Online Information Systems (OIS)

C. Verhoef

VU Amsterdam, Department of Computer Science,
De Boelelaan 1081a, 1081 HV Amsterdam, The Netherlands

x@cs.vu.nl

Abstract

This document describes a proposal for a first-year course in management information systems, with emphasis on online aspects of these systems. It intends to cover both theoretical aspects of management information systems as well as hands-on experience with online information systems.

Introduction

Managing information is more than just clicking a mouse, pounding the computer keyboard, or surfing the Web. It's about integrating the various elements of an organization, technical and non-technical, into a successful enterprise. Our graduates need to understand managerial, organizational and technological aspects of information systems and integrate them into a single, cohesive system that serves the needs of the organization, the wants of the customer, and the desires of the employeesi (See Figure 1). In fact, information systems and the use of technology belong to everyone in an organization. This concept is best carried out through a sociotechnical approach towards information systems, which allows both the technical and behavioral approaches to be combined for the good of the organization. Therefore a hybrid so-called *sociotechnical* approach is needed—a combination of a technical and non-technical or behavioral approach.

Next to that, it is evident that our graduates need to understand the potential of information technology, so in a lab the students will work on the technology side where modeling, hands-on implementation, and the use of structured query languages are important ingredients.

1 Course material

After assessing the following introductory textbooks on management information systems:

- Steven alter, the work system method – Connecting people, processes, and IT for business results, 2006.
- Jessup Valacich, Information systems today - managing the digital world, 2008.
- Haag, Cummings, Management information systems for the information age, 2008.
- O'Brien, Marakas, Management Information Systems, 2008.

- Baltzan, Phillips, Business Driven Information Systems, 2008.
- Laudon, Laudon, Management Information Systems – Managing the digital firm, 2007.

we concluded that the textbook *Management Information Systems – Managing the Digital Firm* by Laudon and Laudon approximates the aims of online information systems best at this moment.

Apart from the textbook there are also MP3s with summaries of the chapters, and review questions plus answers, and there are plenty online resources geared towards the textbook that accompany the course. This information will be made available for the students (e.g. via blackboard). Next to that, there is a reader with background information and assignments for the lab that is continuously evolving.

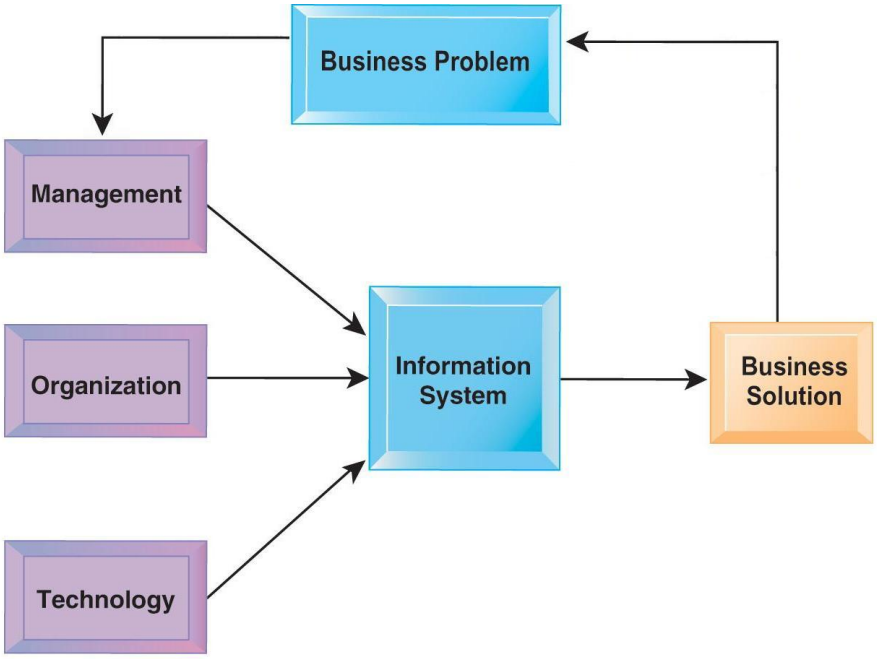

Figure 1: Scematics of the sociotechnological Model proposed by Laudon & Laudon

Course description

period and duration As for the period there are no specific prerequisite courses needed so there is flexibility here. The theoretical part covered by the textbook is treated in seven classes and two hours per week. The practical part covered by the reader is planned in the next period so that the knowledge gained can be applied, and is treated in seven labs and X hours per week.

credits 6 ECTS. In the past, we used both the model where students graduated the course after both parts were done satisfactory, and with separate grades. The latter is simpler and more appreciated by the students.

target students The target audience is first year students IMM (Informatie, Multimedia & Management), Informatica, and KI (Kunstmatige Intelligentie). In the past, the KI-students were second year students. a problem with that is that some IMM students have almost no prerequisite knowledge about information technology, whereas KI-students have a lot of experience already. This makes it somewhat difficult to address bot groups. It would be an idea to see whether the KI-students can do this course in their first year, too.

course abstract (In dutch) Het vak Online Informatiesystemen (OIS) geeft een introductie in de toepassing van informatie en communicatie technologie in organisaties vanuit zowel een technologisch als een niet-technologisch perspectief. Op het college wordt aandacht besteed aan de industriele realiteit van informatiesystemen, en hoe daarmee om te gaan. OIS schets een sociotechnnologish beeld van informatiesystemen en hun online toepassingen. Het vak bestaat uit twee delen, beiden 3 ECTS, waarbij de eerste zeven weken het boek behandeld wordt, waarna in de tweede zeven weken studenten praktisch aan de slag gaan met online aspecten van informatiesystemen. Daar komen aan bod technieken als php, SQL, integratie van SQL in online applicties via PHP, Datalog, SQL-injection, E-R modelleren, en van E-R modellen naar relationele database schema's, en X.

mode of tuition The textbook is covered in a class with a large group where students are also compelled to provide their opinions and ideas, this is facilitated by interactive sessions where issues in the news about MIS are connected to the theory. For instance, how they would design a proper way to deal with online tax forms. The labs are in small groups (2 to 3) and X.

grading Final grading is calculated as follows:

- (50%) examination of the theory treated in class based on the book
- (50%) assignments of the lab

For the examination it is possible to do a midterm assignment where a case is treated by the students halfway the class. If the case is handled properly the grade for the examination can be added with one. For the assignments of the lab 7 out of 10 assignments must have been done satisfactorily.

supervision For the class a student assistant/PhD-student to help with the midterm case and salient issues, and for the lab a number of student assistants, and a PhD-student for coordinating purposes.

prerequisites Students need no prior classes for this class and lab.

resources For the class thee are the following resources:

- the book
- slides
- mp3's

- online background material

and for the lab there is a reader for which one new assignment on modeling is planned.

Learning objectives class

The book contains 14 chapters with theoretical material, and in a course like this twelve will be discussed. For instance chapters on hardware and telecommunications are skipped. However note that some aspects that are specific to information systems are touched upon like highly specialized hardware security modules (Tamper Resistant Security Modules or TRSM) that are designed to be the basis of cryptographic security solutions used by companies like Equens (European payment processors). For instance the PCIXCC card described by Todd Arnold and former VU-graduate Leendert van Doorn (see figure 2).

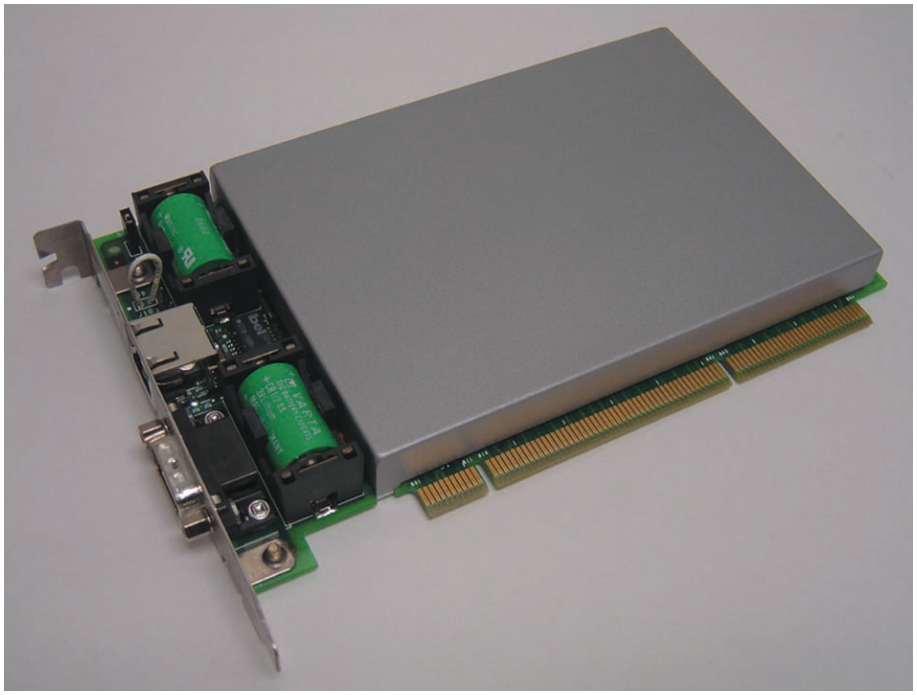

Figure 2: PCIXCC Card

Chapter 1 Information Systems in Global Business Today

After studying this chapter, students are able to:

- Explain why information systems are so essential in business today. Define an information system from both a technical and a business perspective.
- Identify and describe the three dimensions (management, organization, technology) of information systems.

- Assess the complementary assets required for information technology to provide value to business.
- Identify and describe complementary approaches to the study of information systems and distinguish between computer literacy and information systems literacy.

Chapter 2 Global E-Business: How Businesses Use Information Systems

After studying this chapter, students are able to:

- Define and describe business processes and their relationship to information systems.
- Describe the information systems supporting the major business functions: sales and marketing, manufacturing and production, finance and accounting, and human resources.
- Evaluate the role played by systems serving the various levels of management in a business and their relationship to each other.
- Explain how enterprise applications and intranets promote business process integration and improve organizational performance.
- Assess the role of the information systems function in a business.

Chapter 3 Information Systems, Organizations, and Strategy

After studying this chapter, students are able to:

- Identify and describe important features of organizations that managers need to know about in order to build and use information systems successfully.
- Evaluate the impact of information systems on organizations.
- Demonstrate how Porter s competitive forces model and the value chain model help businesses use information systems for competitive advantage.
- Demonstrate how information systems help businesses use synergies, core competences, and network-based strategies to achieve competitive advantage.
- Assess the challenges posed by strategic information systems and management solutions.

Chapter 4 Ethical and Social Issues in Information Systems

After studying this chapter, students are able to:

- Analyze the relationships among ethical, social, and political issues that are raised by information systems.
- Identify the main moral dimensions of an information society and specific principles for conduct that can be used to guide ethical decisions.

- Evaluate the impact of contemporary information systems and the Internet on the protection of individual privacy and intellectual property.
- Access how information systems have affected everyday life.

Chapter 6 Foundations of Business Intelligence: Database and Information Management

After studying this chapter, students are able to:

- Describe basic file organization concepts and the problems of managing data resources in a traditional file environment.
- Describe the principles of a database management system and the features of a relational database.
- Apply important database design principles.
- Evaluate tools and technologies for providing information from databases to improve business performance and decision making.
- Assess the role of information policy, data administration, and data quality assurance in the management of organizational data resources.

Chapter 8 Securing Information Systems

After studying this chapter, students are able to:

- Analyzing why information systems need special protection from destruction, error, and abuse.
- Assess the business value of security and control.
- Design an organizational framework for security and control.
- Evaluate the most important tools and technologies for safeguarding information resources.

Chapter 9 Achieving Operational Excellence and Customer Intimacy: Enterprise Applications

After studying this chapter, students are able to:

- Demonstrate how enterprise systems achieve operational excellence by integrating and coordinating diverse functions and business processes in the firm.
- Demonstrate how supply chain management systems coordinate planning, production, and logistics with suppliers.
- Demonstrate how customer relationship management systems achieve customer intimacy by integrating all customer information and making it available throughout the firm.
- Assess the challenges posed by enterprise applications.
- Describe how enterprise applications can be used in platforms for new cross-functional services.

Chapter 10 E-Commerce: Digital Markets, Digital Goods

After studying this chapter, students are able to:

- Describe the unique features of e-commerce, digital markets, and digital goods.
- Analyze how Internet technology has changed value propositions and business models.
- Describe the various types of e-commerce and how e-commerce has changed consumer retailing and business-to-business transactions.
- Evaluate the role of m-commerce in business and describe the most important m-commerce applications.
- Compare the principal payment systems for electronic commerce.

Chapter 11 Managing Knowledge

After studying this chapter, students are able to:

- Assess the role of knowledge management and knowledge management programs in business.
- Describe the types of systems used for enterprise-wide knowledge management and demonstrate how they provide value for organizations.
- Describe the major types of knowledge work systems and assess how they provide value for firms.
- Evaluate the business benefits of using intelligent techniques for knowledge management.

Chapter 12 Enhancing Decision Making

After studying this chapter, students are able to:

- Describe different types of decisions and the decision-making process.
- Access how information systems support the activities of managers and management decision making.
- Demonstrate how decision-support systems (DSS) differ from MIS and how they provide value to the business.
- Demonstrate how executive support systems (ESS) help senior managers make better decisions.
- Evaluate the role of information systems in helping people working in a group make decisions more efficiently.

Chapter 13 Building Systems

After studying this chapter, students are able to:

- Demonstrate how building new systems produces organizational change.
- Identify and describe the core activities in the systems development process.
- Evaluate alternative methods for building information systems.
- Compare alternative methodologies for modeling systems.
- Identify and describe new approaches for system-building in the digital firm era.

Chapter 14 Project Management: Establishing the Business Value of Systems and Managing Change

After studying this chapter, students are able to:

- Identify and describe the objectives of project management and why it is so essential in developing information systems.
- Compare models for selecting and evaluating information systems projects and methods for aligning IS projects with the firm
- s business goals.
- Evaluate models for assessing the business value of information systems.
- Analyze the principal risk factors in information systems projects.
- Select appropriate strategies for managing project risk and system implementation.

Learning objectives Lab

Reader 1: The Relational Algebra

After doing this lab, students are able to:

- construct a simple relational data model.
- build simple compound algebra expressions.
- use important set-theoretical operations.
- Apply operations for selection and projection.
- Use the various join operations.

Reader 2: SQL and MySQL

After doing this lab, students are able to:

- carry out an interactive SQL session.
- use the basics of SQL.
- Work with SQL's Data Manipulation Language.
- work with QL'sData Definition Language.

Reader 3: Database application programming

After doing this lab, students are able to:

- understand a simple web-based approach to database application programming using a local web browser.
- how to present system output via dynamically generated HTML pages.
- work with the CGI protocol to exchange data from a web client to a web server
- write simple PHP scripts to embed SQL statements and other program code into HTML.
- use a client server architecture for database application programming.

Reader 4: hacking

After doing this lab, students are able to:

- understand the basics of SQL-injection
- understand simple Cross-site-Scripting
- apply this to a specially designed website
- buid saver online information systems

Reader 5: intelligent information systems

After doing this lab, students are able to:

- use Datalog (SWI-Prolog compiler of UvA) as an acwnother database quert language
- carry out simple Datalog sessions.
- understand the overlap and differences between Datalog and relational algebra.

Reader 6: Data Modelling Using the UML

After doing this lab, students are able to:

- carry out a simple database design.
- model data with the entity-relationship model (Entities, Attributes, Relationships Abstraction from representation details).
- understand Meta-modelling (provide a data model to represent data models.
- understand how ER diagrams themselves can be represented.

We will do this via a simple extensible case study (CD-store, camping, student administration, mobile phone shop, etc). The students implement this via a UML-like tool, e.g., DB-MAIN (a database tool from the University of Namur).

Reader 7: Mapping a conceptual to a relational schema

After doing this lab, students are able to:

- understand the connections between the Relational Model and the Entity-Relationship Model (ERM).
- construct ER diagrams to define the (high-level) conceptual schema of a database application.
- use relations to define the (design-level) relational schema of a database application.

With these 7 readers the student carry out ten assignments to show that they indeed satisfied the learning objectives.

Assignment 1: Relational Algebra

Using reader 1 the students have to write down some relational algebra statements.

Assignment 2: SQL 1

Using reader 2 the students have to practice SQL SELECT statements with a MySQL server and write down several statements.

Assignment 3: SQL 2

Using reader 2 the students have to practice SQL CREATE/INSERT/UPDATE statements with a MySQL server and write down several statements.

Assignment 4: PHP

Using readers 2 and 3 the students have to practice PHP with a MySQL server and their own website and create a simple site that lists the content of certain database tables.

Assignment 5: SQL injection and how to prevent it

Using readers 2, 3 and 4 the students have to hack their own website with SQL Injection and XSS and after that they have to secure their own pages.

Assignment 6: Datalog

Using reader 5 the students have to write down several Datalog statements.

Assignment 7: UML modelling

Using reader 6 and the UML tool the students have to create an entity relationship diagram for the database they have been using in the past weeks.

Assignment 8: UML to SQL

Using reader 7 and the UML tool the students have to generate the SQL that was originally used for their database.

Assignment 9: CASE tool modeling

Using all previous readers the students have to create a CASE tool for their website that is linked to the MySQL server.

Assignment 10: Database Reengineering

Using all previous readers the students have to create a database from a piece of COBOL code.

Capabilities

The fourteen identified capabilites are sumarized in Table 1. Writing is done in a mid term assignment during class. Modelling is treated elaborately during labs from various viewpoints. Algorithms are not treated in a classic fashion, but for hacking websites algorithmic thinking is necessary. Analysing and reasoning is addressed via structurizing case studies in the book and labs. Going from informal vague descriptions to implementable formal requirements is part of both class and labs. Programming takes place in the labs and since this is done in small groups of two/three a bit of project-like working is present, although not the main issue. During class it is explained that domain knowledge is key in building the right information systems, and how to extract/use that domain knowledge. OIS is mulitidisciplinary in the sense that a combination of management/people, organiszation/process and technology/implementation is present throughout the class (see Figure 1). It is the main issue of the course where solutions need to be optimized towards managment, organiszation *and* technology. During the labs the students are introduced to a number of tools to model, build, maintain/reengineer information systems.

mondeling communicatie	0
schriftelijke communicatie	1
ontwikkeling & geven van presentaties	0
ontleding wetenschappelijke artikelen	0
modelleren	2
algoritmiek	1
analyseren / logische redeneren	1
wiskunde	0
informeel naar formeel	1
programmeren	2
projectmatig werken	1
hanteren domeinkennis	1
mulitidisciplinariteit	2
kennis van gereedschappen	2

Table 1: Capabilities.

Ongoing developments

In order to cater for delivering students with relevant knowledge and capacities for building, designing, and working with information systems there are discussions with IBM concerning Mainframe technology and with Info Support regarding software factories to deliver modern online distributed information systems. Of course on the one hand we see more and more online information systems, but mainframes are the dominant technology backing those online applications. To give an idea:

- 70% of all the business critical software runs on mainframes [4, p. 13].
- 60% of all mainframe applications makes use of COBOL [3].
- 75% of all production transactions on mainframes is done using COBOL [1, p. 70].
- Over 60% of all Web-access data resides on a mainframe [1, p. 70].
- COBOL mainframes process more than 83% of all transactions worldwide [1, p. 70].
- Over 95% of finance-insurance data is processed with COBOL [1, p. 70]

Therefore, it is important that our students are exposed somehow to Mainframe technology. This is still in an experimental phase where we stimulate interested students to take a short course in Mainframe technology. Our group together with IBM published a paper in the Dutch Informatics Education Congress (NIOC 2007) about these experiments [2]. In the mean time two VU-students won the Benelux IBM-mainframe contest 2007 for which our group advertised among students and lecturers. Thilo Kielmann stimulated his students to take part with a gerat end-result.

Info Support already works with other institutions to use a modern software factory to reliably deliver distributed online information systems using Java and/or .Net using a service oriented architecture. We are currently investigating how and if our students can profit from similar cooperation with VU.

In both cases, there are potential opportunities to use Mainframes and software factories to get students acquainted with these important industrial technologies.

As soon as these discussion mature this will be communicated for further discussions.

References

[1] E. Arranga, I. Archbell, J. Bradley, P. Coker, R. Langer, C. Townsend, and M. Weathley. In Cobol's Defense. *IEEE Software*, 17(2):70–72, 75, 2000.

[2] P. Bruinsma and N. Veerman. De praktijkbagage van de IT-student. In *Nationaal Informatica Onderwijs Congres (NIOC) proceedings*, pages 95–100, 2007.

[3] Ovum. Report on the status of programming languages in europe. Technical report, Ovum Ltd., 1997.

[4] H.M. Sneed. *Objektorientierte Softwaremigration*. Addison-Wesley, 1998. In German.