A FORESIGHT STUDY OF TECHNOLOGY-ENHANCED PROFESSIONAL LEARNING IN EUROPE

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ABSTRACT

The paper presents recent findings from a pan-European foresight study on the future of technology-enhanced professional training. First the paper reviews existing technology roadmapping methodologies and introduces a new approach to developing a roadmap for technology-enhanced professional training. The proposed methodology involves the key phases of identification of prevalent visions (foresight analysis) and gap analysis. Interesting findings from the first foresight analysis phase, which identified the future visions, are presented and discussed.

KEYWORDS: Technology enhanced professional learning, Foresight, Roadmapping, ICT-based training

1. INTRODUCTION: The premise of this foresight exercise

The aim of this foresight study is to map out the desired future for technology-enhanced professional learning (TEPL) in the form of prevalent visions in the community at large. The study represents the first phase of a larger technology roadmapping activity aiming to provide a 10-year-span technology roadmap for European professional training, an initiative which has been launched within the PROLEARN Network of Excellence.

The PROLEARN Network of Excellence [1] focuses on identifying the emerging future e-Learning scenarios and contexts, in the form of future technology-enhanced professional learning resources, and the use of these learning resources for professional training in Small/Medium Enterprises (SMEs) and larger companies. In pursuing this, the PROLEARN Network of Excellence aims to also advance the state-of-the-art in the critical areas of personalized adaptive learning and interactive media, with learning resources connected to real-world settings and reusable in different contexts. The Network has identified the key challenge to be faced in the future with regards to professional training as "the provision of successful and effective technology-enhanced professional training in a variety of real professional situations". The PROLEARN mission is to bring together renowned research groups in the area of professional learning, as well as other key organisations and industrial participants, thus bridging the currently existing gap between (a) research and education at universities and similar organisations and (b) training and continuous education that is provided for and within companies. Through Network awards, best-practice examples, showcases and workshops, the Network's aspiration is to advance European professional training in technology-enhanced environments, and through roadmaps and policy guides, to chart and analyze future trends of the evolution of future professional training tools, environments and scenarios.

In the strife to arrive at a shared vision for e-learning, which is today one of the most distinctly multi-disciplinary sectors driven by technology, it comes as no surprise that roadmapping is one of the most effective tools available. Indeed, technology roadmapping has become a widely used technique during the past decade, on the level of both individual companies and entire industries.

The present paper first describes in detail the specific methodology employed within PROLEARN in order to compile a roadmap for professional technology-enhanced professional training for the mid-term future (the following 10 years). It then follows on to describe the work of the first phase (vision foresight) and discusses preliminary results. The work has brought together external experts and industry stakeholders in order to synthesize and combine knowledge. During this phase, it is important to bring together people with different expertise and scientific backgrounds. For this purpose a high-level symposium with researchers, academics, industry experts and policy makers was organized where the seed visions

were discussed and extended by others [21]. Interviews with companies, forums and virtual communities, and online questionnaires have also been specially set up to collect the views from a wide pool of stakeholders across Europe.

The roadmap is intended to be used as a tool for collaborative strategic planning, which will contribute towards the creation of a shared vision for the future, with emphasis on the anticipated changes in technology, socioeconomic trends and new business opportunities [1]. In our context, a roadmap is a practical guide, which associates the current state-of-the-art with the areas of technology-enhanced professional training of the future. A roadmap should not be considered as a forecasting tool, but rather as a tool for strategic collaborative planning, in order to create a common vision and to provide assistance in planning a course of anticipatory action. Although its limitations are evident - for example, it cannot be guaranteed that its assumptions will be either accurate or timely - its practical application is invaluable, especially for decision- and/or policy-making in the technology and business areas of interest. A roadmap is a time-based plan that defines where we are (state of the art), where we want to go (vision statements) and how to get there (action plan). Specifically the PROLEARN roadmap aspires to be able to identify which R&D areas need to be further nurtured and strengthened and which technological, business and pedagogical sectors of professional training will most likely play a major part in this arena 10 years from now in Europe. Furthermore, as it will be explained in detail later on, in the proposed framework the roadmap is viewed as a learning process for the interested community, which is one of the elements that differentiate this approach from many contemporary roadmapping methodologies.

The time scope of the intended roadmap extends up to the year 2015 and the focus is primarily on the European societies and economies, although to a large extent, the developments in those sectors taking place in other regions will also be reviewed, particularly for regions that are expected to bear significant impact on the evolution of the TEPL domain (e.g. USA, Canada, Australia and others). The roadmap will be developed after a series of steps has been completed so that the future state of technology-enhanced professional training has been adequately analysed, and no inconsistent assumptions or forecasts are being made with regard to the future.

Section 2 presents a brief overview of important aspects of roadmapping and existing roadmapping practices. Section 3 introduces the new approach developed for the purposes of this roadmapping activity and describes in detail the proposed methodology. The next two sections describe the foresight phase, which includes scenario building/analysis (Section 4) as well as derivation of prevalent visions (Section 5), and discuss the results. Section 5 summarizes the findings and draws some conclusions.

2. TECHNOLOGY ROADMAPPING APPROACHES

2.1 What is a technology roadmap?

Technology roadmapping has become a widely used technique during the past decade from the perspectives of both individual companies and entire industries. However, a standard definition of technology roadmapping does not exist, and an examination of roadmaps that have been created indicates that there is considerable diversity among practitioners as to what constitutes a roadmap and the roadmapping techniques employed [2]. During the late 1980s, technology roadmapping was pioneered to help companies anticipate and clarify resource and performance requirements and to plan and systematically manage and integrate complex projects. Naumanen [3] defines a roadmap as a map of presumed future and anticipated changes, comprising of illustrations of market trends, environmental changes, and technology lifecycles, linked together into tangible product line plans and considering the corporate objectives and competencies. A roadmap helps to create an “objective” shared vision with attention to changes in technology, socio-economic trends, new business opportunities, designs and processes.

Roadmapping serves as a tool for collaborative strategic planning and as such it enables us to derive concrete actions needed when striving for the desired futures. Just like any other documented strategy, the roadmap as an end-result should be continuously tested and improved. The success of an industry roadmap is measured against how effectively it has been communicated to and recognized by the relevant stakeholder groups. The value of roadmapping lies largely behind its capabilities to foster and enhance consensus building.

2.2 Overview of Roadmapping approaches

Probert and Radnor [4] estimate that as many as 250 U.S. industry roadmaps exist, a number of which were supported by the U.S. Department of Energy Office of Industrial Technology. Industry (or sector) roadmaps are also becoming widely adopted in Europe. ICI Canada has recently published a roadmapping guidebook [5] for government employees, which divided the types of roadmaps commonly in use into four main categories:

- Industry technology roadmaps, used to assess and extrapolate the direction of market-driven requirements within

an area of technology, and then identify R&D strategies to meet those requirements;
- Science and technology roadmaps, used to select from among emerging technologies;
- Product roadmaps, used by companies to identify the technical processes, and accompanying opportunities and risks, associated with the development of a specific product or service;
- Program roadmaps, used by government or private sector organizations to evaluate how emerging issues might affect the strategic direction of a long-term program.

According to Kappel [6], roadmaps are classified in terms of two dimensions: roadmap emphasis and roadmap purpose (Figure 1).

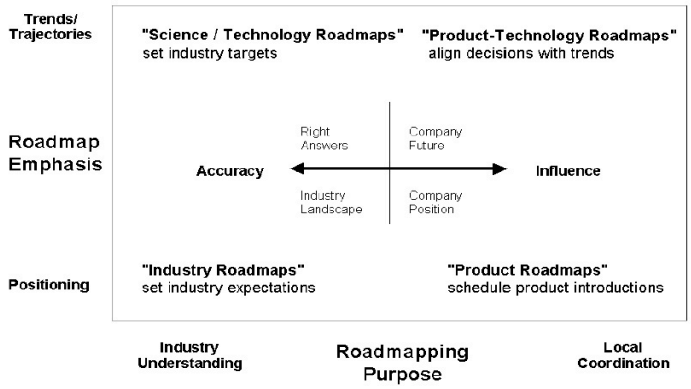

Figure 1. Kappel's Roadmapping Taxonomy.

The horizontal axis delineates between roadmapping activity developed for the generation of insights at the industry level or for coordination at the company level. The vertical axis differentiates the roadmaps themselves by their content emphasis, which can be placed either on specific trends or on positioning within an industry.

More recently, the ROCKET survey in 2002 [7] identified 5 different main categories for roadmaps. In addition to Kappel's taxonomy, the ROCKET project recognizes organizational process roadmaps and replaces product-technology roadmaps with program roadmaps thus emphasizing the sector-based (industry) approach to roadmapping [4, 9]:

- Industry technology roadmaps, used to assess and extrapolate the direction of market-driven requirements within an area of technology, and then identify R&D strategies to meet those requirements;
- Science and technology roadmaps, used to select from among emerging technologies;
- Product roadmaps, used by companies to identify the technical processes, and accompanying opportunities and risks, associated with the development of a specific product or service;
- Program roadmaps, used by government or private sector organizations to evaluate how emerging issues might affect the strategic direction of a long-term program.
- Organisational Process roadmaps involve planning for the change processes within organisations. These are often similar in scope to business process re-engineering exercises.

Garcia and Bray [8] highlight the major uses of and benefits derived from technology roadmapping. The three major benefits are:

1. Roadmaps help build consensus among decision makers about a set of technology needs,
2. Roadmapping provides a mechanism to help experts forecast technology developments in targeted areas, and
3. Roadmaps present a framework to help plan and coordinate technology developments at any level: within an organization (company), throughout an entire discipline (industry), even at cross-industry (national or international) levels.

In a nutshell, the most prominent benefit from technology roadmapping is the provision of information to help make better investment decisions. Furthermore Kappel argues that the roadmapping process not only produces more informed individual decisions, but brings with it better alignment of organizational decision making [6].

In a previous investigation of the roadmapping methodologies of recent projects and initiatives [22], a set of common features has been identified (Time2Learn network, 2004 [10]; BRIDGES group, 2002 [11]; SCORM, 2003 [12]; eLearnTN network, 2003 [13]; IMTI, 2003 [14]; IMS groups, 2000 [15]; Cognitiative, 2002 [16]). Among the initiatives reviewed, the majority have adapted roadmapping methodologies developed by earlier initiatives. The BRIDGES Roadmapper [11] builds on the experience from the IMS groups (Intelligent Manufacturing Systems Expert Group,

Technology Map for Manufacturing [15]) and the IMTI (The Integrated Manufacturing Technology Initiative is a US industry/government partnership that facilitates collaborative development of critical manufacturing technologies [14]). The Time2Learn network [10] adapted the IMTI model for a roadmapping purpose, while the eLearnTN network [13] and the ROCKET project [7] adopted the BRIDGES Roadmapper methodology [11].

3. THE PROPOSED ROADMAPPING PROCESS AND ITS IMPLEMENTATION IN FORESIGHT ANALYSIS

The proposed PROLEARN roadmap aims to provide us with the information of where we are (current state) and were we want to go (vision/foresight/desired future) and from this point we can determine how we can get there (action plan). The process includes the following stages (Figure 2):

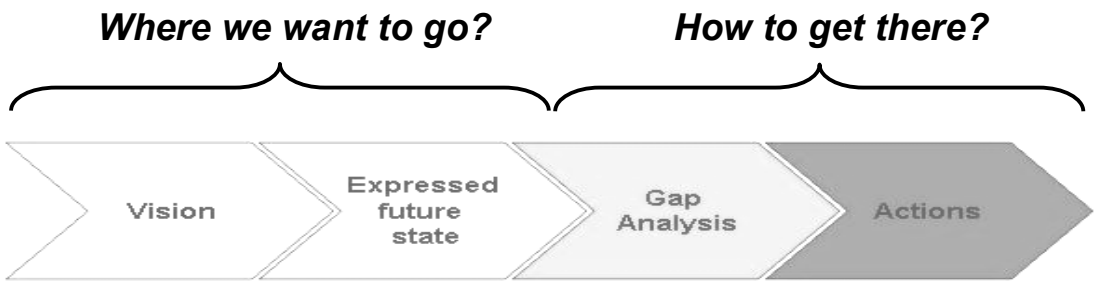

Figure 2. Roadmapping stages.

Vision: tacit idea representing the desired future state

Expressed future state: instantiation of the vision in a formal and systematic way

Gap analysis: between the current state of the art and desired future state (critical capabilities needed to implement one or more vision statements)

Actions: a portfolio of short-, mid- and long-term actions and recommendations, based on the gap analysis

In Figure 2, the first two stages comprise the Foresight phase (outputs: Vision statements and Expressed future state) and the last two stages comprise the Planning phase (outputs: Critical capabilities and Recommended actions). Thus the overall methodology is segmented into two phases:

Phase 1 – Foresight: Scenario-building and Vision statements. In this phase, the future scenarios and the shared visions are identified and effectively the framework is set up for the subsequent gap analysis. Scenarios will be used as one of the means to derive and define the visions, in terms of the core concepts, the influential factors and alternative directions.

Phase 2 – Planning: Gap analysis, Critical capabilities, and Recommended actions. In this phase, the critical elements for achieving the vision statements will be identified and a Gap Analysis of what is available and what is missing (that is necessary for the future) will be performed. The needed critical capabilities will be derived from the visions, and the gap analysis between the current state of the art and the future "desired" state will be carried out. The comparison with the current state of the art will determine as to what extent current R&D and business practices match the desired future states. At this stage, a roadmap will be derived for each vision. Each roadmap will address a single vision and will provide specific guidelines and tasks for the evolution of the related concepts, a time frame and R&D recommendations, and requirements pertinent to the specific vision. Inter-dependencies with other derived roadmaps will also be mapped and discussed.

The following discussion will be concerned with the Foresight Analysis (Phase 1) which has already completed a full cycle and on which results from the analysis are available at the time of writing. In this first phase the main principle is about "finding the currents that lead you where you want to go" (proactive), instead of "floating in the currents you are presently in" (reactive). However, one should bear in mind that everyone tries to formulate their own desired future, and as a result of this no one will have the exact desired future, which means that a lot will depend on negotiation and the future reality will be shaped by the ongoing interplay that will actually come in the future.

In our context, roadmapping is a knowledge creating process that spirals outwards from the core partners of the

PROLEARN Network (individuals, groups, the whole Network) via the Network's associated partners, to the entire scientific community and industry. Therefore, it is both a learning activity and a knowledge creation process for the community that builds the roadmap. We have modelled this knowledge creation process using the general SECI process framework, known as the "SECI Spiral" (Figure 3).

According to Nonaka et al. [17, 18, 19], the key to knowledge creation lies in the following four SECI modes of knowledge conversion, which occur when tacit knowledge and explicit knowledge interact with each other:

1. Socialization (sharing tacit knowledge): The process of sharing experiences (tacit knowledge), thereby creating new tacit knowledge.
2. Externalization (converting tacit knowledge into explicit knowledge): The process of articulation and conversion of tacit knowledge into explicit knowledge.
3. Combination (Systematic combining of explicit knowledge): The process of restructuring and aggregating explicit knowledge into new explicit knowledge.
4. Internalization (Internalizing new knowledge as tacit knowledge by the organization): The process of reflecting on explicit knowledge and embodying explicit knowledge into tacit knowledge.

Our roadmapping process framework (Figure 3) is derived from the general SECI process framework [17, 18] by replacing the triplet of social entities {Individual, Group, and Organization} with {Core Partners, Associate Partners, and Scientific Community & Industry}.

Knowledge creation in a roadmapping exercise is a continuous process where individuals and groups transcend their boundaries by acquiring a new context, a new view of the subject domain, and new knowledge. Knowledge is created through the interactions among individuals or between individuals and their environment thus producing a collective understanding of different views, opinions, visions, intuitions.

To this end, the micro and macro dimensions interact with each other, and changes occur at both the micro and the macro level: The existing visions of the core partners of the PROLEARN network (micro) influence and at the same time are influenced by the environment (macro) with which the network interacts.

As a result, existing visions that are embedded both in the ideas, plans, activities and challenges of PROLEARN partners transcend the boundaries of PROLEARN and through this spiralling interaction a more collective understanding is achieved.

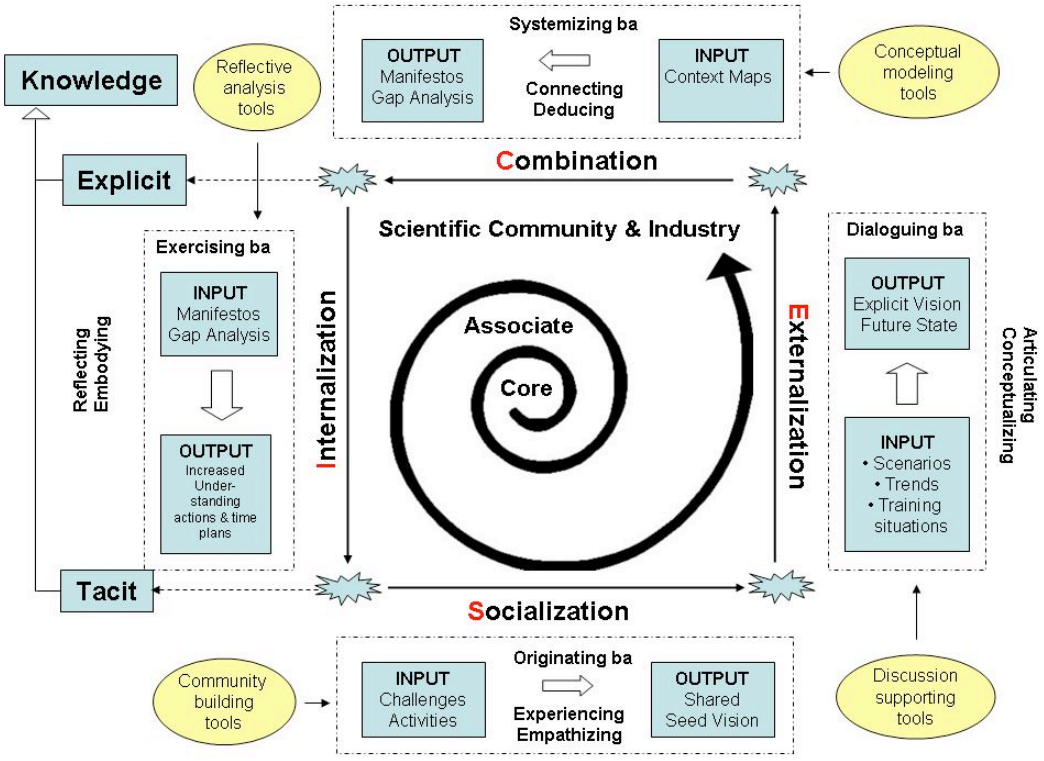

Figure 3. The PROLEARN Roadmapping Process Framework (based on the SECI model).

During the Socialization process, networking activities and community building tools are important. Face to face meetings, various workshops, and virtual meetings were organized to bring together the wider community of the PROLEARN network (both core and associate partners) on a common contextual platform and tap into their collective experience and knowledge.

During the Externalization process, we started by raising awareness of the key issues involved in TEPL, and we tried to express implicit concepts and ideas originated during the socialization process. Individual views and visions were expressed via scenarios produced by PROLEARN partners, and by other experts and initiatives, and also through brainstorming sessions where individual visions were discussed and extended. These activities provide us with a good indication of what TEPL means for different stakeholders in a variety of Professional situations. Desktop research and online surveys are also used during this phase. The aim is to create seed visions that can be used as input for starting a dialogue with external groups.

The next step was to initiate a dialogue with external experts and industry stakeholders in order to synthesize and combine knowledge. During this phase, it is important to bring together people with different expertise and scientific backgrounds. For this purpose a symposium with researchers, academics, industry experts and policy makers was organized where the seed visions were discussed and extended by others. Interviews with companies, forums and virtual communities are also set up in order to test, validate and update the vision statements.

During the Combination process, the outcomes of the dialogues are analyzed in order to clearly systematize concepts, identify trends and factors influencing those concepts and analyze their relationships. During this phase we use conceptual modelling tools. The different context maps will be studied and the final vision statements in form of so-called "Manifestos" will be derived. The resulting knowledge will be formulated and presented using the Conzilla browser tool.

During internalization process, This explicit knowledge, in turn, can be reflected upon and internalized into new tacit knowledge. The vision statements will be internalized following wide dissemination of the manifestos.

This is not a linear process as it will follow at least one more cycle of the SECI Spiral. Figure 4 describes the spiral process which transcends individual views and experiences to collective knowledge at a macro level (definition of desired future state – shared vision).

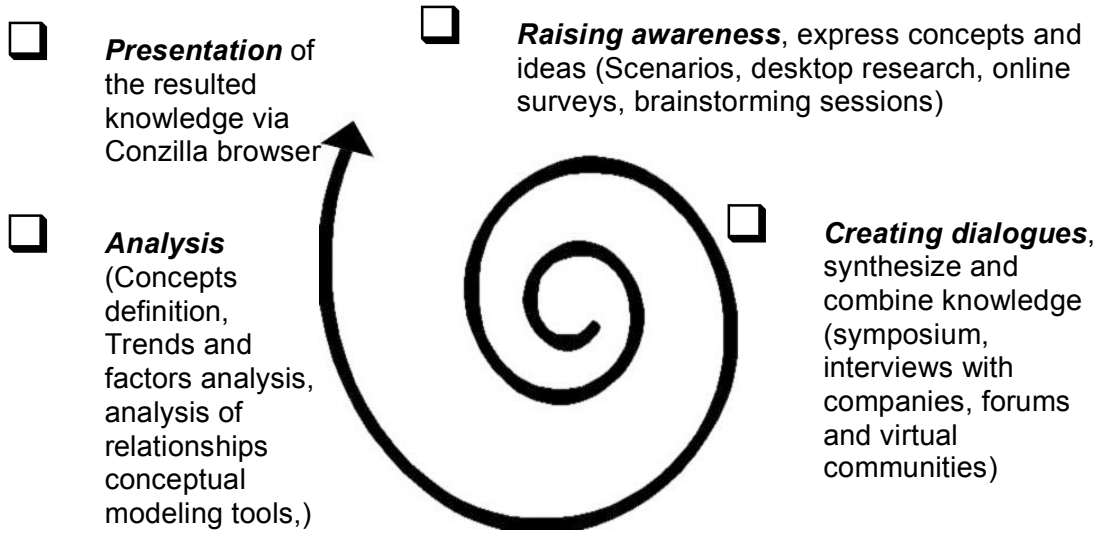

Figure 4. The Foresight activity is underpinned by collaborative knowledge building (a spiralling process of knowledge creation from individual views to collective knowledge).

As explained earlier, the Foresight Analysis took into account both micro and macro levels and encompassed a wide range of activities to support it. The micro level involved raising awareness in relevant foresight issues in TEPL and

included: Scenario writing; Scenario processing and analysis; Extraction of First set key factors; Organization of an International Workshop to derive the initial set of vision statements - PROLEARN Summer School Roadmapping Workshop [23]; Literature studies and desk research; Preparation and circulation of questionnaire on trends and survey to test the questionnaire.

The macro level involved synthesizing and combining knowledge and expertise and encompassed raft of related activities, including: International Roadmapping forums; Multi-target large scale online survey on trends (employing the EducaNext portal, the EU CEDEFOP portal, and the PROLEARN Vocational Competency Centre); a High-Level Symposium with International Experts [21], which produced the second version of the Vision Statements; Interviews with companies (to generate discussion on the vision statements); Set up of virtual communities on the web (employing the EU CEDEFOP portal, and the PROLEARN Vocational Competency Centre); Derivation of future states of TEPL – final version of vision statements.

4. SCENARIO ANALYSIS

In order to draw the roadmap between the current state (As-Is) and the desired future state (To-Be), detailed possible future scenarios were developed. The training solutions described in the scenarios represent realistic everyday training in ten years from now in various professional situations.

Twenty five scenarios were processed and analyzed and the key drivers and factors per scenario were identified. During the scenario analysis process, we have described the primary focus of each scenario as the scenario training context, the business requirements as the driving forces behind the scenario, and the focus areas, where the focus should be if one wanted to realize the scenario. The sources for the 25 scenarios were the following: 11 scenarios have been independently developed by Prolearn core and associated partners, naturally focusing on their respective areas of expertise and based on real market needs; 7 scenarios were analyzed from the work of Norris et al. [20]; Time2Learn Thematic Network (EU): 1 scenario; ROCKET project (EU): 2 scenarios; Ariel Project (EU): 4 scenarios.

Results from Scenario Analysis

Business requirements affecting TEPL

Analyzing the scenarios, we start from identifying the key business requirements which are considered to be the driving force behind the scenarios. The rationale behind these groups of drivers is primarily economic, centred on the use of TEPL in order to improve competitiveness in EU companies.

We have identified 4 different sets of business requirements. Each set has a different focus. The first 3 sets are more focused on the intrinsic business requirements and are differentiated by the intended result of training. The last set is focused more on the market requirements and the emergence of the knowledge exchanges and new ways of knowledge management.

TEPL supporting Continuous Improvement in Companies (micro level): This set concerns changes usually in small scale contributing to the continuous improvement in companies (day to day business, incremental improvements in performance).

TEPL supporting Business Process Re-engineering in Companies (medium level). This set is related to the needed business process re-engineering that take place within the companies.

TEPL supporting Goal Oriented Change in Companies (macro level): This set relates to company changes that are usually of large scale and on a strategic level.

Knowledge exchanges. This set relates to market requirements that have mainly to do with the emergence of Knowledge Exchanges and new ways of Knowledge Management.

Focus areas for TEPL

The next step in our scenario analysis was to identify main priority areas where most of the new challenges are found. We have identified two main areas, the technology one and the socio-cultural one.

Technology Area. Within the technology area, four themes of rapid advancements have emerged: Knowledge markets;

Content Development, management and delivery (anytime, anywhere); Processes, models and infrastructures; "Ambient Intelligence".

Socio Cultural Area: Within the socio-cultural group, the focus areas are: Collaboration & Communities of Practice; Informal learning, capture and exchange of tacit knowledge; New University structures (i.e. Corporate University)**;** Universities as providers of learning services adapted to corporate needs (e.g. New business models for market-oriented design of academic learning solutions); Associations (Professional, Trade Unions) offer access to experts and communities of practice.

5. VISIONS

Initial findings included both the identification of major trends and the articulation of vision statements for the desired future state. We have employed a number of instruments to identify major trends and derive vision statements from stakeholders, including: International Roadmapping forums; Interviews with companies (to generate discussion on the vision statements); Virtual communities on the web and Multi-target large scale online survey on trends (employing the EducaNext portal, the EU CEDEFOP portal, and the PROLEARN Vocational Competency Centre). From the outputs of these instruments as well as the outputs of the scenario analysis above, a raft of *major trends*, which are perceived to be highly influential for the future of TEPL, were identified and categorized as follows:

Market. The *producers* are becoming *consumers* and vice versa – there are indications that this distinction is now becoming irrelevant.

Products and Services. There is a move from *standardized* forms of production and delivery to *customized* forms and from *in-house* operations to more flexible *outsourced* forms.

Company structures. There is a move from *vertical position-based hierarchies* to *horizontal project based interdisciplinary teams*.

People. Career paths are changing - rather than being *employees*, more and more people are now *self –employed*. There is also a move from *national/ethnic identities* towards increasing impact of *interests and motives*. We are also witnessing a *young population* rapidly getting older (*aging population*).

Employees. At the workplace there is a move from *close supervision* to more *independence and responsibility*. Also Europe faces an undeniable trend of an *aging workforce*.

Skills. In the skills base, there is a move from *simpler* to *more complex* skills and from *slowly changing* to *faster changing*.

Work patterns. There is a move from *serial (8 hours)* to *parallel (24/7/365)* work patterns.

Business processes. There is a move from *low capital costs* to *customer perceived values* and from *value chains* to value *nets*.

Companies. Enterprises are witnessing a move from *production of goods* to *provision of services*.

Workforce and eLearning market
In an attempt to summarise the collected views on the effects on the workforce, the general trend seems to be that the new pressures of globalization, competition, skilled labor shortage, and high work complexity are forcing us to work longer and harder, travel more and learn faster. In the eLearning market, the trend seems to be towards a *commodity market* and *commercialization of learning*, both representing highly controversial situations.

Core vision for TEPL in 2015

The PROLEARN Summer School Roadmapping Workshop [23] integrated the results from the various foresight activities and came up with the following core vision the future TEPL: "To support knowledge workers with technology-enhanced learning by promoting motivation, performance, collaboration, innovation and commitment to lifelong learning." In this context, a *knowledge worker* is defined as someone who doesn't just consume knowledge but who is able to create it and who reflects critically on every level of activity in the organization and contributes back. This core vision was broken down into six vision statements that reflect different societal needs.

The six vision statements

Vision statement I: Information Society Challenge. *"Everyone should be able to learn anything at anytime at anyplace."*
The goal is to deliver the right content at the right time for the right person. There are several supporting factors for this vision:
Freedom to select and manage one's own learning
Availability of large variety of choice
Recent advances in Technologies, which can support and facilitate Ubiquity, Mobility, Ambience and Creation, storage, management, access at anytime anyplace
Knowledge brokers
Open content exchanges
Market pull

Vision statement II: Industry Challenge. *"Learning as a means to support and enhance work performance."*
The main goals are to support performance improvements, business process re-engineering and the development of competencies, engineer a shift towards performance driven processes, and provide links between business processes and learning processes. There are many supporting factors:

Realistic Training
Work-based learning activities (including environments, processes, performance standards, performance indicators
Assessment of qualifications and performance
Open Networking infrastructures
The convergence of Knowledge Management, Learning Management and Business Processes
Communities of Practice
Customization of content and learning services
Individual learning strategies which tied to performance and compensation

Vision statement III: Industry Challenge. "*Promote innovation and creativity (entrepreneurship) versus task- and business process-oriented learning."*
This vision encompasses a variety of goals such as:

Goal oriented Changes at strategic level
To develop meta-competences
Human Capital Growth
To promote entrepreneurship
To cultivate and externalize tacit knowledge
To encourage Knowledge sharing
Thinking out of the box
Creativity
Asking the right questions
Leadership

There many factors which support/ can support this vision:

Increased responsibilities & independence
Fast Recovery Mechanisms
New organizational structures
New roles for HR managers
New rewarding schemes
New learning methodologies
Balance between structured and unstructured learning
Value nets
Intelligent Agents
Knowledge networks
Gaming and Simulations

Vision statement IV: Learner's Perspective and Personal Development. *"Learning as a means to increase employability."*

The goals in this vision include resilience, employability, and personal growth. There are several supporting factors:

- Personalization
- Adaptivity
- Non-traditional methods
- Counseling services
- Career planning

Vision statement V: Market take-up. *"Professional e-learning will be a commodity market in 2015."*
Challenges in this vision include market transparency, consumer driven market, one-stop-shopping, wider choice at all levels, and selection optimization. There are several supporting factors:

- Consumer-centric portals
- Aggregating/syndication
- Supply
- Demand
- Matching services
- Broken up "silos"
- Open Content Exchanges
- New business models
- New strategic partnerships

Vision statement VI: Social inclusion. *"High quality learning at the workplace for all - An Information society for all"*
The challenge will be to democratize knowledge Provision and effect the so-called e-Inclusion and equal opportunities for all in the workplace. The supporting factors for this vision are:

- Knowledge centers
- Economics of publishing
- Knowledge roles
- Strategic partnerships
- Multitude of available choices
- New accreditation structures for skills and knowledge
- Learning networks of universities and industries

The Athens High-Level Symposium with International Experts [21] refined the output and produced a second, *condensed version* of the Vision Statements, emphasizing "the promotion of innovation, creativity, flexibility in learning and work, employability, and equal opportunities".

6. CONCLUSION

Recent findings from a pan-European foresight exercise on the future of technology-enhanced professional training have been presented in terms of emerging and future trends and visions describing the desired future state. The study employed a fresh approach to roadmapping and the task of identifying the prevalent future visions involved a series of consensus building activities including scenario building and community-based surveys and forums. The prevalent visions for the next 10 years seem to be centred on leveraging technology to promote on the one hand high performance for businesses through innovation, creativity, and flexibility, and on the other hand increased security for individuals in the form of employability and assuredness of equal opportunity.

Although foresight analysis is often perceived as a complicated and bureaucratic exercise, the most critical factors for success do not lie in the methodological minutiae. Even the best methodology is bound to fail, if the key individuals (responsible for strategic management) and stakeholder groups are not committed to the process. With this in mind, the presented methodology will enable the development of vision-driven roadmaps for professional training, its strength lying in combining the inputs from the wider community as well as a comprehensive spectrum of experts, both from academia and industry and employing a simple and effective process of clear steps.

Further work will entail the completion of the roadmapping process with the implementation of the Planning Phase. A comparison with the current state of the art will determine as to what extent current R&D and business practices match the desired future states. The necessary goals, requirements and tasks will be analysed and specified and will be put in a timescale framework. The results from Gap Analysis will be further analyzed and a portfolio of short term, mid term and long term actions and recommendations will be produced. It is envisaged that priority areas will be identified to reflect

both R&D and market needs, useful for the collaborative planning of future actions in the area of technology-enhanced professional training.

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