in business/management schools. In the United States 51% of the MSc in IS are located in business schools (Gorgone et al, 1997). Also, there are many postgraduate curricula using the term 'management' in their title, such as 'IS management'. This is also pointed out by Gorgone et al that 31% of the MSc programmes in the United States use the degree name 'Management of Information Systems' (Gorgone et al, 1997). These remarks show that the emphasis in IS postgraduate curricula is placed largely on management issues.

According to Avgerou, most university units in Europe do not offer undergraduate IS degrees but IS subjects taught within undergraduate degrees of a different specialisation (Avgerou et al, 1999). In postgraduate degrees, the difference between the proportions of teaching in IS degrees and teaching IS themes in other degrees is considerably narrower. Therefore, postgraduate students in IS degrees are typically characterised by different backgrounds and consequently an IS postgraduate curriculum should offer studies that students from different backgrounds can attend.

3   DESIGN OF A POSTGRADUATE INFORMATION SYSTEMS CURRICULUM

Existing models for IS curriculum development take into consideration at a global level the status of the IS academic field and market needs. However, these models need to be further elaborated to accommodate recent advances in the academic field and market as well as other regional issues. Gorgone states that *'it is recognised that schools will vary in the specialisations they offer in preparations for a career, with each school offering its own unique alternative, determined by faculty skills and local needs'* (Gorgone et al, 2000). Furthermore, according to the ITAA report it is proposed that: *'every university should seek to establish a local alliance to gain meaningful input on how to make course offering more relevant and up-to-date'* (ITAA, 1999). These remarks can be graphically represented in the following figure (Figure 1).
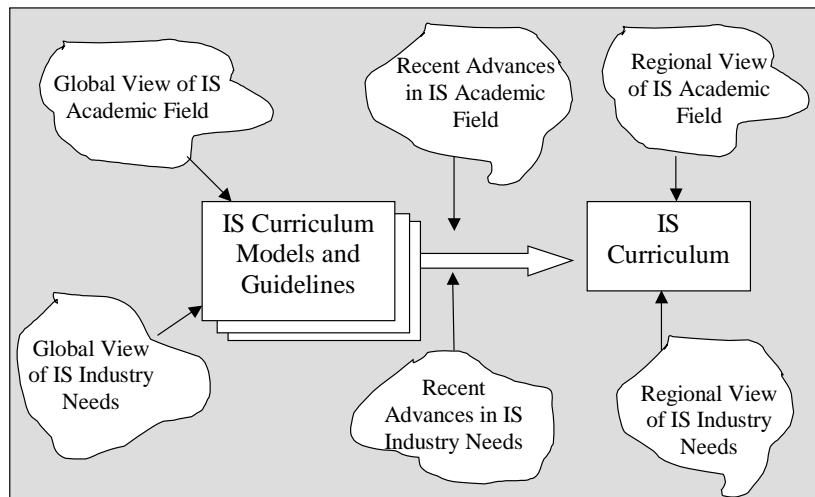
Figure 1: Conceptual View of the Contributing Factors for Designing an IS Curriculum

In order to design the postgraduate IS curriculum for the Department of Information and Communication Systems at the University of the Aegean, the approach taken includes a study of all the above issues, apart from the study of the recent advances of global market needs. These were not thoroughly investigated at this phase, since very few foreign students attend Greek postgraduate programmes (Eurostat, 2000; SOCRATES, 1997) and the demand for well skilled IS professionals in Greece is presently larger than the current supply. However, it is intended that the postgraduate IS curriculum is flexible enough to react to such data, as and when it is collected.

The following subsections describe the activities carried out by the University of the Aegean, as part of the research in RESINFO (Final Report of Project RESINFO, 2000) in order to design a postgraduate curriculum to cover regional industry needs and remain aligned with global practice in academia. These activities were firstly, a three phase survey of the current landscape in order to gain global and recent advances in the IS academic field, secondly, the study of academic field of Information Systems in Greece. These two activities took into account both the undergraduate and the postgraduate curricula. Thirdly, a survey of IS skills demand in Greek industry to reflect both recent advances in IS industry needs, plus the regional view was undertaken.

3.1 Study of the current landscape of IS academic field

The study of the global landscape in the IS academic field was achieved by conducting an international three-phase survey and also by the analysis of other similar recent surveys. These phases of the survey were:

1) *Collection and general analysis of informatics and computer related curricula.* This phase collected from the WWW and organised in a WWW accessible database undergraduate and postgraduate curricula, according to their general characteristics (such as degrees, schools and institutes). This phase studied the presence of terms used in curricula titles, triggered by previous work (Avgerou et al, 1999; Gorgone, 1997) and was applied to the whole number of IS curricula (2298) collected.

2) *Detailed IS undergraduate and postgraduate curricula analysis:* Analysis of the structure and content of 40 undergraduate and 44 postgraduate IS curricula.

3) *Questionnaire analysis:* This was achieved by a questionnaire-based survey that considered the views of 41 heads of IS departments worldwide. The questionnaires were supplemented by the participants through the RESINFO project web site at
http://www.ath.aegean.gr/resinfo/questionnaire/questionnaire.asp

The main difficulty of such wide ranging, international surveys, is that each institution is affected by various interconnected and ubiquitous, cultural and economic factors, for instance the particular employment market needs, the educational and telecommunications infrastructure of each country, the legal status of academic departments, variance in educational systems of accreditation, to name but a few. The resulting diversity of education systems not only among different countries, but also among different academic institutions in the same country, means that there is a variety of degrees offered and variance in the time period required to obtain a degree award.

Another important issue is related to classification, is in the sense of meaningfully representing themes, courses, departments, etc. Recent work in the categorisation of IS themes (Avgerou et al, 1999) was taken into consideration and was extended for the purposes of this survey. In the aforementioned survey, subjects taught were categorised in five groups and allowed for additional subjects under "Other". Those five groups were:

1) Technologies

2) Systems Development

3) Applications

4) IS management

5) Impacts, ethics and policy of IS

In the RESINFO work, this categorisation was adopted and extended with two more categories: *Computer Science* and *Telecommunications/networks*. *Computer Science* includes courses that are traditionally located in Computer Science curricula. Such courses most usually are: Data Structures, Algorithms, Operating Systems, Computer Architecture, etc. *Telecommunications / networks* emerged due to increasing significance of this field in the current and forecast future trends of IS, both academic and industry oriented. Goldman remarks that '*the increase in the importance of data communications and networking from both information systems architecture as well as a business perspective has created a demand for practical and business oriented networking courses*' (Goldman, 1994). This field has grown the last few years at an amazing rate, resulting in a range of courses taught. This category includes courses such as computer networks, network management, distributed systems, network security.

Figure 2 (Final Report of Project RESINFO, 2000) presents a comparative view of subjects taught in undergraduate and postgraduate IS degrees. It can be seen that undergraduate studies worldwide focus mainly in IS development issues, while the percentage of management related courses is considerably increased at the postgraduate level.
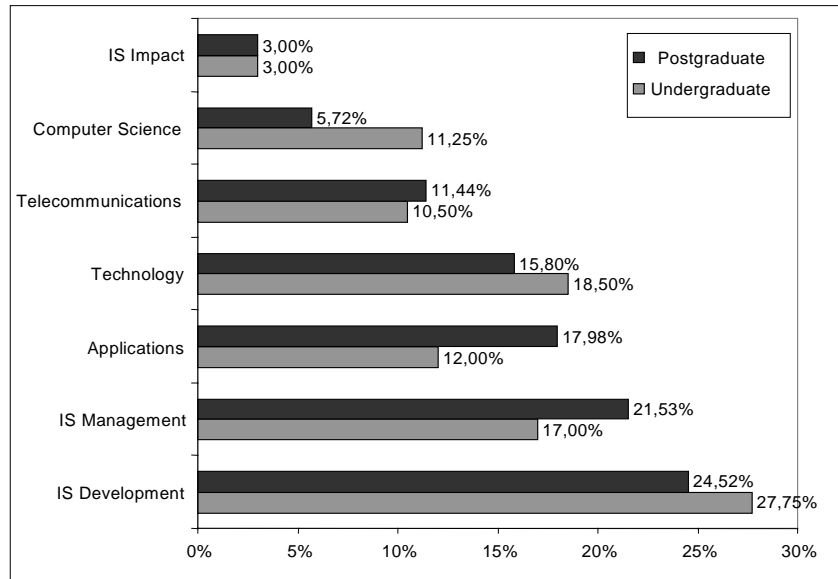
Figure 2: Courses taught in the IS curricula of the sample (Detailed IS undergraduate and postgraduate curricula analysis phase)

Additionally, according the heads of IS departments opinions as shown in **Figure 3**, the orientation of postgraduate studies is mainly managerial, while in the same departments undergraduate degrees are primarily development and design oriented.
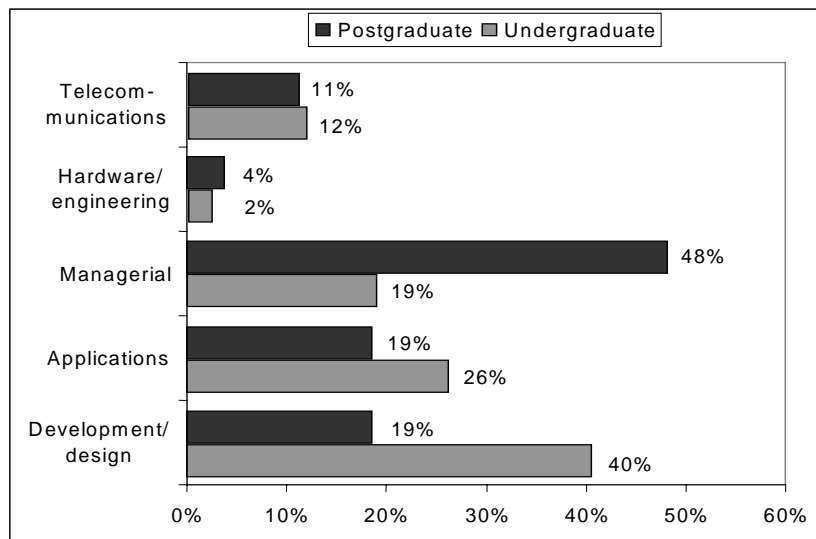
Figure 3: Orientation of undergraduate and postgraduate studies (questionnaire analysis)

Thus according to the RESINFO survey (Final Report of Project RESINFO, 2000), IS postgraduate curricula seem to follow one or more of the following (not always explicitly distinguishable) directions:

▪ Information Systems degrees that are general in scope. Those curricula mainly offer courses that are considered as typical of the IS discipline and usually accept students from a wide area of undergraduate backgrounds. Often, those curricula allow students to specialise in a particular field of IS.

▪ Specialisation in a particular field of IS (such as networks, s/w engineering, IS Security, etc.).

▪ Integration of information systems in the organisational structures / management orientation.

▪ Application orientation. Those curricula focus in a particular application field of IS. A very common practice is the collaboration of an information systems department with a department of another scientific area in order to create and offer those postgraduate studies. In this category, curricula holding names such as "health informatics", "Geographical IS", "Accounting IS" etc. are situated.

Unlike other related disciplines in which postgraduate studies focus mainly in specialisation, it can be seen that IS postgraduate studies follow other trends as well, such as a multidisciplinary orientation, or the management aspects of IS.

During the last decade, several factors, especially those related to advances in information technologies (IT) and new applications, have created the need for the development of new courses in the IS discipline. There are many courses in applications of information systems such as electronic commerce, CSCW, Internet applications & services (Figure 2, Figure 3). Many IS curricula offer telecommunications/networking courses while there is a high percentage of undergraduate and postgraduate curricula specialised in this field.

3.2   Study of the Academic Field of Information Systems in Greece

The second activity that was carried out was the study of the academic field of Information Systems in Greece. Until 1992 the Greek universities were not allowed to offer postgraduate studies at MSc level, therefore, IS postgraduate studies in Greek universities are relatively new. There are very few postgraduate curricula in Information Systems (IS) and Computer Science (CS), and they do not sufficiently cover industry needs. Most of them specialise in specific applications or issues in the IS discipline focusing in technical knowledge and skills.

In comparison, with other European countries, Greek universities host a few foreign students (Eurostat, 2000; SOCRATES, 1997). On the other hand, are many Greek students attending courses in European countries (Eurostat, 2000; SOCRATES, 1997). The implication is that there is a demand for more IS curricula at both undergraduate and postgraduate level in Greece.

The IS academic field in Greece appears under a variety of labels. The diversity of names reflects the philosophy of each department and is also in accordance with the different perspectives used to approach the IS field in Europe (Avgerou et al, 1999). The term 'informatics', which is a term with an unclear overlapping within the field of IS (Avgerou et al, 1999), is mainly used in Greek academic institutions to describe undergraduate degrees.

In Greece, there are 15 computer-related departments labelled under a number of different names. The focus of those departments ranges from Electrical and Computer Engineering to Information Systems. Undergraduate studies in those departments usually focus in computer science and computer engineering issues. These departments are mainly located in schools of science and technical universities. Only two of those departments are located in schools of economics and business. Five of them are offering undergraduate curricula containing courses that are considered typical for the IS discipline. At the postgraduate level there are only six degrees offered, of which only two can be said to be focusing on IS issues.

Up until now, the Greek industry has rapidly accepted the graduates of those programmes whose expertise is mostly technically oriented. However the demand is quite larger than the supply. This has been understood by national academic institutions and there are ongoing efforts for the design of departments and degrees in this area.

3.3   Study of Information Systems Skills Demand in Greek Industry

The third activity carried out, in order to create a brief overview of the IS skills demand by the Greek IS industry, was a survey that aimed to investigate the skills and knowledge that describe the profile of the IS professional, relative to the Greek labour market (Final Report of project RESINFO, 2000). The survey examined the difficulties that Greek organisations face in finding personnel with adequate IS skills, and also

collected the opinions of those organisations regarding the applicability of specific categories of IS postgraduate curricula in the Greek labour market.

This survey was based on questionnaires that were submitted by electronic mail to 100 Greek companies and organisations activating in the area of information and communication systems. 40 of them were filled and returned. The sample constituted IT companies and organisations employing more than 40 people, in which there is an IT department.

The professional areas where the Greek companies experience difficulties in finding adequate staff are presented in Figure 4.
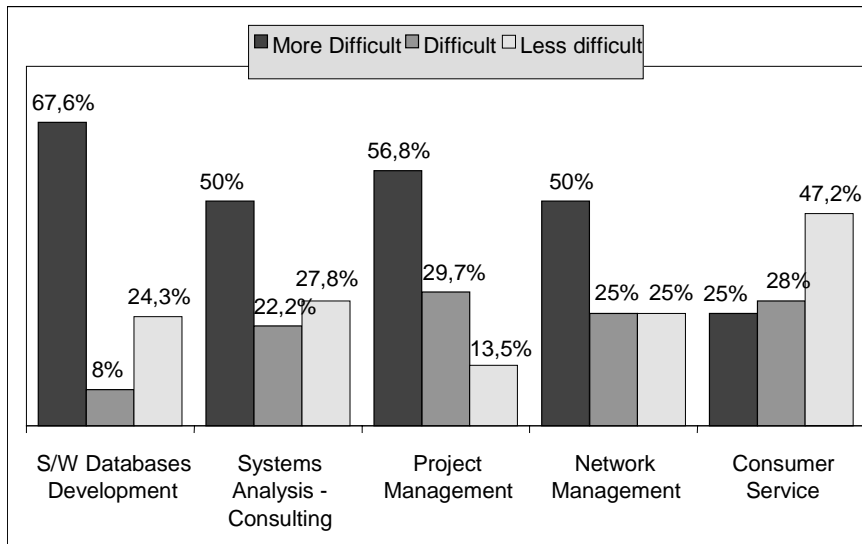

Figure 4: IS expertise categories and degree of difficulty to find personnel with adequate skills according to industry survey results

According to a previous survey of the Greek IS market (Doukidis et al, 1998), there is an emerging need for IS professionals with knowledge in the areas of IS development, telecommunications/networking, and in IS management & consulting. The findings from the RESINFO survey agreed with this. The questionnaire also collected industry opinions about the different postgraduate IS curricula categories that could be offered (Figure 5). These categories correspond to three of the four identified directions current IS postgraduate curricula worldwide, as outlined in section 3.1: that is:

- General IS;

- integration of information systems in the organisational structures/management;

- specialisation in a particular field of IS (such as networks, s/w engineering, IS Security, etc.).

The fourth direction (of application IS postgraduate programmes) was not included in the questionnaire, as the companies questioned operate in a wide variety of application areas.
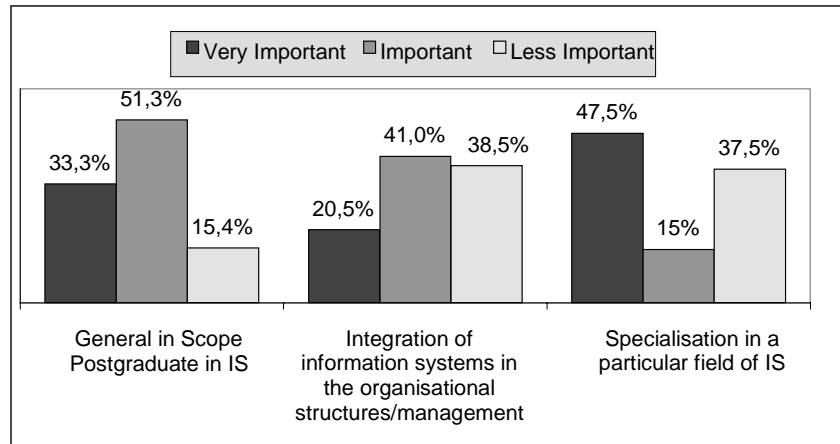
Figure 5: Applicability of postgraduate IS curricula in Greece according to survey results

The RESINFO questionnaire results showed that these three categories are considered by Greek industry to be useful for an IS professional. Most of the participants expressed the opinion that for the Greek IS labour market the most suitable would be a postgraduate curriculum in IS that is general in scope. This can be attributed to the fact that according to the RESINFO survey, the Greek industry faces difficulties in finding professionals in categories of Figure 4. This is not unexpected because there are not many IS professionals in Greece, and consequently, they usually operate in a wide area of IS expertise.

4 CURRICULUM FOR THE DEPARTMENT OF INFORMATION & COMMUNICATION SYSTEMS AND CONCLUSIONS

From the work carried out as described in this section, a curriculum model was elaborated that took into account global and regional views, both of the academic field and of industry.
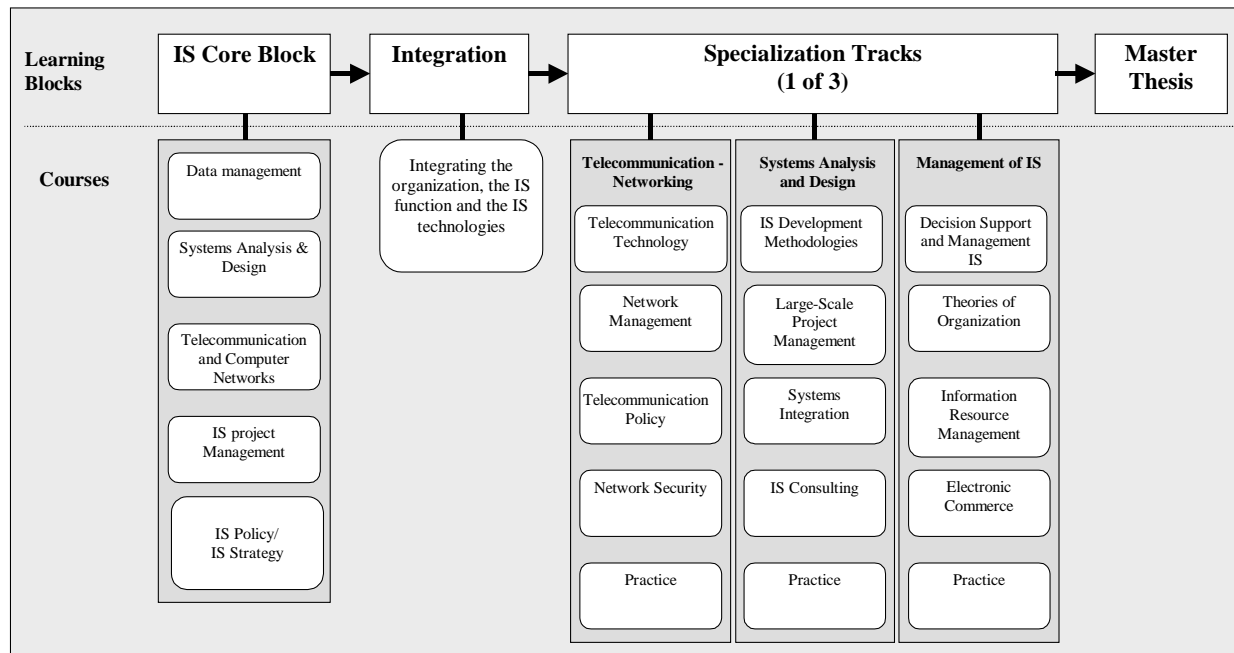
The proposed IS postgraduate curriculum for the Department of Information and Communication Systems is based on the MSIS 2000 model, and adapted to the requirements of the Greek IS industry, as it is presently. Following this curriculum model, graduates are equipped with management and communication skills and also have the ability to further specialise in an area of the IS discipline.

The curriculum courses are divided into the following blocks (Figure 6):

- IS Core, which includes courses which are considered as typical of the IS discipline;

- Integration of IS in the organisational structure;

- Specialisation Tracks, which take into account the particular Greek market needs. These tracks are: Telecommunications/Networking, IS Development, and Management of IS. Every student has the option to specialise in one of those tracks;

- Master thesis;

The IS Core block and the Integration were selected according to the MSIS 2000 model curriculum and guidelines.

The Specialisation tracks are selected according to the local market needs and IS studies offered in Greece. Those tracks could be extended, revised or replaced according to the future development of the Greek market. This flexibility is crucial for the operation of the curriculum, due to the rapidly changing socio-economical and scientific environment. As an example, themes in the 'Management of IS' specialisation track, such as 'Decision Support' and 'Electronic Commerce' are currently located here, although as more and more Greek businesses turn to electronic and mobile commerce, it is foreseeable that these subjects will become part of the core block.

| Learning Blocks | IS Core Block | Integration | Specialization Tracks (1 of 3) | | | Master Thesis |

| Courses | Data management

Systems Analysis & Design

Telecommunication and Computer Networks

IS project Management

IS Policy/ IS Strategy | Integrating the organization, the IS function and the IS technologies | **Telecommunication - Networking**

Telecommunication Technology

Network Management

Telecommunication Policy

Network Security

Practice | **Systems Analysis and Design**

IS Development Methodologies

Large-Scale Project Management

Systems Integration

IS Consulting

Practice | **Management of IS**

Decision Support and Management IS

Theories of Organization

Information Resource Management

Electronic Commerce

Practice | |

Figure 6: *The proposed postgraduate IS curriculum for the Department of Information and Communication Systems, University of the Aegean, Greece.*

The Master Thesis was considered as a very important, compulsory element of the curriculum, which can help student to better ascertain the particularities of designing and developing IS projects.

The time duration for the curriculum is set to 1.5 years, from which the last half is devoted to the development of the Master Thesis.

In conclusion, as Avgerou notes '*different research agendas and perspectives emerge within different socio-economic contexts*' (Avgerou et al, 1999). These differences need to be taken into account in the design of undergraduate and postgraduate IS curricula. On the other hand, in order to reduce the diversity of IS studies among academic institutions, models and guidelines for curricula design have been developed. Thus, curricula designers have to balance generic models and guidelines with the particular socio-economical context of a specific geographical region.

This paper has presented an approach for tackling methodically issues related to views of both the IS academic field and labour market needs and presented a real example of a design of an IS curriculum for the case of the Department of Information and Communication Systems at the University of the Aegean.

The approach taken for the deployment of IS curricula models in a specific environment included:

- Recent advances in IS academic field, and global market needs
- The analysis of the regional view of the IS academic field regarding the level of undergraduate and postgraduate curricula offered and the correspondence among them.
- The local market needs in IS professionals related to the supply by the academia

The postgraduate IS curriculum designed for the Department of Information and Communication Systems, can be characterised as a postgraduate curriculum in IS that is general in scope. The IS Core block and the Integration block of courses are selected according to the MSIS 2000 model curriculum and guidelines (Gorgone et al, 2000), whereas the design of the specialisation tracks block of courses took into account the particularities of the Greek academic and market environment. The curriculum design process includes the opinions of the local market about the IS skills and knowledge demanded and consequently corresponds to the particular market needs.

A further benefit of this design is that the overlapping between related undergraduate and postgraduate degrees is significantly reduced due to the study of the IS skills supplied by the local academic institutions.

In addition, this design increases curriculum flexibility and future adaptability in that future courses can be slotted in, and outdated ones removed, without affecting the overall structure. In view of the rapid technological advances in this field, this flexibility is of considerable benefit, if major overhauls of the curriculum can be avoided. According to the approach demonstrated in this paper, updating the curricula could be carried out as a result of future studies of the local IS academic and market landscape as well as of the global status of IS field.

It is hoped that the approach taken here to design a curriculum can easily be adopted by others seeking either to design new curricula or to update their existing ones.

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