



# TEN Competence



**Building** the technical and organisational **infrastructure** for **lifelong competence development**



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# Project summary and objectives

Early 2005 thirteen organizations - later extended to fifteen - from nine European countries agreed to join forces in developing the most appropriate technical and organizational infrastructure for lifelong competence development in Europe. This infrastructure was to service individuals, groups and organisations alike. Open-source, standards-based, sustainable and innovative technologies were to be the pillars under this infrastructure.

**Professional communities  
to improve your  
professional competence**

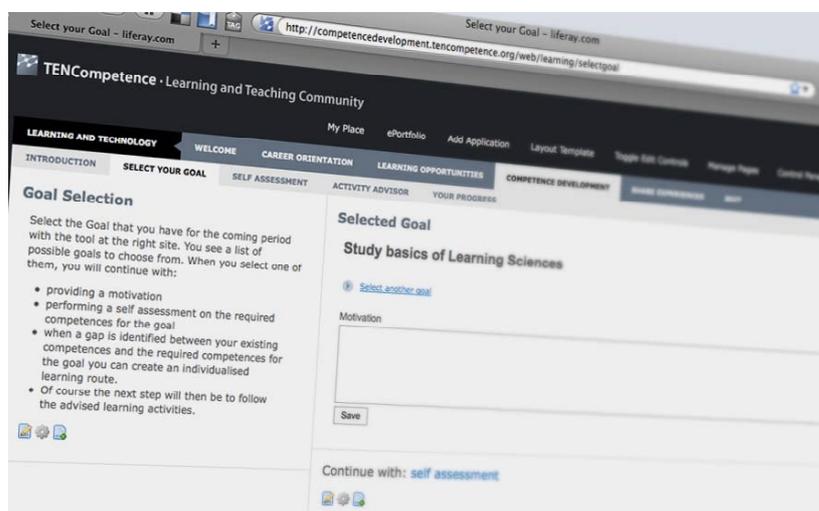


Co-funded by the European Commission, the TENCompetence project started in December 2005. Now, four years later, this document reports on the project's outcomes. Its most evident outcomes are:

- The Personal Competence Manager (PCM), tested and validated in pilots and business demonstrators
- Scientific publications, dissertations and specifications that have advanced the state of the art
- Dissemination and training events
- The TENCompetence Foundation to carry on the PCM (r)evolution

# 1. The Personal Competence Manager

The Personal Competence Management (PCM) comprises an integrative web-based portal environment. The PCM integrates concepts from the fields of e-learning, HRM and knowledge management to provide a very flexible and extendable solutions catalogue to support networks of individuals, teams and organisations in their lifelong competence development. This is possible at all levels of participation - individual learners, teams, and organisations -, at all levels of learning - secondary and tertiary education, including adult, company training, informal learning -, and at all levels of control of the learning goals and process (learner controlled, teacher/trainer/peer controlled, system controlled and mixed).



The Personal Competence Manager

The PCM infrastructure is made available under an open source license. The TENCompetence Foundation co-ordinates the continuous and community-driven evolution of the PCM infrastructure.



## The PCM solutions catalogue

The PCM comprises of a portal environment that integrates a wide range of community functionality like setting up and managing communities, discussion fora, blogging, identity management, 'my space' etc. with specific competence management portlets developed by TENCompetence. In addition a number of web-based tools provide functionality that may also be used separately from the integrative portal environment.

As portal environment TENCompetence selected the open source Liferay portal. All portlets and tools developed by TENCompetence are available under the 3-clause BSD open source license<sup>1</sup>.

### PCM portlets integrated in Liferay

The following portlets support users in their orientation, planning, execution and monitoring of tasks related to their personal competence development:

**Goal Orientation Portlet.** This portlet provides the user with an overview of the competence profiles available in the learning network, based on personal preferences for certain activities, contexts and interests. These resulting competence profiles can then be further investigated through for example the Assessment Portlet to get a first personal positioning on the profile.

**Goal Selector Portlet.** When a user has defined a professional or educational ambition, the Goal Selector Portlet is used to select a matching competence profile as the goal for personal development. The defined goals are reused in the next step of personal development planning, creating a plan to achieve the goal.

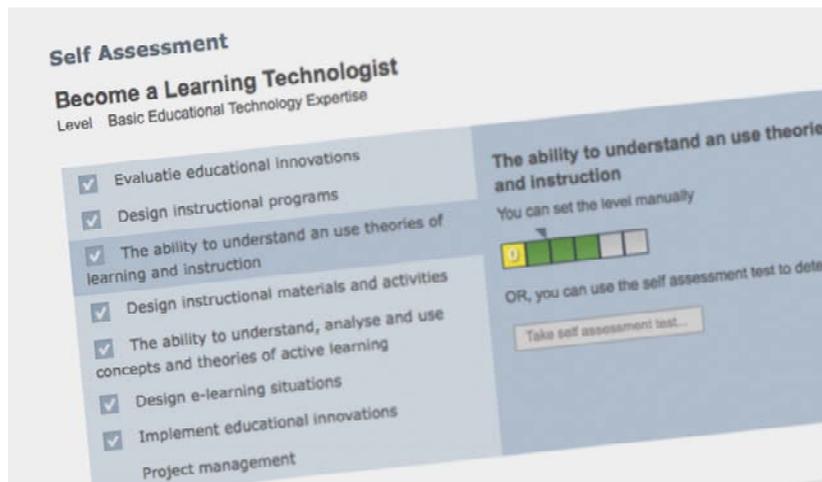
**Test Portlet.** The Test Portlet allows users to take tests in order to self assess aspects that are relevant in setting realistic goals, like aptitude, motivation, personality, learning style, etc.. These tests are created using the QTI Editor Portlet. The outcomes of the Test Portlet are informative, and not directed at a specific competence.

**Assessment Portlet.** The Assessment Portlet helps a user to perform a self assessment for the competences required to achieve the selected goal. After performing this self assessment a competence gap is determined.

**Evidence Portlet.** The Evidence Portlet provides the user with the opportunity to add evidence to the portfolio that provides proof for the mastery of a competence, e.g. linked to the self-assessment carried out through the Assessment Portlet. At the moment this portlet is only available as an integrated functionality in the Portfolio Portlet.

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<sup>1</sup> <http://www.opensource.org/licenses/bsd-license.php>



Assessment portlet

**Activity Navigator Portlet.** The Activity Navigator Portlet supports a user in actually achieving the selected goal, and thus is a key component in the personal development process. First it determines a suitable learning plan for the user, by matching the available learning paths with the identified competence gaps and user preferences. Secondly it directs the user through the appropriate learning opportunities that comprise the learning path.

**SLeD Portlet.** The SLeD portlet is a version of the SLeD IMS Learning Design player, which is running in a portlet. SLeD plays content provided by the Coppercore runtime engine. The application is designed to be re-used and integrated with other systems to provide plug-in Learning Design functionality.

#### **ASTRO Learning Design Player Portlet**

The Astro Learning Design Player is an alternative, and newer, runtime environment to using SLeD. It allows for example modern graphical user interfaces, which are not supported by SLeD. Also this player is designed to be re-used and integrated with other systems to provide plug-in Learning Design functionality.

**Social Help Portlet.** This portlet provides an interface to communicate with other individuals, mainly experts, that can provide answers to the given questions and doubts. At the moment of writing this report, this portlet is still in the testing phase.

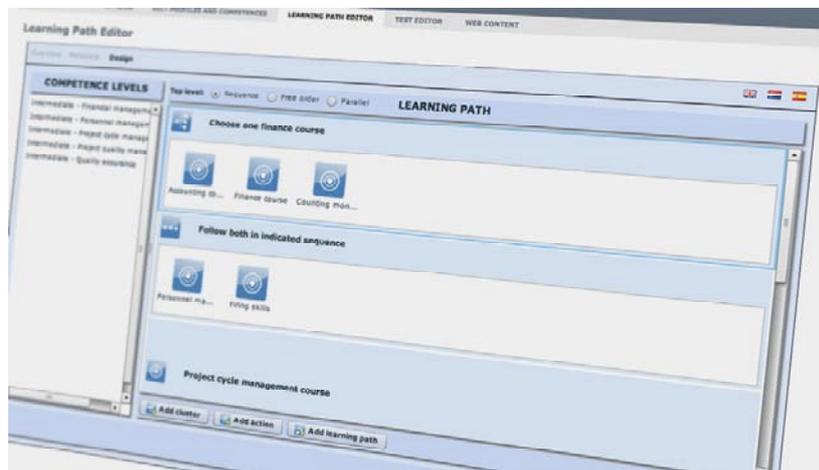
**Progress Portlet.** The Progress Portlet provides different configurable overviews on user behavior and data in the integrated Liferay environment. User data include progress information about competences, competence profiles, learning activities and evidence. The portlet has two main modes. A "journal" mode, where progress can be monitored in detail and a "current" mode, only presenting the current state of a user. The portlet is very flexible and can serve many purposes like that of a configurable portfolio.

The following portlets support the *creation and management* of competence development *networks and services*:

**Competence Model Editor Portlet.** This editor portlet lets an author create and maintain the competence model entities. It includes the definition of competences, competence levels, competence profiles and competence profile levels. These entities are input for all portlets and tools that use competences.

**QTI Editor Portlet.** This portlet lets an author create QTI assessments, according to the IMS QTI 2.1 specification. The tests that are created in this way can then be accessed by users through the Test Portlet and the Assessment Portlet.

**Learning Path Editor Portlet.** A portlet for defining a course of actions which will help the learner to attain a particular set of competences. These actions may be formal (i.e. certified), non-formal (e.g. creative course, sports club training), or informal (e.g. ask a colleague). The result is a learning path compliant to the TENCompetence Learning Path specification. These pre-authored learning paths are input to the creation of personalised development plans with the Activity Navigator Portlet.



Learning Path Editor portlet

**Learning Design Administration Portlet.** This portlet handles the administration of IMS Units or Learning created with the ReCourse tool. This comprises creating new 'runs' for online delivery of the Unit of Learning through the SLeD player, and assigning users to roles (e.g. learner, peer, assessor, coach, etc.) in those runs.

## Stand-alone tools

The following tools are developed by TENCompetence that can be used stand-alone. The web-based tools can also be used into Liferay.

**LearnWeb2.0.** LearnWeb2.0 is a web-based tool for the management and sharing of knowledge resources. It provides users with the convenience of a single environment from which to access Web 2.0 tools best suited to the competence development process. It enables access to a wide array of resources from all over the web which can then be exclusively tagged, rated and commented on by users within the context of their community.



LearnWeb2.0

**ReCourse Learning Design Editor.** ReCourse is an offline desktop application and targets educational practitioners and instructional designers with little experience with the technical specification of the IMS Learning Design specification. It supports modeling and arranging of learning activities and assessment activities graphically. It is based on the Eclipse plug-in framework that enables functionality to be flexibly extended, and current modules include rich text authoring, integration of services, a checker of conformance to IMS LD, visualising of modules, and upload to repositories. The resulting Unit of Learning can be delivered through SLeD or Astro players.

**APIS QTI server and runtime system.** The APIS server for delivering QTI assessment activities supports the most recent version of IMS QTI. The APIS runtime engine provides rendering of all TENCompetence QTI question types. Its architecture allows it to provide web services for consumption by PCM portlets.

**Wookie Widget server.** The Wookie Widget server provides a solution to the provisioning of flexible runtime services for IMS LD. It is integrated into the CopperCore runtime system and functions with SLeD and ASTRO. Wookie has already attracted significant interest from outside the project, to the extent that in September 2009 it was accepted into the Apache Incubator. A community of developers is forming around the server in that context.

**TENTube.** TENTube includes a Video Exchange Channel where members can very easily view, search, comment, rate and submit videos about competence development in general, competence development opportunities and competence development experts; a Network Visualization and Navigation Tool which helps members visualize and browse through the links between people, between people and videos, and between videos; a Profiles Space which encourages members to access information about other members, their interests, competences and networks; and a Game which proactively encourages users to access videos and connects users to each other.

The Big Picture. Modules and Phases (Plays and Acts) can easily be added in one place so you can see the sync points for the Unit of Learning.

A Role Part editor. Quickly assign Roles to Activities and create Activities and Activity Groups on the fly. Role Parts are automatically created!

A Simplified Interface ensures that you can focus on one aspect of the Unit of Learning at a time.

ReCourse Learning Design Editor

## Prototypes

The following tools and portlets were delivered earlier as a prototype and have been used for requirement studies or tests that have been reported in scientific publications. All code is also available as open source software and available for further development.

**Personal Competence Manager, first prototype.** This was the first, fully functional test version of the PCM that was developed in the second year of the project. It uses a Rich Eclipse-based Client and a server. It has been used in many pilots, but is now obsolete by the rebuild in Liferay. Most of the prototypes mentioned below use its server and content editing tools.

**Personal Development Planner (PDP) web tool.** This tool was delivered before Liferay was adopted as an integration environment and was used in many of the TENCompetence pilots. All of its functionality has now been redesigned into the Liferay PCM environment. The tool uses the older PCM alfa server mentioned above.

**Competence Matching tool.** The Competence Matching Tool aids exploration of career opportunities. Similar to common career sites like Monsterboard it allows users to search for jobs based on specific criteria, such as location, industry and salary. In addition, it compares all competences that are required for a vacancy with your own competences. The tool's focus on job vacancies requires that it is connected to a data server that offers these vacancies.

**Overview tool.** This tool aims to give an overview of all the possible formal and informal knowledge resources, units of learning, programmes and learning networks that are available, and to identify the most appropriate one for the user's needs. This tool was implemented first in a Rich Client version and later in a Web-based version called the Goal Orientation Tool. Part of its functionality was later delivered in the form of the Goal Orientation Portlet (see above) which is part of the PCM.

**Network Management/Social Help Tool.** This prototypical tool supports the management of ad hoc transient communities, focusing on mutual, peer-to-peer support of learning network users. It was implemented as a rich client tool. Part of its functionality was later re-implemented as the Social Help Portlet which is part of the PCM.

**Competence observatory.** This prototype has been delivered in the second year of the project to support and inform a future Competence Profile standard, as discussed within the competence community, both within HR-XML and IEEE, and IMS/EP. The Competence Observatory makes competences more manageable by dissociating competences between their higher level, generic and therefore "reusable" aspects and the context in which the competence is applied.

## Building real-world solutions with the PCM

The PCM was built to solve a number of persistent problems in competence development and management:

### Problem 1

Pedagogical models that are applied in training, schools and universities often do not meet the demands of lifelong competence development, and do not effectively use available learning technologies.

### Solution

The PCM supports individual learning, collaborative learning, organisational learning and knowledge management, and in fact provides the tools necessary to integrate these. Authors can create a limitless number of pedagogical models – or learning designs – for online competence development that may include personalisation, remedial loops, group work, peer feedback, etc. The graphical user interface shields the complexity of the underlying Learning Design specification from the author.

### Problem 2

For individuals, groups and organisations it is hard to get an overview of the possible formal and informal knowledge resources, units of learning, programmes and learning networks that are available, and to identify the most appropriate ones for their needs. Also for current e-learning and knowledge management environments provide too little effective support to the users in their various tasks.

### Solution

The PCM provides its users with the convenience of a single environment from which to access Web 2.0 tools best suited to the competence development process. It enables single-entry access to a wide array of resources from all over the web which can then be exclusively tagged, rated and commented on by PCM users for PCM users. This is achieved by isolating competence focused feedback from that of standard Web 2.0 users. This supports both a) learners and knowledge users involved in learning or applying a new skill or complex knowledge, and b) experts, trainers and teachers who provide learning support services in order to increase their bandwidth.

### Problem 3

The pro-active sharing of knowledge and learning resources is a major problem: for a variety of reasons people are not able to (or do not want to) share their knowledge and other resources.

### Solution

The TENCompetence project developed among other things, the LearnWeb tool and investigated and devised social strategies to address this. At the moment one of the project partners is using these outcomes to develop a 'PCM token economy' to support pro-active sharing within a professional community, comprising both the 'business rules' and the supportive software within the PCM portal environment.

### Problem 4

For an organisation in Europe it is still hard to assess the competences of applicants, employees and learners who have studied and worked in a variety of settings.

### Solution

To this end the PCM supports the authoring and management of competence definitions, with the possibility to aggregate these into competence profiles. Users - learners, applicants and/or employees – are able to assess themselves against these competences, upload evidence

from previous learning and experience, determine their present competence gap(s), and select and create personal development plans accordingly. All relevant information is managed in a configurable personal portfolio. Importing existing organizational competence frameworks by employers and sector organizations is also an option.

### Problem 5

Centralized models for the management of a network do not work in Europe because: a) the market is not homogenous, being strongly competitive, and culturally diverse; b) individuals and organisations who collaborate in a lifelong learning infrastructure want to maintain their autonomy and control as much as possible.

### Solution

To this end the TENCompetence project validated the PCM in various organizational, cultural and national contexts with external implementing partner organizations. The PCM portal environment allows the configuration of 'closed', 'open', self-organised and institutional communities, and for users to be members of various communities with varying roles while keeping one 'identity'. The lessons learned from the demonstrators were used to compile a number of potential business models, and to inform the establishment of the TENCompetence Foundation as the motor behind the continuous PCM evolution.

### Problem 6

Although the three areas of Knowledge Management, Human Resource Management and e-Learning share many common themes, there has been little unifying work which integrates models and tools for competence development during learning and working, and across a lifetime.

### Solution

The PCM is based on a range of existing open source tools; integrates Web2.0 resources; implemented learning specifications like the IMS Learning Design (IMS-LD) specification; the W3C Widget specification and the IMS Question and Test interoperability (IMS-QTI) specification at the heart of its tool-set; and incorporates solutions that were newly developed by TENCompetence. PCM implementations have been configured for each of the three domains separately, but were also configured into one integrated environment for continuous professional development.

## How and by whom was the PCM developed?

The PCM was developed by a consortium of European organizations from both the public and private sector, with varying backgrounds in fields like lifelong learning, educational innovation, knowledge resource management, software development, consultancy, specifications development, etc.. The European Commission co-funded the consortium in support of the Union's goal of transforming the EU into "the most dynamic and competitive knowledge-based economy in the world".



TENCompetence partner meeting in Madrid

Consortium partners

The TENCompetence consortium comprised of the following partners:

- Open Universiteit Nederland, through its Centre for Learning Sciences and Technologies (<http://celstec.org>)
- Altran Technologies S.L., Spain, part of Altran (<http://www.altran.com>)
- LogicaCMG Netherlands, now part of Logica (<http://www.logica.nl/>)
- Fundació Barcelona Media Universitat Pompeu Fabra, Spain (<http://www.barcelonamedia.org>)
- Giunti Interactive Labs, Italy (<http://www.giuntilabs.com>)
- Centre for Research and Technology Hellas, Greece (<http://www.certh.gr>)
- The L3S Research Center of the Universität Hannover, now Leibniz Universität Hannover, Germany (<http://www.uni-hannover.de/en>)
- The Institut Européen d'Administration Des Affaires, France (<http://www.insead.edu/home>)
- University of Bolton, through its Institute for Educational Cybernetics (<http://www.bolton.ac.uk/IEC>)
- Universiteit van Amsterdam through its Kohnstamm Institute, the Netherlands (<http://www.kohnstammstituut.uva.nl/>)
- University of Sofia "St. Kliment Ohridski", Bulgaria (<http://www.uni-sofia.bg>)
- Stichting SURF, the Netherlands (<http://www.surffoundation.nl>)
- Synergetics, Belgium (<http://www.synergetics.be>)
- UNESCO-IHE Institute for Water Education, the Netherlands (<http://www.unesco-ihe.org>)
- Agora, Spain (<http://www.edaverneda.org/>)

## Development cycles

The PCM was developed through three cycles. The first cycle delivered a 'proof of concept' system illustrating the basic TENCompetence concepts through a largely static system mock-up comprising of use case descriptions and wireframes - visualization method for presenting proposed functions, structure and content of a web application. The second development cycle resulted in prototypical tools that could already be applied in 'safe world' pilots: with real users, but operated by the consortium partners providing continuous support in the background. The third and last cycle delivered the PCM, that was applied in real-world settings by external organizations, covering formal, informal, public-, and private-sector contexts throughout Europe. During this last cycle the consortium partners only provided support services in the background.



Agora pilot



## 2. Research outcomes and specifications development

The TENCompetence project is a Research and Technology Development (RTD) project. The *technology development* component resulted in the PCM solutions catalogue described above.

Research output of the TENCompetence project was impressive as well and comprised scientific publications, learning technology specifications and a research network of PhD students.

### Scientific publications

TENCompetence participants have published in international journals and presented at (inter)national conferences extensively. Early in the project these publications and presentations were mainly related to conceptualizing the PCM, while later the lessons learned from the pilots and demonstrators became more prominent.

These activities have resulted in 277 publications in international, peer reviewed journals and peer-reviewed books. The project has edited seven special issues of scientific journals and nine conference/workshop proceedings, some of them large international conferences. The project was also present in many conferences and workshops around the world and presented papers or provided keynotes. One of the books that has TENCompetence funded chapters is: *R. Koper (Ed.), Learning Network Services for Professional Development. Berlin, Germany: Springer Verlag, 2009.*

### Learning technology-related specifications

At the intersection of research and technology development the TENCompetence project developed a number of new specifications and implemented these in the PCM. These specifications and reference implementations have been provided as input to various international standardisation bodies.

**PCM domain model & competence definition.** The 'world of PCM' at an abstract level is represented by its domain model (<http://hdl.handle.net/1820/649>). This model has formed the basis for building the PCM portlets and tools, but also defines the logical relationships between them. Competences and competence profiles are at the heart of the PCM domain model. Therefore TENCompetence partners have been active in international bodies involved in defining competence specifications and standards, specifically the Institute of Electrical and Electronics Engineers (IEEE), the European Competency Special Interest Group, and the consortium on Human Resources XML vocabulary (HR-XML).

**Wookie widget server.** What started as the development of a widget server for ReCourse under TENCompetence, has now been accepted as a reference implementation of the draft W3C widget specification and was invited to submit to the Apache Foundation Incubator. The necessary improvements to the code base and documentation were made, and Wookie was accepted into the Apache Incubator in September 2009. A community of developers is forming around the server in that context.

**IMS LD and IMS QTI.** Contacts have been maintained with the IMS Global Learning Consortium regarding the revision of IMS Learning Design (IMS LD) and the APIS runtime system. The latter was developed under TENCompetence to render QTI tests in SLeD and to provide services to the Test Portlet and Assessment Portlet, and was brought to the attention of the IMS QTI group as an implementation and profile of IMS QTI 2.1. The Learning Design tools were exhibited at the *IMS Creativity & Innovation in European Education and Learning Impact* event in Barcelona, where it was given an award as “Most Innovative New Realization of Standards”.

**Learning Path specification.** A learning path model and description was developed as the basis for the Learning Path Editor Portlet. Here each learning action is described by a set of metadata specifying content, process, and planning information (e.g. title, description, assessment, tutoring, delivery mode, contact hours). These metadata play a role in a learners’ process of choosing a learning path in the Activity Navigator Portlet.

## PhD research network

A PhD research network was established, first recruiting PhD students from the partners, later opening up to other students and researchers active in the TENCompetence domain. The annual one-week Winter School was a major highlight, which midway the project was supplemented with the online research seminar series.



TENCompetence Winterschool

During the project five Doctoral dissertations directly based on TENCompetence work were successfully defended; two are scheduled for defense early 2010; and two are still in progress.



### 3. Dissemination and training

TENCompetence has provided keynotes, been an active participant, and often co-organiser, of many national and international conferences, seminars, workshops and training events. Early in the project the dissemination activities tended to focus on the research community, while later they shifted towards the HRM and employability domain.

In total the TENCompetence project and the PCM have been presented at over 250 national and international dissemination events.

Some of the major events comprise Online Educa Berlin (OEB); the European Conference on Technology Enhanced Learning (EC-TEL); the IEEE International Conference on Advanced Learning Technologies (ICALT); the HR-XML summit; EduMedia; the Eifel ePortfolio conference; the Employment Week conference; Zukunft Personal; Professional Training Facts conference; the Annual Conference of the Chartered Institute of Personnel and Development (CIPD); and the nine TENCompetence thematic Open Workshops organized for both researchers and representatives from private- and public sector organizations.



TENCompetence at the Online Educa in Berlin 2009

During project execution the consortium partners participated in a wide range of research and professional networks. Project activities and events were co-organized with the PROLEARN network of excellence; the PROLIX integrated project; Eifel; the APOSDLE integrated project; the IMS Global Learning Consortium; the iCOPER project; JISC; and the European University Continuing Education Network (EUCEN).

Training materials were developed for the pilots and business demonstrators in the form of installation manuals, quick-guides, user manuals, and video screen-captures on system configuration and use.

## 4. The TENCompetence Foundation to carry the torch

The TENCompetence Foundation was established to accept ownership of the TENCompetence project outcomes, and to continue PCM development and promotion.

Next to the project partners other organizations are also invited to join as subscribers, associate partners, or full partners of the Foundation.

- Subscribers can follow developments through regular newsletters and can participate in forums based around stakeholder communities and events.
- Associate partners will have more direct involvement in the maintenance and development of the software and other Foundation activities.
- Full partners form the core of the Foundation and actively contribute to the continuous development through funding or 'in kind'.



Already during the execution of the TENCompetence project the TENCompetence Foundation was established as a legal entity; the Foundation web site was created; a number of illustrative business models for (potential) partners were developed; and an Exploitation Plan elaborates on the operations and procedures of the Foundation on issues like collecting bug reports, how to prioritise and handle change requests, how to submit new functionality requests, on release management and phasing, etc.

## OUNL implementing TENCompetence infrastructure

OUNL is implementing the TENCompetence Personal Competence Manager as part of its strategy to become *the* university for continuous professional development. The Board has allocated E. 1.5 mln. for the implementation of this new business model supported by the PCM, for two domains initially: Learning Sciences and Technologies, and Informatics. Starting in April 2010 with a batch of trial students, the pilots should shift to full operational status in 2011. Parallel to these two pilot implementations, OUNL's technical and organizational infrastructure will be prepared for the transformation by all OUNL domains in 2012.

Ambitions however extend beyond the institutional boundaries. OUNL is also participating in a number of regional and national consortia and projects that focus on employability and continuous personal competence development. The PCM is positioned as a major facilitator in these initiatives.

The TENCompetence Foundation invites all those active in the domains of personal competence development, eLearning and knowledge management to visit the TENCompetence Foundation and its products at <http://www.tencompetence.org>