Utilization of UML in Bulgarian SME – Possible Training Strategies

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Abstract
In this paper we investigate the utilization of UML in Bulgarian small and medium companies as a general purpose modeling language that facilitates the construction of traceable models. The goal is to evaluate the current level and practices as well as the needs for UML training. Considering the application of UML in SME as an example, more general consideration about how to deliver training resources are derived.

Key Words: UML, distance learning, customer's profiling

1. INTRODUCTION

Nowadays management is inseparably related to and relying on software applications that strongly facilitate the decision-making process. Companies extensively use strategic information systems [1] to support their administrative, business and organizational practices.

In a real world environment, there is no a standardized method or technology for the development of multiple systems and applications. However, there are powerful and generic tools, which might serve as a foundation for modeling robust and reliable systems. On such a framework dedicated specific components can be built up to support the multitude of organizational activities. In this context UML as a general purpose modeling language is not restricted to modeling software only but it is commonly used for business process modeling and representing the organizational structure. UML has been used in the early stages of model-driven engineering thus allowing system analysts and software developers to concentrate on more fundamental issues. The main benefit is that UML facilitates the construction of traceable models in a coherent and communicable way.

This justifies the purpose of our research effort, namely to investigate the utilization of UML in Bulgarian small and medium companies. The final goal is to evaluate the needs for proper UML training taking into account the difference in requested knowledge and skills. It should be mentioned that in small Bulgarian software companies the staff recruitment and team building policies diverge to a great extent depending on the specific businesses, the lifetime and the scale of the projects being developed. Moreover recent inquiries testify a lack of basic software development skills that are to be acquired ad hoc by team members during the project development. Such a category of learners should be specifically trained because of their high motivation and pragmatism, the immediate application of the acquired knowledge and skills and the project time limitations. Supporting such companies with properly designed educational resources is an important and economically motivated activity. Such kind of considerations underlay the initiation of the project "Leonardo Upskilling UML"[1] in which the authors participate [2]. Certainly in Bulgaria a few Computer Science curricula only, on hand mainly in private universities, e.g. New Bulgarian University offer courses concerning advanced technological tools – UML, Oracle, J2EE, .Net, etc. So, the necessity of properly tailored to the customers' profile training courses is obvious. The creation of innovative learning materials for work-based UML training is a vital activity.

In view of our previous experience in the field of e-learning as well as our teaching practice [3, 4] we present our attempt to determine possible training strategies for UML. The paper discusses the necessity of distance learning modules especially tailored to the developers in small and medium software companies. In such modules a special attention

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[1] LEONARDO DA VINCI - Upskilling UML, Agreement n° 2005 *-146 36*

should be paid on their granularity, self-control and self assessment facilities and the extreme diversity of training strategies. We also try to evaluate the current level and practices of UML training in Bulgaria. All our considerations are based on questionnaire responses from numerous Bulgarian companies.

The rest of the paper is organized as follows. In Section 2, we report the results of the needs analysis derived from the collected data. Section 3 focuses on training in term of prior training and needs as expressed by the population. Possible training strategies are proposed. We summarize our results in Section 4.

2. NEED ANALYSIS OF UML TRAINING

To investigate the utilization of UML in Bulgaria a proper questionnaire has been developed by Leonardo project partners with the leading participation of Institute National Polytechnique de Toulouse. This questionnaire consists of three different parts. The first part comprises nine questions and tries to determine the company's profile. The following characteristics of a single participant have been collected:

- level of education: certificate, bachelors degree, master's degree, etc.
- level of experience in software development measured in years
- the sector of activity of the firm
- number of employees
- number of people involved in a project
- type of software the company delivers
- applied software method – XP, 2TUP, UP, V Cycle, none, etc.
- usage of UML – never, systematically, for complex projects, etc.

The second part of this questionnaire deals with investigation of the company's UML practices, if any. The goal is to analyze whether the company uses a software method, evaluate the situations in which UML is applied and determine which software tools are used during a software project.
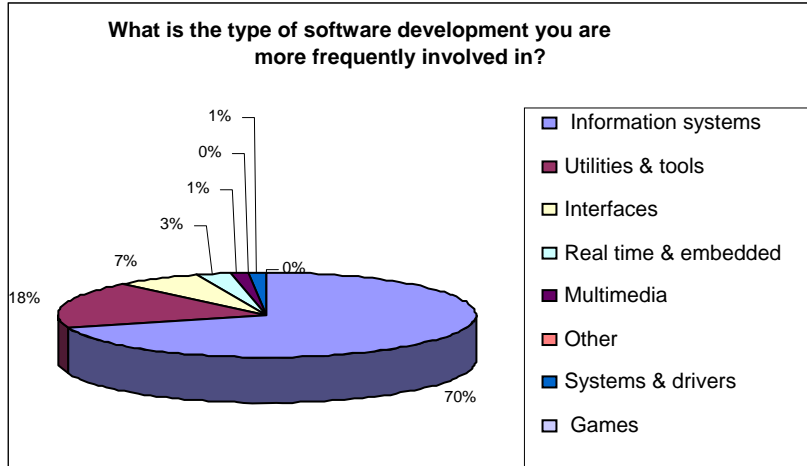
The third part of the questionnaire checks prior and preferred UML training and topics. As it concerns the way of education there are four important characteristics:

- Training method – workshop, tutorial, work-based training, project m web-based training, etc
- UML topic for additional training
- Type of useful learning material – glossary, handbook, textbook, wizard, tutor, etc.
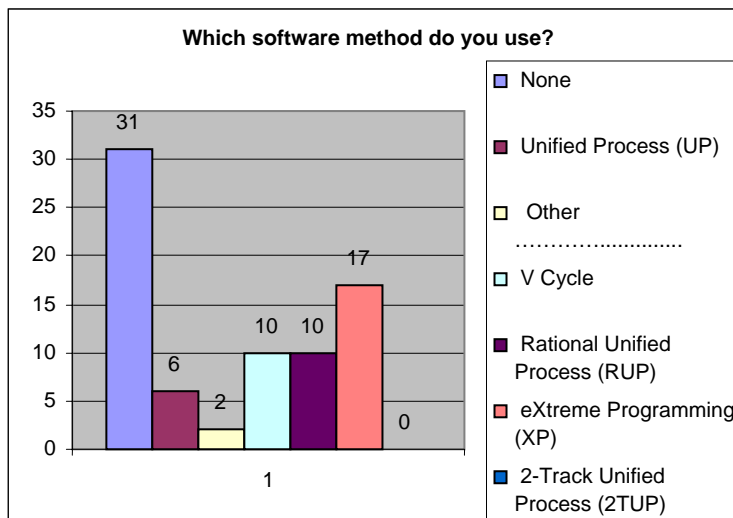- Preferred medium – paper, audio, CD/DVD, Video, Internet, etc

The questionnaire has been administered to more than 100 subjects from different Bulgarian SME. The population concerning the first part of the questionnaire is distributed as follows:

- EDUCATION: more than 90% have a university degree. This shows that the population has a significant initial education.
- EXPERIENCE: more than 85% have more than one year of experience. This is an important characteristic as it makes the assessment of UML practices significant. Over 59% of the personnel have an experience of 5 and fewer years and certainly need additional training.
- SECTOR: The sectors of activity are not balanced. Most of the population comes from administration, communication, finance and education. Industrial sectors are not significantly represented.
- EMPLOYEES: about 36% of the population comes from companies with less than 50 employees. This confirms that the target population is mainly from SME.
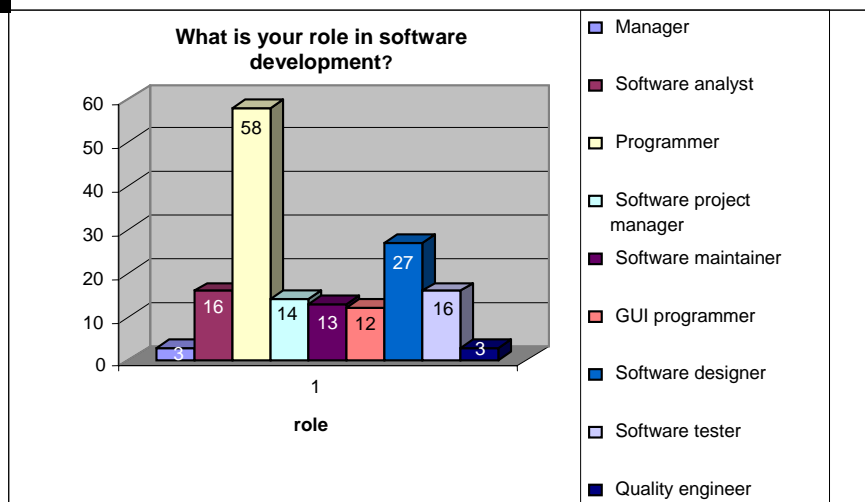
- DEVELOPERS: it is interesting to notice that more than 60% work on significantly large projects. That would normally require rigorous utilization of methodology.

- APPLICATION: not surprisingly 70% work on Information systems and 18% - on utilities.

What is the type of software development you are more frequently involved in?

- Information systems
- Utilities & tools
- Interfaces
- Real time & embedded
- Multimedia
- Other
- Systems & drivers
- Games

1%
0%
1%
3%
7%
18%
0%
70%

- APPLIED SOFWARE METHOD: about 30% use RUP and XP as a software development method

Which software method do you use?

- None
- Unified Process (UP)
- Other ………….............
- V Cycle
- Rational Unified Process (RUP)
- eXtreme Programming (XP)
- 2-Track Unified Process (2TUP)

31 6 2 10 10 17 0

1

- ROLE: the dominating role is that of programmer (58%) for which a relevant capacity can be supposed.

What is your role in software development?

- Manager
- Software analyst
- Programmer
- Software project manager
- Software maintainer
- GUI programmer
- Software designer
- Software tester
- Quality engineer

3 16 58 14 13 12 27 16 3

1

role

- • USAGE of UML: The population targeted by the analysis splits into two groups: 30% use UML and the others do not. This significant result in itself shows the need to train software actors to be more rigorous using methodology.

The second part of the questionnaire investigates whether a company uses UML during the different phases of software development and what are the software tools for UML development. There is a special question that examines the relationship between UML and the code. More precisely the answer of this question shows the order in which UML and the code are applied to discover atypical use. In addition data concerning possible UML academic or vocational training are also gathered. The population response concerning the second part of the questionnaire shows that over 50% of the inquired companies never use UML so their personnel can be considered as a potential learner interested in UML training resources.

When do you use UML?

- ■ Never
- ■ For complex projects
- □ For projects requiring intervention of external partners
- □ Seldom
- ■ When required by the client
- ■ Systematically
- ■ For projects involving large teams
- □ Other ....

0%
0%
6%
9%
19%
1%
9%
56%
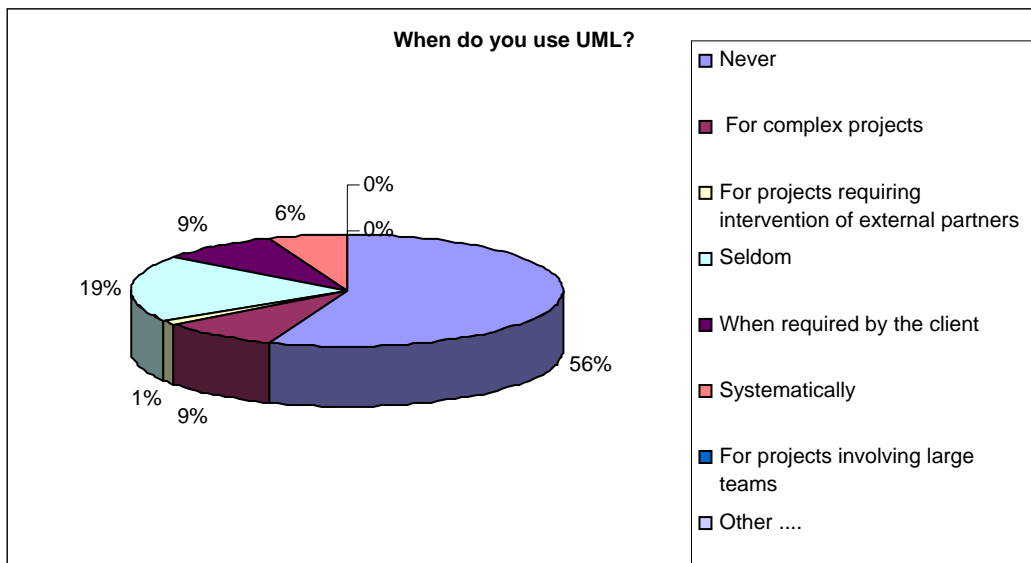
The projects type and size indicate indirectly for eventual need of methodology and specific technologies which should be acquired additionally. Among the inquired persons about 70% are engaged in information systems development and over 60% participate in large projects. A general conclusion about the necessity to apply an all-purpose modeling tool can be drawn. Moreover software actors are to be trained in order to be more rigorous using methodology. About 60% of the investigated subjects use a software method. Among them 10% use Rational unified process (RUP), 10% use V Cycle, and about 20% XP. Illustrations within the learning material should focus on these two tools. 23% produce the code from the UML diagrams. The inquiry does not testify the use of abnormal practices of producing UML from the code.

The third part of the questionnaire deals with the preferred training method and the presentation of the learning materials as well. 23% declare prior (academic or vocational) training of UML and about 2/3 state that they never had UML training. It appears that some of the inquired persons have had self training! Comparing these results to the 30% usage of UML, we can deduce that academic courses and self training are not so effective and custom-tailored professional training is advisable. As it concerns the preferable training methods it appears that about 20% prefer a mix of web-based training and workshop, other 20% - work-based training while about 13% - web-based training. There preferences are to be considered when developing proper learning content usable at the work place via the web and in different workshops. Our investigation outlines the favorite to train UML topics. Among them the methodology and examples are very important – 70%, followed by case studies – 65%, and the theory – 45%. The inquiry exhibits that handbooks and

community of practices are preferable as type of learning materials. Finally the favorite media are Internet – more than 55%, CDs and paper – 20% respectively.

We can conclude that in Bulgaria UML is not quite used when producing software in despite of the presence of proper courses in academic curricula. So, professional training in software companies is strongly recommended.

In our opinion these results are to be used towards profiling the professional training in software companies. It should focus on the:

- target group (companies, personnel, roles of the personnel);
- subject area (type of software projects, used methodologies);
- educational technologies (ways to supply resources, preferred methods for learning/training).

3. PROFILING A DISTANCE PROFESSIONAL TRAINING FOR UML

Emerging small and medium software companies in their majority are targeted to satisfy information requests of other SME's. Often founded ad hoc, for specific project and without proper selection of team members, such companies gain their maturity during the project. The success of the project and the company itself depend crucially on the capacity to acquire new knowledge and the needed skills. Envisaging the constantly increasing demands for information services, small software companies hold a specific niche in the economy and the workforce market as well. Therefore, supporting such companies with properly designed educational resources is an important and economically motivated activity. Having the usage of UML in SME as an example, more general considerations about how to deliver training resources to SME's personnel can be derived.

The choice of the proper teaching methods depends on: the form of education-distance or other type of education and the type of learning - self or collaborative learning. In the case of self depended learning the most suitable methods are delivering handbooks of different shapes, case studies and examples. According to our inquiry for collaborative learning the community of practice is pointed as suitable. The preferred learning style is constructive and pragmatic. Therefore strategies as work-based training combined with workshops via Web are fitting.

Taking into account the results presented in Section 2 the following statements can be formulated:

- the target group of SME's is that of companies without own policy of training;
- the target group of the personnel is that of software developers and designers;
- the main direction of training is methodology – UML among others possible methodologies;
- the target cognitive level is application;
- the preferred education technology is distance training generally based on Web
- the learning units should be designed extremely self contained thus allowing a separate usage;
- the learning units should be example based;
- the learning units should be represented as separate tasks;
- thesaurus or quick reference guide are to be available to assure the context knowledge;
- self-control and self-assessments tools should be available;
- web forum as a form of organization of communities of practice is advisable.

4. CONCLUSIONS AND FUTURE WORK

In this paper we investigate the utilization UML in Bulgarian small and medium companies as a general purpose modeling language that facilitates the construction of

traceable models. The goal is to evaluate the current level and practices as well as the needs for UML training.

The data presented in this report can be summarized to:
- UML is not properly used in the software industry
- training is needed
- the most important topic to be covered should be methodology
- the training should be practically oriented
- the learning content should be web based.

Usually, only large companies can afford own activities concerning the professional training of their employees. Medium and small companies apply a specific policy for their staff recruitment, but they are limited to the available workforce that frequently consists of computer science graduates and undergraduates. Usually these people posses a sound background rather than a readiness to accomplish specific tasks upon an assigned team role. So, the scope of a possible training support consists of all companies without own policy for the staff preparation.

To generalize, there is a need of additional training in software development methodology and information systems as well. We shall continue administering the questionnaire to other Bulgarian companies. Our future work also targets the development of proper syllabi that relate to information systems according to the requirements presented in Computing Curricula 2005.

Acknowledgement:

The authors thankfully express their appreciation of the valuable support to all respondents and especially to those of them who propagated the questionnaire.

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