

AN APPROACH TO TEACHING IT PROJECT MANAGEMENT IN A MASTERS PROGRAM

Vladimir Alexiev*, **Petva Asenova****

PhD, PMP, Technical Director, Sirma Solutions Corp and Sirma IT Consulting,
135 Tsarigradsko Shosse Blvd, 1784 Sofia, Bulgaria
vladimir@sirma.bg, +359 888 568 132 *

Assoc. Prof. PhD, Computer Science Department,
New Bulgarian University, 21 Montevideo St., 1618 Sofia, Bulgaria
pasenova@nbu.bg, +359 2 811 0611**

ABSTRACT

Many Bulgarian IT professionals manage projects but their knowledge and skills in this area are based mainly on their own experience, which is often obtained through trial and error. Although the project manager (PM) has a crucial role for project success, the university curriculum in Bulgaria does not answer sufficiently these business needs. Some aspects of PM are included in university courses on Software Engineering and some short courses on IT PM are offered, but as overall this matter is not covered in depth in any national university. Having in mind this real need, we proposed a new Masters Program on IT PM hoping it will meet the interest of many students representatives of the software business.

This paper presents an approach to prepare PMs for the Bulgarian IT industry through a Masters Program, developed in cooperation between the New Bulgarian University (NBU) and the Institute of Mathematics and Informatics (IMI) of the Bulgarian Academy of Science (BAS). We describe the background, objectives and design of the program, and relations with the business.

Key Words: Masters Program; IT project management (PM); university curriculum, relations between university and business.

1. BACKGROUND

Software development is one of the successful branches of the Bulgarian economy, showing constantly good results during the transition period to market economy. The world financial and economic crisis has reflected on the software business less than other branches. [1, G. Brashnarov, Chairman of the Association of software companies BASSCOM]. In addition to national companies, numerous foreign companies from Western Europe and the US have set up shop in Bulgaria, attracted by the high professional level of many young people in the software engineering field, and lower costs.

There is no comprehensive statistics about the software companies in Bulgaria, because of the dynamic of this industry market. The Bulgarian IT Industry Barometer survey (BITIB) of BASSCOM comes closest to this goal, but it covers less than half of the software companies.

Here are some underestimated numbers [3]:

- The number of IT companies in Bulgaria according to the registration in the portal *jobs.dev.bg* is 175 with more than 10,000 staff.

- Small companies (having less than 15 employees) present 12.57%.
- Middle size companies (having staff between 15 and 100) are 68%.
- IT companies (having more than 100 staff) are 7.43% of all companies.
- Most companies (84%) are located in Sofia.
- 25% to 50% of software production is destined to the national market.

The prosperity of the software industry in Bulgaria depends to a great extent on company and project managers. Furthermore, a large part of Bulgarian national development at present proceeds through EU-funded projects. Therefore Project Management (PM) is of crucial importance for the country's development.

Most Bulgarian IT managers obtained managerial competences during their own practical experience, over a long time, through trial and error. The university curriculum in Bulgaria does not cater sufficiently to the business needs of IT management. The curriculum is oriented mainly to software development, hardware support and technical IT topics. No university provides specialized education on the field of IT management. Some short courses on IT PM are offered in related programs:

- MSc programs on Software Engineering: Sofia University (SU), Ruse University (RU), Varna Free University (VFU)
- Some undergraduate and isolated courses

According to university websites the total number of such courses is less than 20 for the country. IT management topics are covered partially and are presented mostly in a theoretical manner. No specialized BSc or MSc program on IT Project Management existed. Overall, this matter is not covered in depth, and universities do not prepare IT professionals for the wide range of managerial competences:

- Manage projects throughout their life cycle; build an effective team and lead it successfully; communicate with colleagues and clients; obtain familiarity with legal regulations and financial planning; have related organizing skills; evaluate and mitigate risks in project development; understand the needs of the market, etc.

This gave us reason to believe that a master program on IT project management is needed by the IT industry in Bulgaria and it will be met with interest from students and IT companies. So we created a new master program to prepare IT project managers that are able to work in a dynamic environment marked by strong competition.

This paper describes a practical approach to teaching IT Project Management in a Master Program. In particular, we present the common framework of the program, design of subjects, construction of projects and interaction with IT companies. A special attention is devoted to the concepts and issues of IT Project management involved in the program.

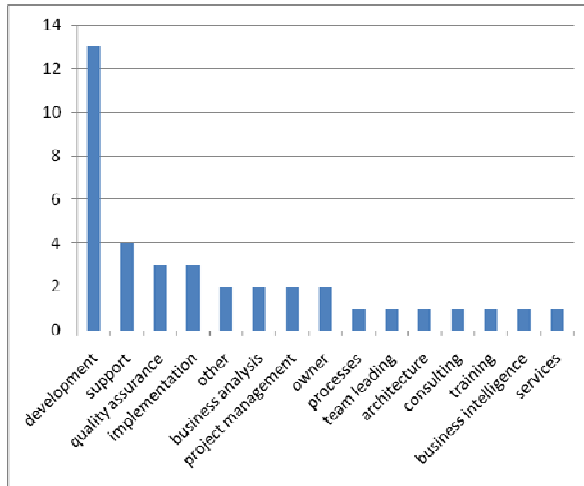
The new program started in NBU / BAS IMI in the fall of 2009.

2. STUDENT DEMOGRAPHICS

The first issue of the IT PM course attracted 29 students. It is interesting to analyze the demographics of this class:

- Most students are working in various IT companies. The class is very strong and includes IT consultants, project managers, owners of IT companies.
- Some of the large companies where students work are: HP, SAP, Computer Sciences Corporation, Kozloduy Nuclear Power Plant, etc
- The gender breakdown is 19 male, 10 female. This is unusually high for the IT industry globally and in Europe
- The average age is about 25 years

- The professional areas where students work cover a wide spectrum: software development, quality assurance, project management, implementation of ERP, architecture, Business Intelligence, IT training, end-user support, software process (including SCRUM), IT consulting. The breakdown of IT areas is shown below (the sum is more than 29 since some students have pointed two areas)



- Although the largest number are developers, the students are ambitious and are aiming at team lead and PM positions. A couple of the students have joined the Project Management Institute (PMI) with the view of obtaining Project Management Professional (PMP) certification.

3. IT PROJECT MANAGEMENT SUBJECT STRUCTURE

Thinking about how to design the Master Program on IT PM, we analyzed the following three elements:

- Understanding about the IT project management
- Business needs of Bulgarian IT managers
- Solutions of some leading universities in the world

We explored the documentation of PMI and related program curriculum of the leading universities in USA and Europe, such as University of Boston (USA), Stevens University (USA), Columbia University (USA), Aston University (UK). Overall, the American universities have leading positions in IT PM in both the business and education. [2, 4, 6, 7, 8]

We also decided to provide some courses on Information Systems, which are a widespread area in Bulgarian software companies. In this way we accepted a pragmatic approach curriculum design.

The **main objectives of the program** are to prepare IT project managers with a wide range of competences, able to manage projects successfully in a competitive, dynamic and open environment.

Students who finish successfully this program will have knowledge and skills in:

- the process of creating, developing and managing IT projects;
- analyzing a project development process and react adequate;
- problem solving and decision making
- managing risk;
- organization and planning;
- law regulations for the IT sphere;

- managing technological recourses, people and finance;
- building and managing effective team;
- leadership and conflict resolution;
- ability to work in international context and with an interdisciplinary team;
- oral and written communication in Bulgarian and English
- design of information systems. [5]

The formulated competences above gave an orientation to the following areas of teaching:

- IT PM
- Human aspects, organizational behavior and leadership
- Software process and project quality
- Technological innovations
- Organizational and law regulations
- Managing finance
- Marketing
- Information Systems issues. [5]

The Bulgarian Higher Education Law determines Masters program composition of 4 terms: 3 terms teaching and 1 term master thesis work. According to the NBU Program Scheme, the students has to cover 30 credits per term as follows:

- 15 credits from courses
- 15 credits from projects
- 15 credits practice
- 15 credits from master thesis. [5]

The standard course is 30 hours and provides 3 credits (1 credit = 10 hours in a successfully completed course).

The program comprises the following 21 **courses**:

- First term:
 - IT PM - 1
 - IT PM - 2
 - Workshop on IT PM
 - Law regulations of projects
 - Information Society Law
 - Management of Financial Resources
 - Leadership and Team
- Second term:
 - IT PM - 3
 - Analysis and Design of Information Systems
 - Managing Human Resources
 - Systems for Managing Business
 - Testing Software and Quality Management
 - Data Mining
 - Architectures of Software Systems
- Third term:
 - Data Warehouse
 - Modern Technologies for Managing IT Production
 - Software Estimation
 - Estimating Risk in IT Projects
 - Managing Marketing

- Statistical Methods
- Writing European Projects
- Practice
- Fourth term:
 - Master's Thesis. [5]

Each course involves a Project/Case that students develop individually or in a group under the supervision of the teacher.

NBU uses intensively the Moodle open-source e-Learning system for distributing course content, discussions, course notifications, etc. Another web-based system is used for course administration and entering official grades.

Students take a pre-defense practice (internship) on project management in a company. They finalize their education with a Master's Thesis. Thesis projects give the possibilities to decide real problems in conditions closed to the real ones. Some projects are supervised by experienced professionals from IT companies. Other projects are presented by students to a jury of 3-4 people, some of which are from the IT business.

4. TEACHING IT PROJECT MANAGEMENT CONCEPTS

In this section we describe the content of the core introductory PM courses (IT PM 1 and 2, and Workshop on IT PM). The problem we faced is how to introduce a large set of topics efficiently, and what practice activities to include in order to impress the topics upon the students. These courses are followed by the **IT PM 3** - advanced course, which continues the first two ones and designed according to the conception of Boston University. [2, 6]

The **IT PM 1 and 2** courses are an integrated sequence based on the course "Principles of Software PM" (Q7503) by Columbia University and including a lot of extra material. Two main topics permeated the courses: theoretical PM (ala PMI) and IT PM (practical aspects)

- Course intro
 - Meeting the lecturer and students. Brief course overview. Overview of the materials: discussion, selection
 - Basics of PM, place of PM amongst other software engineering disciplines
 - What is a project, software processes, project processes. Work and responsibility of the PM. People, process, technology, product. Project stakeholder analysis
 - 36 classic mistakes in PM
- Intro to PM
 - PM process according to PMI and Project Management Body of Knowledge (PMBOK)
 - 5 project areas, 43 processes, 10 knowledge areas. Software development phases
 - Organizational structures. Project charter, Statement of Work (SOW)
- Planning
 - Software Development Life Cycle (SDLC) models. Selecting a SDLC according to project characteristics.
 - Project plans. Work Breakdown Structure (WBS)
- Estimation and budgeting
 - Effort estimation, estimation methods, Function Points/ COCOMO/ parametric/ Use-case based. Intro to Agile estimation and progress reporting
 - Budgeting, project portfolio selection. Return on investment models. NPV, ROI
- Project time management
 - Basics of Project network planning. Critical path method. Gantt chart
 - Working with uncertainty: PERT, Monte Carlo analysis

- Critical chain method, theory of constraints. Agile planning: #user stories, weight, velocity, burndown
- Working with Microsoft Project
 - Microsoft Project tips & tricks. Hands-on lab using Microsoft Project
- Risk and change management
 - Risk management. Estimate uncertainty as a basic risk in software PM
 - Change management
- Development management
 - Team models, working with people. Managing the team, conflicts and motivation
 - Software engineering disciplines. Requirements management as a basic success factor
 - Configuration management
 - Software metrics, what are they useful for, how not to misuse them
 - Programming languages and frameworks and their effect on productivity
- Project control
 - Reporting progress and status. Partial milestones considered harmful. Project metrics. Earned value analysis/management
 - Communication management
 - Software Process Improvement. Software quality management: test scenarios, blackbox/whitebox testing, unit and integration testing, acceptance testing and scenarios, test automation
- Project closure, success factors
 - Project Recovery. Project documentation
 - Deployment and transition to production. Cutover/Migration. Project closure, Post Project Review
 - Defining and measuring success. Company politics, support from higher management. Expectation management

Similar courses were piloted at two MS Software Engineering programs (RU and VFU) before deploying them in the MS IT PM program.

The PM 1 and PM 2 exams were conducted completely electronically (on university computers or personal laptops). Use of any materials was permitted, but no network usage. The exams included the following tasks:

- 2 theoretical tasks involving calculations (Earned Value and Network Diagram)
- 50 multiple-choice questions (based on PMP material)
- Creating a project schedule with Microsoft Project
- Extracting and presenting descriptive and statistical information from the schedule

The **Workshop on IT PM** involved creation of complete project documentation in 7 teams of 4 people each. We were careful to allocate the students in a balanced way (see Areas in section 2). Project documentation was based on the Rational Unified Process (RUP) and involved the following:

- Project charter
- Requirements specification (partial): functional and non-functional
- UML models, architecture (almost not scored, used as background only)
- Project plan
- Microsoft Project schedule, charts and reports from the schedule
- Quality plan
- Test plan
- Risk management plan

The sample projects involve simplified real-world experience of Sirma Group Corp and included:

- BTA: photo management and sales system for Bulgarian Telegraph Agency
- DIPL: work management system for legalizing and certifying diplomas issued abroad
- HOTEL: travel agent reservation system
- LAND: information system for trading of agricultural lands
- PROJ: project management/tracking system
- SEA: issuing certificates for naval years of experience at sea
- SOCIAL: information system for managing social assistance programs

5. CONCLUSIONS

The high student interest and positive comments received so far (start of second semester) show that we have created a useful program. We are adjusting the program based on student feedback:

- Added more practice for better imprint of the material
- Added a Software Estimation course, since estimation and metrics are some of the most important IT manager responsibilities (consider the Standish Group CHAOS reports)

The role of industry was crucial for this program in several aspects:

- Providing requirements and feedback
- Evaluating the course composition
- Providing and delivering some of the content
- Providing experienced lecturers from software companies
- Accessing students projects
- Engaging the students in real-world practice (internships)
- Disseminating the program among the software companies.

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РЕЗЮМЕ

Не малка част от специалистите в софтуерната индустрия ръководят проекти, но техните знания и умения да се справят с тази задача най-често се основават на техния личен практически опит, често съпроводен с проби и грешки. Макар, че успехът на един проект до голяма степен зависи от качествата на мениджъра, университетските учебни планове не отговарят достатъчно на тези бизнес нужди. Някои аспекти на управлението на проекти се третират в курсовете по софтуерни технологии и само на малко места има кратки курсове по управление на проекти, но като цяло тази материя не е покрита в достатъчна степен в българските университети. Като имахме предвид

тази реалност, ние предположихме, че една нова магистърска програма по управление на проекти би била посрещната с голям интерес от много студенти и представители на софтуерния бизнес.

Този доклад представя един подход за подготовка на мениджъри за българската ИТ индустрия чрез обучение в магистърска програма. Описана е обстановката, довела до създаване на програмата, нейните цели и композиция, както и взаимодействието университет - бизнес.