
PRO-ACTT: a Leonardo Pilot Project on Continuing Professional Development

Flemming K. Fink

Aalborg University (AAU), Fredrik Bajers Vej 7A1, DK-9220 Aalborg, Denmark

Boris Simak

*Faculty of Electrical Engineering, Czech Technical University (CTU),
166 27 Prague 6, Czech Republic*

Lucien Mazet

*Ecole Nationale de l'Aviation Civile (ENAC), 7, Avenue Edouard-Belin
BP 4005, 31055 Toulouse Cedex 4, France*

Fernando M.S. Ramos

*University of Aveiro (INESCA), CEMED-Centro de Multimédia e Ensino a Distância da UA Campus
Universitário de Santiago, 3810 Aveiro, Portugal*

Given the speed with which development takes place in the telecommunications field, the need for Continuing Professional Development (CPD) programmes is obvious. The industry needs to find ways to bring new knowledge to its extremely busy employees in a flexible and *need-lead* fashion; and universities need to find ways to identify industry needs and to make CPD programmes available in an appropriate, learner-based way. Against this background, 17 key telecom players in six countries will address this problem in a LEONARDO Pilot project, *PRO-Active Continuing Professional Development in the European Telecommunication Industry: PRO-ACTT*, which will focus on setting up a joint, cross-national industry-university co-operation.

INTRODUCTION

The telecommunications industry is investing a great deal of effort in fulfilling popular demands for mobile communication taking place independently of the physical location of the sender and receiver. GSM mobile telephone technology is extremely innovative, resulting in new concepts and new systems every year. A new product lasts for only one to two years. The consequence of these rapid developments is a heavy demand for engineers with the latest knowledge in all areas of importance concerning the development and manufacture of mobile devices.

There are at least two bottlenecks in the education of industrial engineering staff in an information society. First, there is a wide range of necessary specialisation in information technology and communication. Such specialisation includes mobile communication, but also others such as multimedia, signal processing, speech coding, databases and informatics. The second major bottleneck is the small cohort of population

which is currently entering the labour market, and therefore a severe competition exists between industries, companies and countries to attract and hold talented employees.

At the same time, the telecom industry is a borderless industry. Leading edge knowledge is everywhere, certainly not limited by national borders, and it is growing rapidly. The market itself for mobile telecom solutions is growing exponentially everywhere and industry struggles to keep up.

Still, there are differences in the national contexts in which telecom companies are actors. There are different levels of deregulation, and cultural conditions vary. There are also language and multicultural issues when using telecom internationally. The nature of the telecom industry is truly international.

Therefore, in order to meet the professional development needs of the industry, solutions must also be transnational.

PRO-ACTT unites 17 key telecom players in six countries, all concerned with the best way to meet the

continually changing needs for engineering knowledge in an industry undergoing rapid growth [1]. The parties are six universities¹, large and small telecom companies (network operators, service providers and equipment manufacturers)², a network of SMEs³, and an engineering trade union⁴.

The project focuses on Continuing Professional Development and will strengthen the grounding of university programmes in industry needs and prepare the engineering students of the present for the industry of the future. Both industry and universities will work together under PRO-ACTT to develop methods for:

- rapid, continual assessment of engineering and IT skills needed;
- rapid course development; and
- learning based more on the learner's situation and experience rather than the teacher's knowledge.

Since engineers and technicians in industry are busy people and learners and teachers may be situated in different countries, the continuing education activities envisaged in PRO-ACTT will be based on implementation using distance learning methodologies. This gives the learner the opportunity of choosing the time and place of learning, ie self-directed learning, giving the optimal amount of freedom.

IDENTIFIED NEEDS

Theories and methods in engineering develop very quickly and, combined with new, radical developments in production technologies, give rise to a great number of opportunities to realise new functionalities and new expansion possibilities for European industry.

The extraordinary growth and opportunities in business have created a substantial deficiency in engineers. The mobile telephone industry, which covers both terminal manufacturers, network administrators, and service providers, is currently undergoing remarkable growth. This development is further exacerbated by the commercial success of the sector. Competition is hard and a significant competitive parameter is the level of the professional engineering competence of a

¹ Aalborg University (AAU), University of Twente (UT), Czech Technical University (CTU), Technical University of Budapest (TUB), Ecole Nationale de L'aviation Civile (ENAC), University of Aveiro (INESCA).

² DK: Bosch Telecom Denmark A/S, RTX-Research A/S; NL: CMG Telecommunications & Utilities B.-V., Ericsson Business Mobile Network; HU: MAT-V, EPT (First Pest City Telephone Company), Radiant Termel Corporation, Ericsson Hungary; CZ: SPT Telecom as.

³ Technologie Kring Twente (TKT).

⁴ The Danish Union of Engineers (IDA).

company's employees.

EU companies, including SMEs, compete basically on the best employees with high levels of education and competence who can keep abreast of new developments. To maintain the competitive level of the production apparatus and sufficient flexibility so that companies can quickly adapt to heavy knowledge demands, there must be a frequent turnover of staff or a continual investment in the maintenance and expansion of the organisation's total competence.

This competence must be maintained and developed continually both by the company and by the individual employees. New research results must be integrated into product development as quickly as possible. Therefore, a model must be developed for quick transfer to industry of the knowledge that evolves from research results. The technical staff must develop themselves professionally on an ongoing basis, eg by taking part in appropriate learning processes such as life-long learning.

SMEs have the same needs as larger companies. However, because of their size it is even more important that employees are *on-the-job*. Spending days away undertaking a professional development programme is neither feasible nor necessarily advisable. SMEs are especially vulnerable when individuals are absent.

Given the speed with which development takes place in the telecommunications field, the need is not so much for well-planned CPD programmes where the content is defined and delivery planned well in advance (the traditional mode for teaching at universities). Rather, the industry needs to find ways to bring new knowledge to its extremely busy employees in a flexible and *need-lead* fashion.

Universities need to find ways to identify industry needs and to make CPD programmes available to industry in an appropriate, learner-based way. Therefore, PRO-ACTT will focus on setting up a joint, cross-national university-enterprise co-operation structure in which:

- ever-changing professional needs can be monitored and identified on a continuous basis; and
- the identified needs for CPD can be met within a short timeframe.

The co-operative forum should lead to a maximum use of available resources by:

- linking demand and supply cross-nationally (creating a forum for export of leading-edge knowledge and expertise);
- strengthening the links between universities and local industry by being able to offer knowledge from

other countries;

- ensuring that implementation is nationally appropriate; and
- establishing techniques (for example web-based or perhaps a virtual laboratory for industry) that allow learner-based continuous professional learning (rather than teacher-based teaching).

There are different traditions for co-operation between universities and industry in the partner countries. In the Czech Republic and Hungary a combination of work load of university teachers, marketing issues, and the fact that companies often set up their own training institutes means that traditionally there has not been a close co-operation between industry and academia. In Denmark and The Netherlands, especially in Aalborg and Twente, the universities are newer and were established on the basis of a close co-operation with industry. Therefore the project will lead to sharing of experience with different models for industry-university co-operation.

In the context of the rapidly growing telecommunications industry in Central Europe, the phenomenon appears that subscribers are offered new technologies with which they have neither theoretical nor practical experience. Moreover, the employees of telecommunication providers must be trained to be able to work with new equipment, which increases the need for new educational technologies and intensive courses as the amount of information constantly increases.

As an example, there has been an abrupt change regarding the nature and quality of telecommunications in Hungary in general. The fixed line penetration rate of less than 10% in 1989 reached nearly 30% nationwide in 1997. The mobile penetration rate grew during the same period from 0 to approximately 7%. This situation requires:

- the regular upgrade of teaching material for full-time students;
- the introduction of new technologies into the teaching process; and
- finding new ways to transfer knowledge from universities to industry.

GOALS

PRO-ACTT brings together the key players with the objectives of:

- setting up a larger programme, covering a wider range, than could be achieved by the players individually;
- increasing transfer of knowledge from one coun-

try to another and between industry and university;

- increasing co-operation between industry and universities, also across national boundaries;
- increasing internationality and mobility; and
- acquiring experience with crossborder teaching using the Internet.

Traditional classroom learning does not attract busy telecom industry employees, nor does it meet their need for *state-of-the-art* knowledge at the time they need it. PRO-ACTT will establish a co-operative web-based structure through which researchers and industry employees can *meet*. Information and Communication Technology (ICT) allows learning to take place at the pace and place chosen by the employee. Generally we will be adapting existing methods and material for life-long learning using the medium of ICT. The universities in Twente and Aalborg and Toulouse have special expertise in this area, but it will be applied to the telecom industry specifically under PRO-ACTT. When the ongoing need assessment in the partner companies identifies new subjects arising from research results, these will also be dealt with in one or more of the pilot programmes under PRO-ACTT. Material production will not be in a traditional sense but will be developed for use through the Web.

During PRO-ACTT a model will be developed for comprehending CPD in the telecom industry so that it can become the foundation for the different methodologies that will be developed afterwards. These methodologies include methods for rapid need analysis, teacher training in ICT-based CPD, and rapid course development and delivery.

As observed earlier, the telecom industry is borderless, nonetheless there are differences in the national contexts in which telecom companies are actors. However, the rapidly changing political, economic, social and technological conditions that telecom companies must operate under create similar conditions for them. Technological change is perhaps the most significant factor driving the telecom industry forward. Through methodologies for rapid and continuous needs analysis, PRO-ACTT hopes to contribute to making qualification skills more transparent.

The whole subject of PRO-ACTT is CPD in the European telecommunications industry, since initial education cannot possibly fulfil the existing need in industry for constantly acquiring new skills and knowledge. Initial training, in terms of technological specifics, is quickly out of date. Methods must be found for giving the telecommunications industry the constant update it needs.

SPECIFIC OBJECTIVES

The pilot project aims to develop, implement on a pilot scale, and evaluate the following:

- A structure for cross-national collaboration between universities on the one hand, and operators, service providers and manufacturers in the European telecommunications industry on the other, in order to meet mutual needs for CPD.
- Different models for CPD, including the use of ICT based learning, which would be appropriate for an industry affected by rapid technological changes.
- Methods for fast and continuous assessment of CPD needs.
- Methods for rapid (*just-in-time*) course delivery.

The main target groups for the CPD programmes of this project are technicians and engineers. The participating universities, together with the enterprises with which they work closely, will be carrying out at least one CPD course during the project. This may be based on their own research results, or it might involve transfer of research results and training material from one of the other participating universities.

IMPACT OF THE PROJECT

The universities and the telecommunications industry involved will gain experience through PRO-ACTT with a structured co-operation which can provide fast, continuous assessment of CPD needs as well as Rapid and Continuous Course Development (RCCD) and implementation.

Working together with universities, industry will gain experience with methods for bringing *state-of-the-art* knowledge to employees who are unable to take advantage of traditional, classroom-based professional development programmes because of the nature of their employment.

Due to the internationality of the consortium, the participating telecom industry will gain direct access to university environments specialising in the latest telecom research. It is also in their interests that the closest universities gain experience in offering appropriate CPD programmes. Through the structure for co-operation, the participating industries will also be able to learn how other telecom companies manage the development of the technological competence of their employees.

Through the *training-the-teachers* element of the project, university teachers will learn how to meet the needs of a rapidly changing industry through CPD programmes. Working together with industry, the universities will increase their openness and willingness,

as well as their capabilities, to play an active role in life-long learning. This is a key goal of this project and it is focused on both the strategic level as well as the operational level. The universities have a declared intention to learn how to reorient themselves strategically so that they will be geared to carry out CPD activities. This requires other structures and procedures than the traditional teaching role of the universities. At the individual level, specific teachers will learn how to manage rapid course development and how to prepare and carry out CPD programmes for industry.

One of the main outcomes of the project is expected to be the development of an appropriate model for CPD taking into consideration the needs and capabilities of all the players on both the demand and the supply sides. The meeting of supplier and buyer in a highly dynamic interface makes this pilot project unique.

The project will disseminate its models, guidelines and experience with joint university-industry CPD structures, rapid course development and teacher training in CPD to other universities and to other sectors experiencing rapid change in Europe.

ORGANISATIONS IN THE PROJECT

The original idea for this project arose in Northern Jutland, Denmark. Northern Jutland is a centre of worldwide excellence for telecommunications. It is known affectionately as Mobilicom Valley because of a cluster of about twenty telecom companies in the area [3]. Some have been acquired or established by major international players like Bosch Telecom, Ericsson and Maxon. Most of the others are centres for research and product development or sub-suppliers to the key world players.

When interest for this project arose originally from a request from Bosch Telecom to Aalborg University (AAU) for CPD activities, University of Twente (UT) was the first natural party for AAU to contact. Both AAU and UT are members of the European Consortium of Innovative Universities (ECIU) and have worked together on a number of common interests.

The founding institutions of ECIU have several characteristics in common. All have academic strengths in engineering and social science; all are relatively young, entrepreneurial, and progressive; and all have close relations with industry and to the regions in which they are situated. They are committed to developing and implementing new forms of teaching, training and research; to assuring an innovative culture within their walls; to experimenting with new forms of management and administration;

and to sustaining and nurturing internationally-minded staff.

Both have project-based teaching (UT has borrowed and further developed from AAU). Both are trying to be at the forefront of life-long learning for the society around them, locally, regionally and internationally, and for continuous professional development for industry. Both AAU and UT have special expertise in distance learning, ICT-based learning and the virtual university.

ECIU not only provides a strong background for AAU and UT, but the ECIU universities will also be a natural forum for sharing the experience that is gained during PRO-ACTT.

AAU has ten years of experience with distance learning and an even longer history of close co-operation with industry. It has a history of ten years of building up formal co-operative networks between the different professional areas and faculties at the university and in industry. The mobile telecom area is such a network.

The Danish Engineering Union will try to engage their sister organisations in the other partner countries to participate in PRO-ACTT.

UT has strong experience with ICT-based learning which is of interest to the other partners. Like AAU they have a long tradition of co-operation and good relations with industry in their region. AAU and UT models for university-industry co-operation are of interest to colleagues from the Technical University of Budapest (TUB) and the Czech Technical University (CTU).

Ecole Nationale de L'aviation Civile (ENAC) is one of several highly professional universities in Toulouse. ENAC is of great interest for AAU, with its professional specialisations and its experience with continuing education activities. They are not specialists in telecommunications like the other participating universities, but they do, however, have special experience with data-communication, which AAU and the other partners would like to tap.

Contact with TUB and CTU came through the speech recognition professors at the Centre for Person Kommunikation (CPK) at AAU, who have had previous professional co-operation with these universities. CTU, TUB and a Polish university have a formal co-operation within network theory.

TUB was previously the centre for electronics for COMOCOM. The country was known especially for its highly qualified research people. Ten years ago, however, the telecom industry was weak and disappearing. Partly due to the efforts of TUB, Budapest is now a centre of leading telecompanies. TUB is the only provider of telecom training for the tele-industry

in Hungary. TUB has a forty year old CPD Centre which offers courses to industry, and will be well able to promote the courses that are developed under PRO-ACTT.

Similarly, CTU in Prague is the most respected university in the field of telecommunications in the Czech Republic.

The University of Aveiro/INESCA is a leading research centre in Portugal in the area of telecommunications, and has a strong tradition of co-operation with the Portuguese telecom industry and telecom operators, namely in the areas of ISDN, GSM broadband networks and teleservice engineering.

The industrial partners that each of the universities have brought in are those that these universities have worked with previously or that they wish to build stronger relations with.

In addition, the Union of Engineers in Denmark participates in order to follow developments of potential benefits for other industries undergoing rapid change. They also have strong links to employer associations, eg the Telecommunications Industry sector organisation under the Danish Confederation of Industry, which represents the telecom industry players in Denmark.

In The Netherlands, one of the Dutch partners is TKT, a network of high-tech companies with previous associations with UT. Although the network has not until now been used for CPD purposes, UT intends to build up CPD activities as part of the pilot project.

METHODOLOGY

Phase 1 involves the development of a model for understanding CPD in the context of the rapidly changing environment for the telecom industry. AAU will take the lead and create a working paper that will be distributed for comments from both industry and universities through the PRO-ACTT web-site (which will be developed and created in Phase 1). It is important to obtain common understanding of results of the working paper discussions between industry, universities and the professional engineering associations. It will become the basis for the other work-packages in PRO-ACTT.

Phase 1 also includes development of methods for *rapid* and *continuous* needs analysis which are usable for both industry and universities. The first results from Phase 1 of the needs analysis, as well as the model for understanding CPD in the telecom industry, will form the basis in Phase 2 of:

- the national and cross-national co-operative structure that PRO-ACTT will implement; and

- the *training-the-teachers* activity.

In terms of the structure, implementation must be nationally appropriate, and must link demand and supply cross-nationally; also, it will include the use of Web facilities in order to allow *just-in-time* and *user-led* utilisation.

An exchanges and placements programme (a parallel Leonardo project called PRO-X) will include eight placements, two of which are university to enterprise and two which are enterprise to university [2]. The former will help university staff understand the situation of the hosting telecom industry better. The placements will be part of developing and adapting an appropriate methodology for rapidly and continuously assessing needs for CPD in industry.

The placements in Phase 3 (industry to university) will be part of the adaptation of material and methods for carrying out pilot CPD programmes (also part of Phase 3). Generally, existing methods and material for life-long learning will be adapted using the medium of ICT. When the Ongoing Needs Assessment identifies new subjects arising from research results, these will also be dealt with in one or more of the pilot programmes. Material production during Phase 3 will not be in a traditional sense but will be developed for the Web.

During Phase 4 the courses that are delivered will be assessed for their effectiveness according to the needs stated by the telecom companies and their employees. The CPD model and structure will also be assessed in relation to the changing needs of the sector over the two years and in relation to the capabilities and interests of the universities.

Phase 4 also includes dissemination activities so that experience gained and models used can be applied to other courses, to other industries experiencing rapid change, and to other universities. The fact that Aveiro and ENAC are participating is part of the dissemination strategy. The Telecommunications Industry branch organisation under the Danish Confederation of Industry is also expected to be an active player during the dissemination phase since they represent a number of telecom companies in Denmark. A closing workshop will be of help to a wider group of interested companies, universities and authorities.

CONCLUSION

The need for developing engineering competence is obvious. Universities must act as centres of competence and take the lead in providing industry with the

CPD programmes needed. This paper has described a Leonardo Pilot Project that aims to develop a concept for identifying industrial needs for CPD in a fast and dynamic way and providing industry with the CPD programmes needed.

REFERENCES

1. PRO-ACTT: PRO-active continuous learning in the European telecommunications industry. Leonardo Pilot project no. DK/98/06212/PI/II.1.1.c/CONT.
2. PRO-X: PRO-active learning via eXchange and placements in the European telecommunication industry. DK/98/2/05698/PL/II.1.2.b/CONT.
3. NORCOM: <http://www.norcom.dk>

BIOGRAPHIES



Associate Professor Flemming K. Fink is currently Director of Studies in Electronics and Information Technology at Aalborg University, Denmark. He received his MScEE from Aalborg University in 1978. Subsequently he worked at Odense University and The Engineering College in

Odense, where he established an educational programme in Digital Signal Processing.

Since 1986 he has been doing research and teaching at Aalborg University within speech recognition and digital signal processing. His major research is in auditory modelling, and in co-operation with three colleges he has patented a new concept for parametric hearing aids. Since 1993 F.K. Fink has been Director of Studies and initiated internationalisation of the curriculum and he is very active in setting up postgraduate level Life-long Learning programmes.



Doc Ing Boris Simak CSc graduated from the Czech Technical University, Faculty of Electrical Engineering, in 1981. He has been involved with digital filtration from the very beginning of his scientific work. In 1987 he finished his PhD on *Equivalent Structures of Digital Filters* and in 1996

he became senior lecturer and head of the Depart-

ment of Telecommunications Engineering.

He lectures on the basics of telecommunications technology as well as in specialised subjects dealing with digital signal processing, which is his research domain. Besides DSP, he is also engaged in multimedia technology and data transmission. He regularly participates in specialised scientific conferences. From 1994 he has been a member of the IEEE Communications Society EAMEC committee.



Lucien Mazet received the degree of DipEng in electrical engineering from ENAC, Toulouse, France, in 1972. He joined the Communication Navigation and Surveillance Systems Department at ENAC in 1977, where he worked in the telecommunication team during the period 1977-93. He

is currently Deputy Head of the CNS Systems Department.

Lucien Mazet teaches in signal processing and communication theory.



Fernando M.S. Ramos graduated with a degree in Electronics and Telecommunications in 1979 and a PhD in Electrotechnical Engineering/Telecommunications in 1992. He was appointed Professor in the Department of Electronics and Telecommunications at the University of Aveiro in

1982, and became Head of Department in 1994, holding the position until 1999. He is currently an Associate Professor in the Department and Head of the Multimedia and Distance Learning Centre. He is also project leader and researcher in several national and international projects in the areas of telematics, distributed systems, multimedia and distance learning and is supervising several PhD and MSc thesis in the areas of telematics, teleservices engineering and open and distance learning. He is internal auditor of the European Commission for the Telematics and Transports programmes, and external auditor for the Portuguese Ministries of Economy, Industry and Science and Technology. He is the author and co-author of over 100 scientific and technical papers and project reports.

Proceedings of the 2nd Asia-Pacific Forum on Engineering and Technology Education

edited by Zenon J. Pudlowski

Participants from over 20 countries came together at the University of Sydney, Australia, between 4 and 7 July 1999, for the *2nd Asia-Pacific Forum on Engineering and Technology Education*. Issues debated included those of globalisation, specifically the impact of globalisation on engineering and technology education; the impact of, and responses to, rapidly changing technology and production processes; and the status, quality and importance of engineering and technology education, all of the above in the context of recent economic difficulties in the Asia-Pacific region.

This volume of proceedings includes 78 papers categorised in distinct sections, each section headed by a lead paper thought to be most representative of the area under discussion. Topics covered include the following:

- Promoting engineering & technology in schools
- Vocational education and training
- The impact of new technology on the effective training of engineers and technologists
- Multimedia in engineering and technology education
- Current issues, trends and innovations in engineering and technology education
- Management of engineering & technology education and engineering management education
- Social and philosophical aspects of technology and its impact on modern societies
- Distance education, open learning and related issues
- Academia/industry collaboration programs
- Continuing education needs of engineers and technologists
- Engineering & technology education in other countries
- Effective methods in training engineers & technologists
- Engineering & technology education programs

The papers have been reviewed by independent international peer referees, ensuring their high quality and the value of the Proceedings for some time to come.

To purchase a copy of the Proceedings, a cheque for \$A100 (+ \$A10 for postage within Australia, and \$A20 for overseas postage) should be made payable to Monash University - UICEE, and sent to: Administrative Officer, UICEE, Faculty of Engineering, Monash University, Clayton, Victoria 3168, Australia. Tel: +61 3 990-54977 Fax: +61 3 990-51547