Maintaining Industrial Competence

The Challenges for Continuous Professional Development and the Role for Universities

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Abstract. Poor quality software and projects that fail to deliver are a too-frequent occurrence. There is thus a clear need for greater professionalism throughout the sector and this must be supported by appropriate Continuous Professional Development (CPD). Details are presented of foundation work, undertaken since 2000, relevant to the on-going professional development of IT practitioners. Information is then given on a current project that is concerned with identifying successful industrial practices and the teaching of such in academic programmes including programmes that support CPD. The major challenges that this work has exposed are detailed, current conclusions are outlined and suggestions are given with regard to possible solutions for the problems that clearly exist.

1 Introduction

Although there have been many significant developments in computing during the last 50 years too many software projects still fail to meet all their objectives, and the termination of partially completed projects is also a frequent occurrence. The on-going problem of poor quality software has been repeatedly highlighted in published studies (e.g. Glass [1]), and in major conference presentations (e.g. keynote address by the 2005/2006 President of the British Computer Society at IFIP's 2006 World Computer Congress [2]). The cost of these failures is enormous: a recent article [3] reported that in the UK, between 2000 and 2007, the total cost of abandoned central government computer projects had reached almost two billion pounds. Yet many of the types of problems that act against successful IT project delivery have been clearly identified in an in-depth study which was undertaken by a working group of the Royal Society of Engineering (RSE) and the British Computer Society (BCS). The resultant report [4] on the situation with regard to Complex IT projects included conclusions and recommendations with particular regard to: Professionalism,

Education of practitioners, Project management issues, Role of risk management, Role of systems architecture, Adoption of best practices, and Research in the field of complexity. In the section on Professionalism the report highlighted the following [4] with regard to Continuous Professional Development (CPD):

"Customers should therefore ensure that all senior IT practitioners involved in the design and delivery of 'high consequence' systems have attained Chartered status (the highest level of professional status) and maintain their technical currency through Continuing Professional Development" and "The Office of Government Commerce, together with the Professional Institutions, should assess means of enforcing the registration, and maintenance of professional competence through CPD, of senior practitioners working on high consequence systems"

We see no reasons to assume that the situation in other parts of the world is significantly different to that in the UK and that there is an ongoing international requirement for high quality CPD. It is also clear that there is a major role for Universities to provide education and training programmes that would support CPD requirements.

In the reminder of this paper, we detail work that we have been undertaking in recent years that is relevant to the ongoing professional development of IT practitioners. This is an area that is key to the work of IFIP Working Group 3.4 - the group that is concerned with IT professional and vocational education (it is also the group that the first author of this paper currently chairs and within which the second author is a member). In section 2 we provide information on initial work that we have undertaken relating to professionalism. We then follow this in section 3 with details of an ongoing funded project that commenced in 2005 which is concerned with identifying successful industrial practices and then incorporating the teaching of such into academic programmes including programmes that support CPD. In section 4 we summarise what has been undertaken so far. Then in section 5 we provide details of the major challenges that we perceive to exist, our current conclusions, and some suggestions as to possible solutions to the problems that clearly exist.

2 Contextual Information and Early Work

During the 1990s the International Federation for Information Processing (IFIP) undertook work directed towards defining an international approach with regard to professional standards throughout the whole of the Information Technology sector. In 1999, committees within IFIP approved a document entitled "Harmonization of Professional Standards" [5]. The document addresses six specific areas:

- Ethics of professional practice,
- Established body of knowledge,
- Education and training,
- Professional experience,
- Best practice and proven methodologies, and
- Maintenance of competence.

Starting in autumn 2000, we undertook a series of activities aimed at both promoting and evaluating the IFIP document primarily within the Software

Engineering community. Some 15 international activities were undertaken over the next two years. The most informative of these were: a workshop held at the 2001 Conference on Software Engineering Education and Training (reported in [6]), a workshop held during the 2001 International Conference on Software Engineering (reported in [7]), and an International Summit which was co-located with the 2002 International Conference on Software Engineering (reported in [8]). The overall reaction to the IFIP Professional Standards document by the Software Engineering community was very encouraging [9]. It was recognised that the document defines a framework which should assist the advancement of professional standards. However, the evaluative work also highlighted community concerns that were associated with the areas of: best practice and proven methodologies, maintenance of competence, and the educational support for these areas [9].

Subsequently some further work was undertaken in 2004 on investigating best practices in the Software Engineering sector and their role in the curricula [10]. This did much to reinforce the earlier findings and concluded that: "... there are already what appears to be best practices (or what could become best practices) in operation. But what is too often lacking is the empirical evidence that these practices are really effective, that they can be transferred from one project to another, or from one organisation to another, or that they are scalable."

3 The Current Project

In 2005 the first author of this paper was awarded a prestigious UK National Teaching Fellowship from the UK Higher Education Academy [11] and with it funding to carry out an individually determined research project related to teaching and learning. It was felt that a project related to best practices which built on the work that had already been undertaken in evaluating the IFIP Professional Standards document and which would support the activities of IFIP Working Group 3.4 would be most appropriate. Such a project would also:

- Make use of the knowledge gained from involvement in the ACM and IEEE-CS supported international curricula effort for undergraduate degrees in Software Engineering [12] (both authors of this paper were involved in this effort).
- Reach-out to the wider professional/practitioner IT community.
- Feed into the development of the curricula and appropriate teaching and learning approaches.

The overall aim set for the project was to develop guidelines and recommendations regarding:

- The identification and incorporation of proven industry-related best practices into both undergraduate and post-graduate computing curricula (including curricula that relate to maintenance of competence for existing professionals), and
- Best practice mechanisms for the delivery of such enhanced curricula in a variety of contexts (e.g. remote distance learning).

It was felt that the particular benefits which could follow from the project were:

- Improved working relations between academia and industry.

- Closer agreement between academic outputs and industry requirements.
- Improved teaching and learning approaches.
- More attractive academic programmes (and hence more students).
- Opportunities to support Life Long Learning (e.g. short courses to support "Maintenance of Competence" requirements).

4 Progress

The work which had been undertaken in 2004 [10] had shown that identifying proven best practices would be far from easy. It was therefore decided to progress the new project on two fronts:

- To investigate the various links that already exist between industry and academia to see if information gained via such links could be used as a means of determining truly effective practices.
- To progress work via existing industrial and academic contacts and those formed from activities associated with professional bodies. This was also to be supported by attendance at conferences and meetings where one would expect there to be a reasonable representation from industry.

4.1 Direct Links between Industry and Academia

Four international workshops have now been undertaken to support the project. The first workshop [13] was held at the 19th Conference on Software Engineering Education & Training in April 2006. In addition to highly interactive discussions the there were presentations on papers [14] which addressed: the role of adjunct professors, an Indian company's Academic Interface Program, the importance of industry experience for students, and the role of guest speakers from industry. In addition trials were carried out on a preliminary template which could be used to record interactions. This concentrated on: context, the actors involved, the interaction, analysis, and evaluation.

The second workshop [15] was held at the 28th International Conference on Software Engineering, in May 2006. In addition to discursive sessions there were short presentations to support seven position papers [16] which were organised into four themes. Theme 1: Types of Interaction - this addressed the importance of dialogue with industry. Theme 2: Projects and Solutions for Industry - this addressed collaborations that are driven by projects, strategies for collaboration, and the use of a SE laboratory. Theme 3: Courses for Professionals - this addressed how such could form a two-way communication channel. Theme 4: Industry Assisting Academia – this addressed courses run by industry and how industry could provide data to support research. In addition to support Theme 2 a paper [16] was circulated that addressed technology transfer to small and medium sized enterprises. Further trials were also carried out on an enhanced template which could be used to record interactions. The workshop participants were divided into groups representing each of the four themes detailed above and each group was requested to complete a template for an interaction relevant to their theme and then feed back their feelings

about its use. Finally there was a general appraisal session that addressed particular issues relating to the study of interactions and the use of the templates.

The third workshop [17] was held in August 2006 and formed the first event within the IFIP's Conference on Education for the 21st Century. This in turn was one of the constituent conferences which formed IFIP's World Computer Congress. The main purpose of this workshop was to provide a forum for a group that would not only be Software Engineering orientated. The event took the form of a series of "round table" discussions that addressed various experiences relating to interactions between universities and industry relating to specific academic programs. This event attracted a very different set of attendees compared with the previous two events. There were attendees from several countries that had not been previously represented including: Chile, Ecuador, Puerto Rico, Oman, South Africa, Portugal, and Japan.

The fourth workshop [18] was held at the 14th Asia-Pacific Software Engineering Conference, in December 2007. This was purposefully very interactive in nature with working in groups throughout the day. It consisted of three distinct discussion sessions plus an introductory and plenary session. The discussion sessions addressed: the Industry /University Gap, University and Industry Collaboration, Achieving Real World Experiences. Each session commenced with a short presentation on a relevant position paper [19]. Of particular interest was a particular approach used at a University in Indonesia where to gain group and personal skills the students do not only construct software artifacts but also build boats from old car tyres and bamboo and then have to sail them [20].

4.2 Industry, Academia, and Professional Bodies

The funding provided by the project has enabled the first author to become involved in the British Computer Society's Professionalism in IT programme [21] as a member of its executive committee. This is an ambitious three year managed programme that began in 2005 and which is aimed at proactively addressing various issues relating to professionalism throughout the IT sector. The programme has two key objectives [21]:

1. By increasing professionalism, to improve the ability of business and other organisations to exploit the potential of information technology effectively and consistently.
2. To build an IT profession that is respected and valued by its stakeholders-Government, business leaders, IT employers, IT users and customers – for the contribution that it makes to a more professional approach to the exploitation and application of IT.

The importance of the BCS programme has been recognised by the International Federation for Information Processing (IFIP) and has led to the creation of a Task Force to address key issues that are facing the global ICT industry today with regard to professionalism [22]. An obvious consideration is whether and to what extent the BCS's Professionalism in IT programme can be developed so that it can be used by IFIP's other member organisations. A detailed account of the programme and its development to date, including the work with IFIP, can be found in a paper [23] in

the proceedings of an IFIP Working Conference on Education Training and Life Long Learning that was held in Prague in September 2007.

In addition, to involvement with the BCS's professionalism activities, the project funding has provided support to attend relevant workshops at international conferences [e.g. 24] and various one day events in the UK such as:

- UK Government IT Conference 2007 [25] which addressed IT issues relevant to local government.
- The launch of the UK National Computing Centre's Enterprise Architecture and Systems Engineering (EA-SE) Programme [26] which is related to the BCS's Professionalism in IT Programme.
- A Westminster eForum Keynote Seminar "A UK IT Skills Gap" [27] which involved Members of Parliament.

5 Challenges and Conclusions

The various activities and related research detailed in the proceeding sections have provided many insights into the IT sector and its problems. It has also revealed the many and various interactions that exist between industry and academia. Unfortunately the one area that still remains generally elusive is hard information on proven best practices. Industrial contacts made at conferences and meetings often result in promises to send details of their organisations proven practices. However, in every case what has resulted is a subsequent communication informing us that their practices are confidential to their own company. Clearly there can be no independent evaluation of such practices and the claims of their worth. Also, as was made clear during the 2007 workshop on Realising Evidence-Based Software Engineering [24] there is very little concrete evidence in the literature that stands up to detailed scrutiny. In addition, small surveys undertaken at various conferences have failed to produce any significant evidence that provable best practices do exist. In fact the nil returns could be interpreted to indicate that the reverse is actually the case.

We have recognised that trying to collect information on University/Industry interactions via a paper-based system was likely to have very limited success. Thus during the 2006/2007 academic year we sponsored a number of Master's level projects that had as their goals:

- The development and evaluation of a range of different web-based interfaces for collecting data about interactions
- The development of a database that can be used to hold the data and which will support subsequent interrogation

As yet we have not yet received an easy-to-use system and there is the further challenge that once such a system is delivered we will still have to persuade academics and industrialists to make real use of it.

We have still to complete a detailed analysis of the content of each of the workshops and there are still many hours of audio recordings to be transcribed, analysed, and reported on. However, what has clearly emerged, from the preliminary analysis is that with the exception of student projects, few of these interfaces are ever formally documented and evaluated.

What has become clear is that to a great extent there are two distinct communities – Industry and Academia - and the two interact much less than is desirable. Go to a major international Software Engineering conference and you find relatively few industrialists. Go to a UK government-supported conference that supports the Information, Communications and Technology (ICT) sector (the government's preferred term) and you will find very, very few academics. Also, perhaps too many academics, at least in the UK, are driven by the demands of successive Research Assessment Exercises [28] where to publish high quality academic research papers is a clear aim and applied work with the industrial ICT sector is largely avoided. In addition, we must recognise that currently the normal career progression for an academic in computing is: undergraduate degree, postgraduate degree, enter academia, do worthwhile "academic" research and teach. There is obviously much to be done to bring the two groups closer together.

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