Business Informatics

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Abstract
The rapid changes in recent years demand constant evaluation and modification of education programs. The following contribution summarizes some aspects of study programs in information systems (IS) and focuses on business informatics (BI). As a stream of IS, BI can be described as a method and model-centered approach focusing on business IS. The success of BI derives from the benefits that arise when business administration concepts are combined with computer science technologies and software engineering principles to form a coherent methodological approach. In addition, addressing the need for an innovative and cross-disciplinary study model to equip graduates with transformation skills we have developed a master’s study program in BI. By discussing an example curriculum, this entry outlines the core elements of this program and gives direction for BI as a study domain.

INTRODUCTION
Many universities have offered various programs related to information systems (IS). However, the rapid changes of late demand constant evaluation and modification of education programs. These challenges include, for instance, the move toward programs, which are more applied and professionally orientated. The Bologna Declaration in Europe with its three-level study structure as well as the increasing pressure to ensure funding within most departments adds further pressure to many universities. Despite attempts being made to provide reference to curricula and guidelines, many universities and faculties struggle with the proper direction and design of the IS curricula.

Common reference curricula related to IS are, for example, the IS 2002: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems; and the MSIS 2000: Model Curriculum and Guidelines for Graduate Degree Programs in Information Systems.[1,2] Although proposed for many years, several discussions and disagreement exist on the content and direction of IS curricula and IS as a discipline. A joint task force of the Association for Computing Machinery and Association of Information System is aiming at revising the IS 2002 undergraduate curriculum.[3] At the same time, we are experiencing decreasing enrolments in IS programs worldwide.[4]

To summarize aspects of the existing study programs in IS we focus on business informatics (BI). This entry aims to illustrate differences between BI and traditional IS study programs.[5] We structure the entry as following. First, we summarize the context of information technology (IT)- and IS-related study programs. Then we outline the main characteristics of BI. In addition, we provide a generic framework for IS study programs. Finally, we present an overview of an example study program in BI—the European M.Sc. in Business Informatics at Dublin City University. We conclude the entry by outlining some key challenges of BI as a study domain.

CONTEXT OF IS STUDY PROGRAMS
One of the IS-related challenges at present is the increase in complexity and the growing interdependency between business aspects and IT. Organizational components like business strategy, rules, procedures, and processes, and the organization’s application systems, including hardware, software, and databases, affect and influence each other. Any change in one of these components typically requires modifications in other components, whereas existing systems and structures often act as a constraint on organizations. As a consequence, the demand for graduates capable of analyzing complex information networks and project managers managing large IT projects is expected to increase. Therefore, subjects such as application integration, enterprise architecture, information management, and business process management are increasingly important.[6] In addition, claims that IT is no longer a source of strategic advantage indicate the move from technology-oriented jobs to more business-oriented roles. Universities are expected to provide, in addition to core knowledge of design and implementation of IS, a broad business and real-world perspective.

Graduates should show strong analytical and critical thinking skills as well as interpersonal communication and team skills. A further necessary area of expertise
BI AND IS

Traditionally, universities have focused on management and business studies as well as on computing, software engineering, and computer science. Computing and computer science (e.g., basic informatics) address technical and theoretical bases of IT and software systems. Business and management provide knowledge of the principal functions of management and focus on business operations and decision making (behavioral and organizational components). The combination of both disciplines, which include technical and social components, is generally described as IS. Terms such as management information systems (MIS), business information systems (BIS), or information systems and management (ISM) are also common.

Besides these courses, a growing number of universities, particularly in central and northern Europe, are offering undergraduate and postgraduate degrees in business informatics. The term seems well established in the German-speaking countries; however, it is often considered controversial. Indeed, BI stems from the literal translation of the German term “Wirtschaftsinformatik,” but there seems a controversy about the characteristics of BI. BI is sometimes assumed to be equal to the broad area of IS, though some indications exist that BI has a stronger emphasis on engineering principles and methods.[7] To provide a foundation and to frame the subject of IS discipline, in the following we outline the characteristics of BI.

Management-oriented IS programs sometimes lack consideration of a methodological combination of the theoretical work of computer science with a practical orientation toward designing systems and applications. This methodological focus is the area of BI, which complements traditional areas of IS that focus on explaining real-world scenarios. BI aims to engage constructively to develop solutions tailored to business problems. It takes an active role in aligning business strategy, corporate goals, business processes, and IT. The core element of BI is a methodological approach to describe, explain, predict, and design information and communication systems. It involves the development of terminologies, models, and architectures that are explicit and sharable.

BI can be characterized as

- Interdisciplinary.[8]
- Focusing on business IS as socio-technical systems comprising both machines and humans.[9–12]
- Concerning the inception, development, implementation, maintenance, and utilization of business IS.[13,14]
- Describing the relationship between humans, business functions, information, and communication systems, and technology.[15]

BI can be summarized as a socio-technological and business-oriented subject with engineering penetration.[13] As a science discipline, BI is categorized as

- Applied science that studies real-world phenomena.
- Formal science that creates and applies formal description methods and models.
- An engineering discipline that systematically designs and constructs information and communication systems.[11]

The success of the subject derives from the benefits that arise when business administration concepts are integrated with computer science technologies and software engineering principles to form a coherent methodological approach. It centers on IS architectures and business processes and provides a systematic design and construction of organizational information and communication systems.

BI Subjects

In the following we present a framework for BI and IS for which we amalgamated prominent curriculum guidelines; an undergraduate and a graduate model curriculum predominantly referred to in the Anglophone area with one frequently referred reference curriculum in the German-speaking area.

- The model curriculum and guidelines for graduate degree programs in IS (MSIS 2000).[11]
- The latest version of the IS undergraduate model curriculum (IS 2002).[12]
- The recommendation for BI at universities (BI recommendation).[8]

The work of IS model curricula represent almost 30 years of experience in curriculum development. Started in the early 1970s by the Association for Computing
Machinery (ACM) other organizations, including Data Processing Management Association/Association of Information Technology Professionals (DPMA/AITP), International Federation for Information Processing (IFIP), and Association for Information Systems (AIS), have aided model curriculum development. The IS 2002 model curriculum is the latest version for an undergraduate IS curriculum, published by ACM and AIS. IS 2002 includes detailed course descriptions and prescriptive advice on how to offer an IS undergraduate degree program. For our study we used the latest version of the IS 2002 undergraduate curriculum, although the existing version is now being reviewed by a joint ACM/AIS task force. The MSIS 2000 model curriculum was published by ACM and AIS as a guideline for master degree programs in IS. At a master’s level, the curriculum is designed to accommodate students from a wide variety of backgrounds. It considers a set of interrelated building blocks, including foundational skills, core subjects, integration subjects, and career tracks. Emphasizing on career development skills, the curriculum includes oral, written, and presentation skills; people and business skills; and ethics and professionalism.

The model curricula are explicitly developed to include knowledge elements from three major computing disciplines: computer science, software engineering, and IS. It accumulates long experience in IS curriculum development and provides a coherent structure for a study program in IS. Thus, these model curricula seem to be appropriate, even though the model curricula are primarily based on the educational system and degree structures common to the United States and Canada, with limited acceptance and use outside of this area. The two-level educational structures underlying the curricula proved to be of advantage, as many European universities are restructuring their study programs toward a two-phase curriculum with bachelor and master degrees.

The third curricula we used, the recommendation for BI, is issued by the German Society for Informatics and the Association of University Professors of Management, Germany. It is aimed at providing common directions for education in BI at universities. In contrast to the MSIS curriculum, which provides a detailed recommendation for a curriculum, the BI recommendation is intended as a guideline and is focused on key qualifications and core subjects to be taught. The BI recommendation is mainly oriented toward a study program of nine semesters, leading to a degree of “Diplom-Wirtschaftsinformatik” (diploma/master level in BI).

To cluster subjects and to provide a list of taught subjects, we customized the framework in an iterative process involving expert opinion from 10 academics from different countries. The structure follows the proposed curriculum building blocks in the MSIS curriculum. However, in order to accommodate particular subjects taught in some study programs, we added subject blocks of mathematics and logic, structural science, legislation, and economics, and business engineering, and included often taught business subjects, for example, logistics, procurement, and supply chain management. The list of career electives and domain-specific subjects presented here illustrates just some of the possible topics. The framework is presented in Table 1.

Architectural Focus of BI

In contrast to IS, BI appears to have a stronger focus on mathematics, logic, and structural science. One reason for this could be the focus on the systematic construction and the application of methodological principles, which are often stated as typical for BI study programs. Indeed, mathematical principles are perceived as essential in order to systematically construct, formalize, and analyze models and architectures of IS.

In this regard, business informaticians are often described as IS architects (in the sense of engineers) who are actively and systematically analyzing and designing business IS. Central to this is the subject “Information System Architecture.” IS Architecture describes IS through various models and refer to both a dynamic view in the form of processes and the specification of the overall structure, logical components, and the logical interrelationships of a system. The conceptual description of both views builds the methodological framework for understanding the alignment of software applications and information technologies, business processes, and the corporate strategy. One example of an important architectural framework for BI is ARIS—architecture of integrated information systems.

STUDY PROGRAM IN BI

In keeping with the points identified herein, we outline an example of a BI study program, introduced at Dublin City University—the European M.Sc. in Business Informatics. As an example, we provide an overview of the program in order to give guidelines for similar programs in BI. The central focus of the proposed curriculum for BI is to qualify individuals to lead IS-related transformations of business. This enables them to apply technological solutions and develop IS architectures to solve business problems of organizations. With this goal in mind, the curriculum focuses on an engineering perspective and the integration of cultural studies. The program is intended for students who have achieved a
Table 1  Study framework

<table>
<thead>
<tr>
<th>Informatics and fundamentals in engineering</th>
<th>Business and economics</th>
<th>IS</th>
<th>Integration and enterprise engineering</th>
<th>Informatics in action (representative)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information and Communication Technology</strong> (hardware, software, networks, and communication technology)</td>
<td>Accounting and financing</td>
<td>Fundamentals of Information Systems (types of IS, IS industry, IS relevant legal frameworks, management, and IS)</td>
<td>Business Engineering and IS Architecture</td>
<td>Academia and research Academic and research</td>
</tr>
<tr>
<td>Programming algorithms, data, and object structures</td>
<td>Marketing, production, procurement, logistics Organization, human resources, and corporate management Legislation and economics</td>
<td>Principles of Business Information Systems (principles of functional and process orientation and industry solutions)</td>
<td>Integrating IS Functions, Processes and Data</td>
<td>libraries Biochemistry and molecular biology Consulting</td>
</tr>
<tr>
<td><strong>Mathematics and Logic</strong> (analysis, linear algebra, numeric, logic)</td>
<td>Structural Science (decision theory and methods for strategic decision making (e.g., risk analysis), statistics and quantitative models and methods, operations research, computational modeling, and simulation)</td>
<td>Data Engineering (data modeling and management, knowledge engineering, and business intelligence)</td>
<td>Integrating IS Technologies and Systems</td>
<td>Consumer health information Customer relationship management</td>
</tr>
<tr>
<td><strong>System and Software Engineering</strong> (analysis, modeling, and design)</td>
<td>Managing data communication and networking Information Management (information, knowledge, and people, project, and change management, IS/IT policy, and strategy, ethics, and privacy)</td>
<td></td>
<td></td>
<td>Data warehousing Decision making e-Government information Electronic commerce Electronic publishing Environment management Financing and banking Healthcare information Human factors Insurance management Knowledge management Library services Logistics Multimedia technologies Project management Techniques of IT consulting Technology management</td>
</tr>
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</table>

Source: From Helfert & Duncan.[7]

primary degree in computing, computer science, software engineering, or a comparable discipline. The program is designed to be completed in one calendar year of full-time study and consists of two taught semesters, followed by a third term consisting of a project of practical nature.

The curriculum has an emphasis on engineering principles, and includes a module on structural science, which encompasses management science, data...
The example curriculum as outlined herein comprises a balanced and interdisciplinary structure, which centres on engineering principles and focuses on transformation, models, and methods. The engineering penetration throughout the program is seen as one important characteristic, which differentiates this program from management-orientated IS degrees. In contrast to business administration programs, the production of information managers, often expected in practice, is not the objective of BI. As such, BI can complement the management-orientated stream of the IS discipline.

In conclusion, the BI approach appears to us to be innovative with regard to not only its interdisciplinary character, but also the engineering perspective and the integration of cultural studies and practical experience in an international setting equip graduates with essential transformation capabilities. Indeed, the focus on engineering principles in BI could play an important role in future education programs.

REFERENCES