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TENCompetence
Building the European Network for Lifelong Competence Development

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Thematic Priority: 2.4.10

**D10.4 Report with an assessment of the WP results including ID10.12-ID10.17**

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Duration: 4 years

University of Bolton

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Project Deliverable Report

D10.4 - Report with an assessment of the WP results including ID10.12-ID10.17

Work package
WP10 – Dissemination and exploitation

Task

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Contributors

Authors (Partner)
University of Bolton, OUNL.

Contact Person
David Griffiths (University of Bolton)

WP/Task responsible
Chris Kew (University of Bolton)

EC Project Officer
Mr. Martin Májek

Abstract (for dissemination)
This report summarises Dissemination work carried out by the TENCompetence Project between months 43 and 48. It includes sections on workshops and events, and awareness raising and the TENCompetence Foundation, business models. A proposed standard for aggregating competences is provided, to be submitted to IEEE. A major line of work was preparation for the future of the TENCompetence Foundation, and a Sustainability Plan is provided, including business models, organisational aspects and strategy.

Keywords List
Sustainability, Foundation, business model, competence profile, standard, dissemination, events, outcomes

TENCompetence Project Coordination at: Open University of the Netherlands
Valkenburgerweg 177, 6419 AT Heerlen, The Netherlands
Tel: +31 45 5762605
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1. Introduction

This final period of project activity was in some respects a continuation of the rhythm of core dissemination work which had been established throughout the project. These tasks included ensuring that news was published on the Web site, production of flyers with updated information about project outcomes, internal dissemination of project news, gathering information about partner dissemination activities and archiving and documenting them. Information on these activities is summarised in Chapter 2 of this report, and appendices are provided with information on journal and conference publications, dissemination presentations and project contacts.

However, this reporting period, coming as it does at the end of the project, had a distinctive set of needs, and this has been reflected in the work carried out.

Firstly, the project has prioritised dissemination activities with professionals in commercial and public organisations, rather than academic events. Thus we have exhibited in Zunkunft HRM Expo in Cologne, the Annual Exhibition of the CIPD Chartered Institute of Personnel Development (the largest HR exhibition in the UK), and at Online Educa Berlin. We have also run three events which were directed at professional participants, one in parallel with the CIPD event, and two organised by partners Giunti and INSEAD.

Secondly, a major focus of work has been on valorisation of project outcomes, for which the principal vehicle is the TENCompetence Foundation, to be launched at the end of the project. This brought together a number of lines of work, including:
- planning for the sustainability of partner activities with the Personal Competence Manager, and analysis of their plans to draw lessons for the activities of the Foundation
- identification of a business model framework for the Personal Competence Manager, and development of three exemplar business models
- analysis of the Foundation’s business model, and development of a strategy
- launch of the Foundation and preparation for decisions on rules and regulations and budgets.

These components are brought together in Chapter 4 as the TENCompetence Sustainability Plan.

Additionally, a significant sustainability achievement in one area of the project has been the acceptance into the Apache Foundation Incubator of the Wookie Widget Server produced by WP6.

Thirdly, in work led by partner Synergetics the project took a leading role in developing a draft standard for aggregating competences into competence profiles, which had been identified as a significant gap in the landscape of open specifications. This will be submitted to IEEE shortly after the close of the project. It is described briefly in Chapter 3, and is available in Appendices 3 and 4.
2. Raising awareness and ensuring availability of project outcomes

Throughout the project the journal papers, conference papers and presentations delivered by the project have been gathered in an online compendium, delivered using a DSpace server. DSpace is designed to provide a long term archiving solution, and provides a namespace which is separate from the servers on which the content resides.

The TENCompetence compendium of project outcomes is available at http://dspace.ou.nl/handle/1820/496.

At the close of the project there was a total of 671 items available, divided as follows.

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2.1 Journal and conference papers and dissemination

Appendix 1 provides details of 62 scientific outputs in the form of articles published in international refereed journals; papers presented at selected conferences; book chapters and PhD theses directly based on TENCompetence work.

Details of 66 dissemination activities carried out in the last project year, together with links to DSpace, are provided in Appendix 2.

Readers interested in earlier periods of the project are directed to the TENCompetence DSpace server where a compendium of project outcomes is stored, at http://dspace.ou.nl/handle/1820/496, where 272 TENCompetence publications and preprint papers can be searched and accessed, and 169 presentations.

2.2 Task 10.2: Events

In this final period of the project focused on events which could reach the user group for the Personal Competence Manager, that is to say, HR professionals and business decision makers. Thus in September – November 2009 the project attending two major HR fairs, where the Personal Competence Manager could be shown, and also Online Educa Berlin, the event where the business community and eLearning providers come together for an annual exhibition.

The project also organised three events, which focused on the end users, and made use of
the business contacts of partners.

2.2.1 Professional exhibitions

Zunkunft HRM Expo (September 2009 – Cologne, Germany)

Billed as Europe’s largest HR exhibition, the HRM Expo in Cologne attracted over eleven thousand visitors from industry in the three days between the 22nd and 24th of September. As part of its strategy to target real world” end users from the world of Human Resources and industry more generally, the TENCompetence project disseminated information on its anticipated outcomes from its exhibition stand. The stand featured purpose made posters which complemented the distribution of over thirty flyers and the proactive promotion of the project through targeted introductions, discussion and presentations all of which served to raise the project profile among this important group of stakeholders. Several important contacts were made among stakeholders in the field of training and consultancy. These contacts were added to the list of potential foundation subscribers.

CIPD Annual Conference (November 2009 – Manchester, UK)

The Chartered Institute of Personnel and Development (CIPD) is an internationally recognised professional body for those in the field of management and development of people. Their annual conference and exhibition regularly attract thousands of guests from the UK and beyond. In keeping with the WP10 dissemination strategy for 2009, the project participated in the exhibition over a three day period. The TENCompetence stand attracted over forty delegates with specialist and professional interests in the fields of banking, consultancy, coaching and training. A total of fifteen contacts were added to the list of potential foundation subscribers and fifty flyers were distributed.

Online Educa Berlin

Although Online Educa Berlin fell just outside the project period, it was decided that it was an essential event for dissemination of the Personal Competence Manager and other project achievements. The TENCompetence Foundation had a stand at the event, which was supervised throughout the exhibition opening hours by project partners at their own expense. Flyers and publicity materials were distributed, and names gathered for invitation to join the Foundation.

2.2.2 TENCompetence events

Sestri Levante, 16th July

An event entitled “Learning and Competence Development in Europe for tomorrow and beyond” was held in Sestri Levante, hosted by Giunti Labs, which presented the work of the project and related competence based research to an invited audience of 35, principally demonstration partners and members of the Giunti client group.

The agenda included a keynote from the project leader, Professor Rob Koper, and a presentation on an organisational model for lifelong learning from Jocelyn Manderveld and Bas Krekels (SURF Foundation/Logica). The remainder of the event focused on sharing the results of three business demonstrators of the TENCompetence infrastructure,
and on linking these to other related initiatives.
This was followed by the opportunity to discuss the TENCompetence infrastructure in more detail.

The programme of the event, and slides of the presentations are available at http://www.tencompetence.org/node/208

**Manchester Open Workshop**

The main TENCompetence event in this period was a two day final TENCompetence Open Workshop held in Manchester entitled “Rethinking Learning and Employment at a time of economic uncertainty”.

The Workshop offered an opportunity to think about the relationship between the world of education and the world of work, in a mix of keynotes, round tables, software demonstrations and paper presentations. The event was the occasion of the formal launch of the Personal Competence Manager.

The Workshop overlapped with the CIPD conference being held in a building directly opposite, which provided the opportunity for participants to attend the UK’s biggest HR exhibition in parallel with the workshop. The project also had a stand at the exhibition.

The TENCompetence Personal Competence Manager reference implementations were presented and discussed with participants in small sessions, repeated so that participants could attend those demonstrations which they wanted to see. There was also a call for papers, which resulted in 19 submissions, 9 of which were accepted. The proceedings of the Workshop are currently being prepared for publication.

The programme for the event is available at http://www.tencompetence.org/files/manchester_2009/manc_tencomp_prog.pdf

**Fontainebleau symposium.**

TENCompetence partner INSEAD and its sister organisation CEDEP organised a one-and-a-half day symposium for business people which for logistical reasons fell just outside the project period. It was entitled Inter-Organizational Learning and Competence Development: Web 2.0 Experiences and Trends, and the question directed at participants was “Is your company ready for Web 2.0”.

Key speakers included
- Professor Han van Dissel, Director of CEDEP, Symposium Co-Chair
- Professor Albert A. Angehrn, INSEAD, expert in Collaborative Advanced Learning Technologies, Symposium Co-Chair
- Professor Rob Koper, OUNL, Coordinator of the TENCompetence EU project addressing effective trans-European competence development networks
- Dr Roland Deiser, ECLF & USC, expert in corporate learning architectures, with insights about Web 2.0 adoption patterns and trends in large international companies.

The programme is available at http://www.tencompetence.org/files/InterOrganisational_Learning_Symposium.pdf
3 Standardisation initiatives

In this reporting period work on standardisation proceeded along two lines.

3.1 Aggregation of competences into profiles

First, the project took a leading role in the organisation of a European consensus on the aggregation of competences and their possible correlations and dependencies, coordinated by partner Synergetics. This built on earlier work carried out in IEEE, and collaboration with other projects, in particular Prolix, and the resulting proposals therefore diverge in some respects from earlier TENCompetence proposals and terminology.

The need for this initiative was made more urgent by the important upcoming IEEE meeting in March 2010, where European input on the net step in competency standards is expected, specifically on
1. Proposal competency profile standard
2. The envisioned common semantic model for competency related data.

This presents an opportunity for the European community to make proposals to equivalent American groups to ensure that IEEE takes on board the European position.

The proposals available in annexes 3 and 4 represent a draft competency standard proposal.

The proposal consists of two documents.

a) Proposed Draft Standard for a Competency Model and its instantiation as a Competency Profile

This document proposes an information model for the aggregation of specific competencies and their possible correlations and dependences. This is to act as a knowledge description specifying an object (artifact) such as a person, job, function, role, process, etc…, which is to be used to describe, reference and/or exchange data in the context of lifelong learning, competency and employability management.

The CP information model allows the representation of relationships (correlations and dependences) between competencies or complementary aspects related to competencies, such as they have often been captured in competency frameworks and models, such as criteria, qualifiers, context, and evidence).

In the proposed Standard, the word competency is used in a generic sense which includes KSAOs (knowledge skills, abilities and other characteristics such as intended learning outcomes).

This Standard references the IEEE P1484.20.1 Reusable Competency Definition (RCD) Standard (2007). The IEEE/RCD Standard specifies how any arbitrary competency definition can be captured using a standard data model. In this Standard, the (cor-)relationships & dependences between RCDs are represented using the notion of a Competency Profile in which each node may reference a RCD. Roll-up rules are specified to allow representation of how sub-competencies specified in the Competency Profile can
"roll up" to a broader competency.

b) Competency Related Data Management: a proposed reference model
The purpose of the proposed reference model is to specify data models and processes that enable the broadest, most economical exchange of useful competency-related data among and between communities of practice. The reference model must support different conceptual models of the problem space, as well as various existing best practices. Its scope includes common data models and the specification of some common processes. It specifies some starter set of scenarios that take advantage of the common data models and processes involving competencies. The scenarios meet specific business requirements identified in applications areas such as education, personal development and learning content development as well as hiring, performance improvement and training.

3.2 W3C Widget Specification
The Wookie widget server, developed as part of the WP6 Learning Design Toolkit, is based on implementations of the W3C Widgets family of specifications, particularly Packaging and Configuration\(^1\) and The Widget Interface\(^2\). As of December 2009, Wookie had achieved tested conformance to 89% of the specification according to W3C, and expected to reach 100% conformance by early 2010.

As a result of this engagement the project was able to contribute actively to the W3C standards process; this included participation in mailing lists, presentations at the W3C face-to-face working group meeting at Orange/France Telecom, and submitting a joint white paper with the PALETTE project\(^3\).

As a result of the contributions made to the specification as part of his TENCompetence work on Wookie, Scott Wilson from the University of Bolton was invited to become a member of the W3C Web & Hypertext Applications Group and to contribute formally to the development of the specifications.

The acceptance of Wookie into the Apache Foundation incubator reinforces the status of Wookie as a reference implementation of W3C widgets.

More information about Wookie is available in D6.3 and D6.4.

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4 TENCompetence Foundation sustainability plan

4.1 Introduction

The TENCompetence Foundation has been promoted through the dissemination activities of the project, the events which have been organised, and participation in exhibitions and congresses. However, for this to be sustained plans need to be in place and actions taken to manage the shift of responsibility from the Project to the Foundation. Consequently a major focus of work in this last reporting period has on preparing a sustainability plan for the Foundation, which we present in this section.

This has involved work on a number of different aspects, which include

- Development of exemplar business models which illustrate the use of the Personal Competence Manager
- Development and analysis of the sustainability opportunities and plans of the partnership
- Development of a business model and strategy for the Foundation
- Establishment and activation of the Foundation
- Guidelines for management of the code base.

In this Sustainability Plan we summarise the work of three strands, and propose a strategy for the future activities of the Foundation. This will serve as a base document for the Foundation, representing the starting point for Foundation activities, and a basis for decision making by the Foundation Board.

This report builds on deliverable D10.1 A Formalised Organisational Model for the TENCompetence Associate Partners (http://dspace.ou.nl/handle/1820/881, January 2007), the Articles of Association of the TENCompetence Foundation (October 2007), and the internal deliverable ID10.2 Critical Use Cases and potential Business Model Outlines (http://dspace.ou.nl/handle/1820/1410, July 2008), updated as chapter 2 of this document. It also draws on D4.6 - Report on the results of cycle 3 demonstrators. Some brief observations on the outputs to be sustained.

4.2 Some brief observations on the outputs to be sustained

The outputs whose sustainability has been planned are described in the deliverables of WP3, and so they are not described in detail here. Suffice it to say that together they constitute the TENCompetence Personal Competence Manager (PCM), an integrated infrastructure which provides a framework for the whole process of lifelong competence development. It is made up of a set of service based applications which are accessed through portlets in the Liferay platform. One of the advantages which this approach offers is flexibility, as the provider can decide which portlets to deploy in a particular instance of Liferay, and can also choose to implement other applications which make use of the same services. There are also two applications which are more loosely linked to the infrastructure: the ReCourse Learning Design editor, which creates Units of Learning to be run in the PCM, and TENCompetence Tube, which provides a video based overview of competence development activities for a particular community. Clearly an institution which seeks to deploy the TENCompetence infrastructure has choice in deciding if they wish to deploy the whole range of Liferay portlets, or only a subset, or if they wish to
make use of the services without the applications which TENCompetence provides.

4.3 Link with the Apache Foundation

Before addressing the sustainability of these outcomes, it is worth mentioning one TENCompetence product which is not included here. A significant achievement of the project is that the Wookie Widget Server, entirely developed by TENCompetence, was accepted into the Apache Incubator in September 2009. This is both an effective and prestigious means of developing a community around the Wookie server, and once this is sustainable it can progress to become one of the core Apache Foundation projects. The Foundation decided that it would be wise to take advantage of this opportunity, and so the Wookie code is managed within the context of Apache. Not only is access provided to ASF services for code management, issue tracking, mailing lists, wiki and website support; more significantly, a team of experienced ASF members are mentoring the project to ensure its future success. Apache has also organised two meetings on Wookie, one in London and one at ApacheCon in Oakland California. The latter attracted sponsorship from LinkedIn.

There was very positive reaction to the project, and in particular when we asked if we could credit the TenCompetence project and the EU funding in the Apache Website, we received this response from Dan Brickley of W3C:

I’d love to see it included. The structure of academia tends to reward scholarly paper-publishing but doesn’t really know what to do with software and data work. European projects also tend towards producing deliverables that are mostly likely to be giant PDFs rather than running re-usable code. So when we do finally get useful outputs from European research funding that enrich the open standards / open source scene, please let’s not be shy in celebrating that! Maybe others will follow the great example, and start thinking more seriously about open source life-after-funding for their codebases, rather than taking a ”throw the code over the wall and hope for the best” approach.

4.4 The approach taken in this plan

In this plan we analyse the sustainability of the TENCompetence project results at three levels:

a) At the level of the individual consortium partners. For this purpose each of the larger consortium partners and some of the smaller ones have devised a sustainability strategy for the application of the TENCompetence concepts and outcomes within their own organization. For education partners their strategy tends to be linked to their core process of teaching and learning, while the private sector partners tend to focus on applying the TENCompetence outcomes as a commercial offering. In some cases, like with the OUNL, the project outcomes will be applied both within OUNL’s own core processes, but will also be ‘exported’ to consortia in which the OUNL participates. These sustainability plans are discussed in section 4.6.

b) At the level of future TENCompetence users and service providers. These are organizations or individuals who will use and/or offer services around the implementation and exploitation of the TENCompetence use cases. These were established earlier in the project, and are determined by the problems which they

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4 See D6.4 and D 6.3 for more information about Wookie.
5 Apache Wookie: http://incubator.apache.org/wookie
system is designed to address, and by the analysis of service provider roles carried out in D9.1 appendix 1. Additional insight has been obtained through analysis of the business demonstrators. Users may be training and education providers, formal or informal professional networks, HR-departments, etc. Service providers may be technology providers, content providers, etc. Section 4.6 describes three exemplar business models for the application of project outcomes in the domains of Knowledge Management, Human Resource Management and e-Learning which are listed in the Description of Work as the areas to be addressed by TENCompetence.

c) **At the level of the TENCompetence Foundation.** The TENCompetence Foundation is the vehicle through which valorisation and sustainability will be carried out, with a core task of maintaining on-going development and release of the PCM after project completion. This is the remit of the TENCompetence Foundation. The Foundation was established on the basis of an analysis of a partnership model (D10.1, delivered in year 2). Its membership rules, Board composition and operational structure are discussed, with reference to the Articles of Association, which are provided as an annex to this report.

Drawing on this analysis section 4.8 summarises the actions to be taken by the Foundation in the coming year.

**4.5 Partner sustainability plans**

The first level of sustainability planning was carried out at the level of the partnership in the project itself. For this purpose each of the larger consortium partners and some of the smaller ones have devised a sustainability strategy for the application of the TENCompetence concepts and outcomes within their own organization.

In this chapter we analyse the overall picture for partner sustainability, and draw some conclusions regarding the implications for the sector as a whole.

These results feed into the strategy to be adopted by the Foundation, which is discussed in sections 4.7 and 4.8.

**4.5.1 The Process**

The process of developing the Sustainability Plan was established at the project board meeting in Utrecht, 21st April 2009 and documented in the plan posted to the TENCompetence intranet for WP10 on 24th April.

This process was conducted using a proven approach applied by partner SURF in planning for the sustainability of the projects which they fund. This was adapted for the purposes of TENCompetence, and the resulting request for contributions to the project sustainability plan is reproduced in appendix 6.

The results were gathered and collated, and a summary of the results represented in a grid. This was the basis for further discussions at the project meeting in Sestri Levante, both more detailed discussions with individual partners and also analysis of the sustainability of the project as a whole. Following this meeting an interim sustainability plan was created, delivered in D 10.3. This chapter updates that plan following collection of updates from partners. In general the situation has not changed dramatically, although the overall
feedback from partners is rather more optimistic than it was in July. Rather than referring to the interim plan and describing changes, the whole plan for partner sustainability is provided here, which inevitably means a certain degree of repetition of the content of the interim plan.

For education partners their strategy tends to be linked to their core process of teaching and learning, while the private sector partners tend to focus on applying the TENCompetence outcomes as a commercial offering. In some cases, like with the OUNL, the project outcomes will be applied both within OUNL’s own core processes, but will also be ‘exported’ to consortia in which the OUNL participates. These sustainability plans are discussed in chapter 1. The individual plans are attached as appendix 6.

4.5.2 Overview of partner sustainability plans

We divide the opportunities for TENCompetence partners to exploit the PCM as follows. References are to the individual partner sustainability plans in Appendix 1, unless otherwise stated.

a) Commercial / educational. Lifelong competence development is not part of the core mission for the commercial partners in TENCompetence (although this would be different if they were, for example, Human Resources consultancies). For the educational partners, however, support for competence development is inevitably part of their mission, and the TENCompetence tools directly address their core processes of teaching and learning. Consequently we analyse these two groups separately, in terms of both the TENCompetence outputs as an opportunity for delivering services, and also as a means of improving their internal effectiveness.

b) internal / external. All partners have potential opportunities to apply the PCM either to make their own internal processes more effective, or as the basis for services which they offer to other individuals and organisations.

Commercial partners

The principal commercial partners in TENCompetence are ALTRAN, GIUNTI and LOGICA. Like any organisation, they have a need manage the lifelong competence development of their own employees in order to maintain their competitiveness. In this respect the potential for exploitation of the PCM depends on their existing provision in Human Resources (HR) management, and whether the time is ripe for moving to another system.

All three commercial partners recognise that the functionality of the PCM has the capability to provide valuable services for their clients and within their own organisations. However all three explicitly state that the PCM is in direct competition to existing products.

In the case of LOGICA the company “has its own systems to offer its clients readymade solutions and services to match consultants with job openings and to track and assess the development of its consultants. LOGICA’s first priority is to align these processes worldwide.” (From the Interim Sustainability Plan, D 10.3).
Similarly in the case of ALTRAN the company “has developed and deployed a Knowledge management system that classifies the competences of the personnel using a knowledge tree. This is used by consultants to:

- map its knowledge
- find experts on a specific theme to identify training past courses taught related on a specific knowledge area
- current and completed projects in a knowledge area
- evaluate candidates for a job in their knowledge of a specific area, etc.

(From the Interim Sustainability Plan, D 10.3).

Clearly deployment of TENCompetence in ALTRAN to manage its internal processes would require that the PCM offered this functionality plus additional functionality, and would also have to overcome the resistance involved in changing systems, when both of them incur no charges to the organisation.

In view of this reality, it is encouraging that in the light of progress in the PCM tools since July 2009, both companies are now planning to implement demonstrators of the Personal Competence Manager after the end of the project in order to explore their commercial potential.

GIUNTI are in a similar situation, where there are established HR management products in the organisation. But they do see that there a possibility of applying the PCM in “knowledge sharing among GIUNTI' employees”. However the fact that this opportunity is limited in scope tends to underline the general picture, which is that commercial organisations do not see a motivation for replacing their own HR management processes with the PCM.

**Educational partners**

Unlike the commercial partners in TENCompetence, the educational partners do have a mission to support competence development, and so the TENCompetence tools address their core processes of teaching and learning. However, the way in which these activities relate to lifelong learning varies substantially.

Four of the educational partners have a clear vision of themselves as providers of lifelong learning services, and see a role for the PCM in addressing this.

a) Partner **Bolton** has a policy of becoming a “Professional University”, i.e. focused on preparing learners for participation in the workplace at a professional level, and meeting needs of professionals for extending their competences and gaining new ones. In this area it is planned to implement an internal demonstrator in 2010. The HR training department plans to carry out a pilot with the system once the current review of competence definitions for principal lecturers is complete. The TENCompetence Learning Design Toolkit will be used within the Institute for Educational Cybernetics in its own teaching activities.

b) For partner **OUNL** the major student cohort is professionals between 30 and 45 years old who want to keep up to date in their field, who want to advance their career, or who want to make a career shift. The PCM will be used to implement a new business model for the University. This is based on a subscription system with various

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6 See Altran's revised sustainability plan in Annex 1 below. Logica plans were reported verbally to WP 10.
membership-types related to different use cases: free membership of a professional community, use free online tools (as developed by TENCompetence), access open educational resources and exams for certified courses; and a premium membership to study and receive expert learning and career development services. The technical infrastructure to support this membership model will be implemented in Liferay, applying the tools developed by TENCompetence.

c) Partner **Sofia** is a leading provider of Lifelong training services in Bulgaria and plans to use the whole TENCompetence platform for various training offerings, tailored to the user needs. In doing this Sofia is establishing various partnerships related to the joint use of the TENCompetence platform and tools, mainly with already registered TENCompetence associated partners. University of Sofia is also planning to deploy the results of the project and use them both for the needs of the internal education process in the University, as well as for the providing of lifelong training services to all users interested from them.

d) **Àgora** is a lifelong competence development provider, which is currently is using the PCM on a free access basis and intends to extend this in the areas of competence development in ICT, English and Spanish for foreigners which are the areas of most needs.

4.5.3 Conclusions from partners sustainability plans

**Commercial organisations**

We note that these responses from commercial organisations do not mention the principal benefits of the PCM in supporting individuals and groups in managing their lifelong competences. This suggests that the principal problem for implementation of the PCM is that the potential benefits of integrated lifelong competence management are often not a deciding factor for commercial organisations, because the scope of the PCM is wider than the remit of the companies. The PCM manages competences during a lifetime, and across different domains, while typically the focus of an HR system is on competences strictly related to the specific tasks to be undertaken by employees during their current period of employment. As LOGICA point out, this is particularly the case in a time of economic crisis, when customers are focusing on reducing production costs rather than optimizing HR processes. The also state that the cycles of their own business are typically shorter than those which characterise lifelong competence development.

The same problem with the focus of companies' interests is true for the opportunities for TENCompetence commercial partners to sell PCM based services to their clients. However, in this case there are added barriers to commercial exploitation. Firstly, there is a functionality overlap between the products which ALTRAN and GIUNTI have developed and market, and those aspects of the PCM which might be of interest to commercial organisations. In some cases the use of Open Source software (such as the PCM) is also problematic, either because of company policy, or because of the opportunity cost of lost sales of proprietary products sold by the company. Clearly there has to be a very strong motive for these organisations to move away from the revenue stream of established services with existing products.

All three commercial partners in TENCompetence are providers of a wide range of technical solutions for a variety of purposes, and they do not have a particular mission to support lifelong competence development for their customers (although this is within
their remit). Thus the PCM constitutes one more of the possible systems which they can offer customers.

Therefore the information provided by these partners shows that the possibilities for exploitation in the marketplace are conditional on (a) the fit between the PCM and their current portfolio of technologies, and (b) the interests and preferences of their particular clients.

Secondly, the PCM is new software, and as such it inevitably has a relatively low level of maturity. While it has been tested and trialled, it has not been validated by the market to the same extent as a software product which has been optimised by years of real world applications. Consequently there is some risk involved with moving to the PCM, which is perceived by all commercial partners. This is stated most explicitly by LOGICA. They are platform agnostic, but have a natural preference for working with long established and well supported platforms. Thus they would require a professional service and support department before they would consider selling services based on the PCM to clients. This presents a bootstrapping problem: how can such a service and support department be set up (by a company or by the TENCompetence Foundation) until a revenue stream is available to support it?

It is clear that the commercial use of IT evolves over time, and so one might expect the PCM to achieve adoption gradually. However, the fact that its main benefits relate to lifelong issues which are not in scope for many companies is a strong argument in favour of the conclusion that commercial organisations will not be the drivers for adoption. They are, however, potential beneficiaries of the results of widespread PCM adoption in two ways:

a) the wider context (for example the enhanced ability to locate suitable personnel, support for finding paths to new employment for workers who are surplus to requirements, the ability to integrate competence development objectives to a wide range of competence development opportunities).

b) when the PCM is established in the mind of clients as a good option, they will be able to offer support in implementing and using it. Governmental agencies and similar bodies are likely to be the principal customers in this respect, as educational institutions do not normally rely on IT consultancies.

Thus the information from commercial partners indicates that commercial IT providers will have a positive view of engagement with the PCM once it has achieved a threshold of adoption. This is indicative that Altran, Logica and Giunti all have sufficient confidence in the future of the PCM to create internal demonstrators which will position them to exploit the system as part of their portfolio in the future.

Educational organisations

OUNL, Agora, Bolton and Sofia all aim to provide a service which intervenes in the learners' lifelong competence development. Consequently they have a potential need for an integrated system which can provide a means whereby learners can be supported in identifying their competence development goals, planning how to achieve them, direct them to learning activities, and obtain a record of their achievement. Because of this all four partners intend to make use of the full functionality of the integrated Personal Competence Manager after the close of the project. In the case of OUNL and Bolton this focus on lifelong learning services is a response to a challenging operating
environment, and represents an opportunity to gain a competitive advantage. It should be noted that in some cases the project outcomes will be applied not only within the institution's own core processes, but also be ‘exported’ to consortia in which the partner participates. This is particularly true of OUNL, and also for Bolton (through JISC-CETIS) and for Sofia through close contacts with the biggest Chamber of Commerce in Bulgaria and the Ministry of Education.

However, it is not necessary for an adopter of TENCompetence to work with the whole system. Indeed the purpose of developing a service based system (apart from its technical advantages) is to support a variety of ways of engaging with the system. The information from partners indicates that educational institutions have a motivation to engage in subsets of PCM functionality. For example, an educational institution might decide that it is most effective for them to engage with the system by providing courses, or publishing learning materials, both of which can be contextualised within the Personal Competence Manager.

Other educational partners may make use of project outcomes to conduct research into one aspect of the approach taken by TENCompetence, for example:

- UHANN see opportunities for exploiting LearnWeb (in combination with other tools under development in UHANN) in research which integrates, applies, evaluates and showcases knowledge management tools.
- INSEAD see opportunities to make use of the TENCompetence Tube application as an infrastructure which can be adapted and applied to continue research work on experience exchange and innovation-oriented collaboration.
- FBM-UPF: see opportunities to enhance the quality of the courses which they offer by Visualizing competences and subject matters, without necessarily engaging in the wider provision of lifelong competence development services.
- SURF (a smaller partner in terms of person months, and so with no exploitation plan) see potential, particularly in the use of PDP and ePortfolio linked to courses.

As is the case for commercial organisations, there is also an opportunity for educational organisations to deploy the PCM to increase the effectiveness of their internal processes. Thus partner FBM-UPF plans to apply aspects of the PCM to support the lifelong competence development of FBM-UPF teachers, while partner Bolton plans to use Learning Design approaches in their internal training effort to unify teaching practice across international sites, and to use the Wookie component of the PCM in their Moodle courses.

A number of the constraints which were discussed in relation to commercial partners do not apply to educational partners. There is no opportunity cost in adopting the PCM, because these organisations do not have an income stream from the use of other systems. Moreover there is a strong precedent for the adoption of Open Source solutions, as at least four institutions use Moodle as a key delivery technology. These are typical characteristics for the educational sector as a whole. However, within this positive overall picture, the situation for educational institutions is highly varied, and that the decision to adopt depends on

a) the degree to which the education institution has objectives which are related to lifelong learning
b) the policy which it has adopted to achieve them, including the technology strategy,
both in terms of functionality and in terms of Open Source.

4.6 Business models for use of the Personal Competence Manager

4.6.1 Introduction

In this chapter we present the way in which the Personal Competence Manager (PCM) can be used by others to add value to their activities. The creation of business models for a system which is under development is not an easy task. The field of potential application of the PCM is very wide, and there are very many ways in which added value could be created using it. We do not at this stage know which sectors will adopt the PCM, and in what ways they will use it, so a classification of these approaches is not possible. Still less can we create models which can prescribe how the PCM should be used. However, we believe that business models can provide a way of communicating and discussing the contribution which the PCM can make to businesses and other organisations, and provide a tool whereby they can develop their own ideas. They will also inform the approach taken to the dissemination and marketing strategy of the Foundation.

With this approach in mind, we sought a business model theory which could provide a suitable framework. Our previous work analysed several candidate theories which have been applied to real world economic systems\(^7\). Since the PCM and our thinking have progressed substantially, and we now believe that Osterwalder's theory has the greatest applicability to the Foundation's offering. It also has the advantage of being a relatively recent high level framework, which is applicable to eBusiness, and which is intended to be a tool for people to develop their ideas.

We wanted to develop indicative business models which could both serve as illustrative material for the Foundation, and also provide a starting point for potential adopters to think about their own business models. We therefore chose to describe models for the three core domains addressed by TENCompetence, which is described the project as “connecting three separate domains, e-learning, knowledge management and personal competence development’. The integrated Personal Competence Manager does indeed straddle these three domains, which form a good basis for classifying potential use.

4.6.2 The model framework used

Today's business landscape is characterized by the intense use of ICT (e.g. for e-business), fierce global competition, rapid change and results in increasing complexity, high risk and greater uncertainty than ever before. To articulate the way in which the Personal Competence Manager could meet the needs of companies and organisations in operating in this environment we searched for an effective methodology for describing business models. Building on our earlier research on business models we decided to continue with Osterwalder's theory, and build a new document around this understanding. This model attaches particular importance to technology, and so it is appropriate to a technology based organisation such as the Foundation (as is shown by its use by Ericsson, 3M, and Logica, among other major companies\(^8\)). It also has the advantage of being associated with a template for collecting models. In this chapter we introduce Osterwalder's theory and

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\(^7\) see ID10.2 Critical Use Cases and potential Business Model outlines, delivered in D10.3

\(^8\) Claimed by Osterwalder and his associates on the site for his new book, “Business Model Generation”. See www.businessmodelgeneration.com
apply it to the TENCompetence software tools. In the following chapter we use it to analyse the business model of the Foundation.

What is a business model?
Osterwalder sees the term “business model” as simply a representation of how a company buys and sells goods and services and earns money.

A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams.

In Osterwalder's view, set out in his PhD thesis and subsequent publications, this model serves to unify the layers of business strategy, business organization and ICT, which often consist of different groups of employees with different preoccupations and worldviews. Since the products and services of the TENCompetence Foundation are to be used in many ways world-wide within the broad context of lifelong competence development, it is clear that this model can be applied in equally diverse ways, which it is not possible to predict. However, in the TENCompetence project we identified three areas; e-learning, personal competence development and knowledge management and the model can provide insight into the generic application of the PCM in each area. In each of these the business model is under continuous subject of external forces (Figure 1) including competition, legal, social or technological change and changes in customer demand. It is the manager's role to design or adapt a company's business model by responding to these external forces.

Figure 1: Environment, Business Models, Strategy, Process and Information Systems

The principal elements of Osterwaler's model
In the following three sub paragraphs we subscribe the three elements of the triangle as identified by Osterwalder and will map this to the use of the TENCompetence tools.

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Business strategy may be seen as the task of defining a set of goals and objectives (Drucker 1954; Kaplan and Norton 1992), the steps to achieve them and the way to measure them (Kaplan and Norton 1992). The specifics of the business strategy for adding value to the Personal Competence Manager varies with the specific use case and its user group. The specifics of the business strategy regarding TENCompetence relates to the specific use case and its user group. As regards the business strategy of the Foundation (see chapter 4 of this report) this is fundamentally the same as that for other Open Source Foundations, and is based on the maintenance of the code base, and to this extent it is stable. It's revenue comes from providing value to those who use the software and find it useful, and the way it does this will change. Such changes will result in a changing business model, and therefore both have to be reviewed and updated on a regular basis.

Business organization describes the "material" form the conceptual business model takes in the world, such as departments, units and workflows. Changes in the business model bring up organizational questions, and vice versa, so there is again a need for continuous monitoring and review.

ICT is an important aspect for TENCompetence, where the PCM is directly applied. The value proposition made is that business of a single person, community or even a company can be optimized by using the TENCompetence software tools. In pilots and business demonstrators TENCompetence has seen that it's impact on ICT and a companies infrastructure results in lower ICT costs since most of the software is web-based and training can be done remotely rather then on-site. The outcomes of the pilots and business demonstrators can be found in the report on the results of cycle 3 demonstrators by Hernández-Leo et al. It Personal Competence Manager stimulates employees to develop themselves, with positive impact on their productivity. Again there is a feedback loop between changes in the business model and technology (to take a practical example, can certain tools be accessed behind a firewall?)

Environment
Besides the element in the triangle there are ‘environmental’ factors which influence a business model.
Change in technology has had a strong influence on the TENCompetence project, and led to a switch to web-based tools and eventually selection of a portal environment using Liferay technology. As technology has been a major force in the TENCompetence project, so it will be a significant influence on the evolution of business models for users of the Foundation's software
Competitive forces for the Personal Competence Manager include companies developing systems for e-learning, competence management or knowledge management. These areas consist of numerous players from small companies focusing on assessment to big companies like SAP offering complete infrastructures. The unique selling point of TENCompetence is that the project has built an integrated Open Source system, which as well as being free has a wider and more integrated approach than its competition.
Customer demand. For TENCompetence customer demand is closely related to the willingness of users to use ICT to work on their personal development plans or participate in online training course, which is itself conditioned by the quality of tools.
Social environment. The social environment and social mood can influence the business model of a firm, as analysed by stakeholder theory (Friedman and Miles 2002). The Foundation represents the projects move into this wider context, and it and its members should intervene to create a positive social environment and a buzz of enthusiasm.
Legal environment. The legal environment, and the wider regulatory framework are particularly significant factors in the area of employment, training, and the relationship between the individual and the organisation. They therefore have a strong impact on the Foundation and its users. Since the legal framework changes from country to country, this makes it likely that the tools will be deployed principally at a national level rather than trans-nationally. Policy on Open Source implementation, which also varies from country to country and region to region, can also make a major difference to enabling or discouraging adoption by government agencies.

4.6.3 Use of business models in the Foundation

Our goal in researching and developing business models within the context of a research and development project is to contribute to the knowledge base of the TENCompetence Foundation. Osterwalder describes how business models can be used, and we relate this to the work of the TENCompetence project to show how it can inform the strategy of the Foundation. The five categories of functions are:

- understanding & sharing,
- analyzing,
- managing,
- prospects
- patenting of business models.

Understand and Share
The business models can capture, visualize, understand, communicate and share the business logic.

Capture. The business model of a company is a simplified representation of its business logic. For TENCompetence itself this is challenging, because the aim of the project is not financial, but rather to give everyone in Europe the chance to develop his or her competencies in the lifelong learning domain with free and easy to access tooling. To create a common understanding we organised round table events to share our thoughts and ideas with organisations, professionals and other stakeholders. With the start-up of the TENCompetence Foundation we created a platform were professionals, developers and learners can create communities who work with the TENCompetence tooling and further develop them.

Visualize. As can be shown theoretically and empirically, processing information through the visual system can substantially increase the degree to which complexity can be handled successfully (Rode 2000).

Understand. Business models are complex and especially a business model which could suit the TENCompetence purposes and which covers the domain model is very difficult to understand. The business models provided here have a role in bring together the ideas of Foundation stakeholders and make it a shared and understood ‘belief’. By presenting our domain model and technical infrastructure to our target group via pilots and business demonstrators we create more understanding and awareness of the TENCompetence project.

Communicate and share. The Foundation will take over the task of communicating and sharing the models from the Project.

During these happenings we try to communicate and share what TENCompetence stands for, who is our target group and how we try to help this target group. One could say we communicate and share our business model in a certain way.
Analyze
Every company organization interested in using the products and services of TENCompetence should first analyse where they stand in their business environment and identify why they want to implement the TENCompetence infrastructure. Using Osterwalders template for this will make sure the user gets the most out of the TENCompetence products and services. The goals set within the business model must be made measurable. There must be a framework for observing the changes (in our case Osterwalder's model). The information should then be compared with other organisations. Insight can come from similarities, but inspiration can also come from comparisions with organisation in different fields.

Manage
When a company or organization who is interested in the TENCompetence products and services starts off with the business model template and maintains the concept during its lifespan, this improves alignment of strategy, business organization and technology. This then makes sure the user can react faster to changes in the business environment. Management in this sense includes

- **Design.** where our adaptation of Osterwalder provides a basis.
- **Plan, Change & Implement.** visualizing the model facilitates planning, change and implementation.
- **React.** the model provides a foundation for improving rapid response to change essential in an uncertain and rapidly changing competitive landscape.
- **Align.** the focus of Osterwalder's model is to align the triangle of business strategy, business organization and technology.
- **Improve decision-making.** The business model provides the basis for specific business cases.

Prospect
This refers to elucidating the possible futures of a company. Since TENCompetence is a research and development project focusing on lifelong learning with a new and innovative technical infrastructure we believe that Osterwalder's theory is a good fit. **Innovate.** In order to exploit its software, the Foundation and its members will have to use innovative business models, and the business model template can be used for this. **Business model portfolio.** A portfolio of business models based on the practical experiences of Foundation members would inform members activities. **Simulate and test.** Simulating and testing business models is not easy and requires effort and understanding. The Personal Competence Manager provides a technological platform for doing this.

Patenting
Increasingly entrepreneurs and companies in e-business seek to patent e-business processes and even entire aspects of their business model. For the Foundation, this is a motivation to publish business models and establish them as prior art.
4.6.4 Using Osterwalder’s template

Osterwalder provides a template comprising nine building blocks and their relationships with which organisations can continuously develop and maintain an innovative business strategy.

![Figure 2 Graphical representation of Osterwalder’s business model](image)

We now describe the template, and then discuss the results of an exercise in which we asked partners working in the three TENCompetence domains to use the template to elucidate their business case. The model is divided into four interrelated areas:

**a) Infrastructure**

- Core capabilities: The capabilities and competencies necessary to execute a company's business model.
- Partner network: The business alliances which complement other aspects of the business model.
- Value configuration: The rationale which makes a business mutually beneficial for a business – in a broad sense - and its customers. In fact, this comprises the relations within, and agreements between, all partners in the partner network.

**b) Offering**

- Value proposition: The products and services a business offers. Quoting Osterwalder (2004), a value proposition "is an overall view of products and services that together represent value for a specific customer segment. It describes the way a firm differentiates itself from its competitors and is the reason why customers buy from a certain firm and not from another."

**c) Customers**

- Target customer: The target audience for a business' products and services.
- Distribution channel: The means by which a company delivers products and services to customers. This includes the company's marketing and distribution strategy.
- Customer relationship: The links a company establishes between itself and its different customer segments. The process of managing customer relationships is referred to as customer relationship management.

**d) Finances**

- Cost structure: The monetary consequences of the means employed in the business model. A company's DOC.
- Revenue: The way a company makes money through a variety of revenue flows. A company's income.
4.6.5 The e-learning business model

Since the Open University Netherlands (OUNL) is the largest provider of e-learning in the consortium, they were selected to build the e-learning business model. From an e-learning perspective. The starting point was the increasingly ubiquitous Virtual Learning Environment (VLEs). For instance lectures typically use the VLE to provide course information, upload PowerPoint presentations/lecture notes and sometimes to hand in assignments. In most cases the VLE and the digital materials are used in addition to regular teaching activities, without a change in the basic teaching and learning paradigm.

Overview of the eLearning business model

When introducing the Personal Competence Manager 2.0 (PCM2.0) in an e-learning environment the benefits for the learner could change significantly. The model shows how the PCM can fulfill the needs educational needs of the target customer, who is already employed and has social obligations and therefore less time to study than a regular student. For this customer it is essential to have easy access to an online learning system where speed and support of the distributed learning material plays an important role. The PCM2.0 fulfills these needs with its integrated infrastructure for lifelong learning. When one identifies target customers with the same interests and needs, learners who for instance follow the same course, the PCM2.0 could facilitate with the community functionality. The PCM2.0 is a medium through which learners and educational providers can build up and sustain a professional relation. Delivery of learning material can be distributed via the web which reduces the costs for both parties and speeds up the delivery process. The learning material is available 24/7.

The PCM2.0 is also able to support partner networks by given them a platform to distribute their courses and explore their materials. The up-front investments in the course development process are considerably higher than the costs in traditional teacher-led course development. On the other hand, course distribution is usually much more cost-effective as this is fully electronic. Via feedback from the community the courses can be easily improved and optimized, so the content is there to stay for a longer period than traditional course material.

Finally, the revenue which the TENCompetence infrastructure can create must be sought in income from course delivery, via subscriptions. And by selling accompanying services like extra tutoring time, remedial teaching, extra exam possibilities, and career guidance.

The E-learning Business Model

Context: Developing and offering high quality, personalized and flexible e-learning courses using TENC tooling.\(^\text{11}\)

A large number of institutes in higher education are using Virtual Learning Environments (VLEs) to support e-learning. Lectures typically use the VLE to provide course information, upload PowerPoint presentations/lecture notes and sometimes to hand in assignments. In most cases the VLE and the digital materials are used in addition to regular teaching activities, without a change in the basic teaching and learning paradigm. In contrast, the introduction of e-learning applying the TENCompetence tools in an innovative infrastructure can radically change the value proposition to the learners (customers). This has implications for all components of the business model.

Target customer
The target customers are learners who are already employed and want to further their career. These learners typically have limited time due to professional and social obligations, and are looking for very specific knowledge and skills – only that what they are lacking at the moment. Therefore any educational offering should allow them to follow their own personalized learning paths, and offer them flexibility of time, place and pace. Self-directed learning and independent study is both an opportunity and challenge in this context.

Customer relationship
Given the target audience, customer relationship management will focus the individual learner. However, servicing individual learners for a common course creates the opportunity to establish and facilitate professional communities as an added service and potential business asset. This may create a longer lasting bond between the learner and educational provider.

Distribution channel
In a traditional class room setting the lecturer is responsible for course development as well as its teaching (delivery). In practice the development process, delivery process and tutoring process are very much interwoven, which is facilitated by the face-to-face context. In the TENC e-learning context course distribution involves the creation of a cohort and assigning this cohort to a course instance (‘publication’) after which delivery takes place over the web. Course distribution therefore is largely an administrative/technical process.

Value proposition
The value proposition is to offer high-quality e-learning courses, rich in content and context, allowing learners to follow their own personalized learning paths, and offering them flexibility of time, place and pace. To allow for further flexibility, learners may purchase additional services like extra tutoring time, remedial teaching, extra exam options, and career guidance.

Core capabilities
Developing high-quality courses that can personalized, offer flexibility of time, place and pace, and are rich in content and context, requires a great deal from their developers. They need to be well versed in the subject matter; in instructional design; web design; writing skills for the web; graphics design; multi-media production; and the technical/authoring skills in using TENC tooling. It is very rare to find one person combining all these competences. Therefore developing such courses typically is not a job for an individual, but requires an ‘industrial’ process approach.

This approach advocates working in course teams with a strong division of labor. Second, there is a clear distinction between the course development process and the delivery and exploitation process in which students study, interact with tutors and each others, are assessed, etc.

Partner network
Developing high quality such courses typically is not a job for an individual, but requires an ‘industrial’ process approach. Roles that can be distinguished in the course development process using TENCompetence tooling are project management; instructional design; subject matter expertise; content management; authoring; developmental testing; graphics design and media technology. In addition, roles are required for course distribution (compiling cohorts and publishing course instances) and during exploitation (tutoring, assessment, and certification).

The industrial approach to course design lends itself very well to the distribution of responsibilities for these various roles over a partner network, depending on the core
capabilities and strategic interests of the network partners involved.

**Value configuration**
The value configuration constitutes the combined competences and tool-set of the partner network in creating, delivering and running the high-quality e-learning courses for the intended target audience. Critical aspects of this value configuration are the agreed-upon roles and work processes between the partners; the TENCompetence tool-set and standards to be used (ReCourse, SLED/ASTRO, Widget Server, LearnWeb, and possibly the PDP tool-set as part of orientation); and the overall organization of the total value chain which may be handled by the largest partner, or by a special ‘bureau’.

**Cost structure**
In applying the industrial approach, up-front investments in the course development process are considerably higher than the costs in traditional teacher-led course development. This is due to the considerable competences required. On the other hand, course distribution is usually much more cost-effective as this is fully electronic. The initial high investments may require a solid business plan for either a) potential partners to join the partner network in case of a joint venture, or b) to pre-invest in case of a B2B development model by the main contractor.

**Revenue streams**
Revenues are generated by delivering courses and by selling services like extra tutoring time, remedial teaching, extra exam options, and career guidance. High sales volumes are required to offset the initial high investments, or otherwise unit costs will become very high. The optional services, which also generate revenues, may also become a considerable source of income.

In matching revenues with costs, various models are possible: a consortium model where revenues are distributed according to pre-defined keys; distribution among consortium partners in balance with their input; one key contractor subcontracting to the others in the partner network; certain partners taking full responsibility and corresponding revenues for their effort (e.g. subcontracting tutoring services);

Business case: Facilitating professional development on the basis of regional competence profiles.
4.6.6 The Personal Competence Development model

Overview
Personal Competence Development is a domain in which:

a) Persons are individually (independent of employers) responsible for their career and lifelong learning;

b) These individuals can use the TENC tools (mainly PDP, ePortfolio, Goal orientation, etc.) to manage their learning.

The business model for this domain was based on one of the TENCompetence pilots, carried out by the Empower Limburg Foundation. The value proposition is to offer personalized professional development planning services within a group of fellow professionals. The TENCompetence infrastructure is used to facilitate the network of the participating companies with its employees. Internships, short blended learning courses and classroom-based courses are offered through the network. The added value lies with the unique blend of consortium members with their various backgrounds; the individuals with their individual skills; and the TENCompetence infrastructure for competence profile definition, self-assessment and personal development planning.

Since the pilot was not intended to generate any money streams but to gather and help individuals as much as possible, all costs were covered by the consortium members on mutual terms. As a result no money-related revenues are generated within the pilot and between the participating organizations. However it is interesting to see that revenues which can’t be measured in money terms are increased employability and mobility; shared competence profiles; and increased cooperation and openness between the participating organizations. These outcomes are of particular relevance to governmental and other organisations which aim at the transformation of society, and who are therefore a key target for the Foundation.

The personal competence development model:

Context
The Dutch region of South Limburg is confronted with the following situation:

1. Ageing work force
2. Many young people, especially those well educated, leaving for the north
3. Relatively low educational level of the present workforce
4. Relatively many (very) small SME in manufacturing and construction
5. Within a circle of 35 km bordering Belgium (Flemish and French speaking) and Germany
6. Low labor mobility.

Against this background the Empower Limburg consortium was formed to devise and implement strategic labor market policies. The Empower Limburg Foundation comprises 20 organizations from local and provincial government, the health sector, the education sector, and commercial services providers. Its aim is to improve employability and mobility of the Limburg labor market through joint regional HRM analysis and planning, training and education activities, and fostering a favorable business infrastructure.

One of its recent activities is a pilot project called 'Developing regional competence profiles'. It aims to assist individuals working in the partner organizations to develop their professional competences in order to increase employability and mobility. This is done through:

7. Developing job-related competence profiles that are shared between the participating organizations, thus facilitating the mobility of staff
8. Providing coaching, assessment, and personal development planning services linked to these competence profiles.
9. Initiating staff exchange through internships as part of personal competence development.

Eight out of 20 member organizations participate in this pilot project:
10. Mondriaan Zorg Groep (health insurance)
11. Centraal Bureau voor de Statistiek (National Bureau of statistics) Provincie Limburg (the province of Limburg)
12. UWV (labour market re-integration)
13. Onderwijsstichting Movare (foundation managing 60 primary schools)
14. Open Universiteit (open university)
15. Gemeente Maastricht (Maastricht city council)
16. Licom NV (labour market re-integration).

For the pilot four competence profiles were defined between the eight participating partner organizations:
17. Operational Manager
18. Tactical Manager
19. Human Resource Manager

The pilot is organized and run by a small project team comprised of staff members from the partner organizations.

**Target customers**
The primary target customers are employees from the partner organizations who a) want to keep updated in their present job; b) want to upgrade their competences in their present job (vertical mobility); c) are considering a career shift within their own organization (internal horizontal mobility); or d) are looking for a job opportunity at another organization (horizontal mobility).

Indirectly the participating organizations at large are also customers, albeit with different perspectives: some of them are experiencing a shortage of well qualified staff; others have ageing staffs that is not up to date with recent developments; and again other organizations because of mergers or economic reasons have to lay off staff. All of them may thus benefit from increased employability and mobility of their staff.

**Customer relationship**
All the customers – individuals as well as organizations - are part of the Empower Limburg consortium. The relationship between the project team and the participating individuals is managed through a contact person within each of the eight participating organizations. Most of these contact persons were also involved in defining the shared competence profiles and/or are themselves a member of the project team.

**Distribution channel**
The pilot services are distributed through various channels:
21. Group meetings with participants to exchange experiences and look for (common) development opportunities
22. Face-to-face career coaching and development planning sessions with professional coaches
23. Use of online TENCompetence tools for competence self-assessment and development planning
24. Short courses offered by commercial providers in blended learning mode (Open University of the Netherlands) or in a traditional classroom setting (Fontys School for Professional Higher Education) linked to the competence profiles
25. Internships between the participating organizations.
Value proposition
The value proposition is to offer personalized professional development planning services within a group of fellow professionals. This is done within the context of a regional consortium of employers, thus increasing the opportunities for regional mobility.

The actual development opportunities – following the assessment, coaching and planning activities supported by the pilot – comprise:
26. Internships with one of the other participating organizations
27. Short blended learning courses offered by the Open University of the Netherlands
28. Classroom-based courses offered by Fontys School for Professional Higher Education.

Core capabilities
The core capabilities required to offer the services offered through the pilot comprise:
29. Project management by a part-time project manager from one of the participating organizations
30. Competence profile development by HR professionals from the eight partner organizations, moderated by OUNL
31. Contact persons within each of the eight participating organizations
32. Career coaching by three part-time coaches from the participating organizations
33. Online tools configuration (TENC PDP and LifeRay portal) by OUNL system manager
34. Tools-Helpdesk by OUNL system manager
35. Decomposition of existing courses by course developers into 'mini modules' to be linked to the four competence profiles by OUNL's Faculty of Management Sciences
36. Tutoring of the blended 'mini modules'
37. Internship coordination by a part-time coordinator from one of the participating organizations.

Partner network
The project team and the career services are provided free of charge by the participating organizations by part-time secondment of their staff. This is also true for the internships: these are all settled on mutual terms.

The provision of training services, ensuing from competence gap analysis and personal development planning, is left to the market however. Each participant wanted to follow such a commercial training has to consult his/her supervisor/HRM professional to secure the required budget.

The pilot project team however has been instrumental in identifying relevant courses with educational suppliers (OUNL and Fontys School for Professional Higher Education).

Value configuration
The value configuration comprises the rather unique blend of consortium members with their various background; the individuals with their individual skills from these organizations who form the project team and provide the project services; and the TENCCompetence tool-set for competence profile definition, self-assessment, and personal development planning.

Cost structure
No money is exchanged within the project. All costs, mainly in the form of staff input, are provided by the consortium members on mutual terms. The provision of commercial training services is placed outside the project structure. Each participant wanting to follow such a commercial training has to consult his/her supervisor/HRM professional to secure the required funds.
Revenue streams
Just as no costs are charged, no revenues are generated within the project and between the participating organizations. The ‘invisible’ revenues however are increased employability and mobility; shared competence profiles; and increased cooperation and openness between the participating organizations.
4.6.7 The knowledge management business model

Overview of the knowledge management business model
The knowledge management business model was prepared by Guintilabs, a commercial partner who also guided a business demonstrator in this field. The principal tool used in the demonstrator, and the part of the Personal Competence Manager, which is most relevant to knowledge management, is LearnWeb2.0, which can be used through the PCM Liferay system, or as a stand alone application. It functions as a platform for bringing coherence to information stored on different systems. For more information on LearnWeb2.0, see the deliverables of WP5.

LearnWeb2.0 provides users with the convenience of a single environment from which to access Web2.0 tools suited to the competence development process. The added value of the tool only becomes visible when a significant amount of users take it up and uses it daily. When used in private and/or secured environments good communication and support is necessary within the closed community to stimulate the use of the tool and its services.

The market for LearnWeb2.0 can be compared with the one of other web2.0 tools like YouTube, Flickr, Groupme, etc. The information is shared, stored and distributed via the web. However, it is possible to use LearnWeb2.0 as a closed environment, which could be realised as a service agreement between the Foundation and a customer.

The infrastructure costs for implementing LearnWeb2.0 in an organization are minimal: the set up of a server and internet connection. However, the costs of transferring the knowledge database to the system or providing user training and support may be significant. In common with the Personal Competence Development business model, revenues may not be directly generated in the knowledge management environment. It would be possible to charge a user-fee, but the evidence suggests that this would be unlikely to be a successful model, and it goes against the Web 2.0 approach adopted to knowledge management. Nor is advertising included. Again the revenues could be seen as a more efficient way of knowledge and information sharing for reaching an effective education in a non-formal learning paradigm, and potential implementers are those who see value in promoting this.

The Knowledge Management business model

Infrastructure
- Core capabilities: LearnWeb2.0 is a web application that should be installed and deployed by a technological company or institution. The end users should be confident with web2.0 tools (e.g. knowing YouTube) and should be familiar with eLearning framework, in order to understand some concepts like Metadata or Unit of Learning.
- Partner network: LearnWeb2.0 supports spontaneous communities of people wishing to collaborate. The formation of a community is necessary for an effective and meaningful knowledge sharing. The community may be either a formal group, like the employees of a company, or an informal group, like Facebook fans, as well as lifelong learners in a community of practice.
- Value configuration: LearnWeb2.0 becomes valuable and useful when a significant amount of users is using it daily. It is intended for use by both learners and teachers who wish to share resources and opinions of resources with peer users. It can also be used to facilitate contact between people with similar interests.
Offering

- Value proposition: LearnWeb2.0 is a 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 TENCompetence users for TENCompetence users. This is achieved by isolating competence focussed feedback from that of standard Web 2.0 users. In this way, members of a TENCompetence community are better able to make informed opinions on the value of resources for the purposes of competence development.

Customers

- Target customer: The target audience for LearnWeb2.0 is formed by spontaneous communities of collaborative people. The market similar to the one of web2.0 tools (YouTube, Flickr,...). Other kind of target audience is small communities of people in the educational area: university students, company employees, cultural associations, third-aged groups.
- Distribution channel: LearnWeb2.0 is available only via web access. A twofold interface is supplied: interactive web pages and automated web-services. The server components may be distributed as free downloads.
- Customer relationship: a relation should be established between TENCompetence Foundation and the organization responsible of the server installation (university departments, companies managers, association executive).

Finances

- Cost structure: the start-up of a LearnWeb2.0 installation has minimal costs from the infrastructural point of view: just a server with internet connectivity. All the software components are free and open source. The most of the costs are relevant to the organization, for instance the users’ training or the initial population of significant resources into the repository.
- Revenue: the revenues are not direct. Users do not pay anything and there is no advertising. The revenues should be interpreted as more efficiency in sharing knowledge for reaching an effective education in a non-formal learning paradigm.

4.7 Sustaining the TENCompetence Foundation

Having considered the business models for the use of the Personal Competence Manager software, we now turn to the challenge of sustaining the TENCompetence Foundation which can make these possible.

The TENCompetence Foundation was established on 5th October 2007, and Foundation Board meetings have been held since then in parallel with the project. However, Foundation activities have been limited in order maintain transparency in the use of funding for TENCompetence from the European Commission. The TENCompetence project ended on November 31st, and on that date the Foundation was fully activated.

The Foundation has a Stichting constitution, a model which is regulated by Dutch and Belgian law. The Stichting is used by a large number of organisations, including leading organisations in the field, such as IMS Global Learning Inc, and the Drupal Association. This constitution gives the board maximum flexibility, since as the initiators of a Stichting Foundation you can define the Articles of Association with very few legal restrictions. For example a 'Vereniging' (membership organization) which is also a legal entity has much more restrictions for its Board, and the non-board members have much more influence.
The capital requirements are also nominal. In order to elucidate the niche of the Foundation in the commercial and technological environment, we now extend our application of Oseterwalder’s model to the Foundation itself, following the structure established in section 4.6.

4.7.1 Infrastructure

**Value configuration**
The value proposition of the TENCompetence Foundation is determined by the objectives set out in the Articles of Association, provided as appendix 7 to this document. The objectives of the Foundation are stated in the articles of association as being:

- to support individuals, groups and organisations in Europe in the life-long development of their abilities by developing and promoting the most suitable technical and organisational infrastructure, by making use of open-source, standards-based sustainable and innovative technologies, and anything related directly or indirectly thereto or which can benefit the same in the broadest interpretation of the words.

In addressing these objectives the value configuration of the Foundation is clearly based on the management and use of the Personal Competence Manager software which it controls. Thus the activities of the Foundation are centred around facilitating the effective use of the Personal Competence Manager software. This provides value for users and Foundation members in a variety of ways, depending on their role.

**Partner network**
The Foundation is composed of Full Members, who contribute directly to the organisation. These are considered in the next section. The Foundation also has a partner network, composed of individuals and organisations who have one of two possible relationships with the Foundation, as set out in the Articles of Association:

- **Subscriber**: the simplest form of involvement in the Foundation is to subscribe by using the mechanism provided on the Foundation Website. This entitles the subscriber to **receive project updates, participate in forums and Special Interest Groups, and access those areas of the website reserved for subscribers**.

  Both individuals and organisations may be subscribers, but while individual subscribers are automatically accepted when they subscribe, organisational subscribers must be accepted by the Board.

- **Aspirant Partners** are equivalent to Associate Partners in the TENCompetence project period, that is to say that while there is an alignment of interests between them and the Foundation, which is articulated in a Memorandum of Understanding. Consequently, in the first instance activities will develop from pilots into operational implementations of the TENCompetence concepts and a set of tools in the day to day work of the partners. Aspirant Partners may work on or maintain the code, develop or provide a service, disseminate the work of the Foundation, make use of the software in ways which inform the development of the Foundation vision.

**Core capabilities**

The Foundation as such is composed of full members. These members are those who make a recognised contribution to the Foundation through providing funding or possibly personnel. The minimum annual financial contribution at the establishment of the Foundation was set at €500, subject to adjustment by the Board. The representatives of the TENCompetence consortium have been invited to act as full partners, while aspirant partners can also be invited to become full partners.

The governance of the Foundation is carried out by the Board, consisting of members, and
unpaid officers drawn from the full members (at a minimum, chairman, vice-chairman, secretary and treasurer). The regulations which govern the activities of the Board may be consulted in the Articles of Association.

The Board is to be supported by a manager or management team who can be paid by the Foundation. They are responsible for the strategy (in line with new developments in technology, activities, finance, etc.) and for operational management (coordination of facilitators, resource management, monitoring, etc.).

The Board and management team, and members carry out the core activities of the Foundation, which are to:

- Facilitate and provide leadership to the TENCompetence developers’ network
- Facilitate the TENCompetence users’ network
- Facilitate vision development.

The specific activities are set out in greater detail in the Articles of Association.

Management of these activities is the responsibility of group leaders for each area, drawn from the full members.

**4.7.2 Value proposition offered**

The value proposition offered varies according to the engagement with the Foundation

1. The **value proposition offered to individual subscribers** by the Foundation consists of the provision of **information, knowledge and networking opportunities**.

2. The **value proposition offered to organisational subscribers** is primarily of **mutual recognition**, exemplified by the use of each other’s logos on websites, etc.

3. The **value proposition to Aspirant Partners is defined in the individual Memorandum of Understanding**. This formalises a specific community of interest, which could, for example, relate to **access to pre-releases of a software code, expertise of services, and participation in inter-organisational and inter-disciplinary development projects**.

4. The **value proposition to full partners** is that they have a **strategic and/or operational interest in the continued effectiveness and usability of the Personal Competence Manager software**, which makes a contribution to their own business objectives, either by reducing costs or by providing valuable functionality.

**4.7.3 Customers**

**Target customers**

The Personal Competence Manager is designed to meet the needs of individuals, groups and organisations who wish to develop their own or their members lifelong competences. However, as discussed in D 10.1, the people who are developing these competences will not normally be customers of the foundation. Rather it is the people and institutions which provide the services enabling this lifelong competence development to take place who are the direct customers. This is analogous to the situation for the Apache Foundation, whose customers are not the end users who browse websites created with Apache products, but rather the people who create those websites.

In the VPLAN methodology adopted in D10.11 customers are termed **beneficiaries** and are identified as

1) Organisations, groups and individuals which provide or seek to adapt their practices to encompass competence based learning

2) State agencies who are concerned with the promotion of competence based approaches

3) Individuals and organisations who add value by using the organisation’s software to
provide services which enable the provision of competence based learning.

Dissemination and publicity materials for the Foundation will need to be directed at decision makers in those organisations. These beneficiaries will employ people in a number of roles who will interact with the PCM. These are the people who need to be supported in the forums, documentation and training materials produced by the project, and they include. The roles were analysed in D9.1 Competence Training Roadmap, and the list of roles (slightly adapted in this deliverable) is as follows:

- Requirements analysts
- Architectural designers (connecting the PCM with other services)
- User Interface / Interaction designers (to design the specific PCM instance)
- Systems developers (who adapt and extend the PCM, contributing to the code base)
- Systems administrators
- HR managers
- Trainers
- Pedagogical experts
- Content developers
- Competence framework developers.

4.7.4 Distribution channel

The goods and services provided by the Foundation are largely virtual: downloads of code, exchanges of information on forums, access to documentation and information, etc. Consequently delivery to customers is largely by means of the servers which it maintains. These need to provide for principal services:

- information (including documentation, publicity materials, forums, mailing lists...)
- demonstration of the capabilities of the software in its various configurations
- delivery of software products
- management of the software development process.

In addition the Foundation needs to raise awareness of its offering. The key to success will be effective demonstration of the system in resolving the challenges facing the members, which will encourage other similar organisations to explore the possibility of adoption. Successful implementation will be demonstrated and reported on the Foundation servers, and through press releases, but will also be publicised through members and partners participation in exhibitions and conferences, and publications. These activities provide good opportunities for members to create enthusiasm for the Foundation among their peers. The Foundation may also itself take part in exhibitions and trade shows, where substantial costs need to be taken into consideration.

Customer relationship

The customers of the Foundation are the users of the Personal Competence Manager, and the forms of membership (subscriber and aspirant partner) serve to articulate the relationship of these customers with the Foundation. The management team will monitor and profile the membership to inform Foundation strategy. The PCM has potential applications in a wide range of institutions, and so there is a need to engage with a wide range of actors, rather than a narrow group. In this respect the subscriber role is intended to enable the Foundation to engage with a large community who may in time may wish to play a more active role in using and contributing to the PCM. Engagement with subscribers will not be intensive, in order to encourage easy
participation, and also to conserve Foundation resources. In line with this approach forums and other forms of interaction with subscribers will follow the policy of starting simply, and being expanded to meet the needs of subscribers. These communications will be facilitated under the leadership of the group leaders for each area: developers, users, and vision.

The aspirant partners, on the other hand are intended to be close collaborators with the Foundation, and who have a clear community of interest with it. For these partners the Foundation will work intensively to establish active collaborations with deliverable outcomes defined in the Memorandum of Understanding. The purpose is not to create a contractually binding commitment, but to articulate an exchange of value in a formal way. These activities will be coordinated by the group leaders who will actively manage the relationships between the aspirant partners and full members working in particular areas of the Foundation.

The Foundation inherits from the TENCompetence project an extensive list of contacts and associate partners. This will be used to email invitations to join the Foundation as either a Subscriber or as an Aspirant Partner. During the course of Foundation activities this list will be maintained and extended.

4.7.5 Finances

Cost structure

In order to control costs Foundation will not in the first instance have its own offices. Nor is it considered wise to commit a large budget to a major publicity campaign. These decisions can be reconsidered as and when there are funds available to support them. In the first instance it is likely that the principal cost will be that of running the Foundation's servers. An indicative budget estimate is provided below, which will be used to prepare more detailed proposals for submission to the board.

1. Server connectivity.

   For the past year the TENCompetence project has had its servers on the Amazon cloud. This has worked well, with excellent speed and reliability. It is therefore proposed to continue this policy in the Foundation. The servers which will need to be run are

   - Reference implementation demonstrators
   - Sand pit demonstrator (for subscriber experimentation, regularly wiped clean)
   - Dissemination website, with forums, FAQs etc.
   - TRAC and/or Bugzilla. The project maintains both, but there is an overlap and one or the other can be scrapped
   - FAQs and forums.

   The advice of the team responsible for running the TENCompetence Pilot servers is that a small instance is (technically) too restricted. A typical set up on one virtual machine, which has worked satisfactorily, is as follows

   - based on an Ubuntu Linux 9.04 amd64 (64bit. 9.10 would do just as well btw) AMI ...
   - a large instance (the "smallest" of the large instance types)
   - a 120Gb data volume, mounted to the instance. The database (data files of MySQL), backups and liferay instance(s) are located on that volume
   - an elastic IP, linked to the instance
   - a snapshot. This is an extra safety precaution, you might do without one

   Such an installation can run the main servers required by the Personal Competence
Manager concurrently without any problem (i.e. JBoss + Liferay plus a Tomcat + Liferay plus MySQL).

However, this system has not been stress tested with high volumes, and as traffic picks up it will be necessary to monitor performance. Predicting the cost of these services is not simple, because Amazon has a formula for calculating charges by instance and by use (see their calculator function at http://calculator.s3.amazonaws.com/calc5.html. However, a simple pro-rata estimate from current charges suggests that a cost of $500 per month is not unrealistic, which would be sustainable with a relatively number of full members.

It may be that in future the Foundation also wishes to offer its own services, providing Personal Competence Manager instances for paying customers. If this is the case, naturally the cost structure would change substantially.

Estimate: approximately €6000 per year.

2. Management. It is proposed to employ a part time manager to carry out administrative tasks and to support the board in its activities and decision making. No Manager has yet been appointed, and it is not clear if this will be a direct cost, or if it will be covered by a contribution in kind.

Estimate: unknown, depending on Board decision.

3. Office and out of pocket costs: while the Foundation will not have its own office, there will nevertheless be costs associated with purchase of stationary, postage, telephony, etc., maintenance of project archives.

Estimate: Depending on the guidelines applied, these may be in the region of €1500 per year.

4. Publicity materials for distribution at events where the Foundation has a presence will need to be designed and printed.

Estimate: An initial budget could be €500 for the first year, as posters and stand materials prepared during the project are still usable.

5. Chamber of commerce fees.

About E. 25 Euros per year.

On the basis of these approximations, an indicative budget for the first year is in the region of €8000, leaving to one side the possible cost of employing a manager.

Revenue streams

- The principal revenue stream, at least in the first instance, will be membership fees provided by members. In the Articles of Association this is set at 500 Euros per year, but this can be varied by the board. Contributions can also be made in kind, that is to say by providing developers’ time.

- Another potential source of income is service contracts (such as those offered by Liferay), and other training and consultancy services. However, the judgement of the Board is that there is no guarantee that these would be successful until there is a core of adoption and implementation which potential customers can see and be inspired by.

- Conferences and events organised by the Foundation can be a money making proposition, but for this to be successful adoption of the PCM needs to be quite advanced.

It is therefore planned that initially the activities of the Foundation will be funded by the
subscriptions gathered from the full members, and this will impose restrictions on the activities which can be funded. In this way the financial viability of the Foundation can be assured, without imposing excessive financial demands on members. However, this does not mean a low level of project activity, as the participation of the members in Foundation activities carries no cost. It simply constrains the type of initiatives which the Foundation can undertake.

As the activities of the Foundation gather momentum, and the user community grows, the board will monitor the potential for tapping the additional revenue streams indicated in points 2 and 3 above.

4.8 The next steps

4.8.1 Sustainability strategy

From the work presented in chapters 2, 3 & 4 we draw the following conclusions. The key selling point of the PCM is that it makes it possible to unify competence development activities, over a lifetime and in a range of contexts. This is a new kind of application, which crosses institutional boundaries, and for many institutions its use is rather challenging.

In July the interim sustainability planning indicated that Commercial partners are too strongly focused on current operational concerns for the longer term benefits of the PCM to justify the direct costs and opportunity costs involved in its deployment. They also identified opportunity costs in lost revenue streams from their own proprietary solutions, and the skill set which they have developed around them. Similarly some educational organisations saw their core activity as being the provision of courses, and the aspects of the PCM which support this functionality are not sufficient motivation for them to deploy the system unless they also have an interest in lifelong learning.

This picture remains largely the same in December 2009, although the improved toolset has led to plans for internal demonstrators. However, it remains basically the case that the partners for whom deployment of the integrated PCM makes economic sense are those education partners who can use it to position themselves as lifelong learning providers, and for whom the system can serve as a means of differentiating their offering from the competition, and as a means of providing new services.

Note that this does not mean that commercial organisations and the broad mass of educational institutions cannot engage with the PCM, or use it to provide or consume services. On the contrary the exploitation planning process has shown that most major partners expect to be able to engage in the PCM in one way or another beyond the life of the project. To these should be added two of the smaller partners in terms of project participation (SURF and AGORA), both of whom are keen to continue their engagement. Rather, the indications are that they will not themselves establish a PCM server, or make use of the full range of services which another PCM server offers. This is problematic for the prospects of the PCM only to the extent that equivalent users beyond the project partnership are unlikely to engage with the system until a critical mass of users has been established.

Thus exploitation planning process identifies the key potential adopters within the consortium as educational providers with a commitment to lifelong learning. However, logic indicates that the entities with the greatest potential gain from the deployment of the
PCM are not these institutions (although the benefit for them is clear), but rather the government agencies who are explicitly charged with retraining the European workforce in the face of recession, unemployment, or social dislocation of one sort or another. It is likely that this would be done at the same level as that which is responsible for defining the educational system, i.e. at the level of the member state, or at the level to which this is devolved in a particular state. However, as standardisation of qualifications across Europe is becoming increasingly important, the PCM offers a means of managing such structures across the boundaries of member states. Discussions at the exhibitions which the Foundation has attended have confirmed that some of the greatest interest has come from government funded agencies, for example from Her Majesty's Prison Service in the UK, and a Social Services agency in Copenhagen, and this is reinforced by Giunti Labs, who in their sustainability plan (see appendix 1) identify government bodies as the most promising market sector for the adoption of the PCM.

In the Netherlands we see interest especially from regional perspectives (that is regions within the country). Examples are the Empower Limburg consortium and the Health Academy. The first combines some 20 of the major organizations – mixed background – in the Limburg region with a radius of 50 km. that focus on employability and mobility. The second one is the Health Academy Citypark, roughly same region, where the major Health services providers and the Health Education providers are setting up a consortium to address manpower problems in the health sector: defining shared competence profiles; mapping educational offerings and job profiles on the basis of competences; certification of previously acquired competences; personal portfolio’s; etc. The latter initiative has now been adopted as an innovation demonstrator at national level by the National Vocational Training Platform, total project budget about E. 2 mln. Major problems with these initiatives is that all the partners already have their own ICT infrastructure and that adding another layer on top, or building a new infrastructure next to it, is expensive, technically complicated, and often politically sensitive. Seems to confirm the Antwerp case below.

It was from this perspective that the TENCompetence project added the City of Antwerp as a partner, but this was not successful because the City could not provide personnel to carry out a pilot. It seems likely that this is indicative of the challenge to be faced in penetrating the public service market, i.e., there decision makers realise that there is a need for a system such as the PCM, but the services themselves are under-resourced and inflexible, and it is not easy for them to change the way in which they work without substantial added resources and political will.

However, governmental and public sector organisations are gradually adapting to the requirements of the information society, and a small number of major interventions from the public sector would guarantee a market for actors who only wish to provide or consume services in a particular aspect of the PCM. It is not reasonable, however, to expect this very large scale deployment without convincing examples of effective use on the smaller scale. Consequently **the immediate strategy of the TENCompetence Foundation is to establish and maintain strong sustainable business demonstrators in those Foundation participants who have a business model which can benefit substantially from the PCM, and to expand out from this base.**
Ongoing demonstration of the PCM

Three kinds of demonstrators will be maintained by the foundation to generate interest from potential adopters:

a) Full business demonstrators

- **OUNL** will implement the largest demonstrator, and planning for the deployment of the PCM is at an advanced stage. A pilot project for two OUNL programmes (Learning Sciences & Technologies and Informatics) is underway, funded by the OUNL, which will change the business model of the OUNL from a provider of BA / MA services towards a provider of CPD services. A first pilot with students from Learning Sciences & Technologies will start this April, with the Informatics pilot starting after the summer. In the 2011 academic year the pilot outcomes will be scaled up and will be fully operational in January 2011. Implementation projects for all OUNL programmes will start in 2010.

- **In Sofia** the commitment to the PCM is at the level of the Centre of Information Society Technologies (CIST) institute, rather than at the level of the University as a whole. While CIST has independence and would like to deploy the PCM, it is not in the position to mandate adoption to the institution as a whole (which is the case in OUNL). In this case demonstrators are planned with the partnership network of the CIST.

- **In Bolton** the explicit commitment of the University to work place learning, employer engagement, and the Professional University, and the planning contacts established with the HR and Professional Development departments, indicate good prospects for adoption of project demonstrators. The first stage of adoption will be for the internal PDP and staff competence development programme (which could not be done during the project period because of pending finalisation of the competence framework due in 2010). An opportunity has also been identified in using the PCM and a competence based approach to assist in coordinating with satellite campuses, and in the IDIBL Inquiry Based Learning approach being piloted for use with workplace learners.

- **Agora** plan to extend their use of the PCM with their collective of lifelong learners, using an open access approach. This will be an excellent demonstration of the PCM with a particularly well focused user group. The reputation of Agora for pioneering innovative techniques suggests that this will have substantial impact.

b) Pilot demonstrators. The demonstrators established for pilots will be documented and/or maintained as live systems. Of particular relevance are

- **The Empower Limburg** pilot. This is of particular significance because it was carried out by a consortium including local government, a priority target for the Foundation.

- **The Core Education** pilot. This significant because it was carried out by an SME, which used the PCM to develop a demonstrator of a competence development application which was funded by the publisher Macmillan as a potential delivery system for their complementary offering. SMEs are a key target group for the
Foundation, and this provides an example of how they can leverage the system in commercial activities.

- The **CEDEP** pilot, which is planning to continue use of TENTube Epiq Electric Epiq indicated that they will continue the usage of the TENCompetence infrastructure as the project has ended.
- The **Elsa** pilot, which sees good uses of LearnWeb 2.0 in their offerings, in particular in optional courses and learning activities in which students have sufficient freedom for exploration and testing.
- The **UniGe** pilot, which it is planned to continue after the project has ended.

c) **Reference implementations.** The Foundation will maintain a demonstrator on its own server, which will provide reference implementations of the three main areas addressed by the PCM

- Personal competence development
- eLearning
- Knowledge management.

These will be maintained, extended and updated as the shop window of the Foundation, showing how the latest set of integrated functionality can be combined to address each of the domains.

**Strategy**

The exploitation strategy for the Foundation which emerges from this sustainability planning with partners may therefore be summarised as:

- Use the PCM as a means of establishing innovative services within Foundation members’ organisations which see their mission as providing lifelong competence development.
- Maximise the engagement of other foundation members (SMEs, larger companies, and education providers) by enabling them to offer services or consume them through the PCM.
- Provide a server infrastructure which facilitates 1 & 2.
- Extend participation to the commercial and academic partners of the early adopters, and to the members of the networks to which the early adopters belong. In this regard it is encouraging that Altran, Logica and Giunti all have plans to trial the system internally.
- Publicise the opportunities for effective and profitable implementation of the PCM as a tool for providers of lifelong competence development and related services, through the TENCompetence Foundation.
- Build on success stories of PCM adoption in focused dissemination, with a particular focus on convincing - government agencies, a hard target with high impact - SMEs, who have the flexibility to establish innovative small scale implementations - Lifelong competence development educational providers who recognise the need for an integrated system to support their offering, a soft target which can provide a substantial body of users.
- Build membership of the Foundation in a wide range of organisations, SMEs and individuals in national networks.
4.8.2 Procedures and rules

The Articles of Association of the TENCompetence Foundation provide a clear structure for the organisation, but do not indicate in any detail how it will function in its core activity of managing a body of Open Source code. The governance of this process is in the hands of the Board of the Foundation, but in order to provide them with a proposal for their consideration we have prepared a proposal for managing these processes, as we describe in this section.

In future system development is expected to come from developers who contribute their free time; developers who are allocated time from their employers; and third parties may pay for development time. The Foundation has no authority to mandate their development activities, and so to maintain the coherence and quality of the OSS code base, a solid community and good communications are required. It is proposed that the Foundation follow the common practice of distinguishing between

d) Contributors, who write code and submit them for adoption
e) Committers, who review, reject, accept and or modify contributions

Contributors submit proposed software code to the Committers via the via an appropriate online system. Committers review the submitted code and accept or reject it, or send it back with comments and suggestions for amendment or improvement.

The Committers will maintain two main version of the core code and each supplementary module or related application:
1. A Release version, a reliable working version for working use
2. A Development Tree, which consists of:
   a) A central trunk which is the current candidate for the next release, which can be downloaded by testers and those wishing to explore upcoming features.
   b) Branches of code that is still under development which will be merged into the central trunk when sufficiently stable for trial use.

Committers will be responsible for scheduling announcing and quality checking candidate and final releases. Typically they will take responsibility for sub sections of the code base, either individually or in teams. Committers will be expected to respond within a reasonable time to submitters, providing feedback on the quality of the code, any changes that are required, or reasons for non acceptance so that they can better gauge what is required.

Committers responsible for a code section that find difficulty maintaining their section of the code base or responding to contributors in good time are expected to acknowledge this to other Committers and the Committer Group should then either find a replacement lead or publicly announce that the section in question is being suspended.

The code base requires both developer and user documentation. These tasks often require different skill sets. Developer documentation should be submitted along with the code by Contributors. Committers are responsible for checking accuracy and coherence both with the code and with rest of the developer documentation.

User documentation needs to be developed in parallel with the code. User documentation can be seen as a cross cutting strand, needing to work in close collaboration with code developers but also to provide coherence and consistency across all parts of the code base documentation. To this end there will be a user Documentation Editor who will review and
manage submissions from user Documentation Authors.

A critical function of the Foundation will be to ensure good communications between the Developer and User communities. It has long been known (but seldom acted on) that user engagement is the single most important factor in successful software development (see e.g. the Chaos Report from the Standish Group, 1995). In OSS, particularly where developers are not also users of the software, as in this case, active steps must therefore be taken to facilitate good user engagement.

This function will deal with two main types of issue:
- Bug reports and their resolution
- Users’ desires for new functionality and features.

Users’ bug reports will be submitted via Trac, or an equivalent system such as Bugzilla, and monitored by Committers and addressed by Developers.

The developer groups will maintain a public Roadmap covering current and planned work. As well as informing prospective developers of current plans, it will also inform users. Users will be able to submit desired features and functionalities. Registered Associates (users) will be able to rate proposals in terms of desirability and an ordered list of most desired features will be maintained. Those that are being worked on will be indicated with a link to those working on it. New developers will either be able to join existing teams or indicate that they plan to work on a new section. This will remain informal until a Committer accepts responsibility for it.

Developers volunteering their time are of course not under a requirement to work on any particular feature and may choose to work on any suggested feature or propose new ones. They will however know how popular their feature or functionality is with the user base and also which users are interested and are therefore candidates for participating as co-developers.

Also linked with each proposed function or feature will be a design forum where design ideas are posted and users invited to comment or make alternative design proposals.

**The Software Development Group**

The Software Development Group will consist of:
- Committers
- Contributors.

and
- a Documentation Editor
- Documentation Authors.

The Board will initially appoint the Committers. Thereafter, the Committers themselves will appoint further Committers as needed, based on quality of contributions, i.e it will operate as a meritocracy.

A proposed Committer must be recommend by a current Committer and seconded by either another Committer or a Board member.

The Software Development Group is responsible for the function of ensuring the development and coherence of the OSS code base, as outlined above.
The Community Development Group
The Community Development Group will initially consist of a Community Development Officer with responsibility for the following functions:
- Promote the software and its effective use
- Develop the user community
- Support communication between users and developers of the OSS
- Maintain the community side of the web site.
The Community Development Officer will encourage and coordinate voluntary efforts from the TCA to further these functions.

The Vision Development Group
The Vision Development group is appointed by the Board in response to proposals from the Vision Group leader.
It is responsible for:
- Horizon scanning for technological and social change
- Identifying areas of need which have not been addressed in Lifelong Competence Development
- Proposing strategy to the Foundation Board.

4.8.3 Membership
Following the close of the project, the Foundation Board requested to all partners that they support the activation of the Foundation by taking responsibility for inviting their contacts (both TENCompetence contacts and general contacts) to become members of the Foundation. At the time of writing there have been no requests for withdrawal of members from the Board, and the future composition of the Board will be discussed at the same meeting.
At the same time the Board will invite the project contact list to become subscribers, and the associate partners to become subscribers or aspirant partners, as they see fit.
All TENCompetence full partners have been invited to become full members, and this will be finalised at the first face-to-face Board meeting following the close of the project.

4.8.4 Dissemination
In the last six months of the project the Foundation was represented at a number of major HR Exhibitions, including Employment Week (Brussels), Zukunft Personal Fair (Cologne) CIPD National Exhibition (Manchester), and Online Educa (Berlin). While the Foundation budget which can be allocated to these activities in future will initially be limited, it will be possible to make use of partners existing participation in such events, with the Foundation providing materials, online demonstrators and banners.
The facilitation leaders in the Foundation will coordinate the dissemination effort for the area in which they are responsible, suggesting suitable dissemination opportunities to members, gathering contributions and organising participation.
The management person or team will handle the publication of press releases to mark significant Foundation achievements.
4.8.5 The TENCompetence Foundation dissemination server

The project has made a substantial commitment to the Open Source Liferay portal system by using it to deliver the services of the Personal Competence Manager through portlets. Consequently the only coherent option was to use Liferay as the basis for implementing the Foundation dissemination server. Not only does this demonstrate that we have confidence in the technology which we are using to deliver our services, it also enables us, should we wish, to include our own custom portlets inside the dissemination site.

In the August and September of 2009 work was carried out to develop a Foundation dissemination server. The implementation of the site was carried out by partner FBM-UPF, in consultation with the Board, and taking into consideration the categories of users subscriber, aspirant member and full member, and their activities defined in the TENCompetence Foundation Articles of Association.. A LifeRay platform was set up with a clear structure of nine tabs.

At the end of September the site was online (although not promoted), and its structure established. During the following two months material was gradually added to the site to prepare it for the launch of the Foundation.

The look and feel of the site has been configured so that it matches that of the Personal Competence Manager 2.0, the flagship product of the Foundation.

The content of the site

The first tab welcomes visitors, and is the first page that they see when entering (See figure 3). The welcome page provides basic information about the foundation, updates about the activities of the Foundation, and news about the Foundation site itself.

12 http://www.liferay.com/
The purpose of the Foundation is to facilitate the adoption of a competence based approach to education and training by developing and maintaining open source software.

The software provided by the Foundation was developed within the TENCompetence project, funded by the IST Programme of the European Commission.

The personal Competence Manager

This principal product of the project is the Personal Competence Manager, and related applications. This system is:

- Open Source, released under the BSD three clause license
- Service oriented
- Standards compliant
- Integrated with Liberal

On this server you will find information about the Personal Competence Manager, news and forums.

Please also visit the TENcompetence [personal competence manager demonstrator](http://tencompetenceDemonstrator) to see what can be achieved.

Subscribe to or join the TENCompetence Foundation

If you are interested in the work of the Foundation please subscribe. This enables you to:

- follow developments through regular mailings
- participate in forums and public events
- have access to all areas of this website

You can unsubscribe at any time you wish.

You can also join the Foundation as an Associate or a Full Member.

---

**Figure 3 Screenshot of the Welcome Page**

The next tab offers visitors information about membership of the Foundation. It provides information about the different type of membership (subscription, aspirant and full) and provides mechanisms whereby users can subscribe and apply for aspirant membership.

The next two tabs provide information about the products of the Foundation. “Software” provides an overview of the software which has been developed during the TENCompetence project, and especially the Personal Competence Manager. Next to this is a tab which provides information on portlets, that is to say the range of functionality which can be tab that included in Personal Competence Manager instantiation. Full descriptions are provided of all the portlets available, including a short tool description, some pictures and the different manuals or tutorials that already exists for each tool (See Figure 4).
The next two tabs enables the Foundation and its members to communicate. A “News” tab enables members to stay in touch with developments, while a Forum tab provides a place for discussing the Personal Competence Manager and related issues.

The forum and the News section both have functionality enabling users to subscribe (so that they receive notifications with the content of postings in their in-box) and RSS feeds, enabling the content to be easily consumed by other websites and systems. The forum structure implemented is relatively simple, but it can be easily extended as new areas are
required.

The “Contact” provides a formal means of contacting the Foundation, with a named person and official address.

The “CMS” a tab enables authorised members to upload and manage the different media content that appears on the foundation.

Finally, the “Manuals” tab provides access to the manuals available for the TENCompetence tools created within the project. (See Figure 6).

Figure 6 Screenshot of Manuals page

The future of the Foundation site

The Foundation website has now been passed on from the project to the Foundation as a resource for its future development, and it is to be expected that the content will change and develop once the Foundation activities get fully underway, the Personal Competence Manager evolves, and new materials are developed. Similarly the graphical components will no doubt be adapted, in accordance with the dissemination materials and strategy adopted by the foundation.

At the moment the website is mainly an end-user site, but development activity moves from the TENCompetence project to the Foundation, it will (also) become a developers’ site, with the addition of additional documentation resource areas, and new forums and FAQs. However, this should grow dynamically out of the activity of the development group.
5 Brief concluding remarks

In looking back at this final reporting period there are a number of motives for satisfaction.

The compendium of TENCompetence journal and conference papers is an impressive and permanent record of project achievement, with its quality guaranteed by the TENCompetence Scientific Committee. There are now over 670 items in the collection of which 272 are papers. Also significant contribution was made to the development of standards, in this period through the initiative to establish a competence profile specification, and also through growing acceptance of Wookie as an implementation of W3C widgets and solution to the problems of providing services in IMS LD.

However, the principal output of the TENCompetence project is the Personal Competence Manager which it has produced. This has been reflected in the attention paid to disseminating to a professional audience in this period, gathering contacts to be passed on as a resource to the Foundation, and in the substantial work carried out to develop a sustainability plan which ensures its future use and development. In developing the plan WP10 has drawn together information from all project partners, from theoretical approaches, evidence from project activities, and gathered knowledge of Open Source foundations available in the consortium. The result is a practical plan for the future, which we believe creates positive prospects for the future exploitation of the achievements of the TENCompetence project.
### 6 Appendices

#### 6.1 Appendix 1: Journals and conference papers

The table below provides details of 62 scientific outputs in the form of articles published in international refereed journals; papers presented at selected conferences; book chapters and PhD theses directly based on TENCompetence work.

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<td>Johnson, Mark; Griffiths, David; Hanslot, Zubair</td>
<td>Positioning Learning Design: Learner Experience and the challenges of transforming teaching practice</td>
<td>Rethinking Learning and Employment at a time of economic uncertainty: TENCompetence Open Workshop, Manchester, November 19th and 20th 2009</td>
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<td>In R. Koper (Ed.), Learning Network Services for Professional Development (pp. 43-56), Berlin, Germany: Springer-Verlag</td>
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6.2 Appendix 2: Dissemination presentations

The following TENCompetence dissemination activities were carried out in the last project year.
### Table: Workshop Details

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<td>8th International Conference on Hydroinformatics-HIC 2009: On-line competence based learning in hydroinformatics at UNESCO-IHE</td>
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6.3 Appendix 3: Proposed Draft Standard for a Competency Model and its instantiation as a Competency Profile

Proposed Draft Standard for a Competency Model and its instantiation as a Competency Profile

This working document is intended as a draft for a Standards project which is to be submitted to the Learning Technology Standards Committee of the IEEE Computer Society.

It builds upon previous work of Claude Ostyn and was partially developed with TENCompetence funding. The copyright is based upon TENCompetence Creative Commons.

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Abstract

This draft standard proposal defines an information model for a Competency Profile (CP).

We propose an information model for the aggregation of specific competencies and their possible correlations and dependences. This is to act as a knowledge description specifying an object (artifact) such as a person, job, function, role, process, etc..., which is to be used to describe, reference and/or exchange data in the context of lifelong learning, competency and employability management.

The CP information model allows the representation of relationships (correlations and dependences) between competencies or complementary aspects related to competencies, such as they have often been captured in competency frameworks and models, such as criteria, qualifiers, context, and evidence).

In this Standard, the word competency is used in a generic sense which includes KSAOs (knowledge skills, abilities and other characteristics such as intended learning outcomes).

This Standard references the IEEE P1484.20.1 Reusable Competency Definition (RCD) Standard (2007). The IEEE/RCD Standard specifies how any arbitrary competency definition can be captured using a standard data model. In this Standard, the (cor-)relationships & dependences between RCDs are represented using the notion of a Competency Profile in which each node may reference a RCD. Roll-up rules are specified to allow representation of how sub-competencies specified in the Competency Profile can "roll up" to a broader competency.

1. Overview

This Standard defines an information model for a Competency Profile to be used for describing, referencing, and exchanging data about the (cor-)relationships & dependences between competencies, primarily in the context of lifelong learning, competency development and employability management.

The information model allows the representation of (cor-)relationships & dependences between competencies or complementary aspects of competency, such as they have often been captured in competency models.

In this Standard, the word competency is used in a very general sense that includes skills, knowledge, attitude, and learning outcomes. This Standard references the de facto IEEE P1484.20.1 Reusable Competency Definition (RCD) Standard. The RCD Standard specifies how any arbitrary competency definition can be captured using Standard data model. In this CP Standard, the (cor-)relationships & dependences between RCDs are represented as a Profile in which each node may reference a RCD. Roll-up rules are specified to allow representation of how sub-competencies specified in the Profile can "roll up" to a broader competency.

The Standard specifies that the profile must be a directed acyclic graph, which in essence allows either lists, tree hierarchies and/or correlated aggregation models.

Other Profile shapes, such as a general directed graph, which allow the representation of competency models of arbitrary complexity, are possible but out of scope for this standard proposal.

This Standard enables interoperability among any learning, competency, talent employability, etc… management systems which processes competency information by providing a means for them to refer to common competency definitions and to model the (cor-)relationships & dependences between those common definitions through the use of interoperable Competency Profiles.

Semantic technologies such as SBVR can be used to help underpin, deduct and generate the acyclic directed graph correlation & dependences between competencies.
Today competencies are still largely an organization-specific paradigm, with each organisation or community of practice having their own ‘competency model’ representing the competencies that are acquired (persons), required (task, job, vacancy, function, process) or subsumed (dependencies).

These disparate models don’t lend themselves to be (easily) exchanged however, all while at the same time competencies are more and more used as a (lifelong) knowledge representations of the person, rather than just being there to facilitate intra-corporate processes. As people move ever-faster through life, the need to exchange competency information is increasing exponentially.

### 3-phased approach

The standard is intended to work within single organizations or communities of practice (single model) but increasingly we see the emerging need to have competency profiles used in cross-organisational settings. If competency information is to be meaningfully reused in cross-organisational settings, additional measures are needed. This includes a 3-phased approach using (1) one common framework, from which single organizations can compose (2) their own model, which is then to be instantiated into various (3) profiles for the different artifacts.

The framework delivers extra competency related data elements such as (a selection of) qualifiers, and context and evidence information; These are out of scope of this standard but are mentioned here since they will increasingly become an inherent part of cross-organisational competency frameworks.

The information model in this Standard can be used to exchange these profiles between learning systems, human resource systems, learning content, competency or skills repositories, and other competency related business processes. The CP’s that do conform to this Standard are intended for interchange by machines, just like the RCD that conform to the RCD Standard.
a. Scope

This Standard shall specify the mandatory and optional data elements that constitute a Competency Profile, to be used in the context of lifelong learning and/or personal & employability development.

This Standard is intended to satisfy the following objectives:

- Provide a Standardized data model to represent the parent, child or sibling relationships that may exist between Competency Definitions.
- Reconcile various existing and emerging data models into a widely acceptable model. This includes work that has been done and ideas that have been discussed with HR-XML, ISO, and CEN/ISSS and IMS.
- Provide a Standardized way to represent the result of grouping and decomposing competency information captured in Reusable Competency Definitions. Nodes that represent groupings or products of decomposition can be ‘profiled’ to new or existing Reusable Competency Definitions.
- Provide a (global) unique identifier as the means to unambiguously reference a Competency Profile, regardless of the setting in which this Competency Profile is stored, found, retrieved, or used. For example, metadata that describe artifacts such as learning content, credits, jobs, qualifications, etc may contain a reference to one or more Competency Profiles that provide the classification context of that credit, learning outcome or objectives etc …
- Provide a Standardized data model for additional information about a Competency Profile, such as a title, description, and source, compatible with other emerging metadata Standards.
- Given any Reusable Competency Definition and a Competency Profile that contains a reference to this Reusable Competency Definition, provide the data structure that allows the discovery of related competency definitions through the structure of the Profile.
- Provide a Standardized data model for additional information about (cor-)relationships & dependences between groups of competencies represented by a Reusable Competency Profile Definition, such as relative weights, rollup rules governing how component competencies can be considered to add up to higher level competencies, and proficiency levels required to assert mastery of a competency in the context of a hierarchy of competencies defined by the Profile.
- Provide a controlled vocabulary to express how Competency Profiles are semantically related in a list or hierarchical model.

This Standard specifically does not cover:

- A data format, bindings or coding, except as minimally required for the purpose of exchange between compliant implementations.
- Quality and accuracy in the data itself, although it will describe recommended best practices. For example, this Standard does not cover the quality or validation of the various component competencies that make up a higher level competency, or the relevance of the Reusable Competency Definitions referenced by a node in a Reusable Competency Profile.
- The processes by which a CP is created, generated, maintained or published.
- How the (cor-)relationships & dependences between competencies are stored in a database or learning management system.
- Any representation of (cor-)relationships & dependences between competencies which require a general graph rather than a list or directed acyclic graph.
- Profiling or references to data objects other than Reusable Competency Definitions or other Competency Profiles.
- Certification data models and how they may be referencing CPs.

Note: Certification records nevertheless may reference Competency Profiles along with Competency Definitions. For example, an accredited authority may grant certificates that acknowledge that an individual meets the requirements for a particular competency after walking an associated Competency Profile to identify requirements for component competencies that add up to the target competency.
Personal Competency Profiles (PCPs), as would be found in the competency profiles of individuals or groups, and how they may be referencing CPs.

**Note** (to be moved somewhere else) However, such PCPs can include references to specific Competency Profiles along with references to Reusable Competency Definitions. For example, a personal competency profile may include a collection of certificates which in turn reference Competency Definitions, and that collection may be discovered by inspecting a Competency Profile that references any of those Competency Definitions. Skill gaps may be discovered by finding the Profile nodes for which no evidence of competency exists.

**1.2 Purpose**

The purpose of this Standard is to define a universally acceptable Competency Profile Definition model to allow the creation, exchange and reuse of hierarchical Profiles representing the (core-)relationships & dependences between Competency Definition in applications such as Learning Management Systems, Competency or Skill Gap Analysis, Learner and other Competency profiles, and so on.

The Standard is needed because there are currently many definitions of the terms “Competency Framework, Model, Profile, Map, Taxonomy, Learning Objective, (Intended) Learning outcome, competency, skill, ...etc and very little agreement between how those definitions can be used to define reusable data models to support automation and computer-assisted discovery.

This Standard uses a general definition that can be applied to any scale of competency hierarchy, from shallow ad-hoc taxonomies used in an assessment to deep formal hierarchies representing a domain, sector region or country, all while conserving the same data model regardless of how strictly a particular organization or institution requires the data to be formulated. This Standard also addresses the following needs:

- A common data model that allows the building of various ad hoc or formal models, aggregations, inventories, hierarchies of Competency Definitions.
- A Standard that allows persistent, long lived Competency Profiles, to be created, exchanged among systems, and be maintained.
- A Standard data element by which a specific Competency Profile can be identified as globally unique among compliant systems and repositories.
- A common data model to represent the result of aggregating or decomposing competency information captured in RCDs through the use of additional RCDs representing the products of the decomposition, and to capture assertions about the hierarchical relationship between the original RCD and the subsidiary RCDs in the form of a Competency Profile.
- A common data model for the descriptive or cataloging metadata that give a reusable Competency Profile its value in a reuse environment. Such metadata may typically include the publisher of the Competency Profile, evidence and validation information, and other descriptive information useful to locate an existing Competency Profile in a repository catalog or collection index.
- Correspondence with the IEEE Learning Objects Metadata Standard (IEEE 1484.12.1).

**2. Definitions**

For purposes of this Standard, the following terms and definitions apply. IEEE 100, The Authoritative Dictionary of IEEE Standards Terms, DOI: 10.1109/IEEESTD.2000.322230, should be referenced for terms not defined in this Clause.
**LangString bag**: A structured datatype that represents one or more character strings. A LangString may include multiple semantically equivalent character strings that represent translations of the same meaning into different languages. See also: datatype.

**competency**: For this Standard, a competency is defined as any form of knowledge, skill, attitude, ability or intended learning outcome that can be described as the common currency in the lifelong cross-organisational context of learning, education, training, workplace, performance management or human capital in general.

*Note—The word competency here is to be interpreted as a reusable container concept in the most broad sense, covering KSAOs (knowledge, skills, abilities and other characteristics) including educational objectives, intended learning outcomes, behavioral characteristics, attitudes, aptitudes, etc.. Competency information represented in a Competency Profile may also include facets of competency, such as cognitive, psychomotor and affective, or behavioral indicators of competency.*

The notion of ‘competency’ is conceptual by nature. It makes it reusable. It therefore often needs to be contextualized in order to be used to include all classes of things that someone, or potentially something, can be competent in (aka ‘competence’).

This also offers the advantage of being able to model competencies and context separately, and profit from its reuse and recombination.

**smallest permitted maximum**: For implementation-defined values, the smallest permitted maximum value. See also: clause 4.5.

**value space**: The set of values for a given datatype (ISO/IEC 11404:1996).

**NOTE**: In this Standard, a value space is typically enumerated outright, or defined by reference to another Standard or specification.

### 2.1 Abbreviations and acronyms

- CEN/ISSS European Committee for Standardization
- ADL Advanced Distributed Learning
- IMS IMS Global Learning Consortium
- ISO International Standards Organization
- JTC Joint Technical Committee
- LTSC Learning Technology Standards Committee
- RCD Reusable Competency Definition
- RDCEO IMS Reusable Definition of Competency or Educational Objective
- SCORM Shareable Courseware Object Reference Model
- W3C World Wide Web Consortium
- XML Extensible Mark-up Language
- SPM smallest permitted maximum
- URI: Uniform Resource Identifier
- URN: Uniform Resource Name

### 3. Conformance

Conformance to this Standard is discussed in 4.1 – 4.5.

In this Standard, “shall” is to be interpreted as a requirement on an implementation; “shall not” is to be interpreted as a prohibition.

Note. Since this Standard defines a data model but not a specific binding, and system conformance cannot be defined without one or more binding, conformance of systems is outside the scope of this Standard.
a. Data instances

A conforming data instance shall be an instance of the data model or Smallest permitted maximum values. In this Standard, smallest permitted maximum values are defined for:

- Items with multiple values: All applications that process CP instances shall process at least that number of entries stated. In other words: an application may impose a maximum on the number of entries it processes for a data element with multiple values, but that maximum shall not be lower than the smallest permitted maximum value.
- Data elements with type CharacterString or LangString: All applications that process CP instances shall process at least that length for the CharacterString value (either directly or contained in the LangString) of that data element. In other words: an application may impose a maximum on the number of characters it processes for the CharacterString value -
- of that data element, but that maximum shall not be lower than the smallest permitted maximum value for the data type of the data element.

This Standard defines smallest permitted maximum (SPM) values for data elements with data types that include bag, set, and characterstring. For these data elements, an implementation that conforms to this Standard shall accept and process at least that number of entries or characters specified by the SPM for the element and may accept and process a larger number.

NOTES:
1. The intent is for the SPM values to cover most cases.
2. What "processing" means in the above depends on the nature of the application.
3. This Standard does not define any provision for how and whether a system can process more than the SPM for a particular data element.

4. Conceptual model

4.1 Functional overview

Reusable Competency Definitions (RCD), as defined in IEEE P1484.20.x, may used to capture a competency definition at any level of specificity, from the most precise to the most general. As such the Reusable competency definition captures only a part of the data that define a competency. The more specific a RCD is, the less reusable it is. Often a less precise definition is very useful, especially when trying to compare competency data between different communities of practice.

For example, as a tourist you are typically considered competent to drive a car in a foreign country, even though the details of the competency model for driving competency may be very different between countries. In that case, the gross competency definition is good enough and going into details would impair commerce when it comes to renting a car. In other cases, though, you do want to be able to reference a competency in the context of a specific model that corresponds to the expectations or requirements of a specific community of practice. Such a model can be represented by a Competency Profile. Competency Profiles may represent different models of the same competency.

4.1.1 Modeling

The CP data model is minimalist and extensible. It is purposely neutral with regard to models of competencies and the use of competencies. Competencies and competency models are defined and structured in many ways in different communities of practice. This Standard allows many communities of practice to exchange useful information regardless of the model they use, as long as the model can be represented or exported in a shape that can be represented according the Standard.
4.1.2 Directed acyclic graph (DAG) Profile shape

The Standard specifies the shape of a CP as a directed acyclic graph (DAG). A DAG is a hierarchical collection of nodes that implies containment. If node A has children B and C, it implies that A contains B or C. In competency terms, this would imply that competency A may be decomposed into sub-competencies or competency facets B and C, or that B and C contribute to A. In reality, many so-called existing competency “taxonomies” are not true taxonomies, because the same competency components tend to appear more than once in the model hierarchy. The Standard allows this to be represented in a DAG. The DAG allows a node to have more than one parent, as long as the parent cannot be a descendant of the node.

A simple topology for a DAG is a tree with a single root node and no commonality between sub-trees within the tree. A more complex topology may specify common children for more than one node, or more than one origin node. For example, in the rightmost graph in Figure 4, A, X and Y represent different competencies that have certain component competencies in common. Nodes in a Profile can have specific rules useful for modeling. Different rules can apply to individual nodes.

Rules may be associated with nodes to define interpretations of the Profile. The fact that a rule is defined in the Standard does not imply that it is required in all applications. For example, the required score required rules in Figure 5 may be required in an application profile for an assessment request, but may not be important when reporting a competency inventory for a person. In any case, the Standard defines a default value for each rule. For example, by default it is assumed that proficiency is required for all “children” of a defined competency in order to achieve proficiency for the “parent”.

An application of the Competency Profile may add other rules, but this is outside the scope of this Standard. For example, a Competency Profile may be used to specify how to roll up proficiency data throughout a collection of competency records that reference the RCDs that are represented in the Profile. Each competency record typically references a RCD and includes a data element for proficiency status and maybe proficiency score.

An application that builds or maintains a monolithic personal competency profile, rather than using cross references, might merge data from those competency records with the structure of the Competency Profile, in which case the resulting data structure would include not only the nodes of the competency Profile, but also data elements such as proficiency status for each node.

4.1.3 Profile extension by reference

Profiles may be symbolically merged by references to other Profiles. Any node in a Profile may reference a RCD, another Profile, or both. This is useful to allow the association of a more detailed Profile with a RCD. For example, a list of competency definitions may be extended by referencing Profiles that provide detailed breakdowns the components of those competency definitions as assumed by the creator of the list.

Competency Profiles may also include other Profiles by reference. Application profiles may put constraints on the shapes that can be merged because of the complexity of the resulting Profile. Application profiles may also specify that when Profiles are merged, the referencing node is treated as a functional boundary, and that references to other Profiles are followed only on demand in a more costly operation.

4.1.3.1 Profile extension rules and constraints

If a node in a DAG shaped Profile references another DAG shape Profile with a single origin ("root") node, the root node of the DAG is subsumed in the referencing node. A node in a DAG Competency Profile can therefore represent any other DAG Competency Profile. Several constrains do apply in order to retain sanity:

- The result cannot be a cyclical topology. In other words, a node cannot become a descendant
of itself as a result of merging graphs, because this violates the basic acyclic constraint of a DAG. Implementations must treat any node that would violate this constraint as a leaf node and ignore its reference to another Profile. For example, an implementation may use the same method used by a web site spider to avoid visiting pages or directories that have already been visited through another path.

- The referencing node retains its properties as child node, but the properties of the referenced node in its role as parent remain intact. In the example in Figure 6, nodes E and G must use the rollup rules defined by N for its children. If N references a RCD, and E also references a RCD, the RCDs are considered equivalent. In this case, when E is inspected in the context of its parent, i.e. when E is playing the role of child, the RCD that is visible is the RCD referenced by E. However, when E is inspected in the context of its children, the RCD that is visible is the RCD referenced by N, because E in its role as parent inherits the properties of N.

- If the target of a reference is a DAG with more than one origin, the reference must specify which origin to use. Otherwise it cannot be resolved. This adds some complication to implementations. For this reason, application profiles may want to restrict implementations to single-origin DAG topologies.

### 4.1.3.2 Using a DAG Profile to represent equivalencies and similarities

A known and expected problem with the RCD model is that different communities may define equivalent or similar RCDs because they are unaware of each other's work. This becomes a problem when competency models or records must be reconciled. This can happen, for example, when two companies merge or when educational Standards are consolidated across jurisdictions. Since CPs can be used to represent (cor-)relationships & dependences between RCDs, a natural use of CPs is to represent simple equivalencies and similarities. For example, the CP that defines such a competency equivalency can be referenced as evidence to justify the updating of a competency record that references the equivalent competency.

A common problem in dealing with competency modeling is imperfect equivalencies that are not reciprocal. The equivalency assumptions between competencies X and Y can however be expressed with two Profiles representing the (cor-)relationships & dependences between competencies X and Y. Proficiency in Y implies proficiency in X. Proficiency in X implies proficiency in Y only if there is also proficiency in Z.

### 4.1.4 Data capture

The data in a CP can come from many sources. Typical existing sources include various competency models developed by government agencies, academic and vocational institutions, enterprise and military training departments. Many existing models are either lists or hierarchies / taxonomies that can be captured in more or less automatic ways, depending on how they are encoded. The process might involve splitting the data from the model into two data models – RCD (definitions) and CP (how the definitions are related). A useful refinement on the process might be to look up existing RCD repositories to see whether suitable RCDs have already been defined. The process would then use those RCD rather than creating new ones when possible.

The United States O*NET database or similar occupational database within P(R)ES organisations (public and private employment services) can be mined for specific Competency Profiles - corresponding to a job description that someone builds by walking through the Standard occupational descriptions and the captured ability weights.

For example, for a job that involves accounting and management of a loading doc as well as supervision of twenty employees, an HR person with the appropriate helper tool could identify the appropriate Standard occupation codes in O*NET and automatically generate a Profile of the required competencies and relative importance for the required position, tweak it for the specific requirements of the enterprise, then publish the Profile or pass it on to recruiting agencies.

There are many hierarchical competency models available over the Internet, most of them with
considerable overlaps, many of which can be reprofiled easily into a CP instance with associated RCDs.

4.1.5 Example applications

A Competency Profile can be used to represent the (cor-)relationships & dependences between competency definitions in a:

- job or vacancy competency profile (requirements for the job) (JCP, VCP)
- personal competency profile (acquired competencies) (PCP)
- personal competency gap profile (competencies to learn) (PCGP).

Some other existing or emerging competency data collection specifications or practices may not flexible enough to represent all models, or do not support any meaningful interoperability. This proposed Profile Standard, along with related Standards, would allow the capture of key competency assumptions into a Standard, interoperable way. The competency information could be captured by translating from proprietary or portfolio to a Competency Profile with associated RCDs and possibly competency evidence records if that is part of the original data.

An application of this would be to allow look up of corresponding nodes in a Profile detailing the specific sub-competencies and their relative importance for a job requirement, with the RCD as a key (including the recording of equivalencies or dependencies discovered in ontologies, for example) Once a corresponding node is discovered, its relation links can be explored to guide further analysis. This analysis does not have to be automated to be useful—it could be presented as a guide to a human examiner. For example, if the match is on something like “English verbal skills”, the examiner could be presented with an outline of the sub-skills required for the job and compare that with the outline of sub-skills derived from the Profile that results from the capture of the applicant’s portfolio into a Competency Profile.

4.2 Data model overview

The data model contains the following mandatory elements:

1. **Identifier**: A globally unique label that identifies this Reusable Competency Profile. This identifier uses the same data elements as the Identifier element defined in the IEEE LOM Standard, and consists of two sub-elements: Catalog and Entry. The Identifier is sufficient to reference the competency in any other system. The Identifier may be a handle or digital object identifier according to emerging Standards and practice, e.g. the Handle system and the CORDRA specification.

2. **Title**: A text label for the Reusable Competency Profile. This is a short human-readable name for the taxonomy. While the Identifier provides the definitive reference to the definition, it is typically unintelligible. The Title provides a convenient alternative readable form, but one which is not the definitive label. The Title may be repeated in multiple languages.

The other elements defined by the data model are optional:

4. **Description**: A human readable description of the Profile. This is an optional unstructured (opaque) “text blob” meant to be interpretable only by humans. The Description may be repeated in multiple languages.

5. **Metadata**: Other information about the Profile, including optional metadata.

6. **Graph**: A structured collection of nodes that represent the hierarchical relationship between competencies. There is always at least one node. Some or all the nodes may reference a Reusable Competency Definition, which is not part of the data model, or another Profile that is outside the scope of the Profile that contains the node. This reference is through an identifier with global scope and does not specify a particular location, but rather the identifier of the RCD or Profile, wherever it may be found. A node does not have to reference a RCD or Profile. This may be because the node exists only for the purpose of grouping, because an appropriate RCD or Profile has not yet been found or created for reference, or because a reference to a
RCD or Profile was found to be invalid and has been removed.

A node has a Title, which is a human readable name for the node. This Title may be repeated in multiple languages. If no Title is defined for a node, but the node references a Reusable Competency Definition or Profile, the Title may be obtained automatically from that Competency Definition or Profile. An implementation may also obtain additional data from the referenced object by looking up the referenced object.

A node may have associated rules that specify how implementations may aggregate summary information about mastery of the referenced competencies. For example, one set of rules applies when the node is considered as a parent in the hierarchy, and another set applies when the node is considered as a child in the hierarchy. In the absence of explicit rules specified by the creator of the Profile, implicit default rules are specified by this Standard.

This Standard does not define a specific extension mechanism for the data model. Implementers may create additional data models for competency data and the representation or encoding of (cor-)relationships & dependences between competencies. Such models may be used to augment this model to support different communities of practice.

(End of informative clauses) -
6. Data model

This Clause defines the data elements of a CP

Unless noted otherwise, all components of "records" are optional in a data instance.

NOTES:

1. The use of ISO/IEC 11404 notation is for descriptive purposes only. A complete implementation of the operations defined in ISO/IEC 11404 is not required for conformance.

2. The ISO/IEC 11404 notation describes the semantics of the language-independent data types across all bindings (e.g., implementation of a data type as itself, its subtypes, its subclasses, and its specializations). For example, an ISO/IEC 11404 "record" may be implemented as an SQL table row, or as an XML complexType; an ISO/IEC 11404 "characterstring" may be implemented in an encoding (ISO 646, ASCII, ISO 8859-1, UTF-8, UTF-16, UTF-32, etc.) that supports the repertoire specified in the parameter to characterstring data type.

3. The following language-independent data types used in this Standard are defined in ISO/IEC 11404: bag, characterstring, record, set, state.

4. The labels for data elements and data types are for reference only. There is no requirement that an implementation use the exact same labels, as long as the data elements and data types are semantically equivalent.

5. This Standard does not define a specific extension mechanism for the data model. Implementers may define binding that allow additional elements, or create additional data models for competency data. Such models may be used to augment this model to support different communities of practice.

6.1 Reusable Competency Profile

Synopsis
 reusableCompetencyProfile : record
 { identifier : longIdentifierType,
   rcdRef : longIdentifierType,  // optional
   title : langStringType(1000),  // the parameter value is the SPM
   // optional
description : langStringType(4000),  // the parameter value is the SPM
   // optional
CPSchemaLabel: characterstring(iso-10646-1),  // SPM: 1000 characters
CPSchemaVersion: characterstring(iso-10646-1),  // SPM: 1000 characters
referential: boolean, metadata : bag of anyType,  // SPM: 10 of any type in the bag
graph : ( see clause 6.1.8),
extensions : anyType
}

Description: Depending on the implementation, an instance of Competency Profile shall include one or more of the defined components. The Profile element is a required component. It may not be empty.

All top level elements in the Competency Profile data model are intrinsically unordered.

Note: A binding may impose a particular ordering on CP data elements that conform to that binding. Other than conformance to the binding, no significance is associated or should be inferred from that ordering requirement.
6.1.1 Identifier

Synopsis
identifier : longIdentifierType,

Description: A globally unique label that identifies this Reusable Competency Profile. The Identifier is sufficient to reference the competency taxonomy in any other system.

Subclause 6.2.1 defines longIdentifierType.

NOTE: This identifier uses the same data elements as the Identifier element defined in the IEEE LOM Standard, and consists of two sub-elements: Catalogue and Entry.

6.1.2 Title

Synopsis
title : bag of langStringType(1000),
// SPM: 20 instance of langStringType in the bag
// The parameter value is the SPM for the langString

Description: A single mandatory text label for this CP. This is a short human-readable name for the taxonomy.

Subclause 6.3.1 defines langStringType.

NOTES:
1. The Title may be repeated in multiple languages.
2. While the Identifier provides the definitive reference to the CP, it is typically unintelligible. The Title provides a convenient alternative readable form, but one which is not the definitive label.
   Examples: "English proficiency", "Schmiblick failure diagnostic level 4", "Demonstrates conflict resolution skills".

6.1.3 Description

Synopsis
description : bag of langStringType(4000),
// SPM: 20 instance of langStringType in the bag
// The parameter value is the SPM for the langString

Description: A human readable description of the Competency Profile. This is an optional unstructured character string meant to be interpretable only by humans or unstructured full text indexing schemes.

NOTES:
1. The Description may be repeated in multiple languages.
2. The description is typically more explicative than the title. Examples: "Proficiency in written and spoken English and use of English for meaningful oral or written expression.", "Performance of level 4 diagnostic as specified in IETM #SCMBLK007"

6.1.4 CP schema label

Synopsis
CPSchemaLabel : characterstring(iso-10646-1),
// SPM: 1000 characters
Description: This element contains a label for the schema that defines and controls this CP data instance. If this element is omitted, then a value of “IEEE 1484.20.1” shall be assumed. A conforming implementation may refuse to accept or process a CP instance if the value of this data element is specified, but is not the value specified in the Standard.

NOTES:

1. Different label values may be used to signal application profiles with particular extensions or processing requirements.
2. This element does not describe the schema of the embedded metadata defined in 6.1.7. Every instance of embedded metadata, if any, should include its own schema description.

6.1.5 CP schema version

Synopsis
CPSchemaVersion : characterstring(iso-10646-1),
// SPM: 1000 characters

Description

Describes the version of the schema identified by CPSchemaLabel. If this element is omitted then a value of “1.0” shall be assumed. A conforming implementation may refuse to accept or process a CP instance if the value of this data element is specified, but is not the value specified in the Standard.

NOTE:

1. Different values may be used to signal application profiles with particular extensions or processing requirements.

6.1.6 Referential

Synopsis
referential : boolean, // default = false

Description: The referential data element indicates whether the Profile is self-contained or includes references to other Profiles. If the Profile contains references to other Profiles, this element shall be required and its value shall be true. This element shall be optional if the Profile does not contain references to other Profiles, in which case its default value shall be assumed to be false.

Notes

1. The entity that creates the Profile is responsible for setting the value of this element to accurately represent whether the Profile includes references to other Profiles.
2. This element is included to facilitate implementation efficiency in the processing of Profiles, e.g. to help determine whether a Profile has external dependencies without having to examine every node of the Profile.

6.1.7 Metadata

Synopsis
metadata :
bag of anyType, // SPM: 10 of any type in the bag

Description: Optional embedded Metadata describing this CP.

If a metadata record is included, it is recommended that this record conform to IEEE 148412.1-
2002: Standard for Learning Object Metadata (IEEE LOM). In such conforming records, the version of the Metadata Specification Standard is given in the meta-metadata element of the metadata record. Some of the data elements defined in IEEE LOM are not relevant for a CP and should be omitted. Profiles shall determine which metadata, if any, must be used for conformance with the profile.

NOTES:

1. Useful metadata defined in the IEEE LOM include additional identification as an entry in one or more catalogues, information about the author, publisher, the creation date, and the coverage (in the sense of the Dublin Core as adopted by the IEEE LOM.) The Relation element may be used to relate a definition to a prior version of the definition, and one or more Classification elements may be used to indicate where this particular Profile fits in a larger CP, Profile, model or ontology of competencies or educational objectives. Classification elements may be repeated to reference different models. For example, the CP might represent a Profile of a competency in model A, as well as a Profile of a similar competency defined in a company's custom competency model B.

2. More than one metadata record is allowed in the bag, but if there is more than one record each record should conform to a different metadata specification. An implementation must accept any metadata record that it cannot interpret, but it is not required to interpret such metadata records.

3. A particular binding specification or application profile may impose additional restrictions or requirements.

6.1.8 Graph

Synopsis
graph : record :
(  
defaultEntryNode: localIdentifierType,  
entryNodes: bag of localIdentifierType,  
nodes : bag of nodeType,  
// SPM: (To be discussed. Specify in profiles?)  
),

Description: A mandatory element. This element contains the actual Profile in the form of a collection of directed graph nodes. Any node without a parent is an entry node into the graph.

NOTES:

1. A binding might require a particular ordering of the elements. Such ordering does not imply any meaningful order.

2. Some competency models prescribe an ordering or precedence for competencies. This typically means that competencies must be mastered in a specific order. This, in turn, means that there are dependencies between the competencies so that mastery in A is a requirement for mastery in B, B is a requirement for mastery of C, and so on. This can be described in the DAG by making A a child of B, and B a child of C, etc. without adding an ordering property.

3. 6.1.8.1 Default entry node

Synopsis
defaultEntryNode: localIdentifierType,

Description: This element specifies the default entry node into the graph. It is optional, but an application profile may require it to support applications that require a single entry node even if the graph contains more than one entry node.
6.1.8.2 Entry nodes

Synopsis
entryNodes: bag of localIdentifierType,

Description: This element contains a complete and exact list of the nodes that do not have at least one parent. There is no intrinsic order to the list.

Note – This element is provided to accelerate processing by not requiring a traversal of the entire node collection to identify the entry nodes.

6.1.8.3 Nodes

Synopsis
nodes : bag of nodeType,

Description : Unordered collection that contains all the nodes that make up the DAG. There is no intrinsic order to the nodes, other than the order defined by parent-child relationships. NodeType is defined in clause 6.2.1

6.1.9 Extensions

Synopsis
extensions : anyType,

Description : Application specific extensions to the data model. The extensions may not conflict with a binding of the data model. Extensions may not replace or duplicate elements defined in the data model.

NOTES:

1—The extensions should be defined by an application profile.

6.2 Data types

The following data types are used in conjunction with the data elements described in Clauses 6.1 and 6.2.

6.2.1 Node type

Synopsis
nodeType = record :
( nodeId : localIdentifierType,
  // SPM: 1000 characters
  rcdReference : longIdentifierType,
  // SPM: 4000 characters;
  classLabel : record
  ( model : longIdentifierType,
    token : characterstring,
    bag of langStringType(250),
    // SPM: 20 instances of langStringType in the bag
    // The parameter value is the SPM for the
    // langString
  )
)
Description : This type defines the data model for a single node in the DAG that represents the Profile's topology. The following clauses describe the elements within each node record.

6.2.1.1 Node Identifier

Synopsis

nodeId : localIdentifier,

Description : The value of this mandatory element is a unique label that identifies the node. The Identifier is sufficient to reference the node in the graph. This Identifier shall be unique at least in the context of the CP. There are no semantics associated with the value nodeId element; it is just a key to reference the node.

Subclause 6.x.xxx defines localIdentifierType.
NOTES:

1. If there is any possibility that the Profile may be disaggregated or merged with other Profiles or fragments of Profiles, it is recommended that the Identifier be globally unique. The result of merging Profiles that contain nodes with conflicting identifiers is undefined.

6.2.1.2 RCD Reference

Synopsis

- rcdReference : longIdentifierType,
  // SPM: 4000 characters

Description: This data element contains the identifier of the Reusable Competency Definition represented by this node. If the node exists only for the purpose of grouping other nodes in the Profile, this element may be omitted or its value may be nil. There are no semantics associated with the value of rcdReference element. It is just a key to reference some Reusable Competency Definition, wherever it may be.

6.2.1.3 Class Label

Synopsis
classLabel : record
  (  
    model : longIdentifierType,  
    bag of langStringType(250),  
    // SPM: 20 instances of langStringType in the bag  
    // The parameter value is the SPM for the  
    // langString  
  )

Description: This optional data element contains an optional reference to a model or vocabulary and a short text label for the class of node. This element is provided to allow the provision of a class label or similar label if the node is intended to represent a class in a particular competency model.

NOTES

1. An application may define that the model element is the identifier or locator for a vocabulary specification that complies with the IMS VDEX specification.
2. This element allows the representation of the Profile to various hierarchical models, such as Terminal learning objective (TLO) enabled by Enabling Learning Objectives (ELO)–>ELO, Job competencies implying task competencies, behaviors vs. knowledge, and so on. The specification of node classes is outside the scope of this standard.
3. This element is multilingual to support the meaningful display of the node class in user interfaces. An application may define that only one language is meaningful for the label, in which case the label may be treated as a language-independent token.

6.2.1.4 Title

Synopsis
title : bag of langStringType(1000),  
  // SPM: 20 instance of langStringType in the bag  
  // The parameter value is the SPM for the langString

Description: This optional data element contains a short human readable text label for the node.

If the node references a Reusable Competency Definition and this element has a value,
implementations shall display the title as defined by this element instead of the title of the referenced Reusable Competency Definition. If the node references a Reusable Competency Definition and this element has no value, implementations should display the title as defined by the referenced Reusable Competency Definition. However, this is not a requirement because performance or other considerations may make this impractical. If no title is available for display, but it is necessary to display the node, the implementation shall define what to display.

6.2.1.5 Description

Synopsis
description : bag of langStringType(2000),
  // SPM: 20 instance of langStringType in the bag
  // The parameter value is the SPM for the langString

Description : This optional data element contains a human readable text description for the node.

If the node references a Reusable Competency Definition and this element has a value, implementations shall display the description as defined by this element instead of the description in the referenced Reusable Competency Definition. If the node references a Reusable Competency Definition and this element has no value, implementations should display the description as defined by the referenced Reusable Competency Definition, if available. However, this is not a requirement because performance or other considerations may make this impractical.

6.2.1.6 Parents

Synopsis
parents : bag of longIdentifierType,

Description : Identifiers of the parent nodes of this node in the directed graph topology. This element shall be null, empty or omitted if the node does not have any parent. If a node has no parent, it shall be included in the list of entry nodes (See Clause 6.1.8.2).

NOTES
1. In a DAG, a node may have more than one parent. A corollary is that several nodes may share one or more children.
2. A binding may require the addition of a placeholder element to contain each parent reference in the bag.
3. Although this is not recommended, a node that has one or more parent may be included in the list of entry nodes.

6.2.1.7 Children

Synopsis
bag of record
  (nodeRef: localIdentifierType,
   weight: real(10,7), // range (0..1) default = 1,
   dataRequired: boolean, // default = true;
   proficiencyRequired: proficiencyScoreType,
   proficiencyDesired: proficiencyScoreType,
   // range (0..1) —default = child’s own value
  )

Description : This data element represents the child nodes of this node in the directed graph topology. This element shall be null, empty or omitted if the node has no children. A node shall be prohibited to have children if a symLink to a different Profile is specified for the node.
6.2.1.8 Child Node Reference

Synopsis
children : bag of record
    (nodeRef: localIdentifierType,
     ...
    )

Description: This mandatory data element shall be a reference to another node in the same Profile instance. The reference may not be to an ancestor node of the node that owns the bag of children.

Note – If the bag of children is not empty, every child record in the bag must include a valid nodeRef. An ancestor node may not be referenced because that would result in an illegal loop in the DAG topology.

6.2.1.9 Child - Weight

Synopsis
children : bag of record
    (nodeRef: localIdentifierType,
     weight: real(10,7), // range (0..1) default = 1,
     ...
    )

Description: This data element is used only when the node is a child in a rollup operation where a weight assigned to the information associated with the child node is relevant. For example, if the rollup method is mean, this data element can be used to specify a relative weight among children. In the absence of a specific value, the default value of this element is assumed to be 1.

Because the value of the weight element may be different in the context of different parents, this element is defined in a rule associated with the parent.

Note – This element allows certain rollup operations where proficiency information is summarized in such a way that weights may influence the result. Weights are not relevant in some of the rollup methods defined in Clause 6.2.1.13.

6.2.1.10 Child – Data Required

Synopsis
children : bag of record
    (nodeRef: localIdentifierType,
     ...
     dataRequired: boolean, // default = true;
     ...
    )

Description: This data element is used only when the node is considered as a child in a rollup operation. If its value is false, then the child is included in rollups only if valid proficiency information is available for it. The child is ignored altogether if no valid proficiency information is available for it. In the absence of a specific value, the default value of this element is assumed to be true.
Because the value of the required element may be different in the context of different parents, this element is defined in a rule associated with the parent.

Note – This element allows certain rollup operations where proficiency information should be used if available, but ignored if not available. For example, an individual may be considered a good player if she is competent in all the sports for which proficiency data are available for her, even though the model may list additional sports in which she never participated.

6.2.1.11 Child -Proficiency Required

Synopsis

children : bag of record

( nodeRef: localIdentifierType,
  ... proficiencyRequired: proficiencyScoreType,
  ...
)

Description: This data item specifies a proficiency requirement for a child in the context of this parent node. It specifies that proficiency status can be assumed to be true if the available proficiency measure associated with the child node is at least a certain value. For valid comparisons, the proficiency measure must be expressed in a compatible range. The range for proficiencyRequired is -1 to 1 inclusive. The default value if not explicitly specified is 1.

The proficiencyRequired element defined in the child node's own rules shall be used if 1000 no overriding value is specified in this data element.

NOTES:
1. Because the value of the proficiencyRequired element may be different in the context of different parents, this data element allows proficiencyRequired to be specified in this data element associated with the parent.
2. Proficiency measure is also called "proficiency level", "score" or "success measure" in various specifications and Standards.
3. Application example involving rollup: Node RX references RCD X and specifies a proficiency required of 70%. However, node RX is a child of node RA that specifies that for child RX the proficiency required is 80%. When rolling up competency status information from RX into the competency status information for RA, the proficiency required used to evaluate whether a measure satisfies the requirement will be 80%. This is because the requirements -
4. specified for the context override the requirements specified for individual components of the context. On the other hand, if no rule associated with RA specifies a particular proficiency required for child RX, then the proficiency required defined in the node RX is used by default.

6.2.1.12 Child -Proficiency Desired

Synopsis

children : bag of record

( nodeRef: localIdentifierType,
  ...
  proficiencyDesired: proficiencyScoreType
)

Description: This data item specifies a proficiency requirement for a child in the context of this parent node. It specifies that proficiency status can be assumed to be true if the available proficiency measure associated with the child node is at least a certain value. For valid comparisons, the proficiency measure must be expressed in a compatible range. The range for
proficiencyDesired is -1 to 1 inclusive. The default value, if not explicitly specified, is 1.

The proficiencyDesired element defined in the child node's own rules shall be used if no overriding value is specified in this data element.

NOTE— Application example: The current node references RCD X and a competency evidence record for an individual also points to RCD X, and specifies that the individual's proficiency level 67%. If a proficiencyRequired of 60% (=0.6) is specified by for this node, the individual is not considered proficient according to this Competency Profile. However, if a proficiency proficiencyDesired of 75% is specified, then a learning application might try to engage the individual in a learning activity to achieve the desired level of proficiency, even though the baseline required proficiency is already achieved.

6.2.1.13 Sym Link

Synopsis

symLink : longIdentifierType,

Description : Identifier referencing a Profile used to extend the current Profile by merging an entry node in that Profile with the current node. The binding of the identifier may include the specification of a particular entry node in the target Profile. If the target Profile has multiple entry nodes and no entry node is specified in this element, the default entry node in the target Profile shall be used as entry node. The merging rules are specified in clause x.x (TBD).

NOTES:
1. See conceptual overview for a detailed informative explanation of the Profile extension mechanism.
2. By using sym links, it is possible to keep CPs to an easily manageable size, and to reuse CPs in the context of other Profiles. For example, the same skill definition published by a state standards board may be included in various institution-specific competency models through this mechanism.

SymLink merging rules

When a sym link is used, the target node that is the entry point in the target Profile shall be treated as if it was merged with the referencing node when processing data from the tree. If any two data elements or attributes conflict between the nodes during processing, the element or attribute value of the referencing node shall override the value of the target node. Children of the target node, if any, shall be treated as children of the referencing node when traversing the graph and performing rollups. Deleting a referencing node shall have no effect on the target node. Changing values or data elements of the referencing node shall have no effect on the values or data elements of the target node. Changing values or data elements of the target node shall have no effect on the values or data elements of the referencing node. The only actual merging or override of values or data elements shall occur in the data space of the processing entity.

6.2.1.14 Rules

Synopsis

rules : record

( proficiencyRequired: proficiencyScoreType, 
  proficiencyDesired: proficiencyScoreType, 
  rollupMethod : state(all,any,fraction,units,mean,other), 
  rollupParameter : choice(rollupMethod) of 
  ( all, any, mean : nil, 
    fraction: real(10,7), // range (0..1), 
    units: integer, // must be > 0 

    state(all,any,fraction,units,mean,other) 
)
other: characterstring(iso-10646-1),
// SPM: 4000
)
)

Description: Rules that specify the data processing behavior of systems that use the CP.

If the rules element is not present in an instance, the default value for each the rule elements defined here shall be applied in processing rules. If the rules element is present but any of the rule elements is not specified, the default value for that element shall be assumed in processing rules.

6.2.1.15 Proficiency required

Synopsis
proficiencyRequired: proficiencyScoreType,

Description: This data item specifies a proficiency requirement. It specifies that proficiency status can be assumed to be true if the available proficiency measure for the referenced competency definition is at least a certain value. For valid comparisons, the proficiency measure must be expressed in a compatible range. The range for proficiencyRequired is -1 to 1 inclusive. The default value if not explicitly specified is 1.

The proficiencyRequired element defined in the node's rules shall be used if the node is considered independently of any parent or if no overriding value is specified in the rules of the parent node being considered in an operation. Because the value of the proficiencyRequired element may be different in the context of different parents, a value for proficiencyRequired may also be specified in the child specification rule associated with each parent of this node. For rollup processes, if a value for proficiencyRequired is specified in the child specification of the parent node, that value shall be used instead of the value of the proficiencyRequired element of the child node.

NOTES:
1. Proficiency measure is also called "proficiency level", "score" or "success measure" in various specifications and Standards. Some semantic Profiling may be required for integration with those specifications and standard.
2. Application example: The current node references RCD X and a competency evidence record for an individual also points to RCD X, and specifies that the individual's proficiency level is 67%. If a proficiency required of 70% (=0.7) is specified by for this node, the individual is not considered proficient according to this Competency Profile.
3. Application example involving rollup: Node RX references RCD X and specifies a proficiency required of 70%. However, node RX is a child of node RA that specifies that for child RX the proficiency required is 80%. When rolling up competency status information from RX into the competency status information for RA, the proficiency required used to evaluate whether a measure satisfies the requirement will be 80%. This is because the requirements specified for the context override the requirements specified for individual components of the context. On the other hand, if no rule associated with RA specifies a particular proficiency required for child RX, then the required defined for RX is used by default.

6.2.1.16 Proficiency desired

Synopsis
proficiencyDesired: proficiencyScoreType,

Description: This data item specifies a proficiency requirement. It specifies that proficiency status can be assumed to be true if the available proficiency measure for the referenced competency definition is at least a certain value. For valid comparisons, the proficiency measure must be expressed in a compatible range. The range for proficiencyDesired is -1 to 1 inclusive. The default default value if not explicitly specified is 1.
The proficiencyDesired element defined in the node's rules shall be used if the node is considered independently of any parent or if no overriding value is specified in the rules of the parent node being considered in an operation. Because the value of the proficiencyDesired element may be different in the context of different parents, a value for proficiencyDesired may also be specified in the child specification rule associated with each parent of this node. For rollup processes, if a value for proficiencyDesired is specified in the child specification of the parent node, that value shall be used instead of the value of the proficiencyDesired element of the child node.

NOTE— Application example: The current node references RCD X and a competency evidence record for an individual also points to RCD X, and specifies that the individual's proficiency level is 67%. If a proficiency required of 60% (=0.6) is specified by for this node, the individual is not considered proficient according to this Competency Profile. However, if a proficiency desired of 75% is specified, then a learning application might try to engage the individual in a learning activity to achieve the desired level of proficiency, even though the baseline required proficiency is already achieved.

6.2.1.17 Rollup method

6.2.1.16 Proficiency desired

Synopsis

rudupMethod : state(all,any,fraction,units,mean,other),

Description: This data item applies only when the node is a parent. It specifies how to roll up proficiency information specified by children of the node. The defined methods are:

• all --Proficiency must be achieved for all the competencies represented by children nodes in order to consider that proficiency is achieved for the competency represented by this node. This is the assumed default value if a rollup method is not specified.

• any --Proficiency must be achieved for any of the competencies represented by children nodes in order to consider that proficiency is achieved for the competency represented by this node.

• fraction --Proficiency must be achieved for at least specified fraction of the competencies represented by children nodes in order to consider that proficiency is achieved for the competency represented by this node. The fraction value is expressed as a floating point number in the range 0 to 1 inclusive. 0 means that no child proficiency is required. 1 is the equivalent of specifying that the rollup method is all. 0.5 means that proficiency must be achieved for at least 50% of the child nodes.

• units --Proficiency must be achieved for at least the specified number of the competencies represented by children nodes in order to consider that proficiency is achieved for the competency represented by this node. The number is a positive integer. 0 means that no child proficiency is required. 1 is the equivalent of specifying that the rollup method is any.

• mean --The proficiency measure for the parent node is determined by averaging the proficiency levels for the competencies represented by children nodes. The proficiency status for the parent node can then be determined by comparing that level with the proficiencyRequired value for the parent node. If no proficiency level is available for a child node, the proficiency status (boolean) is used instead, with proficient = 1 and not proficient or unknown = 0.

• other --Another proficiency method is to be used. The other method must be specified by an application profile and is not defined by the Standard.

By default, the rollup method is "all". No available competency data or a value of "unknown" is considered the same as "not proficient" for the purpose of rollup. If proficiency status but no proficiency measure is available for any node, the proficiency measure value is assumed to be 1 if proficient, and 0 if not proficient.

NOTES:
1 — Proficiency measure is also called "proficiency level", "score" or "success measure" in various specifications and Standards.
6.2.1.18 Rollup parameter

Synopsis
rollupParameter : choice(rollupMethod) of

(all, any, mean : nil,
fraction: real(10,7), // range (0..1),
units: integer, //
other: characterstring(iso-10646-1),
// SPM: 4000)

Description: Parameter used only if the specified rollup method is fraction, units or other. The type of parameter depends on the rollup method.

If the rollup method is "other", the parameter is a container for data of any type, and an application profile must specify the method and the data.

6.2.2 Any type

Synopsis
type anyType = (unspecified);

Description: This data type represents any type not specified in this Standard. This Standard does not require an implementation to process data elements of this type when encountered in a RCD instance. The data types implemented in a CP data element with type anyType shall not preclude interoperable bindings of the entire CP instance.

NOTES
1. If implementations specify or require data elements for which the type is defined in this Standard as anyType, this Standard recommends that the implementations provide the means to interpret and validate the implementation-specific data. For example, an implementation that uses an XML binding should include a valid XML schema that can be referenced in RCD instances bound in XML documents, and the schema should be documented.
2. The data types used in the container should be defined by an application profile.

Examples:
- An application profile might specify an additional data element for "desired proficiency" to use along with "required proficiency" in CP instances that represent a position competency model for hiring.
- An application profile might specify a rollup method that is not defined in the standard, and embed the specification for that rollup method as an extension in a standard-conformant instance.
- An application profile might add references to contextual information that can be used to make an instance of the standard data model more context-specific.
- An application profile might add metadata to identify the identity that set a proficiency level requirement, and to reference the enterprise policy that is the source of the requirement.

6.2.3 LangString type

Synopsis
type langStringType(length) =
record
-
)
language :
languageType,
string : characterstring(iso-10646-1)
// SPM: The length parameter
);

Description : This data type consists of a language specification for a string and the string itself.

**Examples**
The following are three examples of localized strings: "Information Technology" in French, "localization" in British English, and "xxx" in Japanese hiragana:

( "fr", "Technologies de l'information" ),
( "en-GB", "localisation" ),
( "jp-JP- jongh", "xxx" ),

### 6.2.3.1 Language

**Synopsis**
language : characterstring(iso-646),
// SPM: 250 characters

Description : The language data element specifies the language of the localized string. The format of this data type is a character string consisting of a required language code followed by multiple, optional, hyphen-prefixed subcodes (see examples below).

The following rules apply to the language code part of the character string:
- 2-letter codes are defined by ISO 639–1.
- 3-letter codes are defined by ISO 639–2.
- The value prefix "i" is reserved for registrations defined by the Internet Assigned Numbers Authority (IANA).
- The value prefix "x" is reserved for private use.

The following rules apply to the first subcode part of the character string:
- 2-letter subcodes are ISO 3166–1 alpha-2 country codes.
- Subcodes of from 3 to 8 letters are registered with IANA.

Rules for additional subcodes are unspecified, except that the length of any subcode cannot exceed 8 characters.

**NOTE**—The language code is often given in lower case and the subcodes (if any) in upper case. However, the values are case insensitive.

**Examples**

"en-GB"
"de"
"fr-CA"
"it"
"grc" (Ancient Greek, until 1453)
"en-US-NY-NY"
"eng-GB-cockney"
"Profile-PG-buin" (Austronesian -Papua New Guinea Buin)
"gem-US-PA"
6.2.3.2 String

Synopsis

string : characterstring(iso-10646-1),
// SPM: The length parameter

Description: The string data element contains the text of the localized string.

6.2.4 Local identifier type

Synopsis

type localIdentifierType = characterstring(iso-10646-1)
// SPM: 4000 characters

Description: This data type is an identifier (a label) associated with an object that is intended to be unique within the context of usage of the object. The character string shall conform to the syntax for Uniform Resource Identifiers (URIs) as defined by RFC 2396.

NOTES
1. This Standard recommends that the URI be a globally unique identifier in the form of a Uniform Resource Name (URN) (see RFC 2141 [A5]) or a Handle as defined in the Handle System [Ax].
2. Depending on the binding, these data elements may be implemented as explicit or implicit. The binding may be a combination of explicit and implicit representations of these data elements. For example, in an XML document they may be implicit in the structure of the document if the shape of the graph is a simple tree.
3. Depending on the implementation, the values in the parents and children collections may be implicit, may be explicit and literal or may be an implementation-specific identifier or pointer. However, any conforming implementation of a Reusable Competency Profile must represent no less than the information specified in this Standard for any component that is present in the implementation. For example, even if a node is represented by a relative pointer to achieve data compression in a particular binding, the identifier for that node must be resolvable to a conformant identifier type when the tree instance is transmitted to another conformant implementation.

6.2.5 Long identifier type

Synopsis

type longIdentifierType = record (catalog: characterstring(iso-10646-1),
// SPM: 4000 characters
entry: characterstring(iso-10646-1)
// SPM: 4000 characters
);

Description: This data type is an identifier (a label) associated with an object that is intended to be unique within the context of usage of the object. The character string shall conform to the syntax for Uniform Resource Identifiers (URIs) as defined by RFC 2396.

NOTE: This Standard recommends that the URI be a globally unique identifier in the form of a Uniform Resource Name (URN) (see RFC 2141 [A5]) or a Handle as defined in the Handle System [Ax].
6.2.6 ProficiencyScoreType

Synopsis
type proficiencyScoreType = real(10,7);
// range -1..1

Description: This data type is a proficiency score on a continuous scale constrained to the values -1 to 1 inclusive. Negative scores are allowed to permit the representation of "negative proficiency", e.g. if a person is actually dangerously inept in the execution of a task.

NOTES
1. Negative scores are allowed to permit the representation of "negative proficiency", e.g. if a person is actually dangerously inept in the execution of a task.
2. This type Profiles exactly to the scaled score type defined in IEEE 1484.11.1.
3. Rollups and comparisons of scores from different sources require a common scale. Various proficiency scales or grading methods may be Profileped to and from the ProficiencyScoreType. For discontinuous scales, the Profileping typically involves ranges or thresholds. Such Profilepings are outside the scope of this standard.
6.4 Appendix 4: Competency Related Data Management: a proposed reference model

Competency Related Data Management (CrDM)

a proposed reference model

Luk Vervenne
Jehad Najjar
Claude Ostyn

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13 This work has been inspired by the work of the late Claude Ostyn, my predecessor as IEEE/LTSC WG20 Chair (Luk Vervenne)
1. Introduction

Purpose and scope

Purpose. The purpose of this proposed reference model is to specify data models and processes that enable the broadest, most economical exchange of useful competency-related data among and between communities of practice. The reference model must support different conceptual models of the problem space, as well as various existing best practices.

Scope. The scope of this proposed reference model includes common data models and the specification of some common processes. It specifies some starter set of scenarios that take advantage of the common data models and processes involving competencies. The scenarios meet specific business requirements identified in applications areas such as education, personal development and learning content development as well as hiring, performance improvement and training.

Many scenarios, many divergent beliefs

Based on experience and theory, there are many ways to look at the interrelated fields of competency, assessment, performance and learning.

This proposed reference model tries to (1) provide a framework that can be used to represent many of those visions and models and (2) capture or support existing data and best practices. The purpose of this model is not to eliminate the richness of ideas and implementations, but rather to act as a liaison between communities of practice aiming for the broadest, most economical exchange of useful information.

It must be clear that there are different scenarios corresponding to completely different business goals. For example, the needs of education, personal development and learning content development are clearly different of those of employability, recruitment, performance improvement and training. Nevertheless these different scenarios can still take advantage of common data models.

Scenarios and standards for data and modeling that are feeding into for this model include

- IEEE 1484.11.1-2004 Content Object to Learning Management System Communication Data Model
- HR-XML Competency 3.0 draft
- HR-XML Assessment 3.0 draft
- IMS Reusable Definition of Competency or Educational Objective (RDCEO)
- IEEE P1484.20 Reusable Competency Definition
- LETSI SCORM 2.0 (draft)
- European Qualification Framework (EQF)
- Various LMS implementations and descriptive documents
- Various documents, articles or books describing or referencing competency modeling and competency and performance management.
2. Competency Definitions

Some of the terms used in this document may have different nuances in different application domains and communities of practice, therefore, we will introduce some of the main terms used in this document. This is to be seen as the onset of a broader effort to reach consensus on “Common Semantics for Employability”, a target for which HR-XML and IMS recently agreed to setup a joint liaison group.

**Competency** means the proven ability to use KSAOs (knowledge, skills, personal, social and/or methodological abilities, and other characteristics) in learning and workplace situations, and in professional and personal development. Therefore, the concepts (1) skills, (2) knowledge and (3) abilities are subcomponents of the container concept competency. The term competence is similar but puts more emphasis on the capability to successfully apply these competency facets or types in a specific context.

**Knowledge** means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study.

**Skills** mean the ability to complete tasks/solve problems by applying knowledge & know-how.

**Learning outcomes** means statements of what a learner knows, understands and is able to do on completion of a learning process. In other words, it is a list of user competencies which include knowledge, skills and attitudes.

**Qualified Competency:** competencies can be qualified by using qualifiers such as level (of proficiency, importance, expertise), or being assigned a relevance, ageing, weight factor, or being mandatory/optional, etc …

**Competency Framework:** a reusable set/repository of competencies and qualifiers used by multiple organizations, teams or groups, to compose different competency models.

**Competency Model:** a specific selection of reusable competencies and qualifiers to be used in a specific setting.

**Competency Profile:** as an instantiation of a competency model a Competency Profile (CP) is a set of (acquired/required) aggregated competencies with well defined co-relationships, that, together, acts as a truthful knowledge representation for a specific object type such as person, job, task, function, process, learning objective, learning outcome, etc.

**Competence** = the capability of an actor to perform in an ecological niche or specific context, using an aggregation of one or more competencies (KSOA’s).

**Qualification** means a formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcome to given standards.

Nevertheless, in this reference model it is possible to collect and manipulate data relating to
competency, regardless of what competency means.

This reference model identifies and defines a modular set of simple data structures. The simple data structures can be used

- as building blocks in more complex data structures.
- to capture various existing or new data.
- in different processes to implement various scenarios.
- in different contexts (and sectors) to support different usage scenarios.

3. Competency Standards Evolution

The IMS Reusable Definition of Competency or Educational Objective (RDCEO) specification was proposed to provide means to create common understandings of competencies that appear as part of a learning or career plan, as learning pre-requisites, or as learning outcomes. The specification can be used to exchange competency definitions between learning systems, human resource systems, learning content, competency or skills repositories, and other relevant systems.

The IMS RDCEO specification was then put to form the backbone for the IEEE LTSC Reusable Competency Definitions (RCD).

HR-XML consortium - dedicated to the development and promotion of a standard suited for XML specifications to enable e-business and automation of human resources-related data exchanges – developed an XML schema to enable exchange of information about competencies within variety of business contexts. The specification binds IEEE RCD definitions with information about the context and evidence related to the RCDs.

![Figure 1: Evolution of competency standards](image)

IEEE Competency Profile (CP) is a proposal for standardizing the describing of information about the relations between competencies of one person. The different types of relations between competency definitions (RCDs) in one IEEE CP are introduced later in this document.
4. Competency Framework (CF) --> Model (CM) --> Profile (CP)

In trying to make competencies useful for cross-organizational and/or cross-context settings we seek a number of communalities. An industry sector or a region may choose to setup a competency framework, holding all RCDs needed. Furthermore the framework defines the number of qualifiers to be used.

Finally the framework allows for one or more RCDs aggregation levels to be used. There are basically 3 different aggregation (complexity) levels for competency profiles (CPs); see figure 2:

1. List (a flat collection of competency definitions)
2. Tree or Hierarchy (a “competency taxonomy”)
3. Correlated network (or ontology, typically represented by a complex graph in which arcs represent the semantic relationships between the nodes)

A single organization can now select RCD to compose one or more models, using specific RCDs, an aggregation level, and by assigning the right qualifiers. Once the model is defined, specific competency profiles are defined as (partial) instantiations of a competency model. A CP always is attached to an artifact such as person, job, function, role, process, task, learning material, … (PCP, JCP, FCP, …)

Regardless of the aggregation structure of the competency profile, it is a collection of nodes, and each node may represent a different RCD. The same RCD may be represented by different nodes in different profiles. The competency profiles are only profile containers. They are not competency definitions themselves, but they represent a set of known relationships between (reusable) competency definitions. Given an RCD that is represented by a node in a profile, you can use the profile to find its relationships with other RCDs.

![Figure 2: big picture of competency metadata management](image-url)
5. Basic Building Blocks for Competency Management

RCD Reusable Competency Definition
GUID Global Unique Identifier (a URI)
RCD_GUID Reusable Competency Definition GUID
QCDRef Qualified Competency Definition Reference
CP Competency Profile (aggregation/ profile of RCDs)
ER (single) Evidence Record
EDR Evidence Distillation Request
PCP Personal Competency Profile
CRER Competency Required Evidence Records
xCPC Competency Profile for another ‘artefact’ such as process, task, function, job, role, ...

Scenarios of Building Competency Profiles

This section shows how the building blocks (RCDs) can be used and related to form more complex data structures, such as the Competency Profiles (CPs):

Basic Competency Profile– example 1

A basic competency profile (CP) can be represented as a taxonomy which is a hierarchy of atomic nodes (CPNODE). Each node in the hierarchy may include the identifier of a reusable competency definition (RCD). The nodes “roll up” from lower level competencies into higher level competencies. In a more elaborate competency profile, the nodes may include a qualified competency definition reference, which also includes a qualifier such as levels of proficiency, expertise, importance or relevance and confidence ratings, ageing etc...

Evidence Distillation– example 2

An evidence distillation request can be formulated to specify that there is a need to assess for a specific level of proficiency on (1) a particular competence described in a reusable competency definition (RCD) or (2) of the full competency profile as a knowledge representation of the subject or subject group.

The distillation process therefore can be as simple as a single assessment or as complex as ‘distilling’ any evidence source available into the resulting CP. The result of an evidence distillation process is specific to a person or group and references an evidence distillation request and the collection and processing of all evidence available.

Descriptive data about the raw evidence presented can be assessed, predigested and stored as evidence records. The evidence distillation process results in a Personal Competency Profile, being an instantiation of the Competency Model. As such it provides statements as to what RCDs are present and whether the required proficiency levels of the single RCDs was obtained.
Evidence Records – example 3

An evidence distillation request leads to a Personal CP defined as a set of RCDs. Each RCD is referenced by a node in a particular competency model (CM). This node has children, which means that the competency is decomposable. A more specific assessment request can be generated for every one of the component competencies, by just following the structure of the Competency Model (taxonomy).

As each component competency is assessed, an evidence record for that component competency is generated. The evidence records for each of the component competencies can be “rolled” up by following the profile defined in the competency profile as the instantiation of the competency model. The summary evidence distillation record may be generated as the result of rolling up individual evidence assessment results.

5.1 Reusable Competency Definition (RCD)

A Reusable Competency Definition (RCD) describes the aspects of a competency that are common and generic to different people, situations, etc. That is to all the reuse of the same definition for different purposes in different contexts and by different people or applications.

To enable their findability and reuse, an RCD is described with a set of metadata elements:

- GUID: a globally unique ID, which allows RCDs to be published and referenced in many automated or relational processes. For example, the same RCD may be referenced in metadata for a learning object or for an assessment instrument, and in an assessment request in a recruitment workflow. RCDs are ‘forever’ and their RCDID should be ‘globally unique’, not in the least because other data depends on them. If a new edition of a RCD is published, it must use a different identifier.
- Title: human readable title of the RCD.
- Description: free text describing the RCD.
- Definition: the creator of the RCD can specify a model and provides statements specific to that model.

RCDs may have additional metadata because they may be valuable intellectual property that may make it worthwhile to include them in trade transactions. Metadata may also be used to specify the kind of competency (e.g. skill, knowledge, ability, ..), qualifiers related to the RCD etc… The data model shown here is both represented in the IMS RDCEO specification and the IEEE RCD.

5.2 Competency Profile (CP)

Competency Profiles have their own identifier because profiles may be reused and referenced. They have additional metadata beyond title and description because CPs are valuable intellectual property that may make it worthwhile to store at least some of them in repositories and maybe include them in trade transactions.
5.3 Reusable Competency Definition GUID (RCD_GUID)

The Global Unique Identifier is used to identify an RCD, in most cases it's a URI.

It can use the “Catalog/Entry” approach, where an RCD identifier is built from 2 parts that can be concatenated into a single string. This is similar to the IMS and IEEE LTSC building globally unique namespace identifiers in W3C XML.

The catalog part is a globally unique identifier for a catalog or naming authority; for example it identifies Corporation X, the skills inventory at Corporation X, or the O*Net catalog. The IETF RFC 2396 for URI (Uniform Resource Name) defines a format for such identifiers. The identifier may correspond to an ICANN registered domain name (e.g. corporationx.com").

The format of the entry part of the RCD_GUID is specified by the catalog owner or naming authority, who is also responsible to ensure that the entries are unique within the catalog or name space designated by the catalog part of the RC_GUID.

The syntax of the parts of the RC_GUID must be such that, if they are concatenated, the result will be a valid URI string according to RFC2396.

The RCD_GUID is not a standalone building block—it is always included in something else. Therefore a RCD_GUID has no identifier of its own. The RCD_GUID can referencing a so-called Subjectory. A Subjectory is human readable semantic infrastructure that provides a global unique identifier to each concept. If the RCDID is referenced and defined by a Subjectory, the Subjectory is the registered naming authority, and the Entry is the name.

5.4 Qualified Competency Definition Reference (QCDRef)

A Qualified RCD Reference (QCDRef) combines an RCD ID with one or more qualifiers. The qualifiers are applied when the RCD is used to evaluate a competency for a particular person or context.

5. The most common qualifier is a proficiency level. For instance, the European Qualification Framework (EQF) specifies eight levels of proficiency.

6. But there are many other levels: importance, expertise,

7. Or other qualifiers dealing with relevance and confidence rating, ageing

8. US Dept. of Labor’s O*NET specifies qualifiers

A qualified competency definition reference can be included in an assessment prescription or assessment request: “Please assess Jan Hoel for competency X at the level of beginner”.
A difficulty in standardizing qualifiers is that there may be many different scales or vocabularies. For proficiency level, this reference model proposes a simple percentage scale (0% to 100%) onto which different level vocabularies can be profiled. This scale also profiles to IEEE 1484.11.1. It is important to note that the QCDREF has no identifier of its own because it is not a standalone building block—it is always included in something else.

Competency proficiency level scale include optional negative values. This allows direct profiling to the IEEE 1484.11.1 data model and to ADL SCORM 2004. A negative proficiency level could be used to specify a “damaging” level of skill, where a skill has been badly learned in such a way that it can actually cause damage, which is worse than not having learned it at all. A pilot who regularly crashes airplanes might get a worse proficiency score (negative score) than a pilot who has no experience yet (score = 0).

5.4 Competency Profile Node (CPNODE)

Typically, a node in a competency profile represents a particular competency. It may also represent an element or facet of a competency. For example, a competency node may have children nodes that represent aspects such as motor, cognitive and affective aspects.

A node in a competency profile may reference an existing RCD, or not. For example, a node may exist in a competency taxonomy only for the purpose of grouping other competency nodes. In a taxonomy, the node with the title “English skills” might exist only as the parent of other nodes that reference existing reusable definitions for specific skills. If a GUID of an RCD, a proficiency level or other qualifiers are specified, this part of the node data profiles exactly to a Qualified Competency Definition Reference (QCDRef).

Different types of profiles “wrap” a CPNODE into a more complex object, depending on the aggregation structure of the profile. For example, a taxonomy (tree structure) adds possible parent and child relationships to any basic competency profile node.

The node has an identifier of its own because it may be referenced from other parts of the profile structure, or even from outside the profile structure, e.g. there may be a reference to “node x in profile y”.

Competency Profile Nodes have additional attributes that are specific to the hierarchical aggregation structure of the taxonomy. Taxonomy nodes (aka taxon) have a parent node and may have child nodes. Only one node in the taxonomy has no parent; that is the root node. The parent, children and sibling attributes may be implicit rather than explicit. For example, if the taxon is encoded as an XML document, the parent, children and siblings relationships may be implicitly represented by a hierarchy structure in XML

- If a taxon has siblings, it may have a weight relative to its siblings. For example, in a particular competency model, writing skills may be more important than speaking skills.

- If a taxon has children, it may have associated rollup rules that govern how the child competencies “add up”. For example, either A or (B and C) is required.

A competency ontology node is more complex than a competency taxonomy node, because any node in an ontology may be related to any other using semantic rich or poor relations, and/or have different constraints over ruling them.
5.6 Evidence Distillation Request (EDR)

An assessment request is a reusable data object that includes a Qualified Competency Definition Reference (QCDRef) and therefore, a reference to a RCD. In addition to a proficiency level, other qualifiers in the QCDRef may also specify different assessment dimensions.

If the referenced RCD is also represented in a competency profile (list, taxonomy or ontology), the assessment request may include a reference to that competency profile. In that case, the profile can be used to determine automatically which component competencies, if any, will need to be assessed and how proficiency on those competencies will contribute to the target competency.

The assessment request may also include a list of one or more acceptable forms of evidence (see figure 3), which in turn dictate what kind of assessment is acceptable.

The assessment request may be generic, or it may identify a target person or group. For example, it might specify that all new hires need to be assessed on awareness of best practices for personal security.

As shown in the figure above, the universities are responsible for generating different types of evidence records. These evidence records are then contextualized (by linking them to related context where are belong/apply). The reusable evidence records then are distilled –using appropriate algorithm – into an RCD, which is the basic building block for competency profiles. Its is important to note that the distillation process is done automatically using smart algorithms and input from experts in the competency domain.

Evidence distillation request (EDR) application example

Rob wants to specify a standardized way to assess a particular competency for which an RCD exists. He knows that the RCD is also referenced by a node somewhere in an existing competency profile.

Rob creates an EDR that references the RCD through a qualified reference. He also specifies which competency profile should be used to identify other related or component competency definitions for the target RCD.

Paul is a recruiter who needs to assess a candidate on a specific competency. He can look up the EDR's available in his company and can reuse or cannibalize an existing EDR. Paul specifies the person to assess, as well as a particular assessment instrument to use. Paul then passes this EDR to the entity that will administer the assessment.
5.7 Evidence Record (ER)

An evidence record captures a proof of competency for a particular person and a particular reusable competency definition (RCD). The proof of competency is typically summarized as a true/false value. It may also be qualified by a score which represents a measure of satisfaction or proficiency level. Note that this type of record may also be used to represent a documented absence of competency.

The confidence rating is assigned by the entity that manages or receives the data for the competency evidence record. Typically, it is determined by policy and based on the type of data source and the data source itself. For example, if the data source is an applicant’s resume it will typically elicit less confidence than if the data source is a 360° assessment or formal assessment.

A digital signature may be associated with an ER to assert its integrity and authenticity. This may be required by an application policy if this record is transmitted or stored without the supporting data.

The identifier of the person is typically opaque, but can be passed to a resolution system to uniquely fingerprint an individual. If the entity that is asking for resolution person identity is not authorized, the resolution simply fails and privacy and security are maintained.
5.8 Competency Required Evidence Records (CRER)

The Competency Required Evidence Records (CRER) captures the set of required evidence records for a particular reusable competency definition (RCD) of a person/function; in addition to satisfaction and confidence scores. This means that for each RCD, a list of evidence records required need to be identified. Each competency (RCD) can require (and be related) to one or more evidence records (ER).

The proof of competency is typically summarized as the most reliable true/false value available from the Evidence Records (ER). It may also be qualified by a score (satisfaction or proficiency level).

Note that this type of record may also be used to represent absence of required competency.

Evidence to support the competency is provided by one or more evidence records. A competency profile may be referenced, because evidence records might address component competencies, or this record itself might be for a component competency.

Not by accident, this data model profiles to the data model embodied in the HR-XML Competency 1.x specifications. It also allows profiling to the IEEE 1484.11.1 and SCORM 2004 information models for “objectives”

**Competency Record (CR) application scenario**

Debbie is being assessed for a competency defined by an RCD as part of an annual review. This is the first time she is being assessed on this particular competency. She does a self-assessment, her supervisor does a assessment, and HR conducts a 360° assessment that includes this competency. Each of these assessments results in an evidence record (ER) for this particular competency.

The self-assessment evidence comes in first. A competency record is created, referencing the evidence from self-evaluation, that shows that Debbie satisfies the requirements of the competency, with a score of 100%, but this is tempered by a low confidence rating since this is a self report.

Next the evidence from the 360° assessment comes in. It shows that Debbie has a proficiency of 70%. Per company policy, this evidence has a higher confidence rating than the self-report evidence, and thus the competency record is updated to show a score of 70%.

Next the evidence from the supervisor comes in. It states that Debbie is unqualified. However, by company policy the 360° assessment evidence has a higher confidence rating than evidence from an individual supervisor. The supervisor’s evidence is not sufficient to modify the competency record.
Competency Record auditing scenario

Ken is involved in an accident, which brings into question Ken’s mastery of a particular skill. Ken’s competency record show that he satisfies the requirements for the skill, with a score of 90%. An auditor uses the competency record to locate the supporting evidence records, and finds two ERs in the HR database. One shows that Ken stated he mastered the skill on his employment application. The other shows that Ken was assessed for that skill in an online test. The ER record that resulted from that test includes a reference to an Assessment Result Record (ARR) record with all the details of the test. The Assessment Result Record is no longer online, but can be retrieved from the company archives for inspection.

Competency Record use of a competency profile scenario

Ken is involved in an accident, which brings into question Ken’s mastery of a particular skill. Ken’s competency record shows that he satisfies the requirements for the skill, with a score of 90%. The RCD for the skill is referenced by a node in a competency profile, which is identified in the competency record.

The competency profile is used as a guide to identify the component competencies for the skill in question. The RCD_GUIDs for those competencies are used to look up the corresponding competency records, to determine whether Ken was deficient on any of those component competencies. This lookup fails for one of the component competencies. There is no competency record stating whether Ken is qualified on that component competency. Ken needs to be assessed on that component competency, because this may have been a contributor to the accident.

FINAL NOTE:

It is increasingly clear that a "task model" (taxonomy or ontology of the tasks) separate from a competency model (collection of RCDs and small, ad-hoc competency hierarchies) may be the way to go to make it all work, where:

- **task** = something that is done, or that needs to be done
- **competency** = what the person or team doing a task needs to master in order to be able to do the task

A reusable task definition has about the same "aggregation structure" as a competency definition (see Task in ASAT), in that it has:

- title
- description
- statements (action, condition, criteria)
- possible related tasks

Task definitions can be assembled in a "job description" that also provides context for each task, e.g. "removing a wheel" can be a task in a garage mechanic job description, but can also be a task in a convoy driver job description. By recognizing that there are a lot of those (e.g. thousands of occupational definitions) that may be very complex, it is possible to keep the competency/training side of things simpler and manageable by not having to represent all that complexity in the simpler competency models (simple trees) used for training.
### Appendix 5: List of Associates and contacts

#### 6.5.1 List of TENCOnpetence associate partners and contacts

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<td>Distinguished Visiting Scholars Programs. Joint publications Joint applications for research funding. Co-experimentation and validation of LT.</td>
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<tr>
<td><strong>3</strong></td>
<td>Pilots with integrated system, evaluation and dissemination.</td>
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<td><strong>4</strong></td>
<td>Collaboration and exchange of achievements.</td>
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<tr>
<td><strong>5</strong></td>
<td>Future user, technology service provider to members, promotion of best practices, dissemination.</td>
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<tr>
<td><strong>6</strong></td>
<td>Dissemination and collaboration in LD., knowledge and competence development education process modelling.</td>
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<td>IMS-LD pedagogic CATD scenario. Evaluation of CATD support tools in Seville university.</td>
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<td>Exchange of doctoral students. Joint virtual research seminars. Dissemination in Baltic region.</td>
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<td>Joint training and activities. Collaboration in pilot and software component development. Contribution to use cases.</td>
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<td>Pilot design prototype of adaptive testing, test with math students. Disseminate and evaluate field test</td>
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### D10.4: Report with an assessment of the WP results including ID10.12-ID10.17

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6.6 Appendix 6: Individual partners sustainability plans

6.6.1 Agora

Agora is planning to continue working with the Personal Competence Manager after the end of the project, building on the success of the pilot carried out during the project. The main areas to be addressed will be mainly the same as during the pilots, i.e. competence development in ICT, English and Spanish for foreigners which are the areas of most needs. The learning path guidance provided by the Personal Competence Manager is particularly relevant to Agora, because it is intended to use the system in self-study open access sessions which are scheduled into learners timetables. Indeed, at the time of writing the system used in the pilot is in use in the open access self study sessions scheduled for Agora participants. These are held in a computer room with the attendance of a technical support person. The principal challenge is in the development of new competence profiles and materials, but it is expected that the improvements in this aspect of the Personal Competence Manager since the close of the pilot will help considerably with this. In any event it is expected that some training will be necessary for the teachers and volunteers who will be setting up the system for learners.

6.6.2 Altran

Opportunities: TENCompetence tools and methods could be integrated in the Altran Technologies intranet for extending our services regarding:

- Knowledge Management, HHRR, Formation Departments
- Map Consultant’s Competencies
- Help in career development
- Look for experts in specific areas
- Creation of social networks
- Suggest Courses to consultants
- Look for Candidates in specific areas.

Deployment: There are three lines for the valorisation of TENCompetence main results (tools and methods). First the possibility of using tools internally, second to offer them to our clients and third to use Competence Management methodology and domain model to extend our offer in knowledge management consultancy. First two ones require the implementation of a Business Demonstrator able to show main functionalities to Altran directors and managers and to our clients. However, in case of the new tools that will be provided in the last version will cover previous requirements, we will follow a deployment plan as follows:

1. Install a Business Demonstrator (just done for Mechanical Engineering in Aeronautics) to check and analyze the functionalities presents in the versions available in June. Extend it to other areas of Altran companies.
2. Extend this Business Demonstrator with the tools of the final version of
TENCompetence. This will be carried out in the first quarter of 2010.

3. Internal use
   - Study the different choices for integration of the tools in Altran’s ERP
   - Adapt models and concepts of TENCompetence to our systems
   - A Competences Map has been included in the company’s ERP that allows classifying the competences of the personnel following a knowledge tree. This tool, that is already deployed, is used by the consultants to map its knowledge, to find experts in a concrete theme, to identify what training courses has been taught related to a specific knowledge area, what projects has been done or are been accomplished regarding to a knowledge area, what candidates to a job offer has been evaluated having knowledge of a concrete area, etc.
   - An Observatory has been included in the company’s ERP that allows identifying the consultants with similar profiles to a given one.

4. External commercialisation
   - The AltDesign commercial Line of Altran Technologies and the Direction of Operations of Altran CIS has been in charge of identifying potential customers interested in competence management.
   - HHRR departments of major companies
   - Technological firms and multinational companies (to facilitate hire and mobility)
   - Define Altran offer in Competence Management based on:
     - Helping clients to develop competences map for their own company
     - Developing tools to manage profiles and competences inside their own intranets or ERPs (matching, observatory, etc.)
     - Helping clients to define learning path and career plans based on personal competence development plans.

5. Altran Technologies will remain a member of TENCompetence Foundation to ensure the continued development over the long term.

Actions to be taken
The following roles will take responsibility for deployment.
1. Knowledge Management Direction will be in charge of the deployment plan
2. Further development through our Information System Department
3. Strategy and Organization Direction
4. AltDesign line in Altran Technologies and Operations Direction of Altran CIS will be in charge of the commercial development.

Budgets: The budget involved will be from the Quality Assurance and Knowledge Management department. This department has a budget to develop and to deploy support systems and tools.

Training: A Foundation team dedicated to technical support to solve possible problems, incidences and questions would be desirable.

Opportunities for deployment of TENCompetence software products in Spain
From a commercial point of view, Altran Technologies could use the TENCompetence concept and its tools by driving the offer mainly to two kinds of companies. Firstly, those enterprises dedicated to the HR and people selection like staffing agencies: This kind of companies could have interest in the TENCompetence concept and its tools lie in all the improvements carried to find the more appropriated profiles from the definition of competences needed to cover the job offers. In this way, these companies could offer to its clients, better fits of the profiles of the selected people to the demanded necessities in a shorter period of time. Secondly, Consulting and Engineering companies: The focus should be in medium and large enterprises (more than 250 employees) and multiple national or international head
offices, with a high number of projects and very high level of mobility of engineers from one project to another. The necessities that TENCompetence can cover in this kind of enterprises are similar to the ones studied in this Altran Technologies pilot. This are: Selection of external candidates to hire, definition and development of the career development of the engineers, selection and assignment of the best professionals to work in a project, finding experts to give technical support to a determinate project, definition of the teaching requirements for each profile and assignment of the most appropriate courses for the engineers according to their competences and objectives.

6.6.3 Bolton

Opportunities
1. Bolton has a policy of becoming a “Professional University”, i.e. focused on preparing learners for participation in the workplace at a professional level, and meeting needs of professionals for extending their competences and gaining new ones. A wide range of courses are offered, many of which are components of wider qualification frameworks. The PCM provides a means whereby this offering can be contextualised, and support can be offered to learners in navigating towards their desired competence profile.

2. University of Bolton expansion in Ras Al Khaimah, United Arab Emirates. The same educational experience is to be provided at both campuses, though the courses are delivered by non-UK staff. This creates a requirement for a unifying description of the educational experience which is greater than that normally required at a face to face institution.

3. Presentations have been made of the PCM to the Bolton University HR department in using the PCM to facilitate the new personnel development provision for Principal Lecturers.

4. The Wookie widget server (within Bolton and beyond) as a means of delivering flexible services.

The IDIBL project establishes an inquiry based learning approach for the University. A pilot has been run to use the Learning Design Toolkit to define the workflow for the negotiation of a learning contract, and it is planned to extend this with the new Astro player. The PCM has a potential application in facilitating of learners’ navigation through the space of possible support available to them in their enquiry.

5. The IEC runs a Masters in learning technology, aims to use new developments in learning technology worked on in the department in delivering the course, in particular the LD Toolkit. This will be a key component of a module currently under preparation for delivery in China, where the work of TENCompetence has attracted attention. More generally, Learning Design will become part of the department's technology that will underpin aspects of the research that we undertake, including business games, and models of pedagogy.

Constraints
There is pedagogic and organisational resistance to technological change. There are currently major technological changes at (e.g. a new VLE, Moodle), plus well established technologies. It is hard to argue that a new technology is required, which will not duplicate current functionality. So propositions for introduction of new technologies have to be very carefully managed.

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14 [http://www.bolton.ac.uk/ProspectiveStudents/CourseGuide/Cpd.aspx](http://www.bolton.ac.uk/ProspectiveStudents/CourseGuide/Cpd.aspx)
The Wookie Widget server is constrained by resistance to added complexity in the Virtual Learning Environment. However successful demonstration of this seems to have overcome this resistance.

Use by the Bolton HR department is constrained by the current review of competence structures (HERA). Once this is completed the HR department would like to conduct a pilot with the PCM.

The Professional University policy is relatively new, and the transformation to be achieved not fully articulated. It is therefore hard to be sure how the PCM will fit with the policy as it evolves.

The competence approach used by the PCM has the potential to support the unification of criteria in Bolton's campuses abroad. However is not one of the core TENCompetence use cases, and work will need to be done to apply the system in a new way.

Deployment. Bolton will deploy the PCM with the LD Toolkit. It will also maintain participation in Wookie use and development, in the context of the Apache Incubator.

**Tools:**

Wookie will be deployed experimentally to add services to the institutional VLE (Moodle).

The pilot use of the Learning Design Toolkit in the context of IDIBL will be furthered. Liferay based PCM system will be used in pilot activities to assess the viability of its use within the context of the Professional University policy. A pilot is under discussion for representation of the University of Bolton CPD offering.

**Roles**

Use of the TENCompetence outputs in University of Bolton will be coordinated by Dai Griffiths, Reader in eLearning at the Institute for Educational Cybernetics. His role will be to support the process of planning and implementing use.

The use of the Wookie Widget server will be coordinated by Scott Wilson.

Use of outputs in IDIBL will be coordinated by Stephen Powell, and subject to approval by the IDIBL project.

**Budgets**

The use of Wookie is funded by internal projects in the University of Bolton. A business plan has been developed as part of the submission of the software to the Apache Incubator.

The IDIBL project is funded by the departments who run the individual courses which make use of the IDIBL methodology. Costs will be minimal as we have in-house expertise.

CPD offering would be funded by core University of Bolton budgets.

**Actions required.** Bolton needs to establish new strategic partnerships and promotional activities, which can be carried out in the context of and with the support of the Foundation.

At present each school of the University is engaging with the business community in its own area of expertise, with no coordination. This will be necessary for use of the PCM in facilitating the Professional University policy. This alliance building has started with the business school or the engineering dept and built environment, which have the greatest unmet need for up-skilling. The Foundation representative from Bolton will coordinate this work. As regards support for the Professional University policy, the system has already been demonstrated university decision makers, including the Head of Collaborative Partnerships and Employer Engagement, and an internal demonstrator will be prepared with the final PCM system. The PCM has also been demonstrated to the academic director of the Ras al Kaimah campus with a good reception, and the application of the PCM will also be explored in 2010.

New partners will be required to help University of Bolton develop innovative
applications of the Learning Design Toolkit e.g. business games, which may lead to future shared projects and funding proposals.

**Training**
Training in IMS LD related technologies can be handled in house by University of Bolton. Use of the PCM will require training as soon as possible in the key functionality available, particularly PDP and competence definitions.

**Sectors in country**
Most promising from University of Bolton perspective are business, built environment, engineering, creative industries.

Health is a possible area, but it has a very well developed competence based structure already, which may make adoption difficult.

In the wider context, government agencies and other public bodies with responsible for social welfare are a good target.

In all these areas, overcoming traditional practices is a major challenge, cutting across the areas identified. Moreover, the tradition of competence based approaches is viewed poorly because of history. In many areas the use of the PCM would be easier to achieve if the word competence were completely avoided.

### 6.6.4 Giunti

**Opportunities**
The principal opportunities for use of TENCompetence products in Giunti Labs are as follows:

4) Using LearnWeb in other research projects.
5) Maintaining contacts with our current Business Demonstrators.
6) Linking LearnWeb with Giunti Labs’ tools, mainly the Hive repository.
7) Combine Giunti Labs’ offering with Open Source tools.
8) Possible knowledge sharing among Giunti Labs’ employees.

**Constraints for the use of TENCompetence products:**
First of all, the link of TENCompetence tools with Giunti Labs’ tool requires the adaptation of some drivers and the compliance of the formalisms.

Second, the combination of proprietary products with open source tools raises some IPR issues.

In case of combination with tools coming from other research projects (e.g. TARGET Knowledge Sharing Platform), a technology alignment will be necessary.

**Deployment plan:**
Giunti Labs plans to deploy the results with the following guidelines:

- Giunti Labs is considering taking advantage of LearnWeb as a starting point on the way to implement TARGET Web 2.0 Knowledge Sharing platform. A possible variation is the usage of the proprietary Hive repository in place of Fedora.
- Support to Business Demonstrators for future projects. This implies both to support University of Genoa, who already finished the first pilot, and to support University of Florence, who delayed the pilot.
- Widening products and services offering.
- Internal circulation of awareness.
**Actions to be taken**
*Which tools will be deployed, and for who?*

LearnWeb, as a tool for searching and sharing knowledge between community users. Who in what role will manage of the deployment plan, and what in general terms are their responsibilities?

The responsible for the deployment of TENCompetence tools in Giunti Labs will be the Project Portfolio Control Board (PPCB). The PPCB is responsible for handling a portfolio of projects given a constrained pipeline. The PEA (Project Execution Approval) gate is under its supervision. Members are:
- Chief Operation Officer (COO)
- Chief Marketing & Sales Officer (CMSO)
- Chief Financial Officer (CFO)
- Sales Directors
- Chief Solution Architects
- Project Management Officer (PMO) and Lines Managers (SW Development/Content Development/Test/Support).

*How will this be funded (after the TENCompetence funding period), and what are the budgets involved?*

The budget involved will be either from the Production Department or from Research Funding. This Production Department has a budget to develop and to deploy support systems and tools.

*What needs are there for future users be trained & supported? What services are required to support the users?*

A team dedicated to technical support to solve possible problems, incidences and questions will be desirable.

**Opportunities for deployment of TENCompetence software products in Italy**

Giunti Labs is an international company, working all over the world. We plan to promote the TENCompetence-based products with the same effort both to Italian market and to world-wide market. In the specific of Italian market, we think that local government bodies could be the most interested in TENCompetence products, as well as third-age associations and educational centers.

**6.6.5 UHANN**

**Opportunities:** LearnWeb enhanced with the InterWeb platform provides a platform for integrating, evaluating and showcasing knowledge management tools that are under development at the UHANN – currently GroupMe! and SpreadCrumbs.

**Constraints:** At July there were shortcomings in the tool set of the PCM which precluded commercial exploitation. For internal application support would be required from management, via the eLearning Support Group, ELSA, and integration with Stud.IP institutional system would be necessary. Therefore Hannover aims to concentrate its efforts on LearnWeb 2.0. In any event adoption of tools should start with small scale experimentation and iterative refinement.

**Deployment:** LearnWeb 2.0 will be deployed as an experimental tool for the support of knowledge management as a platform for integrating our own experimental tools, GroupMe! and SpreadCrumbs. The initial target group will be UHANN staff, who will use LearnWeb 2.0 for knowledge management at the workplace. Regular use and feedback will be solicited by means of targeted studies.
Roles: The final responsible for the deployment plan is the head of our group at the UHANN, Wolfgang Nejdl. At the moment, the responsibility is delegated to Eelco Herder.

Budgets: LearnWeb 2.0 will be used in internal projects at least during the next two years. Two Ph.D. students will continue to be involved with the tool as part of their Ph.D. research. The actual budget depends on the evaluation of outcomes and prospects. Most likely we will position LearnWeb 2.0 in the NoE Stellar as well.

Training: A team dedicated to technical support to solve possible problems, incidences and questions will be desirable.

6.6.6 INSEAD

Opportunities: The principal opportunities for INSEAD are in the use of TENCompetence Tube in different versions and adaptations. At CEDEP, in INSEAD Programmes, and in other educational and non-educational institutions.

Constraints: The principal constraints identified are the lack of familiarity with Web 2.0 tools shown by some users, and difficulties in using TENTube behind a firewall.

Deployment: INSEAD will deploy TENTube after carrying out further developments that it was not possible to carry out in TENCompetence.

Tools used: TenTube:
GMPTube, used in the General Management Programme (GMP) at CEDEP.
Laboranova project. InnoTube supports and stimulates innovation-centred knowledge exchange among distributed groups and communities.
Eagle Tube and ChangeMasters Tube to support and stimulate experience exchange and innovation-oriented collaboration among people deploying our management simulations.

Roles: CALT will take responsibility for the deployment and diffusion of TENCompetence Tube.

Budgets: Internal R&D budgets, and potentially new EU project submissions, Cost of development: 80,000 Euros.

INSEAD changes needed: We believe we have reached a mature stage; minor adaptations will be required for different deployment contexts.

Training: We currently have a User’s Manual and Training Videos. If demand grows, we plan to offer a workshop on how to best deploy TENCompetence Tube.

Sectors in France: There are opportunities for TENCompetence products in France in a wide range of sectors: Research, Teaching, Business, Public Sector.

Actions to promote: Quick links to articles and webpages describing TENCompetence Tube.

6.6.7 Logica

Opportunities: The Personal Competence Manager could be used in our HR department
● to regulate LOGICA’s HR processes
● creating competence profiles of LOGICA staff
● using the assessment functionality to assess its employees
● use the tools to support and provide training to its employees
● as an internal repository for sharing and communicating information.
Constraints
1) LOGICA has its own systems to offer its client readymade solutions and services.
   1. to match consultants with job openings
   2. to track and assess the development of its consultants.
LOGICA’s first priority is to align these processes worldwide. It will then look at tooling.
2) Replacing current systems with TENCompetence products would lead to high costs with a major technical impact on the organization (over 40,000 employees).
3) Prior to offering PCM based services to interested organisations, there needs to be access to professional support, and the tools need to be proven in business use.
4) TENCompetence themes are not of daily interest for customers, who presently focus on reducing production costs rather than optimizing HR processes. Moreover LOGICA’s business typically has a short run-time whereas in TENCompetence this is much longer.

Deployment: LOGICA currently has no plans to deploy the PCM in a commercial context, but expects to create a demonstrator.

Sectors in Holland: There is demand for more technology in learning environments in the Netherlands, in primary, secondary and universities. We see a lot of SAP methodology being integrated.
Schools are merging into big organizations to combine forces on mostly administrative level. New technology could
   • cut these costs
   • provide the users, students and teachers, with a standardized registration and student tracking system.
The Foundation could collaborate with suppliers of student management systems, like SAP, who could learn and improve their products looking at the strategy and project outcome of TENCompetence.

6.6.8 OUNL

Opportunities
The major OUNL student cohort is between 30 and 45 years old, and employed. These are professionals who want to keep up to date in their field, who want to advance their career, or who want to make a career shift. These motives closely resemble the major TENCompetence use cases, and thus the infrastructure developed by TENCompetence can be expected to meet their needs.

Constraints
OUNL is a distance learning university, formally part of the Dutch higher education system and thus bound by its legislation. Some of the central TENCompetence concepts like acknowledging competences acquired on the job, keeping up to date through professional learning networks, tailor-made development trajectories, etc. do not fit well the traditional higher education structure, practices and funding regime.

Deployment plans
The TENCompetence concepts and tools will be implemented in two of OUNL’s core processes: a) its educational offering through the OUNL faculties, and b) its regional function as an expertise centre in the field of life long learning.

New OUNL business model based on TENC concepts and tools
Within OUNL the TENCompetence project is conducted by the Centre for Learning Sciences and Technologies (CELSTEC), responsible for OUNL’s R&D remit. Two years ago CELSTEC organized a one-week strategy session with the OUNL Board and Deans to investigate options to introduce the TENCompetence ideas in OUNL’s educational
offering. This was followed up by several more of such meetings, eventually resulting in the draft of a radically new business model for OUNL early 2009. This has now been approved by the Board, and a two-year pilot with two OUNL faculties will start in September 2009. The Board has allocated € 1.5 mln. for the pilot.

The model is based on a subscription system with various membership-types related to different use cases: free membership of a professional community, use free online tools (as developed by TENCompetence), access open educational resources, and in general keep up to date; basic membership to keep up to date and to be able to study and sit exams for certified courses; and a premium membership to study and receive expert learning and career development services. In addition it will be possible to buy additional services (extra tutoring, exam opportunities, assessment on previously acquired competences, etc.).

The technical infrastructure to support this membership model will be implemented in Liferay, applying the tools developed by TENCompetence.

_The following steps are planned in piloting and implementing the new OUNL business model:_

a) **R&D:** this is the TENCompetence project, which ran till December 2009
b) **Pilot project for two OUNL programmes:** starting in September 2009 and fully operational in 2011
c) **Implementation projects of all OUNL programmes:** starting September 2010
d) **Exploitation:** For the two pilot programmes by January 2011, the other OUNL programmes will follow after that

Step 1 is carried out by OUNL-CELSTEC as the coordinating partner of the TENCompetence project, while step 2 will be carried out by OUNL-CELSTEC within the context – and financed by – the OUNL. The two pilot programmes to be piloted in step 2 are Learning Sciences & Technologies and Informatics.

Steps 3 and 4 will be carried out under direct coordination by the OUNL Board, and will build on the experiences gained with the two pilot programmes under step 2.

In these two pilots OUNL-CELSTEC will gain experience with configuring the technical infrastructure; implementing the tools and services; developing the corresponding work processes and systems; devising new roles and functions, and training staff. This way the pilots will provide information on the required effort, costs and implementation speed for steps 3 and 4.

**Health Academy Limburg**

OUNL participates in the Health Academy Limburg, a consortium of educators and service providers in the health sector. The consortium was formed to address the issue of Netherlands’ aging population, and the staff shortage – quantitative and qualitative - that is already apparent in the sector, but which is expected to lead to serious problems within a few years. The province of Limburg is ‘leading’ in the Netherlands in this respect, with the highest average age and the lowest birth rate.

OUNL participates in this consortium as the expertise centre in the field of blended and lifelong learning. The OUNL Board has contributed € 100,000, to the first phase of the project, through staff input, a.o. to lead the Work Package that designs the consortium’s future ICT architecture, which is expected to incorporate many of the concepts and tools from TENCompetence.

**Vocational Training Platform**

The Health Academy Limburg has attracted national attention, and as a result was requested to submit a proposal for extending its scope to the national level for the Platform Beroepsonderwijs (National Vocational Training Platform). This has recently (November 2009) been approved, with a total budget of € 2 mln. One of the three components of this 3-year project will be the design and (pilot) implementation of a
'virtual health services architecture' comprising TENCompetence concepts and components like competence profile editing and management, the Personal Development Planner, a life long personal e-portfolio, acknowledgement of previously acquired competences, and learning networks.

**Service Centre Life Long Learning Limburg**

This is another regional consortium, in which OUNL partners with vocational and higher vocational institutions to support the private sector organizations in competence development through learning networks as part of their HRM strategies. Assessment of previously acquired competences and the innovative application of ICT tools like those developed by TENCompetence are the central aims of the consortium. These will be applied in pilots with a.o. process industries and the health sector. All partners have contributed to the start-up phase, and the Province of Limburg approved the funding proposal in October 2009, and the formal kick-off is planned for March 2010.

**6.6.9 Sofia University**

CIST at University of Sofia is one of the main providers of Lifelong training services in Bulgaria, and as such is interested in using the whole TENCompetence platform for various training offerings, tailored to the user needs.

We are also interested in providing the TENCompetence framework as an open lifelong competence development framework to the whole society by hosting the main hardware servers needed for the use of the framework.

University of Sofia is planning to deploy the results of the project and use them both for the needs of the internal education process in the University, as well as for the providing of lifelong training services to all users interested from them.

We are planning to establish various partnerships related to the joint use of the TENCompetence platform and tools, mainly with already registered TENCompetence associated partners. At first place we are planning to continue our collaboration with the Ministry of Education and Sciences in further developing and enlarging the ICT Teacher training Program. We also plan to continue our cooperation with the Technical University in order to provide several new business demonstrator projects at several SME’s. We have close contacts with the biggest Chamber of Commerce in Bulgaria in order to develop competence profiles for various economic sectors and on the base of this to prepare complex lifelong competence development and evaluation programs for all these economic sectors. ; next week TENC will be presented at an industry event in Sofia. At the Sofia University itself the TENCompetence framework is used in three MSc programs for teachers education, software development and business innovations. We also reuse some of the TENC tools in other EC funded projects like ShareTec and OpenScout.

We are planning to deploy all TENCompetence tools and to use them both for education of students, as well as for providing lifelong competence development services for external consumers.

We will continue to use the same team, who was responsible for the implementation and the support for the whole TENCompetence framework during the project lifecycle.

The continuing use, deployment and reuse of the TENCompetence framework and tools will be funded by the Scientific and Research Department of the University, from the financial sources accumulated from all research projects executed in the University, including those in which TENCompetence framework is used.

We already accumulated enough experience in providing TENCompetence tools and framework for external projects and regard the current practice as a real success, so we don’t plan any significant further changes in this direction.
We think that there are good opportunities for deployment of TENCompetence software products in Bulgaria, which have been proved by the pilots and business demonstrators already implemented.

We will provide TENCompetence framework first in the public education sector, and will support all the main lifelong competence development initiatives in Bulgaria. Also, we will provide lifelong competence development services to all Bulgarian companies, who are interested in formalizing their job competence profiles and developing individualized personal lifelong competence programs for their employees.

From our experience so far, the Web-based tool look more promising, as they are flexible, independent, easy to manage and configure. We would be interested to see how LifeRay can be used for hosting all web services, and all additional portlets as well.

In order to promote better the use of the TENCompetence framework and software tools, the training and marketing instruments need to be more reliable and complete, and a continued effort is needed to maintain and improve the professional quality of the software.

6.6.10 FBM-UPF

There are two potential opportunities for use of TENCompetence approach and products in FBM-UPF:

a) Lifelong competence development of the FBM-UPF teachers.

FBM-UPF has a Center for Teaching Quality and Educational Innovation\(^{15}\) (CQUID, because of the acronym in Catalan), in charge of providing opportunities for teachers to continuously enhance their teaching competences or develop new competences depending on the needs identified (e.g., usage of the virtual campus, how to write a subject matter plan according the EEES guidelines). In this respect, the CQUID has identified the following problems:

- University professors are very busy, and the number of activities offered each year is so high that makes it difficult for teachers to identify and plan the activities more relevant to them.
- The activities are proposed according to what the teachers demand in general and along the needs that emerge from the educational policy changes, but they do not respond yet to a FBM-UPF strategy of leading the professors to have a specific teaching competence profile (whose competences may differ in the different teaching domains: medicine vs. engineering).
- The teachers often participate in more informal learning sessions (e.g., teaching innovation workshops) external to the CQUID. The CQUID cannot track these actions.

The TENCompetence approach and products could help the CQUID to define teaching competence profiles for their university teachers, so that they can plan their personal learning plans identifying the activities that best suit their needs. The ePortfolio would be of special relevance, since it would allow teachers to collect the CQUID or external evidences supporting the competences they master.

b) Visualizing competences and subject matters, ePortfolio and informal learning opportunities for University students.

The TENCompetence products can offer solutions to the following problems identified by

\(^{15}\) http://www.upf.edu/docencia/en/
the Teaching Quality and Innovation Unit of the Engineering Education Studies. 

- Students lose the global view of the competences they are developing along the studies and how the different qualification levels are related to the subject matters.
- They do have a virtual campus with closed communities for each subject matter but lack of a place to informally discuss and share.
- The facilitation of students’ mobility between universities in Europe because of the definition of competences (more easily comparable) needs still supporting tools.

The FBM-UPF researchers participating in TENCompetence planned to meet key decision makers in order to discuss the deployment of the results of the project. The main constraint that is foreseen at the institutional level is that the university has recently adopted an LMS (Moodle), which has been and is continuously been adapted to the needs of the institution. The introduction of new products needs to be carefully managed. A point of success would be the transparent integration (in terms of final users, i.e. authentication) of tooling. In order to tackle some of the problems identified (mobility of students, definition of teaching competence profiles) the deployment of the TENCompetence results could be eventually deployed in partnership with other institutions (other universities in Spain and Europe).

The approaches or/and tooling that are considered to be deployed are competences visualizations, planning and ePortfolio portlets in Liferay (in the case of b) University students), and planning and ePortofolio portlets in Liferay (in the case of a) University teachers).

The use of the TENCompetence outputs in FBM-UPF will be coordinated by Davinia Hernández-Leo, Lecturer/Researcher at FBM-UPF and Director of the Teaching Quality and Innovation Unit of the Polytechnic School at FBM-UPF. Her role will be to support the process of proposing, planning and implementing use. The funding will come from educational innovation projects internal to FBM-UPF, the Generalitat of Catalonia or the Spanish Ministry of Education.

In terms of training, the CQUID and La Factoría supporting services for professors at the FBM-UPF would need an initial training in the approaches/tooling so that they can support teachers and students later. A continuous support by TENCompetence Foundation would be also probably required by these services at FBM-UPF. In general, we think that there are opportunities for deployment TENCompetence results in Spain (mainly, the PCM as an integrated system that can be customized according to specific needs). Pilots and business demonstrators have shown that interested organizations have been mainly SMEs that need flexible and personalized approaches to offer internal competence development and social services for competence development (such Agora). A website of reference with discussion forums, demonstration of tools and (user and developer) manuals would promote the use of TENCompetence.

16 http://www.usquidesup.upf.edu/en
6.7 Appendix 7: Articles of Association of the TENCompetence Foundation

On this fifth day of October, two thousand and seven, there appeared before me, 

\textit{mr.} Hubertus Maria Laurentius Simons, notary practising in the municipality of 

Voerendaal:

Eric Kluijfhout, born in Vlissingen on the twenty-seventh day of August nineteen 

hundred and sixty, (identity card number: IF4325719, issued in Voerendaal on the seventh day of August two thousand and six), residing at Jeustraat 53, 6367 EV Voerendaal. 

The person appearing indicated the wish to create by this deed a foundation subject to the 

following articles of association:

\textbf{Name, Registered Office and Duration}

\textbf{Article 1}

1. The foundation is named: \textbf{Stichting TENCompetence}.

2. Its registered office is in the municipality of Heerlen.

3. It is established for an indefinite term.

\textbf{Objects}

\textbf{Article 2}

1. The objects of the foundation are to support individuals, groups and organisations in 

Europe in the life-long development of their abilities by developing and promoting the 

most suitable technical and organisational infrastructure, by making use of open-

source, standards-based sustainable and innovative technologies, and anything related 

directly or indirectly thereto or which can benefit the same in the broadest 

interpretation of the words.

2. The Foundation attempts to realise its objects through:

1. Facilitating and providing leadership to the TENCompetence developers’ network 

by means of:

a. Coordinating development activities;

b. Managing software assistance;

c. Managing software issues and versions;

d. Monitoring how the software is used;

e. Monitoring developments and trends in other applications;

f. Organising ‘coding sprints’ and ‘plug fests’;

g. Organising and providing training;
h. Hosting software services necessary for the PCL to function, and the collecting of URLs required for this purpose.

2. Facilitating the TENCompetence users’ network by means of:
   a. Acting as a bridge between users and vision development;
   b. Support and training;
   c. Collating and evaluating experiences with the system from Leven Lang Lerenden;
   d. Monitoring new requirements;
   e. Operating a Competence Development Network for training;
   f. Hosting Competence Development Networks showcases;
   g. Providing information about TENCompetence and its benefits;
   h. Coordinating and publicising services offered by TENCompetence.

3. Facilitating of vision development by means of:
   a. Organising meetings to share visions together, where appropriate, with external experts;
   b. Keeping the Vision Group up to date, where necessary by renewing it;
   c. Motivating the Vision Group;
   d. Facilitating discussions;
   e. Documenting interactions;
   f. Publishing results (internally and/or externally).

3. These three activity clusters are the responsibility of three leaders or leadership groups, consisting of the TENCompetence aspirant partners and full partners: the Development Group leaders, the User Group leaders and the Vision Group leaders, who perform the activities as described in Article 2 section 2. The task of the Development Group can be expanded by the direct development of software through the recruitment of such developers by the Foundation.

4. Types of involved parties and their roles. The Foundation has three types of parties involved in its activities, with roles as follows: Subscriber, Aspirant Partner and Full Partner.

1. **Subscriber**
   The simplest form of involvement in the Foundation is to subscribe to the objects of the Foundation by signing a declaration. This gives the subscriber a right to:
   - updates on developments through mailings, such as newsletters;
   - participation in forums, public meetings and Special Interest Groups;
   - access to the Partner website (or parts of it).
   This limited form of involvement enables the Foundation to create a sufficient size
of community of involved parties that at some later point in time may wish to play a more active role. In exchange for this, the Foundation provides information, knowledge and networking opportunities. Individuals and organisations may both be subscribers. The value of an organisational involvement as a subscriber consists primarily of mutual recognition, exemplified by the use of each other’s logos on websites, etc. Individual subscribers are automatically accepted by signing the aforesaid declaration whereas organisational subscribers must be accepted by the Board.

2. Aspirant Partner

The nature of the activities carried out by aspirant partners will differ according to the progress of the TENCompetence project. As each project phase is completed, there will be an increasing understanding of the opportunities for TENCompetence to develop Life-Long Ability Development within its own organisation. At the end of the TENCompetence project, activities will develop from pilots into operational implementations of the TENCompetence concepts and a set of tools in the day to day work of the partners.

A Memorandum of Understanding is drawn up for each aspirant partner, setting out the relationship between the partner and the Foundation. Aspirant partners can contribute to the Foundation’s activities in many ways, including:

- working on the software code, maintaining the operation of a software service needed for the PCM, or providing funds or personnel;
- maintaining the software used within the organisation itself, where coordination is to the benefit of both parties;
- disseminating the work of the organisation (e.g.; for organisations such as EUCEN and EDEN);
- using the software in important activities together with institutions or user groups that can contribute to future development of the system through, for example, identifying user experiences;
- contributing to the development of guidelines for future investment and decision-making;
- developing specific software services, based on the TENCompetence infrastructure, for specific educational niches.

In return, the aspirant partners define the benefits of their participation in the TENCompetence activities. These are set out in the Memorandum of Understanding, and could, for example, relate to access to pre-releases of a software code, expertise of services, and participation in inter-organisational and
3. Full Partner
The representatives of the TENCompetence consortium partners can act as full partners. Aspirant partners can subsequently become full partners and current consortium partners are able to leave the Foundation at the end of the TENCompetence project. The status of full partner is recognition of the contribution made to the Foundation through providing funding or possibly personnel. The minimum annual financial contribution is determined each year and at the time of establishment of the Foundation is set at €500 (five hundred euros). If a full partner fails to pay this, this is a ground for the Foundation to terminate the status of full partner and for the Board to dismiss the relevant director. In such a case, the Board may however reinstate the status of full partner if this is in the interests of the Foundation.

5. Memorandum of Understanding. The Foundation will enter into an agreement with aspirant partners which will be formalised by a Memorandum of Understanding. This Memorandum of Understanding sets out the relationship between the aspirant partner and the Foundation, for example the formal relationship between an open source software foundation and the Foundation within which the two work together to develop software. The approval of the Board is required before entering into a Memorandum of Understanding.

6. Open access. All materials resulting from the Foundation’s activities as described in Article 2, section 2 will be public and freely accessible. The TENCompetence software will be available under the open source BSD software licence (New-BSD, 3-clause; http://www.opensource.org/licenses/bsd-license.php). Articles, reports documentation, etc., will be available under the Creative Commons Attribution-ShareAlike licence (http://creativecommons.org/licenses/by-sa/2.5/nl/). All software code, documentation and development products are managed in a Concurrent Versions System Repository.
1. The board of the Foundation shall consist of at least three members whose first appointment is by this deed. The number of members – having regard to the condition in the previous sentence – shall be determined by unanimous vote of the Board, consisting initially by virtue of this deed of three persons.
2. Immediately following the establishment of the Foundation the partners in the TENCompetence Consortium will be asked to become Full Partners and for their representative on the Consortium Board to be delegated as Board member.
3. The Board (except for the initial board, the members of which are appointed) shall choose from its members a chairman, vice-chairman, secretary and treasurer. The functions of secretary and treasurer can also be filled by one person.
4. Board members representing an organisation must have received full mandates for this.
5. Board members are appointed for an indefinite term. If there is any vacancy on the Board, the remaining Board members shall decide by unanimous vote (or the one remaining Board member shall decide) on the appointment of the relevant number of replacement Board members within two months of the vacancy/vacancies arising.
6. If for whatever reason the Board is without any of its members, then the remaining member or members will nevertheless form a legally constituted Board.
7. The members of the Board are not paid for their work, although they are entitled to reimbursement of the costs incurred in the performance of their functions.
8. In the performance of its activities, the Board shall be supported by a manager or a management team responsible for:
   1. The strategic development of the Foundation in line with new developments in:
      - technology;
      - activities;
      - financing;
      - etc.
   2. Operational management (the management and operation of the system), including:
      - coordination of facilitators;
      - resource management;
      - monitoring;
      - etc.

These two functions can be carried out by one person in the role of Chief Executive Officer, or by a management team if the scope of the work and availability of funds justifies this. If the function of Chief Executive Officer is not filled, the role is taken by the secretary or such other Board member as designated by the Board.
Board meetings and decisions

Article 5

1. Board meetings

   The secretary or such other Board member so appointed by the Board shall convene
   Board meetings and draw up an agenda at least fourteen (14) days before the meeting.
   The agenda should include all relevant background information in respect of the
   proposals. Decisions may not be made in relation to matters not on the agenda unless
   they are approved unanimously by all Board members in attendance.

   Meetings must be convened at least twice per year, and as frequently as the chairman
   shall deem desirable and/or where one-third of the Board members request a meeting
   in writing to the chairman, setting out precisely the matters to be dealt with. If the
   chairman does not comply with such a request so that the meeting can be held within
   three weeks of the request, those requesting the meeting are themselves entitled to
   convene the meeting having regard to the stipulated formalities.

2. Chairing meetings

   Meetings shall be chaired by the chairman of the Board. If he is absent then the
   meeting shall elect its own chairman.

3. Quorum and voting

   The Board can only take binding decisions at a meeting if such meeting is attended by
   the majority of Board members or their representatives.

   The Board may also take decisions outside meetings providing that all Board members
   have had the opportunity to communicate their opinion in writing, telegraphically, by
   telex of telefax, or by e-mail. When a decision is taken in this manner, the responses
   sent in will be collated by the secretary into a report to be appended to the minutes
   after they have been signed by the chairman.

   Each board member has the right to cast one vote.

   Insofar as these articles of association do not prescribe any greater majority, then all
   Board decisions shall be passed by an absolute majority of votes validly cast.

   Abstentions are deemed to be votes not cast.

   All voting at a meeting shall be oral, unless the chairman deems written voting to be
   desirable or if any party with a right to vote requests written votes. Written votes must
   be by unsigned, sealed papers. In the event of a virtual meeting, voting shall be by e-
   mail or by some other verifiable method.

4. Veto

   A Board member may only issue a veto with regard to admitting a new Full Partner, if
   such aspirant partner constitutes a threat to the interests of the relevant Board member
and/or the organisation that he/she represents. In such a case the veto can be quashed by a unanimous vote in favour by all Board members present, providing that they represent at least two-thirds (2/3) of the full complement of Board members.

5. **Representation**

A Board member may be represented by a fellow Board member upon production of a written mandate deemed sufficient in the opinion of the chairman. A Board member can only represent one other Board member.

6. **Minutes**

Minutes shall be taken of the matters discussed at the meeting by the secretary or such other person present at the meeting designated by the chairman. Minutes of Board meetings shall be made available to Board members without delay. Board members have fifteen days after the minutes have been distributed to raise comments about them. Thereafter, the definitive draft minutes will be adopted at the next meeting (whether or not convened for that purpose) and signed by the persons who acted as chairman and secretary at the meeting to which the minutes relate.

**Powers of the Board and representation**

**Article 6**

1. The Board has the task of managing the Foundation, which includes:
   - preparing and drawing up the annual implementation plans;
   - financial matters, including the drawing up of annual financial reports;
   - organisation and re-organisation of the Foundation;
   - defining and maintaining standards, including quality management procedures; architecture, software and technology standards; and open source licences.
   - appointment of the chief executive officer and possibly of other members of the management team;
   - acceptance and reimbursement of full partners;
   - amendment of the Foundation’s articles of association;
   - resolution of problems and conflicts;
   - winding-up of the Foundation;

2. The Board is authorised to enter into agreements for the acquisition, disposal or encumbrance of registered land.

3. The Board is not authorised to enter into agreements that bind the Foundation as a guarantor or principal joint debtor, or provide guarantees or undertakings for the debt of another party, unless the decision to do so is taken by a unanimous vote of all current Board members.
4. Bequests may only be accepted with the benefit of an inventory.

**Article 7**

1. The Board represents the Foundation at law and extrajudicially.
2. The authority to represent the Foundation is vested in two Board members acting jointly.
3. If there is only one current Board member, then he/she alone may represent the Foundation.
4. The Board may grant a mandate to one or more Board members, or to any third party, to represent the Foundation within the limits set out in the mandate.

**Termination of membership of Board**

**Article 8**

1. Board membership shall end:
   a. by written notice of retirement, or retirement pursuant to Book 2, Article 298 of the Dutch Civil Code;
   b. through death or being placed under guardianship;
   c. through insolvency or request for a moratorium;
   d. through dismissal by the Board in accordance with the following provisions.
2. The Board may only dispense with the services of a Board member other than at his/her own request if this decision is taken at a specially-convened meeting at which the member in question is given the opportunity to make representations.
3. At this meeting, at least two-thirds of current Board members should be present or represented. The decision must be taken by a majority of at least three-quarters of validly cast votes.
4. In the event that the majority of two-thirds of current Board members as specified in section 3 are not present or represented, the decision to dismiss can be taken at a second meeting convened for this purpose irrespective of the number of Board members present or represented, provided that the decision is taken by a majority of three-quarters of the votes validly cast.
   Such a second meeting must be no sooner than two weeks and no later than four weeks following the first meeting.

**Financial year and annual accounts**

**Article 9**

1. The financial year of the Foundation runs concurrently with the calendar year.
2. At the end of each financial year, the Foundation’s books shall be closed. The treasurer shall draw up a balance sheet and profit and loss account for the financial year just ended, which financial accounts (accompanied by a report from a chartered accountant
or accountant / financial consultant) shall be presented to the Board within six months of the end of the financial year.

3. The annual accounts shall be adopted by the Board.

**Regulations**

**Article 10**

1. The Board is entitled to draw up regulations covering those matters that are not covered by these articles of association.

2. These regulations may not contradict these articles of association or the law.

3. The Board has power to amend or suspend these articles of association at any time.

4. The adoption, amendment or suspension of such regulations is subject to the provisions of Article 11 section 1.

**Amendment of articles of association**

**Article 11**

1. The Board has power to amend these articles of association. Such a decision must be taken by a majority of three-quarters of votes validly cast at a meeting at which two-thirds of Board members are in attendance or represented.

   If two-thirds of Board members are not present or represented, then no sooner than two weeks and no later than four weeks after this meeting a second meeting shall be convened and held, at which the decision discussed at the previous meeting may be taken, irrespective of the number of Board members present or represented, provided that the vote is carried by at least three-quarters of the votes validly cast.

2. Unless the amendments are made by notarial deed, they will be invalid.

3. The Board members must file an original copy of the amendment, together with the amended articles of association, with the Trade registry of the Chamber of Trade and Industry for the district in which he Foundation has its registered office.

4. Every Board member has the authority to execute the relevant deed.

**Merger**

**Article 12**

The Board has power to decide on a merger within the definition of Book 2 Title 7 of the Dutch Civil Code.

A decision to merge is governed, *mutatis mutandis*, by the provisions of Article 11, sections 1 and 2.

**Dissolution and winding up**

**Article 13**

1. The Board has power to dissolve the Foundation. Such a decision is governed by the provisions of Article 11, section 1.
2. Following its dissolution, the Foundation continues to exist insofar as this is necessary to wind up its assets.
3. The Board shall wind up the Foundation.
4. Those persons winding up the Foundation shall ensure that the dissolution of the Foundation is recorded in the register referred to in Article 11, section 3.
5. During the winding up, the provisions of these articles of association shall remain in force as far as possible.
6. Any credit balance in favour of the dissolved Foundation shall be applied as far as possible in accordance with the objectives of the Foundation.
7. Upon completion of the winding up, the books and documents of the dissolved Foundation shall be kept by the youngest Board member in age involved in the winding up, for the period of time specified by the law.

**Final provisions**

**Article 14**
The Board has the power to decide upon any matter not covered either by the law or these articles of association.

The party appearing before me then stated that, pursuant to the provisions of Article 4, sections 1 and 3, the first Board members of the Foundation to be appointed are:
1. Evert Jan Robbert Koper, born in Amsterdam on the fourteenth day of March nineteen hundred and fifty-seven (identity card number: ID4309148, issued in Valkenburg aan de Geul on the twenty-first day of March two thousand and five), residing at Putweg 10, 6301 KL Houthem, in the municipality of Valkenburg aan de Geul, married, appointed as chairman;
2. Eric Kluijfhout, aforesaid, appointed as secretary;
3. Joseph Petrus Jacobus van den Broek, born in Terheijden on the sixth day of September nineteen hundred and fifty-seven (passport number: NG6836514, issued in Heythuysen on the thirtieth day of June two thousand and four), residing at Eikendreef 6, 6081 EA Haelen, in the municipality of Leudal, married, appointed as treasurer.

This deed was executed in Voerendaal on the date specified in the heading hereto.
The person appearing has proved his identity to me, notary.
He has been given and has had explained to him the content of this deed.
The person appearing stated that he did not require the content of this deed to be read out in full, that in good time before its execution he had received a draft of the deed and that he understood its contents, and that he agreed to a limited reading of its contents.
Immediately thereafter there was a limited reading of the deed after which it was signed by the party appearing and by me, notary, on #