On the Challenge of Creating an Attractive Research Master Program: Graduate Education Avant-la-Lettre

Sjaak Brinkkemper Ronald Batenburg Johan Versendaal
Lidwien van de Wijngaert Remko Helms Rik Bos
Slinger Jansen Marco Spruit Pascal Ravesteijn Erik Huizer
Inge van de Weerd Eva Baaren Marijn Plomp
Henk van der Schuur

Center of Organization and Information
Department of Information and Computing Sciences
Utrecht University

Abstract

In this paper we describe the design and background of the MBI program at Utrecht University. We show how research and education are combined in various courses. We provide quantitative data on the program and conclude with some lessons learned. We claim that the step towards a graduate school that unites MSc education with PhD research is not a difficult one.

Keywords Educational program design, graduate education, MSc program, research, business informatics

1 Program and Course Design for Research

In 2004 the Department of Information and Computing Sciences started six research master programs and the Master of Business Informatics (MBI) program was one of them. The MBI program turned out to be very popular immediately and the program grew into one of the larger MSc programs of Utrecht University. In order to adhere to its high norms, the staff of the MBI program was faced with many challenges. The number of students is large, the education load is high, and research time is limited. The subject matter of Business Informatics requires large scale and sometimes cumbersome empirical research. But there is no lab with experimentation facilities available, in fact, our lab is society. The many organizations and individuals applying IT are the guinea pigs. This requires an educational program that not only educates for research, but provides continuous involvement in research.

When designing individual courses it is clever to create ways to combine research with education:

1. Courses are strongly tied to the research interests of the staff
2. Students arrange for empirical data through respondents or experimentation
3. Student assignments should prepare for writing scientific papers
4. PhD students obtain research results through course assignments of students or through MSc projects

Utrecht University has established Graduate Schools as part of its strategic plan to become a high quality and internationally renowned research university. At the moment the organisation of the Graduate Schools is still in its infancy, and cannot be compared with the American graduate schools. We would like to show in this paper how we designed both the MBI program as well as the individual courses for a research master program. We think the step towards a full-fledged graduate school is relatively small and therefore can be made in the coming years.

The paper is then organised as follows. We start with discussing the vision, objectives and structure of the MBI program in section 2. Then sections 3 to 6 present the course designs of four courses illustrating the academic contents as well as a selection of the research output resulting from the course. Section 7 provides some shorter descriptions on courses and student involvement. Quantitative data on the scientific output generated in student projects are presented in Section 8. Some lessons learned are discussed in the final section of this paper.

2 Vision, Objectives and Structure of the MBI Program

The Master in Business Informatics is founded on the vision that 'business' (i.e. organization, management, society) and 'informatics' (i.e. IT, software) are two domains that need to be combined to improve what can be called the product software value chain. From the very first idea behind a product software solution, through the phases of designing, programming, delivering, implementing and governing product software, it takes an integrated approach to achieve the strategic benefits and overcome the many barriers that characterize the complexity of product software deployment. The mission of the MBI program can be hence formulated as teaching students the key skills to help user organizations to take advantage of ICT, and likewise help product software companies to improve their products and organization. These skills are primarily based on the academic body of knowledge from both organization and computer sciences.

The MBI leverages the advantage of offering a two-year curriculum instead of a one-year program that is mostly offered by other universities. The program consists of a total of 120 credits (ECTS) that roughly consist of three parts: fundamental courses, optional courses and the thesis project. Within these three parts, the principle of integrating and aligning the business and IT domain is leading, although some courses are more originated from one of the two domains.

The four fundamental courses of 7.5 ECTS each are offered through the first year, aiming to provide the basic fundamentals for each MBI student to become an

'MBI researcher'. A specific fundamental course at the very beginning of program is dedicated to achieve group cohesion as soon as possible, as the students will cooperate through the study on several occasions and in professional-like setting. Also, MBI staff, new and enrolled MBI students meet and get acquainted to build an cooperative and informal atmosphere. Principles of project management are directly applied, as all students need to write a study plan and formulate their personal goals and ambitions ("where to you want to be in two years, and what are you going to do within our master program to achieve this?").

Then, four fundamental courses are offered in each of the four periods:

- E-Business
- Enterprise Architecture
- Method Engineering
- Knowledge Management

The four courses are described in detail below. From a curriculum/mission point of view, the fundamental courses are scheduled to lead students from more 'generic' to more 'specific' areas of business informatics. While the e-business course addresses the strategic-business view on IT, the enterprise architecture courses puts students more into the position on how to actually design strategic opportunities into an appropriate IT environment. The method engineering course provides students with the a generic and overarching vision on using methods for both software, system and organizational design. The knowledge management course can be seen as the 'closing' course of the array of fundamental courses, in which many methods, models and theories previously taught come together into a specific (key IS) domain.

The six optional courses (also 7.5 ECTS each) within the MBI program provide significant space for students to develop their specific interests and explore other domains. A number of optional courses are directly related to the research areas of the MBI staff. In this way, students get early involved in the running research lines, as well can also contribute to these. Some examples of staff research related optional MBI courses are:

- Adoption and Use of ICT
- ICT-Entrepreneurship
- Business Process Management
- Management Control

Below, these courses are also described in more detail. Next to these, three optional courses are specifically designed for MBI students but are provided by other scholars within the department of information and computing sciences, i.e.:

- Finance
- Advanced Research Methods
- Supply Chain Management
- Chain Computerization

An increasing number of MBI students also take optional master courses from other faculties and schools at Utrecht University, and from other Dutch universities and universities abroad as well. This improves a broad academic and international orientation. Examples are courses in governance at the Utrecht School of Economics, IT Security at Leiden University, IT management at Lund University, strategic management at the University of Florida.

Finally, the (45 ECTS) thesis project is the major closing assignment of the MBI program in which each MBI student needs to plan and conduct his/her own research under the supervision of one of the staff members and an external coach. All MBI thesis projects are a scientific-driven study on a relevant Business Informatics topic. Some thesis project are executed 'internally', as part of the staff members research domains. Most thesis projects however, are conducted in collaboration with a relevant (sponsoring) organization (i.e. a knowledge or IT-intensive company, mostly one of the leading IT and/or consultancy firms). The list of affiliated organizations that host MBI students in their thesis project is extensive and steadily increasing. To avoid that students are hat perform their thesis project mainly outside the department, they mandatory attend the MBI colloquium. In this biweekly occasion, students present their thesis project in progress, providing a stimulating opportunity for them and teachers to share knowledge and contacts. Finally, for all thesis projects writing a publishable paper is required, next to the thesis document. This has resulted in an increasing stream of publications, many in refereed journal and proceedings as well. Students and supervisors co-author these papers. Some examples are van de Weerd et al. (2007), Beukers et al. (2006), Helms & Buysrogge (2006), Fabriek et al. (2008), Wijaya et al. (2008), Wieringen (2006).

At the end of their MBI program, students have been developing themselves into a qualified researcher in general. During the program, they are also triggered to think of a specific talent, interest and future career them aim to achieve. Over the history of the MBI program four 'graduation profiles' have emerged:

- researcher in business informatics
- business consultant
- ICT consultant
- product software entrepreneur

Looking at the over 100 MBI alumni, most are employed as business or ICT consultant. It can be considered as a important achievement that these alumni are still involved in the MBI program, for instance as (part-time) PhD student, guest lecturer or thesis coach.

3 E-Business

The master program course 'E-Business' relates to the extended enterprise and its IT-enablement and support. Cooperation between organizations has become a strategic activity and takes many forms. Firms intensify their outsourcing activities, integrate

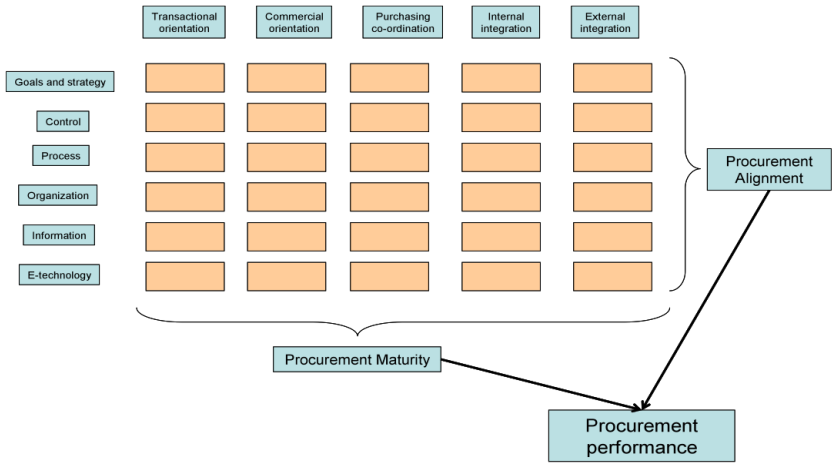

Figure 1: Business IT Alignment framework

supply chains, invest in customer and supplier relationship management, form strategic alliances and partnerships, etcetera. How can IT help organizations to achieve win-win relationships with their environment, considering the increase in interdependencies and inter-organizational coordination problems? In this course this challenge is addressed from both a managerial and technological perspective. In practice, students will jointly perform a scientific research project to apply different theoretical and empirical approaches to the subject.

The course runs yearly from the very start of the Business Informatics program (for 6 consecutive years now). There are three key principles leveraged in the practical part of the course: performance of organizations, maturity of organizations (with respect to business and with respect to IT), and alignment of maturity perspectives. Based on the hypothesis that the degree of maturity and the degree of alignment between different maturity perspectives influences the performance of an organization, a specialized framework is created, operationalized and validated by the students. An example of such a framework is depicted in figure 1.

The vertical dimensions represents the perspectives of an organization between which alignment can be obtained; the horizontal dimension represents the degree of maturity (from left to right). The (depicted) cells contain the operationalization of the framework.

The construction, operationalization and validation of the framework in the course has led to numerous scientific publications, some of them even with the student as first author. In 2003, the main topic in the practical part, was on Customer Relationship Management, leading directly or indirectly to the following publications: Batenburg & Versendaal (2004); Tromp, Versendaal, Batenburg & Duinkerken (2006), Batenburg & Versendaal (2008a). In 2004, the practical part dealt with Product Lifecycle Management, leading to the following scientific publications: Batenburg & Helms & Versendaal (2005), Helms & Batenburg & Versendaal (2006). From 2005 to 2008 Procurement and Supplier Relationship Management was the main topic of the course and the practical part was executed in cooperation with Berenschot, who provided

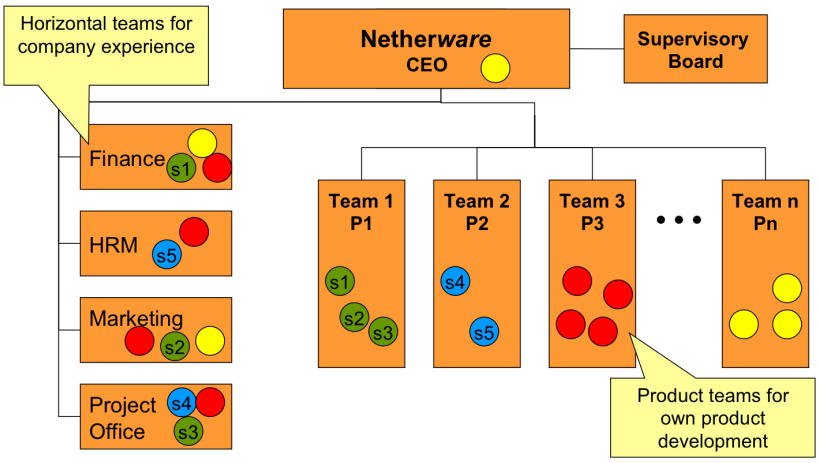

Figure 2: Netherware Virtual Company Organization

us with practical insight and respondents for interviews. The direct and indirect scientific procurement output from those course years was: Versendaal, Batenburg & Beukers (2005); Beukers, Versendaal & Batenburg (2006), Duinkerken, Batenburg & Versendaal (2006), Batenburg & Versendaal (2006), Kroese, Teuling, Versendaal, Batenburg & Kamp-Slootweg (2008), and Batenburg & Versendaal (2008b).

4 ICT-Entrepreneurship

ICT-Entrepreneurship is an innovative Master course in the Master study Business Informatics at Utrecht University. ICT-Entrepreneurship aims to educate students about entrepreneurship in the software industry. The course achieves this aim by means of the virtual Netherware Company, an organization that enables students to develop their own product ideas in a structured environment. Product ideas can be developed in any domain, as long as they are software related products or web services. ICT-Entrepreneurship does not specialize in software engineering, financial management, or marketing, but instead mixes such subjects to prepare students for entrepreneurship in real life.

The ICT-Entrepreneurship course takes 10 weeks. Each week a session of four hours and a session of eight hours is planned. During these sessions there will at least be two sessions of 45 minutes of theory. During the rest of these sessions students are working on their product ideas. Students work as if they are working in a company, so the sessions are compulsory, and students generally attend all sessions due to their intensity and the high workload of the course. The entry barrier for the course is that students must provide a description of a product idea they have for a software product. If these ideas are not good enough, students are advised to come up with a better idea. Once the idea is satisfactory, students can join up with the course.

Figure 2 shows the organization of the Netherware Company, the virtual company that supports the ICT-Entrepreneurship course. The Netherware Company is managed by the Chief Executive Officer (also the senior instructor of the course) who

is in charge of a number of business units. The business units are run by assistant professors and course assistants and consist of product teams. Product teams are student teams working on their own product idea and can consist of between one and four people. See www.netherware.nl for more background on the various products the students have developed over the years. The students are part of both a product team and a horizontal team. In horizontal teams, with names such as human resources, technology, and finance, students learn to manage a company. Experience is gained into running and organizing a company, within specific domains. The finance horizontal, for instance, is responsible for dividing virtual capital around to make sure the product teams can keep running whereas the human resources department solves problems amongst employees, decides on wages, and organizes fun extracurricular activities. A Board of Governors, consisting of IT entrepreneurs and venture capitalists plays an important role in assessment and feedback towards the starting enterprises. In the fifth week of the ten week course the teams present their first version of the business plan to the Board of Governors and receive limited feedback on their plans. At the end of course there is a final presentation of all business plans and prototypes of the software products. The Board of Governors divides a virtual amount of Euros among the most promising enterprises. Frequently, members of the board will provide extra advice in one-on-one sessions and present experiences during classes. Besides a course that is judged by students as intensive, hard, and a lot of fun every year, ICT-Entrepreneurship has been a wonderful opportunity to do research on novel forms of education. In cooperation with the Educational research and service centre of Utrecht University (IVLOS) research has been undertaken on the educational concept of ICT-Entrepreneurship: Ten Berge et al (2005, 2006a, 2006b), Nab et al (2006, 2007). The course of ICT-Entrepreneurship has enabled academic research into business models, software ecosystems, and software reuse. In the area of software reuse we have shown that pragmatic and opportunistic reuse of components is, though generally considered harmful, a way to rapidly compose and develop useful and successful products. With two co-authoring students we have published on two cases from the ICT-Entrepreneurship class (Jansen et. al, 2008).

5 Method Engineering

In the Method Engineering course, students learn to design, construct and adapt methods, techniques and tools for the development of information systems. The course consists of two parts, a theoretical and a practical part. During the lectures, method engineering theory is taught, in which the students learn about all areas within the method engineering domain, such as situational method engineering, meta-modeling, method comparison and method assembly. During the workshops, students work on their assignments, in which they apply the theory acquired during the lectures. The Method Engineering course lends itself very well to be used as input for research. In her PhD research, Inge van de Weerd works on a generic and open knowledge infrastructure for Software Product Management. Since companies have their own maturity level and their own situational context, the infrastructure is being designed in such a way that it can support situationality and growth in maturity.

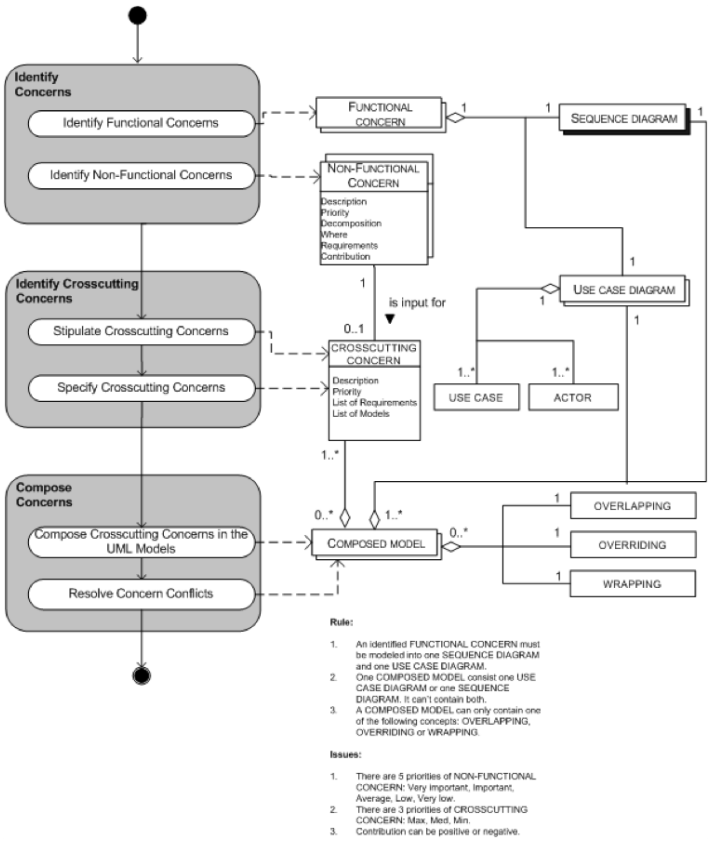

Figure 3: Process-deliverable diagram of Aspect-Oriented Requirements Modeling

During the workshops, the students write papers on methods and techniques in the Software Product Management domain, which can be added to the knowledge infrastructure. The workshop assignment starts with the students selecting a subject (which can be a method or technique) in the domain of Software Product Management. This subject can for example be a requirements gathering method or a technique for modeling product roadmaps. The students are then asked to carry out several assignments around this subject, which in the end results in a paper. First, the students carry out a literature research, in which they describe the origins of the method or technique, relations to other research papers, and possible case studies or experiments in which the method is actually used in practice. Also they give a high-level description of the method or technique, and describe which kind of companies can benefit of this method (in terms of maturity level and situational factors, such as size and sector). The next task is constructing a process-deliverable diagram of the method. In this process deliverable diagram, the process and deliverable of the method or technique are modeled. An example of such a process-deliverable diagram can be found in Figure 3. The students are also asked to describe a fictitious example of their method or technique in use, in order to clarify the process-deliverable diagram. Finally, the students present their work, correct each others work by peer review and use the comments to finish their paper.

The best papers (papers with the grade 7 or higher) that are produced by the students during the course are stored in a knowledge infrastructure. This knowledge infrastructure is online accessible, uses Wiki technology and contains descriptions of various methods and techniques in the domain of software product management (see www.softwareproductmanagement.org) . Anybody with an interest in software product management can access this knowledge infrastructure, read the articles, and contribute to it. Several papers on Software Product Management and the online knowledge infrastructure have already been published. In Weerd, Versendaal and Brinkkemper (2006), the concepts for the knowledge infrastructure are described and in Weerd, Brinkkemper, Nieuwenhuis, Versendaal and Bijlsma (2006), the reference framework for Software Product Management is explained.

In an earlier year various subjects were investigated during the Method Engineering course, among which Business Planning. That year there was the first ever organised European Conference on Entrepreneurship and Innovation, for which the two best course papers were selected and adjusted to fit the requirements of the conference. One paper utilized method engineering techniques for the customization of assumption checking in business planning (van Duinkerken & Brinkkemper, 2006), whereas the other created a framework for situational business planning (van Ee & Brinkkemper, 2006).

6 Diffusion of Information Technology

The goal of this course is to provide students with a thorough base with which they can understand and even predict the success or failure of new Information and Communication based products and services. In order to reach this goal, the course built up from three components. The first part is formed by an overview of models and theories that explain the adoption and use of new technologies. Examples of theories that are highlighted in class are Rogers Diffusion of Innovations, the Technology Acceptance Model and Actor Network Theory. The second component of the course is a case that can change every time the course is offered. Last year the case was centred around developments in Interactive and High Definition Television. In a number of class lectures the most important technical, organizational and policy developments were described. Also an overview of the market structure as well as legal aspects was provided.

The third component of the course is the research part in which students are required to set up a small research project related to the case. Due to the limited time in which the research has to take place, students often choose to interview a limited number of experts that have the answer to a specific research question. Other students take a more quantitative approach and set up a small (web) survey or even experiment. Students discuss their progress in weekly classes. During class they will receive feedback from their professors as well as their peers in a group that is not larger than 16 students. Results of the research have to be reported in the form of a scientific paper. Only the papers that are of the highest quality will be send to scientific workshops, conferences or journals. Last year, this has resulted in two accepted papers: Huiden et al. (2007), Joor et al. (2007). One paper was on Internet

broadcasting and was presented on a EuroITV pre-conference workshop in 2008. The second paper describes an experiment that was conducted to measure the effect of framing a High Definition Television (HDTV) clip. Results show that participants are unable to discriminate properly between digital and high definition signals. This in turn may influence the selling strategy and/or adoption speed of HDTV. As a top 3-paper on the EuroITV conference, it was accepted for a special issue of ACM Computers in Entertainment.

Summarising, we can say that the theories provide an strong basis for the course. The case can be updated or altered every year and the research involves students in the academic process. Combined, these three components (thorough theory, flexible case, specific research) offer the possibility to offer a strong scientific approach in a fast changing environment of Information and Communication technologies.

7 Research and Student Involvement in Other Courses

7.1 Introduction to MBI

As students increasingly had questions about the master, the graduation procedure, and as we noticed that students were not interacting sufficiently with each other, we decided a more focused approach was required towards the master. We introduced a course that focuses solely on the master structure itself. The Introduction to MBI course is worth 1 ECTS and is administratively part of the final graduation project, even though it takes part at the beginning of the MBI course. The course is built up out of six classes, each with a special focus: (1) Introduction to the program and professors, (2) Course preparations, (3) Creating a study plan,, which also presents the opportunities to follow courses at other universities in the Netherlands and abroad, (4) Final thesis project, and (5+6) Students presenting themselves, their study plan, and their ambitions in two sessions. The final session is closed with informal drinks to further stimulate contact and interaction between students. This especially helps to integrate the students entering the MBI program with a BSc from an other institution with those that continue with a BSc from Utrecht University.

7.2 Enterprise Architecture

As part of the master course Enterprise Architecture, students have to draw up an architecture model of a real enterprise. To achieve this, they get four lectures on our Enterprise Architecture Modeling (EAM) technique and then work together in small groups to produce the required models. A representative of the enterprise has to approve the models, and declare they really represented the given situation at the enterprise. These representatives were mostly having a position in the IT-department, and were reporting to business management. A major goal we had in mind when constructing this course was to present an easy to learn method for modeling enterprise architectures. In order to evaluate to what degree we succeeded

we launched a questionnaire among the students that performed the case studies. We received 23 reactions. The general direction in the answers suggests the following: the method is indeed easy to learn and easy to read. However, the different models we use in the method are not experienced at the same level of difficulty. In fact, the model showing the enterprise functions and their interrelationships is considered the most difficult. Given the relative complexity of this model, this is understandable and the feedback we received is used to give the students more detailed instructions on drawing up this specific model. The results of this study were published recently in Koning & Bos & Brinkkemper (2008).

7.3 Business Process Management

Starting in 2006, the Business Process Management (BPM) course was developed and given in cooperation with the Hogeschool Utrecht (Utrecht University of Applied Sciences). The main goal of the course is to let students experience the issues related to BPM implementation in a company and across the supply chain. The course contains two parallel tracks:

- Practical business process management system implementation
- Research assignment and theoretical seminars

During the practical sessions students learn how to implement a BPM-suite (Cordys), and participate in workshops at the business laboratory of Hogeschool Utrecht. They will create and implement a simple supply chain solution case in Cordys, and let the business partners collaborate with each other according to predefined public processes using web services. Developing key performance indicators and management dashboards for the monitoring of business operations concludes the business case. To be able to let students work with a BPM-suite a cooperation was started with the Cordys company. During the course consultants from Cordys give several technical sessions and the university has a direct access to their development department in India (which also benefited Cordys because many bugs and performance issues were discovered during the courses).

During the seminars, theoretical elaboration will take place on the issues related to the implementation of Business Process Management (Systems). Besides the course lecturers many companies are involved during the seminars. There is always a mixture of developers of BPM solutions (e.g. Oracle, BEA Systems, Cordys), consultancy organisations (e.g. Capgemini, O&I, AtosOrigin) and end users involved (e.g. Fortis, ABN AMRO, Interpay). Also each year a research assignment is given to teams of 4 students. In 2006 students had to explore the critical success factors when implementing BPMS (Ravesteyn, 2007), during the 2007 course students were assigned different research approaches to validate critical success factors of BPMS implementation (Ravesteyn & Versendaal, 2007), and in 2008 students had to develop BPMS implementation fragments in relation to preassigned critical success factors (Ravesteyn & Jansen, 2008). Outcomes of the research assignments are presented and defended by the students in class and a report with the analysis and conclusions have to be provided in written format. Based on the different reports and the data collected, it is the goal of the lectures to write a scientific publication.

This unique form of cooperation between universities and companies, together with the integration of research in an educational course has been presented at several BPM educational conferences Ravesteyn & Versendaal (2007), Ravesteyn (2007), Ravesteyn & Jansen (2008).

7.4 Capita Selecta

Talented students are invited to perform a project in collaboration with one of the professors, as a kind of honors project, and is called Capita Selecta. The project focuses on writing a scientific paper with some authors including the professor. Usually the staff have some half written paper concept or some interesting idea for a paper. The student is the primary author and in some two to four months the paper is written and submitted to a conference. If the paper gets accepted the student gets funding for presenting the paper at the conference. Lately the student mer Faruk Aydinli managed to write a paper for the European Conference on E-Government (Aydinli et al. (2008)), which was subsequently selected for publication in the Electronic Journal for E-Government.

7.5 MBI Summerschool

Each year the MBI professors organize a summer school focused around a relevant and current topic. In 2008 students were even graced with opportunities for two summer schools, a trip to a scientific conference in Bled, Slovakia, and a trip around Eastern Europe to study distributed product software development.

Distributed Product Software Development in Eastern Europe

In 2008 two professors and 10 students undertook a summer school to Eastern Europe to study the subject of distributed development. The trip turned out to be legendary. Approximately 9 months before leaving preparations started to gather locations to visit in Eastern Europe. These locations consisted of both Dutch software companies that have distributed their software development to the region and a collection of Eastern European universities, where we received campus tours and classes. We were not expecting that we would end up with a jam packed program of 20 days, touring from Prague, to Brno, to Budapest, to Cluj, to Bucharest, to Craiova, to Novi Sad, and then finally back home. The end-result of the course was a book and a conference, in which each student presented their specific findings regarding a subject such as the software development process, legal structures, software testing, etc. Overall, the trip was a wonderfully enriching experience for students, who had to sleep in cheap hostels, yet show up looking exceptionally formal for our meetings and research the mornings after.

E-Sourcing at the E-Business Conference in Bled, Slovakia

In 2007 and 2008 a selected group of 6 students took part in the MBI summer school 'Bled', under supervision of two lecturers. The theme of the summer school project is e-sourcing, i.e. supporting and innovating the process of selecting and

contracting suppliers (as part of the procurement process) through web technology and IT. After an academic literature study and desk research on e-sourcing, several consultancy firms were visited and invited that also sponsored this summer school. Then, a hands-on e-sourcing simulation project was co-organized, using the Oracle e-sourcing suite. In this project, three teams of MBI students realistically executed the role of buyer or supplier, and negotiated with students from Ireland and Slovenia in a number of e-auctioning rounds. Based on these experiences, papers were written that were presented at the (20st and 21st) international e-business conference, in Bled, Slovenia. The papers were presented at the 'Students Bazaar session' at the conference, in competition with master students from several other European countries. Results form the conferences were bundled and provided as a conference report for the sponsoring companies. The papers of the Utrecht students are Levantakis et al. (2007), Guner et al. (2007), Kieboom (2008), Kusters (2008), Veldhuizen (2008), Emaus (2008), Vogels (2008).

8 MSc Research Thesis

The MBI thesis Project is a mandatory and final part of the MBI program. It is a scientific research assignment on a relevant subject which should always fit the interest of the O&I-group. In essence it tests the level and scope of academic ability that have been acquired during the Master study. The deliverables are (a) a thesis document, (b) a public presentation of the thesis, and (c) a scientific paper. For the final evaluation the students attitude and process are evaluated as well next to the deliverables.

Students are allowed to start with the thesis Project when all mandatory courses have been passed and no more than 15 ECTS (or two courses) of optional courses are still open. Although the research assignment can be carried out within the Institute, most students opt for an internship at one of the external organizations in the groups extensive network, which includes all major players in the IT industry.

Students can only start with the thesis Project when the Program Coordinator and the Proposal Committee grant admission, based on a proposal with a number of predefined sections such as Research trigger, Problem introduction, Research questions, Research approach, Timetable and Relevant literature. Special attention is given to the research question and research approach. Does an answer to the research question contribute to the state-of-the-art in the scientific field? Was the appropriate research strategy chosen? For example, many students apply a qualitative strategy to help explore a new IT phenomenon, or follow a design methodology to improve a current situation by developing a model which is subsequently validated empirically.

At the end of the thesis project the students have to start writing a scientific paper. Based on the results and the capabilities of the student, a proper research outlet is selected, e.g. a workshop or conference, or a (inter)national journal. Not all students manage to get a paper out of their thesis project, but as table 1 with quantitative data on student research output shows that about half of the students manage to write a scientific paper during their MBI study, and even 16 out of the

Category	Number	Percentage
Students	118	100
Students with no paper	60	50.8
Students with one paper	42	35.6
Students with multiple papers	16	13.6
Total papers	78	100
Paper in preparation or submitted	9	11.6
Workshop paper	14	17.9
Conference paper	38	48.7
Journal paper or book chapter	17	21.8

Table 1: Scientific output of student projects

118 students publish 2 or more papers. Conferences are the best outlet for students, where the European Conference on Information Systems, the premier scientific event in the area of business informatics, a popular target is.

9 Lessons Learned

During the five years the MBI program exists we have made various observations which resulted into adaptations of our policies and courses. The most important lessons were:

- Students can easily be motivated to write a scientific paper. The good students see it as an asset to their curriculum vitae, even for those not aspiring to become a researcher. Most students are working very hard to complete their course work and writing a paper is part of that.
- Early selection during the first courses of the MSc program is essential in order not to spend too much energy on poor students. In the beginning years the parole was to get every student to a MSc degree, which was too ambitious. Although all students are obliged to write a scientific paper, it is not possible to comply with this, and this rule should be applied in a flexible manner.
- Establishing a personal relationship with the students helps in getting a high quality research atmosphere. When teachers try to learn the names of the students by heart, and drink coffee during the breaks with them, the‘’ students find themselves being respected and involved.
- Trips to conferences and workshops are an excellent incentive for students. We have made arrangements for some travel budget for the students. To keep it affordable, students are only allowed to submit a paper to a workshop or conference in Europe, and when several students co-author a paper only one is paid for. It then happens that the students share the budget and provide half of the costs themselves.

Generally speaking we have experienced that the model of Graduate teaching where Master students and PhD students are collectively educated in research, is already possible in the current educational system. The students can be easily trained in reading literature, doing state-of-the-art research, and writing research papers. Designing Master programs and courses in conjunction with the design of a PhD research educational system is not that difficult. An even more formalized graduate school system is *the* way to go for the European universities, let's have them at Utrecht University!

Acknowledgments

We wish to thank all MBI students who contributed with their time, energy and works to the courses and the research results. Without their efforts the research results reported here would not have been possible.

This paper commemorates also the departure of Ronald Batenburg from the Department of Information and Computing Sciences, one of the co-founders of the curriculum, and the program leader and study advisor since the start of the program in 2004. We thank him for his inspiration, energy, and teaching qualities serving many students and colleagues.

References

Batenburg, R. and Versendaal, J. (2008). Maturity Matters: Performance Determinants of the Procurement Business Function. Submitted to: ECIS 2008 European Conference on Information Systems. Galway, Ireland, 9-11 June 2008.

Batenburg, R. and Versendaal, J. (2008a). Business/IT-alignment for customer relationship management: framework and case studies. To be published in: Int. J. Electronic Customer Relationship Management.

Batenburg, R.S., & Versendaal, J.M. (2006). Alignment matters - Improving business functions using the Procurement Alignment Framework. UU-CS (Int. rep. 2006-002). UU WINFI Informatica en Informatiekunde.

Batenburg, R.S., Helms, R.W., & Versendaal, J.M. (2005). The Maturity of Product Life Cycle Management in Dutch Organizations. A Strategic Perspective. UU-CS (Int. rep. 2005-009). UU WINFI Informatica en Informatiekunde.

Batenburg, Ronald & Versendaal, Johan (2004), Business alignment in the CRM Domain: Predicting CRM performance. In: Proceedings of the 12th European Conference on Information Systems, Turku, Finland, 14-16 June 2004.

Berge, H. ten, Nab, J. & Brinkkemper, S. (2006). Netherware: analyse van de opzet, resultaten en succes- en faalfactoren. Rapportage EMP-project 2005-2006. Utrecht: IVLOS, Universiteit Utrecht.

Berge, H. ten, Ramaekers, S.P.J., Brinkkemper, S. & Pilot, A. (2006). Netherware: analysis, results, and success factors of the designed curriculum unit. UU-CS (Int. rep. 2006-016). UU WINFI Informatica en Informatiekunde.

Berge, H., Ramaekers, S., Brinkkemper, S. & Pilot, A. (2005), Analyzing the design of an authentic task in higher education: teaching entrepreneurship for software products in a virtual company. Paper presented at the EARLI conference, Nicosia, August 23-27, 2005.

Ten Berge, J., Ramaekers, S., Brinkkemper, S., Pilot, A., & Nab, J. (2008). Teaching Entrepreneurship in the Software Branch: The Design of an Authentic Task in Higher Education. Education and Information Technologies. (in press)

Beukers, M., Versendaal, J.M., Batenburg, R.S., & Brinkkemper, S. (2006). The Procurement Alignment Framework - Construction and Application. Wirtschaftsinformatik, 48(5), 323-330.

Beukers, Mark, Johan Versendaal, Ronald Batenburg & Sjaak Brinkkemper (2006). The Procurement Alignment Framework: Construction and Application. Wirtschaftsinformatik 48(5), pp. 323-330.

Dirkjan Joor, Wilco Beekhuizen, Lidwien van de Wijngaert, Pascal Ijegalu What you expect is what you see. Paper presented at 6th European Conference EuroITV 2008, Salzburg, July 2008. Published in: Changing Television Environments, TICSP Adjunct Proceedings of EuroITV 2008, Tampere 2008.

Duinkerken, van, W., Batenburg, R.S., & Versendaal, J.M. (2006). The Added Value of E-Procurement for Buyer-Supplier Interaction applying IT using the E-Procurement Maturity Framework. In Ned Kock (Ed.), Encyclopedia of E-Collaboration. Hershey: Idea Group Reference.

Duinkerken, W. van & Sjaak Brinkkemper (2006) Customized assumption checking in business planning. Proceeding of the European Conference on Entrepreneurship and Innovation. Academic Conferences, Paris.

Ee, Tim van & Sjaak Brinkkemper (2006). Situational business planning. Proceedings of the European Conference on Entrepreneurship and Innovation. Academic Conferences, Paris.

Emaus, T. (2008), Semantic Web and eSourcing. Poster presented at the Professor Ren W. Wagenaar ePrototype Bazaar, 21st Bled eConference ECollaboration Overcoming Boundaries Through Multi-Channel interaction, Bled, Slovernia, 15-18 June.

Fabriek, M., Brand, M. van de, Brinkkemper, S., Harmsen, F., Helms, R.W., (2008). Reasons for Success and Failure in Offshore Software Development Projects. In Golden W., Acton T., Conboy K., van der Heijden H., Tuunainen V.K. (Eds.), Proceedings of the 16th European Conference on Information Systems, June 9-11, Galway, Ireland, pp. 446-457.

Guner, M., Pigmans, K. and Josaputra, Y.L. (2007), Cross-case analysis on the use of e-sourcing. Paper presented at the Professor Ren W. Wagenaar ePrototype Bazaar, 20th Bled eConference eMergence: Merging and Emerging Technologies, Processes, and Institutions, Bled, Slovernia, 3-6 June.

Helms, R.W., & Buysrogge, C.M. (2006). Application of Knowledge Network Analysis to identify knowledge sharing bottlenecks at an engineering firm. In: J. Ljungberg & M. Andersson (Eds.), Proceedings of the 14th European Conference on Information Systems.

Helms, R.W., Batenburg, R.S., & Versendaal, J.M. (2006). PLM Roadmap: Stepwise PLM implementation based on the concepts of maturity and alignment. International Journal of Product Life Cycle Management, 01(04), 333-351.

Jansen, S., Brinkkemper, S., Hunink, I., Demir, C., (2008). Pragmatic and Opportunistic Reuse in Two Innovative Start-up Companies. IEEE Software, Special Issue on Opportunistic Software Systems Development, November/December 2008.

Kieboom, M. (2008), The Effectivity of Decision Support in E-sourcing. Poster presented at the Professor Ren W. Wagenaar ePrototype Bazaar, 21st Bled eConference ECollaboration Overcoming Boundaries Through Multi-Channel interaction, Bled, Slovernia, 15-18 June.

Koning, H., Bos, R., Brinkkemper, S. (2008). A Lightweight Method for the Modelling of Enterprise Architectures Introduction and Usage Feedback. Proceedings of the 3rd Workshop on Trends in Enterprise Architecture Research.

Kroese, E.C., Teuling, J.M. den, Versendaal, J.M., Batenburg, R.S. and Kamp-Slootweg, H. van de (2008). Aligning procurement: An e-procurement mapping and deployment model. To be published in: IPSERA 2008 Proceedings of 17th Annual Conference of the International Purchasing & Supply Education and Research Association, Perth, Australia, 9 - 12 March 2008.

Kusters, R. (2008), Benefits of e-Sourcing. Poster presented at the Professor Ren W. Wagenaar ePrototype Bazaar, 21st Bled eConference ECollaboration Overcoming Boundaries Through Multi-Channel interaction, Bled, Slovernia, 15-18 June.

Levantakis, T. , Tax, B. and van Weeghel, R. (2007) Sourcing with the Oracle E-business Suite. Paper presented at the Professor Ren W. Wagenaar ePrototype

Bazaar, 20th Bled eConference eMergence: Merging and Emerging Technologies, Processes, and Institutions, Bled, Slovernia, 3-6 June.

Nab, J, Pilot A, Brinkkemper S, ten Berge H (2007), Authentic competence-based learning in university education in entrepreneurship. In Proceedings of the 17th Global Conference on Internationalizing Entrepreneurship Education and Training, Gdansk, Poland.

Nab, J., Brinkkemper, S., Berge, H. ten & Pilot, A. (2006). Netherware: The effects of a synthesis of a course, incubator and coaching facility. In D. Remenyi (Ed.), Proceedings of the European Conference on Entrepreneurship and Innovation (pp. 143-150). Reading, UK: Academic Conferences Limited.

Ömer Faruk Aydinli, Sjaak Brinkkemper, and Pascal Ravesteyn, 2008. Business Process Improvement in Organizational Design of E-Government Services. Published in the Conference Proceedings of the 8th European Conference on E-Government, Lausanne, Switzerland.

Ravesteyn, P. 2007. Business Process Management Systems: Hype or New Paradigm. Published in the Conference Proceedings of the 18th conference of the International Information Management Association, Beijing, China.

Ravesteyn, P., Jansen, S. (2008) A Context Dependent Implementation Method for Business Process Management Systems (Submitted for publication) Ravesteyn, P., Versendaal, J. 2007. Success Factors of Business Process Management Systems Implementation. Published in the conference proceedings of the 18th Australasian Conference on Information Systems, Toowoomba, Australia.

Roel Huiden, Victor Scholte, Martijn van der Steen, Floris Vlasveld, Erik Huizer, Internet Broadcasting: Viable or Not? The Producers Point of View, Workshop Interactive Television Commerce and Advertising, 6th European Conference EuroITV 2008, Salzburg, July 2008. Published in: Changing Television Environments, TICSP Adjunct Proceedings of EuroITV 2008 , Tampere 2008.

Tromp, S., Versendaal, J.M., & Batenburg, R.S. Duinkerken, W. van (2006). Application of the Business-IT Alignment framework within the Telecommunications Industry. In: ICTTA06 Proceedings of the 2nd IEEE International Conference on Information & Communication Technologies: From Theory to Applications, 24-28 April 2006, Damascus, Syria, pp 262-267.

Veldhuizen, R. (2008), What is the Best Way to Anticipate for Implementing an e-Sourcing Application in Organizations? Poster presented at the Professor Ren W. Wagenaar ePrototype Bazaar, 21st Bled eConference ECollaboration Overcoming Boundaries Through Multi-Channel interaction, Bled, Slovernia, 15-18 June.

Versendaal, J.M., Batenburg, R.S., & Beukers, M. (2005). Busines Alignment in the Procurement Domain. UU-CS (Int. rep. 2005-001). UU Universiteit Utrecht.

Vogels, A. (2008) Strategic Benefits of E-sourcing. Poster presented at the Professor Ren W. Wagenaar ePrototype Bazaar, 21st Bled eConference ECollaboration Overcoming Boundaries Through Multi-Channel interaction, Bled, Slovernia, 15-18 June.

Weerd, I. van de, Brinkkemper, S., Nieuwenhuis, R., Versendaal, J., Bijlsma, L. (2006). Towards a Reference Framework for Software Product Management. Proceedings of the 14th International Requirements Engineering Conference, Minneapolis/St. Paul, Minnesota, USA, 312-315.

Weerd, I. van de, Versendaal, J., Brinkkemper, S. (2006). A product software knowledge infrastructure for situational capability maturation: Vision and case studies in product management. Proceedings of the 12th Working Conference on Requirements Engineering: Foundation for Software Quality (REFSQ'06), Luxembourg, 97-112.

Weerd, I. van de, Weerd, S. de, Brinkkemper, S. (2007). Method comparison: A case study in game production methods. Proceedings of the IFIP WG 8.1 Working Conference on Situational Method Engineering: Fundamentals and Experiences, IFIP Volume 244, 313-327.

Wieringen, F., Huizer, E. & Wijngaert, L. van d. Catching the Consumer: HDTV as the application that drives user demand for broadband. In B. Preissl (Ed.), 17th European Regional Conference on Internation Telecommunication Society (pp. 1-5)

Wijaya, S., Spruit, M., Scheper, W. (2008). Webstrategy Formulation: benefiting from web 2.0 concepts to deliver business values. In: Lytras, M. et al. (eds), Emerging Technologies and Information Systems for the Knowledge Society, Lecture Notes in Computer Science, Vol. 5288, Official Proceedings of the First World Summit on the Knowledge Society, WSKS 2008, Athens, Greece, September 24-26, 2008, Springer Berlin / Heidelberg.