Competence Modelling for Human Resources Development and European Policies
Bridging Business, Education, and Training

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Christian M. Stracke (Ed.)

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Competence modeling is gaining more and more importance in the human resources sector. Global competition, the increasing speed of markets and new technologies give a special meaning to the description of competences and their measurement. Companies have to optimize human resources management in order to be more efficient and effective. Closely associated with this is the increasing need for personal and organizational development and the identification of training needs and change management methods. In order to achieve this, companies and other organizations have to focus less on learning inputs and more on learning outcomes. The shift requires a way to describe competences and to measure them by observing performances instead of considering only official qualifications and certificates which do not include competences and skills gained by working experience. This development is supported by competence models.

Future challenges and demands on competence modeling in Europe are a common understanding of important terms like competences, skills and knowledge, the development of a harmonized competence framework as well as a continuous upgrade of qualifications and a global transfer of European approaches.

The presented development is an opportunity both for employers and employees. With the help of adapted competence models employers can face international competition and optimize their personnel research. Competence models can also support employees in their personal development and training providers on the creation of adaptable training programs. The increased transparency in the field of qualifications will also facilitate the work of public authorities.

This book contributes to the development in the human resources sector by offering different views and solutions on competence modeling and by giving suggestions for the future implementation of competence models.

Christian M. Stracke (Germany) presents potential use cases and impacts of competence models. A general competence model with a standardized competence structure and taxonomy of levels is introduced and adapted to the vocational education and training (VET) sector after giving some general
application scenarios. Furthermore leading European initiatives on competence modeling and the current standardization activities are presented.

Simon Grant (United Kingdom) and Cleo Sgouropoulou (Greece) focus on competence leveling. After describing the most important basic frameworks of level definitions, the leveling system of the eCOTOOL competence model is presented. This model allows the user to both define competence levels and assigning them to specific competences, skills or knowledge. Finally examples for the usage of the eCOTOOL competence model are given.

Kenji Hirata (Japan) describes the recent development concerning the exchange of semantics of competency and current standards. Furthermore he presents a new skill standard project named InfrasS. This project is focused on the social infrastructure industry and provides a hierarchical skill tree based on a competence modeling methodology. Regarding this structure a data model specification is developed.

Vocational education and training and labor market challenges in Albania are addressed by Mirela Cini and Frederik Cuclari (both from Albania). After presenting the state’s view on VET the effects on the Albanian socioeconomic development are described. Finally the authors analyze the need for a better VET system and discuss the challenges of the VET system in Albania.

Ismail El Haddioui and Mohamed Khalidi (both from Morocco) are focusing on the learner’s motivation in e-learning. After picturing the necessity of creating a more effective interaction between the training content and the learner, the learner’s behavior is analyzed by measuring eye positions and eye movement. This technique is called eye tracking and reveals also emotions like the level of attention or tiredness of the learner.

Mio Yanagisawa (Japan) and Kenji Hirata present a descriptive competency model corresponding to specialized communication competency. After showing the problems of lack of communication skills, the structure of competences on the one hand and communication on the other hand are analyzed. Based on this a model is developed.

Yury Kosulnikov, Boris Pozdneev and Maxim Sutyagin (all from Russia) focus on competence modeling in the e-learning sector. First, the situation on higher and secondary professional education in Russia is explained together with the need for standards concerning learning, education and training (LET). Then competences and a standardization of terminology for the e-learning sector are introduced. The authors build on their experiences in the
ISO/IEC JTC1 SC 36 (Vocabulary of E-Learning, Working Group 1) as well as on the Russian National Technical Committee 461 (Information and Communication Technologies in Education).

Describing the problems blind and visually impaired (BVI) users face concerning the participation in the web and e-learning with the help of a verbal protocol analysis (VPA), Rakesh Babu and Dr. Rahul Singh (both from the USA) design a new cognitive user-centered approach to develop accurate competence models. With this approach BVI user can be integrated into the training program of their organizations.

After presenting the challenges of a task analysis and the basics of cognitive tasks, Eriko Shimoda (Japan) and Kenji Hirata develop a methodology for the connection between tasks, activities and competencies together with a cognitive task model and a learning sequence model. With this approach the authors bridge the gap between mental processes and competence modeling.

Usha Singh (India) shows how competence modeling can affect the motivation of employees in a positive way. An Analysis of the social, cultural and economic drivers of socio-economic change in India is presented and connected to the development of suitable learning platforms. Thus a basis on decision-making on e-learning and development of social communities is developed.

Finally Sirko Schulz and Tino Schuppan (both from Germany) focus on a European Framework for e-Government Competences. After giving an introduction on e-government the results of the COMPATgov project analysis concerning needed and actual competences in the e-government sector are presented. These results recommend the development of a specific competence model for e-governments. Based on this a first set of e-government competences has been developed.

The contributions on competence modeling and (e-)learning give an overview over current developments in different sectors from different point of views. Therefore this book provides a basis for further discussions in the development of new technologies and methods in the field of competence modeling.

The presented contributions were reviewed and selected amongst all paper submissions for the European conference “COME-HR” (Competence Modelling for European HR and Policies: Bridging Business, Education, and Training). This conference is organized by the European eCOTOOL project, which deals with the development, exchange, and maintenance of VET
certificates and their accessibility and transparency throughout Europe. In this context the eCOTOOL consortium hopes to contribute to the ongoing development in the area of competences.

Christian M. Stracke and Karna Wegner

Keywords:
Competence modeling; Competences; Skills; Knowledge; Human Resources Development; Learning, Education, and Training (LET); Competence Development and Quality Development; Vocational Education and Training (VET); WACOM; eCOTOOL; COMPAT; Competence Standards; ISO/IEC JTC1 SC36; ISO/IEC 20006; Generic Reference Model for Competences; CEN TC 353; Metadata for Competence Modelling; Level; Ability; Framework; Information Model; Data Model; XML Schema; Competency Tree; Competency Semantics; Standard Specification; Labour Market in Albania; Communication Competency; Action Verb Analysis; E-Learning; Eye Tracking; Eye Movement; Gaze Tracking; Learner Profiling; Learner Behaviour; Extensible Markup Language (XML); XQuery; XML Data Base Management System (XML DBMS); Action Verb Analysis; Verbal Protocol Analysis (VPA); Accessibility and Usability, Blind and Visually Impaired (BVI) Users; Cognitive Task Analysis; Learning Steps; Cognitive Competency; Indian Public Sector; Workforce Motivation; E-Government Competences; E-Government; Public Service Personnel.

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Abstract: This paper will summarize the potential use cases and impacts of competences and skills in the new area, often called "Digital Age": It will highlight the roles and benefits of standards and metadata for HR development and points out the special support that competence models can provide for the quality development in learning, education, and training. In this regard, the main characteristics of this innovative approach called competence modelling and its relevance in vocational education and training (VET) can only be summarized. A general competence model with a standardized competence structure and taxonomy of levels is introduced and discussed for the general application scenarios and for the specific use cases in vocational education and training. It can be shown that competence modelling and the presented competence model lead to an improvement of the working places, of the organizational and individual development, to an increase of the mobility worldwide as well as to a higher transparency and
recognition of competences and skills. Finally leading European initiatives on competence modelling are introduced and the current standardization activities are highlighted.

**Keywords**: Competences, Skills, Knowledge; Human Resources Development; Learning, Education, and Training (LET); Competence Development and Quality Development; Competence Modelling; Competence Model; Vocational Education and Training (VET); WACOM; eCOTOOL; Competence Standards; ISO/IEC JTC1 SC36; ISO/IEC 20006; Generic Reference Model for Competences; CEN TC 353; Metadata for Competence Modelling.

0 Introduction

This article introduces the tasks and potentials of competence development and competence modelling as an innovative and very promising approach and explains the application scenarios and benefits of competence models as appropriate and comprehensive instruments for their implementation. The leading key question is: "How to support and improve the quality and the outcomes in learning, education, and training?" The answer results in the innovations and changes that can be realized and provided by learning outcome orientation. Competence models will be identified as appropriate means for quality development based on the general definitions of quality development and competence development and of the principles for competence modelling. After the short explanation of their main use cases, current European research consortia are explained working in different sectors for the establishment of competence modelling. To summarize, this article points out the special support that competence models can provide for the quality development in learning, education, and training: In this regard, we can only highlight the main characteristics of this innovative approach called competence modelling and its special relevance in vocational education, and training (VET).
1 Definitions of Competences and Competence Models

Since the beginning of the so called "digital age", the importance and impact of competences and of competence development is increasing constantly: And that is true not only for the (new) media competence (also often called media literacy) but for the whole society itself. The European Commission underlines in the "Digital Agenda 2020" the growing weight and significance of competences for the future of Europe and the whole world community and for the international mobility that is confirmed by experts from human resources (HR) and learning, education, and training (LET), too (cf. EC 2010). This progress covers all sectors, branches and levels of the society, from the family via kindergarten, school and education, working life until the lifelong learning, and in particular the business and economy including the human resource development and vocational education and training (VET). It is strengthened by the two core factors of the globalisation and the worldwide establishment of the internet (world wide web) with their direct and indirect consequences as the global markets, worldwide networking, communication and competition, digitalisation of services that Friedman summarizes in his simplified phrase "The world is flat" (2006).

The term competence is currently on top of the agenda and there are several reasons: Competences, their building and measurement are becoming more crucial for business success in our times of increasing flexibility, speed and globalisation within the economy. Organisations and in particular enterprises have to face more complex and unpredictable challenges in markets and societies due to the globalisation and stronger competition - together with growing requirements and cost pressures (especially in the economic crisis). The concept of competence (that is traditionally combined with successful acting in unknown situations in central-European region) offers a theoretical basis for the development of strategies, methods and means for solving the current tasks. Enterprises have to take advantage from their employees by efficiently and effectively supporting and managing them to survive in the market by success and innovation. In addition the needs for personal and organizational development have to be identified and vocational training and change management methods have to be introduced and evaluated.

However the term "comptence" is defined in many different ways, in particular in the business practice. Thus, strong initiatives are taking place in the human resource development and in the vocational education and
training to harmonize the whole competence area on the basis of the requirements from all stakeholders of the business, political systems and societies. The aim is to develop valuable and adaptable instruments for the building, measurement, and modelling of competences.

For this ambitious and long-term objective, the term competence and its historical development and definition have to be defined. The historical development lines of the term competence in the different science disciplines verify the variety and complexity of meanings and views on the term competence. In the psychology, White has used very early the term competence to designate skills developed by self-organization and required for the performance (1959). In the semantics and only a few years later, Chomsky (1962) defined competence as the self-organized ability to construct and understand a potentially unlimited amount of sentence using a limited set of vocabulary and thus, to manage speech acts as a competent speaker. And based on these concepts, two different schools of thought were developed in different directions: The first line continued the ideas by Chomsky broadening them at human being's acting in general, the second line used the competence term for society criticism and combined it next to the coping in particular with the generation of social situations.

This short overview demonstrates the increasing relevance and importance of the concept of competence independent from the variety of different traditions and understandings. In the following we are using the term competence with its general meaning that was defined by Stracke (2011) as:

**Competence** is the ability (that cannot be observed directly but only by activities) to adequately and successfully combine and perform necessary activities in any contexts to achieve specific tasks or objectives.

Using this definition as the basis, the potential (non-observable) competences and the (observable) activities performing the competence can be distinguished. That is most important and can be expressed by using the following simplified representation:

- **Competence: = Knowledge + Skills (+ individual ability)**
- **Activities: = Performance of Knowledge + Skills + Competences (+ individual ability)**
Competences can be built and exist without being demonstrated and performed. Most important is the fact that they are non-observable: They are only shown and observable by acting, i.e. by performance and activities. Only activities can be observed and measured.

The Competence Model that is presented in the following chapters is completely in line and compliant with the unique ISO quality standard for IT-supported LET (ISO/IEC 19796-1 2005) as well as with the international quality management principles of ISO 9001 including the TQM philosophy and the PDCA cycle (Plan, Do, Check, Act): Thus, it ensures both, international interoperability as well as flexibility for organizational and individual adaptations (cf. Stracke 2006a).

For implementation of competence models in human resources and vocational education and training (VET), competence development has to take into account three dimensions as shown in the following figure:

![Figure 1. The Triangle of the Competence Development](image)

The following four main target groups using competence models exist in vocational education and training:

1. Managers: Managers who are responsible for hiring new employees or human resource development are interested in enlarging existing
and developing needed qualifications. Therefore they are depending on finding out a balance between these two tasks to fix training needs for their employees. Managers have to define requirements for specific working places and job offers to ensure that candidates apply who comply most with the needed requirements.

2. VET providers: On the other side there are the vocational education and training providers. They adapt themselves to the needs of enterprises, national institutions and other organisations for a suitable offer.

3. Learners: They are the third target group: The same adaptation goal applies for individuals (= the learners) planning their personal development at any age.

4. Organisations: Finally there can be organisations like enterprises or public authorities developing their own competence model and competence profiles due to their very specific and extraordinary needs.

A competence model is required for the introduction of competence modelling and harmonization of competence descriptions. Two main components of a competence model are: 1. the competence structure and 2. the competence levels.

With a selection and detailed description of all competences and the definition of the levels it is possible to adapt and implement a Competence Model.

The following table shows the criteria and elements that have to be fulfilled for the standardized description of competences and skills to achieve a consistent and comparable competence structure within Competence Models:

<table>
<thead>
<tr>
<th>The Competence Structure</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Action Verb</td>
<td>[e.g., &quot;to develop&quot;]</td>
</tr>
<tr>
<td>Object</td>
<td>[e.g., &quot;project management plan&quot;]</td>
</tr>
<tr>
<td>Optional elements</td>
<td>[e.g., &quot;for E-Learning projects&quot;]</td>
</tr>
</tbody>
</table>

*Figure 2. The Competence Structure*

The competence structure can be used to (1) introduce competence modelling and a competence model for the first time or to (2) integrate it into existing competence models and their pool of competences.
For the levels, the European Commission has issued and supported the European Qualification Framework (EQF): Its eight levels are defined by a set of descriptors indicating the learning outcomes relevant to qualifications at that level in any system. The reduction and adaptation of these eight levels to five levels is proposed for easier application and implementation into practice (cf. Stracke 2011).

It is possible in general to describe all required competences according the following template for competence descriptions:

<table>
<thead>
<tr>
<th>Competence &quot;XXX&quot; [e.g., E-Learning PM Planning]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure of the competence &quot;XXX&quot;</td>
</tr>
<tr>
<td>[according the competence structure: e.g., &quot;to develop project management plan for E-Learning projects&quot;]</td>
</tr>
<tr>
<td>Definition of the competence &quot;XXX&quot;</td>
</tr>
<tr>
<td>[any written plain text, i.e. free text field]</td>
</tr>
<tr>
<td>Target group of the competence &quot;XXX&quot;</td>
</tr>
<tr>
<td>[e.g., group of employees, single working place]</td>
</tr>
</tbody>
</table>

Knowledge contained in and required for competence "XXX"

<table>
<thead>
<tr>
<th>Name of Knowledge</th>
<th>Definition of Knowledge</th>
<th>Minimum required level</th>
</tr>
</thead>
<tbody>
<tr>
<td>[e.g., PM Basic Knowledge]</td>
<td>enter your definition here</td>
<td>enter the minimum required level (1 to x) here</td>
</tr>
<tr>
<td></td>
<td>enter your definition here</td>
<td>enter the minimum required level (1 to x) here</td>
</tr>
</tbody>
</table>

Skills contained in and required for competence "XXX"

<table>
<thead>
<tr>
<th>Name of Skills</th>
<th>Definition of Skills</th>
<th>Minimum required level</th>
</tr>
</thead>
<tbody>
<tr>
<td>[e.g., Drawing of Plans]</td>
<td>enter your definition here</td>
<td>enter the minimum required level (1 to x) here</td>
</tr>
<tr>
<td></td>
<td>enter your definition here</td>
<td>enter the minimum required level (1 to x) here</td>
</tr>
</tbody>
</table>

Competences contained in and required for competence "XXX" (optional)

<table>
<thead>
<tr>
<th>Name of competence</th>
<th>Definition of competence</th>
<th>Minimum required level</th>
</tr>
</thead>
<tbody>
<tr>
<td>[e.g., E-Learning Design]</td>
<td>enter your definition here</td>
<td>enter the minimum required level (1 to x) here</td>
</tr>
</tbody>
</table>
By describing all required competences according to this competence structure, a "pool of competences" can be set up: In a specific use case these competences have only to be selected that are most important in the case of a specific job description and that have to be defined.

A competence model includes all competence descriptions of all selected and defined competences that are relevant for a specific organisation. Thus, the competence model can easily be derived from those existing competence descriptions. In addition a job profile can be developed as the application of the table for competence descriptions for a specific job at a working place within a specific organisation. In this way, job profiles can easily be derived from those existing competence descriptions.

2 Competence Development and Quality Development

Competence development and quality development are becoming more and more important for success of the organisations and their business: Currently their adaptation and integration into a common approach has been started due to their similar objectives and requirements (cf. Stracke 2011). Competence development can benefit from the long-term experiences that have been made in the fields of quality development and that only be summarized here in brief.

Quality development is a crucial task for vocational education and training as well as for human resources, learning, education, and training in general: A long-term debate has focussed the quality development regarding the different quality issues, aspects and approaches (cf. Deming 1982; Juran 1951; Juran 1992; and for an overview Stracke 2006a). Quality development in its broad sense can be defined as follows (cf. Stracke 2006b):

Quality development covers every kind of strategy, analysis, design, realisation, evaluation, and continuous improvement of the quality within given systems.
A long process is needed to establish and integrate quality development throughout a whole organisation. Once started, it has to be a continuous ongoing circle to be successful (cf. Crosby 1980; Deming 1986). Quality cannot be described and fixed by a simple definition, because in itself quality is too abstract to have any impact. Thus, quality has to be specified according to the given context and situation considering the perspectives of the involved stakeholders (Donabedian 1980). It is important to identify the relevant aspects and to define the suitable and relevant criteria. To find a consensus amongst the different views and perspectives is necessary to gain a common understanding of quality for the given context and situation due to different and sometimes contradictory needs and definitions of quality by all stakeholders (for detailed explanations on context determinations cf. Donabedian 1980; Crosby 1980; Deming 1986).

Consequently, quality awareness is the basic requirement for the adoption of quality development by all stakeholders from any organisation. On the other side quality awareness will also be raised by the implementation of quality development. For a sustainable integration of quality development within the whole organisation and to ensure the involvement of all stakeholders, it is crucial to build a quality strategy and to integrate the quality objectives into the educational and business processes (cf. Stracke 2010b). In addition the stakeholders' needs and responsibilities have to be integrated into the overall quality development. The process of the adoption, implementation and adaptation of quality development can roughly be divided into three steps based on three different levels that need to be covered and addressed for a sustainable and long-term quality development (for the three level concept of the introduction of quality development cf. Stracke 2006b):1

1. Level of the individual person: to address and convince the employees;
2. Level of the organisation: to define and meet the business requirements;

---

1 The presented research findings are partially results of Q.E.D., the flagship initiative for quality in learning, education, and training worldwide, see: <http://www.qed-info.de>.
• Integration of quality development involving all stakeholders: to involve all relevant persons including the internal and external suppliers and customers.

The following figure demonstrates the dependence of the three levels of competence development that are building up on the other one:

![Three levels of Competence Development](image)

**Figure 4.** Three levels of Competence Development

### 3 Competence Development and Competence Modelling

The term "Competence development" is used in a broad sense here and covers all processes that are relevant and dealing with the planning, modelling, strengthening, evaluation, and the continuous improvement of the competence of learners and learning organisations. By this definition, the competence development includes as the general term the competence modelling, the competence building and the competence management.
Competence development is based on the important and influential theory on cognitive development by Jean Piaget. He called his theory "genetic epistemology" to explain the cognitive development of children (Piaget 1953). The competence development in HR and LET is not yet discussed for a long time and basic theories and approaches are still lacking at the moment. In particular a harmonized and integrated reference model for the adaptation and implementation of quality and competence development is missing that is currently under development (cf. Stracke 2011): This article provides general insights and proposals for this ambitious task.

Competence development consists of four processes that are building a continuous improvement cycle following the philosophy of the Total Quality Management plus the analysis and definition of the context conditions and competence strategy (cf. PAS 1093 2009):

0. Competence context and analysis;
1. Competence description;
2. Competence measurement;
3. Competence building;

The competence modelling combines the two processes competence description and competence measurement - but not completely: the first definitions of the competence description are related to the general structure and thus they are specified at the beginning and not during the processes of competence modelling.

The relations between the four processes and the context analysis are shown in the following diagram:
In the Phase "Competence Context and Analysis" the general conditions will be identified and a needs analysis with all responsible stakeholders including the decision makers (the top management, the department leaders, etc.) is realized. Thereby the strategic goals and the requirements for the Competence Modelling are investigated and the result is defined and documented in the Competence Strategy.

In the Phase "Competence Description" the (organisation-specific) Competence Model is developed that contains the definitions of the three dimensions of the Reference Framework and the Competence Catalogue next to the Competence Strategy (from the Phase Competence Context and Analysis before). The Competence Catalogue consists of the (organisation-specific) definition of competences and activities that can be developed through top-down processes (e.g. strategy workshops with the management, rating by experts, core competence investigation, prospective orientation, or a combination thereof, etc.) as well as bottom-up processes (e.g. Critical-Incident Technique, rating by experts, structure work-analysis consultation (objective or subjective), employee suggestion scheme or a combination thereof, etc.).
In the Phase "Competence Measurement" the Competence Profile (target and current status) is created. To this end an organizational level (individual, group, or organisation) is chosen and its relevant goals, tasks and situations are determined and described. Thereafter the methods for the observation and measurement of activities are chosen and described. Subsequently, the relevant competences and the activities that constitute them as well as the necessary Competence Levels from the Competence Catalogue are determined for the chosen organizational level. These selections and determinations are documented in the so-called Competence Profile (target status) for the selected organizational level. Afterwards the measurement of the competences (indirectly achieved through the observation and measurement of activities) is carried out, with which their current status are investigated. The analysis of the Competence Measurement is then documented in the so-called Competence Profile (current status) for the chosen organizational level.

In the Phase "Competence Building" the activities for building the competences are created for the chosen organizational level from the basis of the Competence Profile. For this purpose the Competence Development goals are determined first and prioritized on the basis of a target-performance comparison. Finally appropriate activities for Competence Building in the form of opportunities for human resource development and for learning, education, and training are developed and carried out. The desired result is a Competence Change in the chosen organizational level.

In the Phase "Competence Evaluation" the activities for competence measurement and building for the chosen organizational level as well as the Competence Model and Competence Management as a whole are evaluated. The evaluation of activities for Competence Building is based on a second Competence Measurement (indirectly achieved through the observation and measurement of activities). This is particularly aimed at the analysis, assessment and optimization of the opportunities for human resource development and for learning, education, and training for the chosen organizational level. The analysis and evaluation of the competence development and measurements in total, along with the continuous improvement of activities for competence building, particularly serves to create a Competence Balance Sheet on the basis of a target-performance comparison along with the assessment of the development itself. Furthermore, the organisation-wide Competence Management is evaluated on this basis of these results; this serves particularly to analyze, assess and
optimize the organisation-wide Competence Model (including the organisation-wide Competence Strategy). The central goal of the Phase Competence Evaluation is therefore the optimization of the entire Competence Development and the Competence Model (cf. Stracke 2011).

To summarize, competence models are required and used for describing and measuring competences: Thus, competence models are the core instruments for competence modelling and its implementation. The following chapter summarizes the main application scenarios followed by their core use cases.

4 Main Application Scenarios for Competence Models

The presented concept of competence modelling has demonstrated the importance to focus competences and activities and introduced the competence model. It describes the competences for individuals such as employees, trainees, pupils, students, lifelong learning and adult learners and groups of them and can be applied to all sectors and branches. Currently competence models are not used by many organizations and there is a lack of and need for a standardized and harmonized competence model and structure. The presented competence model is closing this demanding gap: In particular all vocational education and training stakeholders can benefit in many use cases from the introduction and adaptation of the competence model. In VET, the objectives and application scenarios for competence models are to achieve:
In this way the new and innovative concept of competence modelling leads to an improvement of the working places, of the vocational education and training, of the organizational and individual development, to an increase of the mobility worldwide as well as to a higher transparency and recognition of competences and skills.

5 Main Use Cases for Competence Models

A Competence Model describes the competences required to successfully perform in a particular job and organization. This set of competences is then used as basis and standard for the description of the specific jobs, the selection of new staff, the evaluation of the on-going performance of the whole staff, the analysis of training needs, and the classification and provision of tailor-made vocational education and training for competence development. The main use cases of the Competence Model for the fields of in VET and human resources development are shown in the following figure:
The presented Competence Model is completely in line and compliant with the unique ISO quality standard for Learning, Education, and Training, ISO/IEC 19796-1 (2005), as well as with the international quality management principles of ISO 9001 including the TQM philosophy and the PDCA cycle: Thus it ensures both, international interoperability as well as flexibility for organizational and individual adaptations (cf. Stracke 2006a).

Currently, two major European research consortia are addressing and dealing with competence modelling for different sectors and application scenarios: WACOM for the water sector and eCOTOOL for application of competence models in European policies and international standards. These two European initiatives will be described, a third European research project called COMPAT has been started recently and will transfer their results into
the public sector and services, namely into eGovernment. In the following two chapters, the two leading European consortia on competence modelling WACOM and eCOTOOL will be introduced in brief with their different focus and sector approaches.

6 WACOM - The European initiative for water competences

WACOM is the European research project for harmonizing water competences throughout whole Europe and for integrating competence modelling into the European water sector coordinated by the University of Duisburg-Essen, Germany. The project WACOM (WAter COmpetences Model Transfer) transfers the European Qualification Framework (EQF) and the German Reference Model for the Competence Modelling PAS 1093 into the water sector and its Vocational Education and Training (VET) throughout whole Europe. That enables the identification of the VET needs by employees and learner, of required competences and qualifications at specific working places as well as of the improvement of transparency and comparability of VET opportunities and products.

The development of the WACOM instrument is supported by the transfer of the competence and qualification model into the water sector and by the adaptation for the selected topic management of sewage treatment plants.

WACOM has an impact on vocational training in the whole water management and in additional sectors.

The main WACOM products and impacts are:

- **Competence model for the water sector**: Development of WACOM (the WAter COnpetences Model) as the establishment of a competence model for the water sector based on EQR and PAS 1093: The aim is the foundation of the vocational training on the principle of competence modelling based on the identification of the specific demands and needs of the water management and existing practice concerning competence models in the water sector.

2 For more information see the COMPAT website: [http://www.compategov.eu](http://www.compategov.eu).
• **WACOM instrument**: Optimization and adaptation of WACOM (the WAter COmpetences Model) to the vocational education and training systems and cultures in Europe. Finally the WACOM instrument is used for the description of the competences and qualifications and for the improvement of their transparency and comparability.

The WACOM Competence Model (WCM) describes the core competences for the employees working in the water sector and can be applied to the Wastewater Treatment Plants (WWTP) and transferred to other branches. In this way WACOM leads to an increase of the mobility throughout Europe as well as to a higher transparency and recognition of qualifications and competences. The competence model is composed of water competences which were developed out of personal interviews with water experts and from an analysing process of the water sector reviewed and refined by the outcome of the WACOM national workshops and the WACOM Online Survey. A detailed description of all collected competences allows a standardised usage of the WACOM competence model.

The Water Competences are the complete list of core competences for the water sector directly related to the requirements and needs from the water sector, the working places and job profiles. The WACOM Competence Model (WCM) includes templates for the application and adaptation by the European water sector.

### 7 eCOTOOL - The European initiative for competence modelling

eCOTOOL is the European research project for harmonizing competence descriptions throughout whole Europe and for integrating competence modelling into European policies, namely the Europass Certificate Supplement (CS) coordinated by the University of Duisburg-Essen, Germany. The two main objectives of eCOTOOL as stated in the work plan are:

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3 For more information see the WACOM website: [http://www.wacom-project.eu](http://www.wacom-project.eu).
1. Improving the creation, exchange and maintenance of vocational education and training (VET) certificates and their accessibility and transparency, and
2. Increasing the European mobility and transparency of VET systems.

These objectives will be achieved through the creation of a competence model and structure for European policies and in particular for Europass CS. The main goal is the introduction of a pan-European standardized structure to describe competences, skills and knowledge for the harmonization of Europass with other European instruments such as EQF and ECVET and with e-competences. The development of compatible instruments and tools which supports the creation, maintenance and exchange of competence descriptions within VET certificates will ensure its realization.

For this objective eCOTOOL has developed a Competence Model that consists of two parts:
1. The eCOTOOL High Level Competence Model and
2. the eCOTOOL Technical Competence Model.

The eCOTOOL High Level Competence Model provides the general structure for the definition and description of the competences, skills and knowledge called ability items in their entire collection as general term. The following figure presents the structure for short description of ability items including an example:

<table>
<thead>
<tr>
<th>Ability item short description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Action verb</td>
</tr>
<tr>
<td>Service and maintain</td>
</tr>
</tbody>
</table>

*Figure 8. Structure and Example for Short Description of an Ability Item*

This standardized structure for the description of ability items, i.e. competences, skills and knowledge, is used as the basis for the definition of a single ability item (competence, skill and knowledge). The following figure shows the standard and template of the eCOTOOL High Level Competence Model for the definition and description of a competence, skill and knowledge:
### Form A: eCOTOOL High-level model item definition table

<table>
<thead>
<tr>
<th>Ability item short description</th>
<th>Action verb</th>
<th>Rest of short description</th>
</tr>
</thead>
<tbody>
<tr>
<td>KSC classification</td>
<td>knowledge, or skill, or competence</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unique id code</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Author/authority</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Level assignments</th>
<th>Level scheme</th>
<th>Level</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Categorisation</th>
<th>Classification scheme</th>
<th>Term</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Full description</th>
</tr>
</thead>
</table>

**Figure 9. Structure and Form for the eCOTOOL High Level Competence Model**

This general standard and template of the eCOTOOL High Level Competence Model for the definition and description of a competence, skill and knowledge can be used and integrated in any generic competence model, instrument and international, European and national policy on human resource development, learning, education and training and in particular with European policies like the Europass instruments.

In addition the eCOTOOL project concentrates on the Europass Certificate Supplements (CS) which is the one of the five Europass instruments providing documents and guidelines for the description of qualifications throughout Europe. The Europass CS is a framework for VET providers to describe required qualifications of vocational occupations. The facilitated creation of certificate supplements helps to formulate the requirements for a specific job as well as to discover easily which qualifications job-seekers need for specific employment opportunities. The project restructures the content field three of the Europass CS where the required qualifications for
each job have to be listed. In this way, eCOTOOL contributes to the European Lifelong Learning Programme (LLP) by enhancing significantly the transparency throughout the labour market. In current Europass certificate supplements only a couple of phrases describing the required qualifications are listed in the relevant field three. Within eCOTOOL the consortium partners shared their expertise concerning competence modelling, the Europass Certificate Supplement and the VET-sector and created a structure for describing qualifications consisting of competences, skills and knowledge. This structure was created out of comparing several existing European policies like the EQF, the Key Competences, ECVET and is based on the German PAS 1093 for Competence Modelling (PAS 1093 2009).

8 Vision

Finally we would like to broaden the view on competence and quality development in LET and on competence standardization in the future. What are the main activities today for future development of competence standards?

ISO/IEC JTC1 SC36 is the unique official formal standardization body for IT-supported LET at the international level. The scope of SC36 is defined as: "Standardization in the field of information technologies for learning, education, and training to support individuals, groups, or organisations, and to enable interoperability and reusability of resources and tools" (SC36 2006).

For more information see the eCOTOOL website: [http://www.ecompetence.eu](http://www.ecompetence.eu).

The abbreviation stands for: "International Organization for Standardization (ISO)/ International Electrotechnical Commission (IEC) Joint Technical Committee 1 (JTC1) - Information Technology - Subcommittee 36 (SC36) - Information Technology for Learning, Education, and Training (ITLET)". Members of SC36 are National Bodies (NB), i.e. national delegations of appointed experts, and Liaisons Organizations (LO) without voting rights (cf. [http://www.iso.org/jtc1/sc36](http://www.iso.org/jtc1/sc36) and [http://www.sc36.org](http://www.sc36.org)).
The first substantial standard that was developed, approved and published by SC36 in 2005 is the quality standard RFDQ (Reference Framework for the Description of Quality Approaches), ISO/IEC 19796-1 ("Information Technology — Learning, Education, and Training — Quality Management, Assurance and Metrics — Part 1: General Approach") (ISO/IEC 19796-1 2005). It is providing a generic Reference Process Model and the first quality standard of the multi-part ISO/IEC 19796 series. The quality standard has been implemented worldwide6 and adopted as European Norm EN ISO/IEC 19796-1 by the European standardization Committee CEN TC 3537. Currently its adaptation and integration into a common approach combining quality and competence development has been started (cf. Stracke 2011).

In 2008, SC36 has started its initiative for the development of a Conceptual Framework for Standards that will be accompanied by several Technical Frameworks for different use cases and target groups. The presented Generic Reference Model for Standards in the field of IT-supported LET (ITLET) is a helpful and supporting contribution on the long way towards such a generic ITLET framework.

In 2009, SC36 has started another standardization initiative for the development of a Generic Framework for Competence Standards acknowledging the increasing importance of competence modelling and competence models. It will be developed in three parts by starting with the first part on the general framework: The presented first General Reference Model for Competence Standards is a helpful and supporting contribution on the long way towards such a generic competence framework (cf. ISO/IEC 20006 2011). Finally the multi-part ISO/IEC 20006 series on competency will

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provide a competency model as a General Framework based on Asian, American and European specifications (cf. ISO/IEC 20006 2011).

Competence and quality development are crucial and indispensable for the long-term success of learning opportunities and in particular of vocational education and training: To reach an economical benefit through competence modelling and building, standards are offering a sustainable support. Their adaptation, implementation and integration can be regarded as one of the main tasks for the future.

10 References


What is a level of competence?

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Abstract. In areas where competence can be greater or lesser, a level of competence defines a reference point that someone may have, or may not yet have, attained. Levels may be specific to an area or, often, generic, in which case they are assessed for specific areas of ability. Levels must first be defined in frameworks, and then competence concepts can be assigned levels following those frameworks. The eCOTOOL competence model offers information structures both for defining levels and for assigning them. This is intended to contribute to effective interoperability specifications. Examples of defined levels stretch back in history to craft guilds, and today they come in many forms. Examples are here presented, which the eCOTOOL model covers well. The eCOTOOL competence model offers a good way of understanding what a level of competence is.

Keywords: level, ability, skill, competence, framework, level definition, level assignment, information model.

1 Interoperability background

Information about people’s abilities and competence has always been valuable when decisions are made about who should undertake some work,
or who should be engaged to perform a particular role as part of a job. As a consequence, it is also valuable to have information about what courses of learning, education or training (LET) are designed to result in the acquisition of what competence. With the widespread development of information and communications technology (ICT), it becomes important to be able to represent information about abilities and competence in ways that can easily be communicated electronically, so that ICT tools can process such information efficiently and effectively. Such tools could potentially help individuals, institutions and employers in (among other things) designing, planning and recording LET; in expressing claims and requirements for abilities and competence; and in recruitment and selection.

Some attempts have been made to represent information about competence in standardised ways. Well-established examples of this include RDCEO from IMS (2002) and its generalisation, RCD from IEEE (2007). Newer examples include the draft specification called “InteropAbility” (InterCom, 2011); work within the European ICOPER (2011) and eCOTOOL projects, and work underway in the MedBiquitous (2011) consortium’s "Competencies" working group.

In the ICOPER project, for example, the PALO model (Najjar et al., 2010, 2011) represents level elements thus: "This element captures ranking information about the learning outcomes and/or assessment records of learners. This includes proficiency level, interest level, weight, ageing." However, this is not intended to, and does not, cover the definition of levels. In all cases known to the authors (except eCOTOOL) the representation of levels of competence is solely in terms of assignment, rather than definition, of levels. (The distinction will be clarified below.) For assigning educational levels, a long-standing approach shared by many of the existing initiatives is with Dublin Core (DC) metadata. DC has a term entitled "Audience Education Level" whose definition is "a class of entity, defined in terms of progression through an educational or training context, for which the described resource is intended." However, DC does not give any particular level scheme, system or framework; nor does it set out to represent information relevant to defining level schemes.

The eCOTOOL competence model (Grant, Sgouropoulou & Thanopoulos, 2011; eCOTOOL, 2011) is intended to provide a better, practical approach to representing the structure of concepts related to occupational competence. It offers an important step on the path towards interoperability of level definitions by including a model for level definition as well as a related
definition of level assignment. This eCOTOOL model is built on some concepts that are useful to rehearse first.

2 Useful concepts

People generally want to compare people's ability, and to engage the most suitable person they can find for any particular job, from an organisational role of responsibility, to a one-off job anyone might ask a tradesperson to do. Informally, they may do this through word of mouth reputation, but this is liable to be unreliable, mainly because different people's view on what is "good" or "better" may differ, unless the scale is defined more precisely. To achieve greater clarity, here a few useful concepts are defined.

Rankable and binary ability

An ability concept against which we can assess people as better or worse may be called a "rankable" concept, as in principle people can be ranked against it. Sports and entertainment give many familiar examples of this. Whether someone is a better or worse football player, or a better or worse singer, is at least loosely correlated with how successful they are in their career and how much they are paid. Rankable competence concepts from other areas could be seen to include programming ability, musical ability, typing speed and accuracy, linguistic proficiency in different languages. There are many more.

In contrast, if an ability concept is expressed in a way that it is either possessed or not – "attained" or "not yet attained" – we call it a "binary" concept. Examples of binary concepts might be:

- the ability to juggle 3 balls for a minute;
- the ability to coherently apply styles to a word processed document;
- the ability to knit a woollen scarf;
- the ability to safely take blood samples from patients.

In each case, it is reasonable to expect an assessment to give a yes or no result.

On the basis of understanding rankable and binary ability or competence concepts, it makes sense to think of levelling as an approach to defining binary concepts from out of what may be a rankable concept continuum. Levels are one good way of giving better definition to a competence concept.
What is a level of competence?

that allows judgements of better or worse. They are a step forward from simply letting individuals claim they are good at something.

**Level assignment and level definition**

A clear distinction can be made between the ideas of defining and assigning levels. Most people’s experience with levels is confined to judging to which level something should be assigned. One can ask, what level of learning are particular materials and objects suitable for? Are a set of instructions suitable for beginners or experts? Language courses may start assuming no knowledge of the language at all, but equally may assume a certain proficiency, on top of which more will be learned. A course in calculus would most likely be incomprehensible to someone who had not mastered basic algebra. Thus we assume a set of levels, and assign things to those levels, perhaps without reflection on how the levels are defined.

In the field of European education and mobility, the EQF (European Commission, 2008) is a good example of a level framework to which one can assign things. In each of the three defined areas (knowledge, skills and competence) the EQF defines 8 levels. For example, the EQF says that competence level 5 applies to areas where people "exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others". It is important to understand that this it is not assigning EQF competence level 5 to a descriptor. Rather, the given words, agreed by the Commission, define EQF level 5 competence. The EQF levels are not concepts that can be recognised independently of words used to describe them. When one assigns another concept to EQF level 5 competence, one compares the definition of the competence-related concept with the descriptor above, and one makes a judgement that EQF level 5 competence is the best fit of the level definitions offered in the EQF.

**Generic and specific level definitions**

Wide ranging level frameworks like the EQF tend to define levels that we can call "generic", as they apply to many different specific areas of ability. For instance, EQF knowledge level 4 is described as "factual and theoretical knowledge in broad contexts within a field of work or study", and it is obvious that this is only able to be assessed in relation to a specific field or area. But as well as this kind of framework with generic definitions, there
are also frameworks built for particular occupational areas that give specific criteria.

For example, in the Knowledge and Skills Framework (KSF) of the UK’s NHS (2004) there are 4 levels, applying to all their dimensions of knowledge and skill, but these 4 levels have no generic descriptors of their own. The KSF just gives specific descriptors for each level of each dimension of knowledge and skill. An example that is similar in some ways is the European e-Competence Framework 2.0 (e-CF), developed by the CEN Workshop on ICT Skills (2010), which defines both generic and specific descriptors for their 5 levels. The e-CF, as well as defining their own levels, also assigns the e-CF levels to EQF levels.

Assessability

Competence-related concepts come in many forms. There are very broad and vague concepts such as "communication skills" that may act as headings for gathering evidence, but are not definite enough to allow any reliable assessment of people. A concept is rankable, as introduced above, when it gives enough definition to allow a comparative assessment of people against the concept, and a concept is binary, as introduced above, when it is defined sufficiently clearly to allow a "yes/no" assessment of whether a person has that ability.

Specific levels of competence are normally defined in such a way that they can be assessed as binary concepts. Generic levels, on the other hand, are not in themselves binarily assessable. To get a binarily assessable concept, one must put together a generic level and a specific field or area. The definition of the specified field or area would ideally in itself be a rankable concept.

3 Levels in the eCOTOOL competence model

The eCOTOOL competence model is based around an earlier idea that appears in other models of competence, including the MedBiquitous (2011) work mentioned above. This basic idea is that competence-related concepts can be defined separately, standing alone, and that information about the relationships between these concepts can also be given separately. Broader (greater) abilities are seen as containing (or including, or relying on) narrower (lesser) ones. This allows competence frameworks to be built up
from separate definitions, and it maximises the potential for reuse of concept definitions, rather than requiring every framework to redefine, often in only slightly different words, what are essentially the same competence concepts.

But structuring competence definitions hierarchically does not of itself imply a treatment of levels. This is where the eCOTOOL model comes into its own, making use of the concepts discussed in the previous section, offering a new approach to modelling levels of competence. Most importantly, assigning and defining levels are seen in the eCOTOOL model as separate, though closely related, ideas.

Level assignment

The eCOTOOL model allows any ability definition to be assigned a level within any number of level schemes or frameworks. The example given with the eCOTOOL high-level competence model explanation (Grant & al., 2011) (written to give background to pilot testing of the eCOTOOL tools) gives an example from UK National Occupational Standards (NOS). "Service and maintain domestic natural gas systems and components" can plausibly be assigned to level 2 of the UK National Qualifications Framework, level 3 of the EQF (both of which are widely known schemes), and level 2 of eCOTOOL’s own level scheme. Any number of level schemes can be devised, for different purposes, and there is nothing to prevent anyone assigning any competence-related concept to any level scheme, published or not published. This is supported by eCOTOOL, with the constraint only that each level scheme should be identified by its own unique URI.

Level definition

The eCOTOOL high-level competence model envisages the definition of levels as subtly different from the kind of "functional analysis" (Carroll & Boutall, 2011) in which broader concepts are analysed in terms of narrower concepts. The example of level definitions given in eCOTOOL’s high-level model relates to a higher education benchmark. Some learners study the topic of moral, ethical and social implications of agriculture. The subject benchmark accepts that the definition “recognise the moral, ethical and social issues related to the subject” can be displayed by learners to different levels. The benchmark specifies three generic levels, threshold, typical and excellent, that are defined for competence in this subject area. (The subject is there understood to be agriculture, horticulture, forestry, food and
"Threshold" is defined as "recognise the existence of moral and ethical issues associated with the subject"; "typical" is defined as "recognise and be able to comment on the moral and ethical issues associated with the subject" and "excellent" is defined as "recognise, explain and evaluate the moral and ethical issues associated with the subject". The eCOTOOL example then goes on to suggest that, perhaps, threshold could be associated with the number 30, typical with 50 and excellent with 70, though these numbers are given as just one possibility. In practice, it would be up to the body defining the level scheme to allocate the numbers that it thought both appropriate, and most likely to be familiar and useful to those using the levels.

More precision is added by the eCOTOOL (2011) technical model. There, a single level definition is specified as having to contain: the identifier of one levelled concept, effectively a binary concept that can be directly assessed; the identifier of the level scheme or framework; and a level number. Without the level number, there would be no reliable way of knowing which level is higher than which other level. In addition, the level definition may contain an unlevelled concept identifier, and a level label for human reading.

Once a set of level definitions have been created, it is possible to assign things either directly to the defined levels, or to a point between them, using the numbering system.

4 Examples

Defined levels have been features of society for a very long time. The traditional craft guilds could be said to have defined ability in a craft at three levels: apprentice; journeyman, and master craftsman. (There were other things one could also say they were doing, but these will not be discussed here.) This at least would allow someone to request a specific level of craftsman rather than simply relying on hearsay about who was "good".

To take an initial arbitrary example (found through web search), in the European fluid power industry, an organisation called CETOP has a web page called "Managing your level of competence", on which they define three generic levels. Level 1 is "Doing activities according to an established procedure. These activities are repetitive or of short duration. If faced with a problem, then calling for assistance or following a set procedure." Level 2 is
"Carrying out various actions which need an understanding of technical factors. These could lead to an interpretation (tolerances, operating methods) or the application of various and non-repetitive instructions. This can imply checks, simple diagnoses and an ability to react to changes. Team work is often essential." Level 3 is written as "Imply a wide and complex range of activities, using one's initiative and making decisions on certain technical aspects (specifications, resources, processes). The ability to carry out a plan of operation, to identify and remedy errors is an important attribute. For these positions, taking responsibility (work quality, results) is expected." CETOP then assigns these levels to competence-based qualifications that they define themselves.

This is much the same in structure as many other generic level schemes, including the EQF (European Commission, 2008), and the language proficiency level scheme used by the Europass Language Passport. As mentioned above, eCOTOOL also offers a generic level scheme with 5 levels, for cases where there is no better option available. The only things that need to be supplied to fit the CETOP scheme into the eCOTOOL model are universal identifiers – for the framework as a whole, and for the three levels. The identifiers preferred by eCOTOOL are URIs, as the Semantic Web is set up to work with them, and they are a great aid to interoperability.

The European e-Competence Framework (CEN Workshop on ICT Skills, 2010), mentioned above, gives examples of more specific levels. For instance, taking an arbitrary example from the middle of the e-CF, e-Competence area D.9 has the title "Personnel Development", and its generic description is "Diagnoses individual and group competence, identifying skill needs and skill gaps. Reviews training and development options and selects appropriate methodology taking into account the needs of the individual and the business. Coaches and/ or mentors individuals and teams to address learning needs." According to the e-CF, this ability can be greater or lesser, and the e-CF defines it at their levels 2, 3, and 4. Level 3 has the definition "Monitors and addresses the development needs of individuals and teams", while level 4 is defined as "Takes proactive action and develops organisational processes to address the development needs of individuals, teams and the entire workforce." Particularly given the earlier examples, it is easy to see how this can be treated effectively within the eCOTOOL model.

The UK’s NHS (2004) KSF, also introduced above, is structured in a way that is quite comparable to the e-CF, and is equally easily represented within the eCOTOOL model.
A rather different explanation of levels is given by the relatively new UK QCF system where there are awards, certificates and diplomas (Skills Funding Agency, 2011). The QCF define level as "An indication of the relative demand, complexity and/or depth of achievement, and/or the autonomy of the learner in demonstrating that achievement." However, there is nothing essentially new about the level scheme itself, which is unchanged from the UK’s National Qualification Framework level descriptors (QCA, 2004). This is a generic level scheme similar in structure to many others.

5 Conclusion

The eCOTOOL competence model is able to represent separately both level definitions and level assignments as in the examples above. The way in which it clarifies that distinction, and related ones, is a significant step forwards towards a better understanding what a level of competence is.

The information models to be presented as eCOTOOL outcomes will serve as input for building interoperability specifications able to represent information about abilities, skills, and competence, complete with levels as described and used by existing competence frameworks. This will allow ICT tools to hold this information coherently, and in particular web-based tools can soon afterwards be expected to help with a wide range of practical tasks that involve information about competence and its levels.

6 References


What is a level of competence?


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Developing a Specification for Competency Semantics

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Abstract. The Japanese government has developed skills standards for each industry. In 2010, a new skills standard project launched for social infrastructure industry, called InfraSS. Asset management was considered as a key work function in this domain in the 21st century. InfraSS was developed based on a competency modeling methodology, including asset management competency. It was defined as a hierarchal skill tree, with relevant knowledge, and with several explanations. In cooperation with the project, an association developed data model specification which could deal with semantics.

Keywords: Data model, XML schema, Competency composition, Competency tree, Competency semantics, Standard specification

1 Introduction

While each concept of competency must be ambiguous because of its hypothetical construction, certain competency information exists in a real system as a data. For example, a company sets up “X communication skill” as one important assessment dimension (factor) or educational objective, then the term of “X communication skill” as a label exists and is exchanged in real world. The HRM system and e-Learning system can deal with the data. Whether the definition or meaning of its skill is clear or not, and also whether the definition exists or not, the data should be exchanged among stakeholders, organizations and the other ICT systems and applications. From the late 1990s, some industrial and academic associations have developed information technology standard specifications for skills and competency on a global level to address the interoperability requirements
and environmental complexities of organizations (Blandin, Frank, Simone & Hirata, 2010). Some examples include work spearheaded by the following organizations: IMS global learning consortium (IMS), HR-XML consortium, IEEE-LTSC, OMG, and also ISO/IEC JTC1 SC36 (ISO-SC36).

Some of specifications could solve interoperability issues, but several problems for management and exchange of competency information still remained (Hirata & Brown, 2008). One of the main problems is how to express and to exchange semantics of competency. For this problem solving, ISO-SC36 has developed the conceptual reference model for competency (ISO/IEC TS 24763, in printing). The Japanese ministry of economy, trade and industry (METI) and its institute (IPA) developed semantics information model for competency (Hirata, Ohara & Makiuch 2007). The society of human resources markup-language (HR-MLs) has developed a data model for competency semantics in cooperation with Japanese government (2011).

The existed specifications provided manners of identifying and exchanging competency information, including the data of identifier, name, creator, and so on. These are indispensable to communicate among different systems in human resources management (HRM) and information and communication technology for learning, education, and training (ITLET). Some of stakeholders and organizations would like to know competency semantics, because competency was ambiguous. Especially, stakeholders who want to commit competency semantics, such as teachers, learners, instructional designers, HRD staffs, learning content developers, and so on, need to know its detailed information.

Having characterized information regarding competency semantics, such as explanations, the organization/institute which made them, action, assessment methods and their relationships, the entities relevant to competency are useful to refer and to understand what a competency is, not only for information systems and also for understanding by humans. The other entities relevant to competency, especially those focused on semantics, can provide characteristic and contextual information. The entities are indicated or combined by the classes of ISO/IEC TS 24763.

This means two aspects are needed to build information model or data model for competency. One is to identify the entity itself, which is constructed by a set of information elements for identifying the existence of competency. The other one is to express the semantics of entities, which is a set of information elements or properties for specifying and characterizing a
Developing a Specification for Competency Semantics

competency. So, based on ISO and HR-MLs standard specifications, this paper discusses the basic perspective of modeling and implementation of competency information into systems for dealing with competency semantics.

2 Purpose

A data model for competency semantics was developed and verified by introducing to InfraSS competency and skill entities. Before developing it, patterns of information relevant to competency and features of competency construction as semantics were researched and organized. Then data model for competency semantics was developed.

3 Competency information aggregation

There are various patterns of implementation of competency information. Competency information itself is expressed with using various elements or properties. As the implementation of competency information is complex, we suggested separating three types of competency information aggregation as an implementation guide. The three types were competency trees, competency compositions and competency packages.

3.1 Competency Tree

A competency tree is one of the aggregation patterns that composes a set of skills or competencies and is a digitalized expression for its parent-child relationship. A set of competencies is usually a hierarchal structure that consists of several members of competency. In other words, a competency is defined in a certain set of competencies as a tree structure, that is, a lower competency is a child, and a competency set by several competencies is a parent. For example, “IQ: intelligent quotient” is the most famous concept of competency. Almost all IQ theories were structured by several competencies, such as speaking competency, writing competency, calculating competency and so on. “SFIA: skills framework for the information age” is a well-known skill structure focusing on industrial
perspective. It has six skills as the 1\textsuperscript{st} layer, and also each skill from the 1\textsuperscript{st} layer has several sub-skills as children and it is like to a tree structure. In other hands, companies also set their own competency tree as a list or dimension for human assessment. Almost all of these competency trees consist of several competencies, including skills, knowledge and/or attitude. Figure 1 shows a part of the social infrastructure skills standard (InfraSS 2011) by the Tokyo Metropolitan Government and Ministry of Internal Affairs and Communications. InfraSS has 6\textsuperscript{th} layers as a tree structure. The 1\textsuperscript{st} layer is divided into 5 categories, element technology skill of bridge, technology management skill of bridge, bridge asset management skill, social skill, and business skill. The figure shows the bridge asset management skill area. The 6\textsuperscript{th} layer, although there is no information in the figure, is set by relevant knowledge.

3.2 Competency composition

Competency composition is one of the aggregation patterns that consists of structured relationships by elements, properties and/or attributes, and is used to identify, exchange, and express competency information including its semantics among systems. Figure 2 shows an example of semantics expression for a certain competency in InfraSS. “Capital expenditure evaluation skill” was picked up as a competency. InfraSS project introduced the semantics expression method by the ETSS skill meta model (Embedded Technology Skills Standard by METI).

3.3 Competency package

Competency package is one of the aggregation types that integrated ways into other entities related to a competency. There are various entities regarding a competency, such as educational objectives, educational resources, educational record, job description, career record, level information, and so on. Competency package is one of the guides for implementation into other entities and systems.
<table>
<thead>
<tr>
<th>2nd Layer</th>
<th>3rd Layer</th>
<th>5th Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Management</td>
<td>Asset Management Strategy and Planning Skill</td>
<td>Asset Management Policy &amp; Strategy Making Skill</td>
</tr>
<tr>
<td>Lifecycle Skill (AML)</td>
<td>(A32: Asset Management Support Skill (AMS))</td>
<td>Demand Analysis Skill</td>
</tr>
<tr>
<td></td>
<td>Asset Information Management Skill (AIM)</td>
<td>Strategic Planning Skill</td>
</tr>
<tr>
<td>Whole Life Cost Justification</td>
<td>Lifecycle Delivery Skill (ACD)</td>
<td>Asset Management Planning Skill</td>
</tr>
<tr>
<td>Skill (WLJ)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Management Skill (RIM)</td>
<td>Risk Assessment &amp; Management Skill</td>
<td></td>
</tr>
<tr>
<td>Asset Information Systemizing</td>
<td>Sustainable Development Skill</td>
<td></td>
</tr>
<tr>
<td>Skill (AIM)</td>
<td>Weather &amp; Climate Measuring Skill</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Review &amp; Audit Skill</td>
<td></td>
</tr>
<tr>
<td>A33: Asset Organization</td>
<td>Organizational Development Skill (ODE)</td>
<td>Contract &amp; Supply Management Skill</td>
</tr>
<tr>
<td>Management Skill (AOM)</td>
<td></td>
<td>Organizational Structure &amp; Culture Skill</td>
</tr>
<tr>
<td></td>
<td>Human Resources Development Skill (HRD)</td>
<td>Competency &amp; Performance Management Skill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Asset Management Training &amp; Development Skill</td>
</tr>
</tbody>
</table>

Table 1 Competency tree of asset management competency in InfraSS
Explaination: Financial numbers to be based on the cost of any capital treatments needed to maintain the component to the required standard over the life cycle. If a component does not normally require any treatment to maintain its life indefinitely, no charge applies to that component. Life assumptions must be reviewed annually and adjusted as necessary.

<table>
<thead>
<tr>
<th>Element</th>
<th>Instance</th>
</tr>
</thead>
<tbody>
<tr>
<td>verb</td>
<td>Analysis</td>
</tr>
<tr>
<td>Object</td>
<td>Asset-value, Benefit-evaluation</td>
</tr>
<tr>
<td>Tool</td>
<td>LCC calculation, Balance sheet</td>
</tr>
<tr>
<td>Method</td>
<td>DCF method, Capitalization method &amp; criteria</td>
</tr>
<tr>
<td>Role</td>
<td></td>
</tr>
<tr>
<td>Outcome</td>
<td>Report of asset value analysis</td>
</tr>
<tr>
<td>Prerequisite Knowledge</td>
<td>Accounting, Flowability index, Liquidity assets</td>
</tr>
<tr>
<td>Situates Knowledge</td>
<td>Asset ratio, Governmental policy, Financial condition, Net asset value</td>
</tr>
<tr>
<td>Resources</td>
<td>Capex manual, AM guideline, Governmental &amp; federal policy</td>
</tr>
<tr>
<td>Performance Process</td>
<td></td>
</tr>
<tr>
<td>Taxonomy</td>
<td>InfraSS.ver2011</td>
</tr>
<tr>
<td>Placement</td>
<td>AM/AML/WLJ/</td>
</tr>
<tr>
<td>Level</td>
<td>InfraSS.ver2011.skill_level</td>
</tr>
<tr>
<td>Relation</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2  Semantics composition of asset management competency

4 Component types of competency information

For expressing and exchanging competency information, including semantics information, its properties or attributes should be identified and used with same manner for interoperability. Many properties and attributes have already used in SkillsNET, ETSS, HR-XML competencies, IEEE RDC, TENCompetency learning paths specification, eCOTOOL, and so on. These were researched and organized based on ISO/IEC 24763 and the ETSS skill meta model.

ISO/IEC 24763 took up information objects of metadata. These objects can be considered as information properties regarding competency semantics. These objects are action, actor, criteria and methods, environment, evaluation/assessment process, LET institute, outcome, role, and competency itself. These objects are divided into two types for modeling competency semantics. The reason for this is to answer the
requirements of system interoperability. One is for only exchanging information among systems. These were organized as a Basic Competency Component (BCC). This is a set of properties or attributes for identifying competency information, for example, ID, title, description, creator and so on.

The other is for expressing semantics or contexts of competency as a Semantics Competency Component (SCC). The ETSS skill meta model focused on expressing meaning of skill and also competency. The model pointed out the importance of the essential functions of skill and competency, which proved the existence of a skill and a competency. Several researches and projects also suggested it (e.g. Brown and SkillsNET). These properties are actionVerb and object. Hence there are many types of other properties for expressing the features of a competency. These properties were analyzed and divided into 2 categories as compositions.

So the SCC is a set of elements for the expression of competency semantics. The semantics properties for competency can be organized into 3 types. But these do not always need to be implemented as separated compositions. Competency Essential Component (CEC) and Competency Scenario Component (CSC) focus on the meaning of competency itself, in other words the modality, performance, constitution or figuration. These properties are the classes of ISO/IEC TR 24763 which has direct relation with the competency class. CEC is a set of essential properties for the semantic expression of the meaning of a competency. For essential expression, the key factors are the “actionVerb”, and not only behavioral, but also cognitive verb and affective verb. While it is normal that an action verb accompanies an “object”, the verb can be dropped off for expression of knowledge.

CSC is a set of properties for the semantic expression of meaning of a competency. This component is “modifier” which gives more specific meaning or determinative. It is modification is related to the action verb, object or a set of them. (e.g. tool, prerequisite knowledge, process, outcome, role, and so on). The Competency Context Component (CCC) is a set of properties for the expression of context information with a competency. This is the information of indirect relation to competency class in ISO/IEC TS 24763. (Example: taxonomy, placement, relation, assessment and so on.)
<table>
<thead>
<tr>
<th>Component</th>
<th>Sub Component</th>
<th>Explanation</th>
<th>Examples of property</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Competency Component (BCC)</td>
<td></td>
<td>a set of elements for identification of a competency information.</td>
<td>id, title, description, creator</td>
</tr>
<tr>
<td>Semantic Competency Component (SCC)</td>
<td></td>
<td>a set of elements for expression of competency semantics</td>
<td>—</td>
</tr>
<tr>
<td>Competency Essential Component (CEC)</td>
<td></td>
<td>a set of essential properties for semantics expression of meaning of a competency.</td>
<td>actionVerb, object</td>
</tr>
<tr>
<td>Competency Scenario Component (CSC)</td>
<td></td>
<td>a set of properties for semantics expression of meaning of a competency.</td>
<td>tool, process, prerequisite knowledge, outcome, role</td>
</tr>
<tr>
<td>Competency Context Component (CCC)</td>
<td></td>
<td>a set of elements for expression of context information with a competency.</td>
<td>taxonomy, placement, relation, assessment</td>
</tr>
</tbody>
</table>

**Table 3 Component types of competency information**

### 5 Implementation of semantics information to XML

After these researches and discussions, a data model for competency semantics was developed (HR-MLs 2011). Some of the examples are shown in figure 2 and 3. Basically in XML, there are two types of expression. One is schema, the other XML data. In the figures, sample schema and XML data are listed. Figure 2 shows the XML schema and data for a competency essential component. It is composed by id, name, actionVerb and object. Figure 3 shows two types of implementations for an element as a property of semantics. This is example of “object” properties. The information entity is implemented by several ways in an XML manner. Figure 3 shows two types of implementation for an object. The upper side of the figure shows simple text information called simple type. The downside shows complex type, which has several elements, attributes, or properties.
6 Conclusion

A discussion of existing specifications and projects, pattern and feature of competency semantics were specified and organized to express and exchange among information systems. Initially, three patterns of information aggregation were made clear to deal with competency information referring to the social infrastructure skills standard. A competency tree was for the expression of the whole competency model. Competency composition was for the expression of the features of competency, in other words, this is the main target for exchanging and managing competency semantics. Competency package is for the practical usage in deferent systems and applications. Then competency composition was focused on, which expresses competency semantics directly, and then a lot of properties for expressing semantics were picked up and organized based on previous studies and works. Four types of components were found and each component was categorized by the feature of semantics. These segmentations must be useful for the implementation and definition of competency meaning as a guide. Finally, a data model for competency semantics was developed and some examples were shown. This data model complied with existing standard specification, system and application can be introduced to this model if they want to deal with semantics information and to enrich their system for users.

7 References


IEEE 1484.20.1 (2008) Reusable Competency Definition. IEEE LTSC.


Stracke, C. M. (2009). PAS 1093 Competence modelling human resources development. The German standardization body, DIN.
XML Schema

```
<xsd:complexType name="CompetencyEssentialType">
  <xsd:sequence>
    <xsd:element ref= "CompetencyEssential" minOccurs="1" maxOccurs="10"
               use="optional"/>
  </xsd:sequence>
  <xsd:element name="CompetencyEssential">
    <xsd:complexType>
      <xsd:list>
        <xsd:element ref="Essential_Id"/>
        <xsd:element ref="EssentialName"/>
        <xsd:element ref="ActionVerb"/>
        <xsd:element ref="Object"/>
      </xsd:list>
    </xsd:complexType>
  </xsd:element>
</xsd:complexType>
```

XML Data

```
<id> infraSS2011_s03_010202fu </id>
<name> CapitalExpenditureEvaluationSkill_Essential </name>
<actionVerb> analysis </actionVerb>
<object> Asset-Value Benefit_Evaluation </object>
```

Figure 4  Example of data model implementation for competency semantics (1)
Figure 5  Example of data model implementation for competency semantics (2)
Vocational educational training and labour market challenges in Albania

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Abstract. This paper presents and discusses view of the state of Vocational Education Training (VET) in Albania and how this system has affected socioeconomic development of Albania. Despite progress in reforming VET system, Albanian VET system continues to have poor reputation from a qualitative point of view, and a low percentage of learners, youth or adults have been involved. An examination of several indicators in different sectors shows that VET should be improving its image and status. The challenges facing VET in Albania are also discussed.

Keywords: Human capital, vocational education training, labour market, Albania.

1 Introduction

Human capital development is recognized as an important factor for the positive impact in the overall process socioeconomic development of the world. “Human capital development is shaped by different policies, including education and training,
employment and active labour market policies, as well as cross-cutting policy issues related to equity and social inclusion, competitiveness and innovation policies” (ETF 2010, 3). Becker (1993) shows that education and training are the most important investment in human capital. Although the Albania has managed to decrease the percentage of people who have low levels of education, this remains disproportionately high when compared to the corresponding percentage in the EU States.

Reforms of VET have designed in the Albania as part of reforms of education systems. Since 2000 this process started to be introduced in Albania, through different processes and particularly through laws covering the whole education system or some parts of it. The VET reform in Albania has been strongly influenced by foreign donor interventions. Implementation of VET reforms has started in Albania supported by EU CARDS programmes. This has involved establishing links with the labour market, building labour market intelligence, promoting the involvement of social partners, developing new curricula and teacher training, and introducing occupation-based curricula and learning-outcomes-based approaches (Xhumari-Vaso 2005). Despite progress in reforming VET system, Albanian VET system continues to have poor reputation. More efforts are needed to address the following challenges: (i) VET system continue to remain focused on inputs; (ii) the relations between the VET school and businesses are weak which has a negative impact on pupils’ skills and competencies, and create barriers to pupils to be oriented to the labour market (ETF 2007); (iii) vocational education is not attractive as general education; (iv) the role social partners is not sensitive in VET and lack of sustainable financial mechanisms. Therefore needed a modernization of VET to transform the existing system in a quality system of quality-oriented education and training, with access to the labour market and in compliance with EU standards of qualification.

Any reform in the VET system needs to be closely linked to an analysis on the trend and structure of the labour market and society. “VET (regardless of the level) aims to provide skills that can be immediately applied on the labour market in the targeted occupation” (OECD 2009, 2).
2 Background

2.1 Socioeconomic background - Albania

In 1991, Albania adopted a market economy, significantly changing the business culture in the country. As might be expected, the transition period has been difficult, but Albania has achieved remarkable results. Real economic growth per year has been in a constant manner between 5-10%, in an average of 8% every year and 6% from the year 2001. Economic growth is one of the highest between countries in transition. Albania’s economic growth can be attributed mainly to agricultural production. Agriculture, which previously was the main sector of economy, in 2008 accounted for 18.5% of GDP and 43.7% of the country’s total employment (INSTAT 2010). In previous years, construction sector companies had been growing strongly but this scenario has declined in recent times (ILO 2011).

Economic development became a state priority and, as a result, the startup and operation of private enterprises was encouraged. According to official data obtained by the INSTAT (2010), Albania had 109,267 private enterprises by 1991. About 92% of total enterprises are with 1-4 employed. The most part, 62%, have only self-employer.

According to Labour Force Survey 2009, the working age population in Albania represents 87.9 percent of total population aged 15 years and over. The labour force participation rate that measures the proportion of working-age population of a country which is active in the labour market, either by working or looking for work is 61.9 percent in Albania in 2009. The unemployment rate in 2009, according to official statistical data, was 13.8%, whereas the employment rate was 53.4% (INSTAT 2010). The employment structure by sectors reveals that there is a declining tendency in employment in agriculture private sector, while employment in non-agricultural private sector has an increasing tendency.

2.2 Region of Korca – Albania

Region of Korca is the major economic centre in Albania’s southeast, as a region with a distinct identity, deriving from its urban history, civic tradition,
culture and human scale and surrounded by a beautiful natural setting, at the foot of mountain over a fertile agricultural plateau. Moreover, the city is perceived as a dynamic pole of regional development resting on complementary economic activities and fully utilising local skills, assets and potentials. The Prefecture of Korca, includes the districts of Korca, Pogradec, Devoll and Kolonje. The biggest town is Korca, which is the center of the region (*Figure 1*).

![Figure 1. Map of Korca Region](http://www.visit-korca.com/files4users/images/news/2011/qarku_i_korces.jpg)

The economy of Korca is based on three sectors (agriculture, production and construction, services), constituting a particularly positive mixture of economic activities; however, the overall emigration rate and the ratio of labour-emigrants to total population exceed the national average, indicating

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a lack of employment opportunities and non-dynamic labour market. In addition, the leading employment sectors are subject to structural changes which may cause increased unemployment and affect social cohesion; most notably, the labour-intensive textile manufacturing industry which employs 1/4 of the active workforce, especially women, is expected to decline due to increased labour costs.

According to INSTAT (2010), the economically active population of Korca City is 74,801 people, while the registered unemployment rate reaches 12.3% and long term unemployment rate 10.8%. These numbers are somewhat lower than the national average. Rural unemployment is currently a major social and economic problem, which according to data from the communes is estimated to reach as high as 60%.

According to official data obtained by the INSTAT (2010) in this area there operate about 7812 enterprises out of which 7350 are micro (1-4 employees).

The following part provides an overview of the main sectors of Korca’s economy, identifying for each sector level of development and challenges for future.

Agro-processing - Korca is an important processing centre; considering the number of business enterprises, it is the third largest concentration of agro-processing in the country. It has been suggested that agribusiness is the future driver of the local economy in a process which will require the modernization of current farming practices, attraction of investments and structural reforms towards patterns of vertically integrated production (combining production, processing and forwarding facilities). Furthermore, despite the fertility of Korca’s plateau and the presence of skilled workforce, the agricultural sector is characterized by low productivity, rendering the city relying to food imports and afflicting the dynamic agro-processing sector, the latter being dependent on interregional and international imports of raw material; the main reason can be traced in the combination of land fragmentation and lack of supporting associative structures that would allow for investments and modernization of farming practices.

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9 City development vision 2009. This study was implemented by the Municipality of Korca and World Bank.

10 According to the Regional Council of Korca’s paper on Regional Social Development Strategy 2005,
More attention should be given to the organization of the knowledge infrastructure to stimulate effective cooperative knowledge production and learning (Mulder and Kupper 2006). Agricultural education can serve as a structural lever for innovation in agriculture (Mulder 2005).

Textile manufacturing - 40 textile manufacturing enterprises operate in Korca, accounting for 4,500 employees; that is, 1/4 of the total employment and far more than half of the local female employment (INSTAT 2010). This labour intensive industry, where Albanian manufacturers work as subcontractors (in charge of cutting, sewing and finishing) for foreign (most likely Greek) partners (which provide the imported raw material and forward the finished product to the international markets) is expected to decline, since the gradual rise of average wages in Albania may lead foreign contractors to seek cheaper subcontractors in the Far East and elsewhere.

As indicated in the Strategic Economic Development Plan for Korca11 “…only those companies that create direct business relationships with large foreign clients, who bypass foreign brokers, will have a chance to survive”; in other words, structural reforms towards integrated production-marketing ventures may leverage the effects of this anticipated foreign capital flight to a certain extent, keeping Korca as a factor in the textile industry; however, it seems unlikely for the industry to preserve its current role as leading employer.

Tourism - Despite its remote location and poor connection, Korca presents a budding tourist industry which provides a significant source of economic activity and income. The rich natural and cultural heritage of the city (old city, several museums including the best-endowed medieval museum in Europe) and the wider area (traditional settlements of Voskopoja and Dardha, national parks of Prespa and Drenova, etc.), along with modern attractions and organization of important cultural and recreational events (beer festival, exhibition of contemporary art, hosting of an accredited international anthropological conference, etc.) attract large numbers of visitors, rendering tourism a quite dynamic economic activity with significant future potential.

Construction - Almost 30 incorporated firms, engaging 2,000 employees and self-employed operators, carry on construction in the “formal” sector in and around the city of Korca; furthermore close to 15 firms are engaged in

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manufacturing building materials. Incorporated constructors cater to household demands and construct private homes and apartment houses in the “formal” private sector, in a process largely fuelled by labour-migrants' remittances. To a lesser extent, they respond to demands from the business sector, constructing commercial and other business facilities. Public works are also a major sector of engagement, which is largely dependent on funds from international donors, as the national and municipal finance is quite limited today. Thus aspired, the incorporated construction firms and manufacturers of building materials, search for ways and means to penetrate the national market and establish relationships with international construction interests.

Certain small, unincorporated construction outfits cater to the demands originating in the “informal” sector. In the case of Korca the relative weight of this sector is rather small and expected to decline along with the gradual formalization of residential development.

Foreign remittances of capital from emigrants generate income in the city and finance the construction sector, which also relies heavily on foreign direct investments in infrastructure projects.

3 Labour market analyse

Labour market analyse is intended that through the identification, recognition, study, discussion and evaluation of data supplied by the businesses of these sectors, the better defined needs of the labour sector for skilled specialists in relevant fields and based on evaluation by new requirements that raised for education and vocational training to the tasks defined for the future VET. This discussion and analysis after the final opinions with the participation of business, local government and the VET providers will eventually be available to these organizations for programming and improve their activity in the future. Suggestions, conclusions reached from this analysis will serve also for active policy-making which would be served entities or employers to meet their needs for employment of workers to form the relevant standards set by companies.

Final goal of this analysis consists of active policy making and drafting of sectoral or regional strategies that will positively affect the labor market.
4 Picture of current needs of the labour market

This section provides a more detailed view of the training needs of four sectors. The following results are part of VET Survey in Korca Region (2010) that is carried out by University of Korca.

Construction sector - In the construction business the main need is related to highly qualified employees: engineers e.g. for plumbing, accountants, finance officers. There is also a need for employees on a lower level: e.g. drivers, diggers, crane operators, drivers for specific construction machines, e.g. fork lifts. For that these businesses should be run professional schools that are currently in the town of Korca, offering professional practice at the same time giving opinions on their quality and compliance with current labour market that is required today. About 90 per cent of companies in construction business have contacts with professional education institutions that prepare specialists who are required of them in this labour market, only 10 per cent of them have been students of these schools to make professional practices and these based on personal ties. About 90 per cent of companies say that graduate students responded to their company standards. It is noted that 80 per cent of them do not have adequate knowledge of how students are graduated.

Retailers sectors - In the Retailers Sector the need is for specialized sales personnel, normally they don’t have enough knowledge about the products they are selling and insufficient communication skills.

Textile sector - In the textile sector, the main need is for sewers, especially having experience in usage in specific machines (e.g. singer sewing machines). Based on the responses of the representatives of the ten subjects interviewed shows that companies are more concerned about the qualifications of staff who recruit for having previous experience working in the same process for flexibility at work, so that an employee could recognize more than one work process, to be able to spend in other processes, when not working in its process.

Agro processing sector - In the food-processing sector the main need is for specialists in the usage of the food processing equipment, e.g. in wine and sausage production. Also they need unqualified staff for seasonal work. Moreover, there is a need for higher qualified personnel like economists.

Tourism sector - Restaurant owners said that they need well trained coos and also waiters, especially in the high season which is spring and fall in Korca and summer in Pogradec. Some restaurant owners said that they
would be interested in acquiring more marketing skills, e.g. by taking part in a training course. Hotels work together with restaurants and they shift personnel from the hotel to the restaurant and vice versa. They stated that they need service personnel, especially women trained in housekeeping.

5 Conclusions

Despite progress in reforming VET system, Albanian VET system continues to have poor reputation from a qualitative point of view, and a low percentage of learners, youth or adults have been involved. Any reform in the VET system needs to be closely linked to an analysis on the trend and structure of the labour market and society. Society requires VET system to be able to continuously provide qualified labour force, which should be adapted, appropriately, continuous changes occur in the labour market and the economy as a whole. For this reason the employment policies will always oriented more by the integration of VET system. Human resources development and increase the professional level of the workforce is not only necessary condition for solving the problem of unemployment, but also to ensure the country's economic growth in general. The key point for improving professional qualification of workers and meeting the labour demands is the close collaboration between VET and social partners. A successful model should be the one where the state will finance a decentralized VET system and the local actors will carry out their responsibilities for planning, organizing and managing the offer based on local business demand. The actual model is far from being effective and its output is producing human resources equipped with abilities not requested by labour market or not in compliance with market demand.

The challenge facing VET reform is to strategically meet the new skill needs of predominantly small employers while remaining flexible enough to respond to skill requirements for new economic activities and organisational cultures. The new VET system should offer broader profiles and should be better integrated with the education system and more responsive to economic developments. The best way to ensure that the curriculum of vocational and technical training institutes to better understand and meet the training needs of businesses is to be enable the “disconnect” between businesses and training institutes (Cini et al. 2011).
6 References


Abstract. In e-learning, it is necessary to create more effective interaction between the educational content and learners. In particular, increasing motivation by stimulating learners' interest is very important. Users' eyes can be a significant source of information to analyze learner behavior. What we look at, and how we do that, can be exploited to improve the learning process. Eye tracking is the process of measuring either the point of gaze ("where we are looking") or the motion of an eye relative to the head. An eye tracker is a device for measuring eye positions and eye movement. This paper introduces the use of eye tracking technology to track and analyze the learners' behavior on e-learning platform. Specifically, interesting areas of the course for each learner and also the learner's emotions like level of attention, stress, relaxation, problem solving and tiredness.

Keywords: E-Learning; eye tracking; eye movement; gaze tracking; learner profiling; learner behavior.

1 Introduction

In a virtual learning environment, learners can lose motivation and concentration easily, especially in a platform that is not tailored to their needs. Our research is based on studying learner’s behavior on an online learning platform to create a system able to clustering learners based on their behavior, and adapting educational content to their needs.
Eye movements provide an indication of learner interest and focus of attention. They provide useful feedback to personalize learning interactions, and this can bring back some of the human functionality of a teacher. With a study of eye movement, learners may be more motivated, and may find learning more fun.

2 Eye tracking technology

2.1. Eye tracking methods

Many different methods have been used to track eye movements since the use of eye tracking technology was first pioneered in reading research over 100 years ago (Poole & Ball 2005):

- Electro-oculographic method (EOG): Relied on electrodes mounted on the skin around the eye that could measure differences in electric potential induced by eye rotation (Baccino 2002).

- Scleral search coils method: This technique required the wearing of large contact lenses that covered the cornea (the clear membrane covering the front of the eye) and sclera (the white of the eye that is seen from the outside).

- Corneal-reflection method: Most commercial eye-tracking systems available today measure point-of-regard by the "corneal-reflection/pupil-centre" method. These kinds of trackers usually consist of a standard computer with an infrared camera mounted beneath a display monitor, with image processing software to locate and identify the features of the eye used for tracking. In operation, infrared light from an LED (Light-Emitting
Diode) embedded in the infrared camera is first directed into the eye to create strong reflections in target eye features to make them easier to track (infrared light is used to avoid dazzling the user with visible light). The light enters the retina and a large proportion of it is reflected back, making the pupil appear as a bright, well-defined disc (known as the bright pupil effect). The corneal reflection (or first Purkinje image) is also generated by the infrared light, appearing as a small, but sharp, glint (10. Poole & Ball 2005).

Figure 2. Corneal reflection (The glint) and bright pupil

Once the image processing software has identified the centre of the pupil and the location of the corneal reflection, the vector between them is measured, and, with further trigonometric calculations, point-of-regard can be found. Although it is possible to determine approximate point-of-regard by the corneal reflection alone by tracking both features eye movements can, critically, be disassociated from head movements (10. Poole & Ball 2005).
2.2. Eye-Movement Metrics

Eye movement is typically divided into fixations and saccades, fixation is the moment when the eyes are relatively stationary, taking in or encoding information, and saccade is an eye movement occurring between fixations, typically lasting for 20 to 35 milliseconds. The purpose of most saccades is to move the eyes to the next viewing position. Visual processing is automatically suppressed during saccades to avoid blurring of the visual image. Most information from the eye is made available during a fixation, but not during a saccade (4. Shrestha 2009).

The resulting series of fixations and saccades is called a scanpath. Scanpaths are useful for analyzing cognitive intent, interest, and salience. Other biological factors (some as simple as gender) may affect the scanpath as well. Eye tracking in human-computer interaction studies typically investigates the scanpath for usability purposes, or as a method of input in gaze-contingent displays, also known as gaze-based interfaces.

Figure 4 shows a scanpath tracking on an online travel website. A circle indicates a fixation and a line indicates a saccade. The size of the circle is proportional to the fixation time, and a number shows the order of the fixation.
Figure 4. Scanpath tracking on an online travel website (expedia.fr).

The scanpath gives a clear idea about the visual path including the order and duration of fixations. In this example consists of a web page divided in three columns, we can see that the user has focused primarily on the middle column before moving to the left column and finally to the right column. The number and size of the circles indicate that the user spent more time on the first two columns than the right column.
2.3. Eye tracking vs. gaze tracking

Eye trackers necessarily measure the rotation of the eye with respect to the measuring system. If the measuring system is head mounted, as with EOG, then eye-in-head angles are measured. If the measuring system is table mounted, as with sclera search coils or table mounted camera (remote) systems then gaze angles are measured (4. Shrestha 2009).

In many applications, the head position is fixed using a bite bar, a forehead support or something similar, so that eye position and gaze are the same. In other cases, the head is free to move, and head movement is measured with systems such as magnetic or video based head trackers.

For head-mounted trackers, head position and direction are added to eye-in-head direction to determine gaze direction. For table-mounted systems, such as search coils, head direction is subtracted from gaze direction to determine eye-in-head position.

2.4. Using an eye tracker

Most eye-tracking software are commercial, however, there are some free software as Gazetracker. It is free, and almost complete.

After attaching a camera, the application starts by detecting the pupil (1), however, we can select it manually. And then, we must configure the tracking engine; most eye trackers contain three types of tracking: eye tracking, pupil tracking and glint tracking, you can also activate all three at the same time (2).

Video-based eye trackers need to be fine-tuned to the particularities of each person’s eye movements by a calibration process (3). This calibration works by displaying a dot on the screen, and if the eye fixes for longer than a certain threshold time and within a certain area, the system records that pupil-centre/corneal-reflection relationship as corresponding to a specific "x,y" coordinate on the screen. This is repeated over a 9 to 13 point grid-pattern to gain an accurate calibration over the whole screen.

Finally, you can configure the software to redirect the mouse cursor to the gaze position, or display a new cursor for tracking.
3 Eye Tracking in E-learning

Applications that use eye tracking can be categorized as either diagnostic or interactive. Diagnostic applications show where the learner's attention has been caught, thus providing evidence of the learner's focus of attention over time. In the interactive type, the eye movements are used to replace an input system, such as mouse, allowing the user to interact with a computer using only the eyes (3. Al-Khalifa & George 2010).

3.1 Learner's emotion tracking

The data collected from eye-tracking devices indicates the person's interest level and focus of attention. From eye position tracking and indirect measures, such as fixation numbers and duration, gaze position, and blink rate, it is possible to draw information about the user's level of attention, stress, relaxation, problem solving, successfulness in learning, tiredness, and
more. Even emotions can be tracked, and based on the data; the eye-tracking system can provide more personalized learning (3. Al-Khalifa & George 2010).

For example, if the average pupil size has progressively increased within a certain time interval, also user workload may have augmented. A decreased blink rate in the same period would further confirm such a supposition. When detected, such evidences could for example be used to dynamically modify the learning path, proposing a topic related to the main one but less complex (a sort of break). Or, if the user is potentially having problems in understanding something, extra information may be displayed.

Since several external factors may come into play, however, it is practically impossible to be absolutely sure that these signals derive from changes in the user emotional state. Therefore, rather than undertaking direct actions, such as displaying help windows, the system can assist the user indirectly with gradual assistances. For example, when signs of non-understanding or high mental workload are detected, the system simply proposes links to additional material, which progressively enlarge as the signals of stress persist. When eye data suggest that the user may be tired, and the session has been going on for more than a configurable time interval (e.g. one hour), a message advising to take a break is shown (6. Calvi, Porta & Sacchi 2008).

And here are some experimental evidence in psychology / physiology:
- Mental workload depends on the fluctuation of the rhythm of the pupil area.
- Saccade occurrence rate and saccade length decrease with increased complexity of the task.
- Saccadic and blink velocity decrease with increasing tiredness.

3.2. Learner's interest tracking

We can track learner's interest according to his eye movement on an online learning platform. In this example, we used a free Eye Tracker "Gazetracker 2.0 Beta", and we have activated the "Eye mouse" option to redirect the mouse cursor to the gaze position. We can use any eye tracker provided that it supports the "Eye mouse".

The web page is divided into several areas "<div>", each div contains a different type of information of the same chapter and we will calculate the time spent by the learner on each div by tracking the mouse cursor. To do this, we use two Javascript events: onMouseOver and onMouseOut,
whenever the cursor enters a div, it starts a timer that calculates the time in milliseconds, and it stops when the cursor leaves the div or when user leaves the entire page, using setInterval() and clearInterval() functions. When the cursor enters again the same div, the timer continues where it stopped last time.

---

**Figure 6.** Web page divided into 4 areas to track learner's interest
Tracking data will be stored in the database; teachers can find the gaze duration statistics of each area and for each learner. We converted the durations from millisecond to second to make them easier to understand.

**Table 1. Gaze duration statistics**

<table>
<thead>
<tr>
<th>Learner</th>
<th>Div 1 (Text)</th>
<th>Div 2 (Interactive Flash animation)</th>
<th>Div 3 (Schema)</th>
<th>Div 4 (Video)</th>
<th>Learner Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learner 1</td>
<td>210.22 sec</td>
<td>73.40 sec</td>
<td>43.05 sec</td>
<td>165.25 sec</td>
<td>491.92 sec</td>
</tr>
<tr>
<td>Learner 2</td>
<td>144.12 sec</td>
<td>124.67 sec</td>
<td>29.87 sec</td>
<td>170.45 sec</td>
<td>469.11 sec</td>
</tr>
<tr>
<td>Learner 3</td>
<td>243.49 sec</td>
<td>142.32 sec</td>
<td>12.01 sec</td>
<td>98.71 sec</td>
<td>496.53 sec</td>
</tr>
<tr>
<td>Div Total</td>
<td>597.83 sec</td>
<td>340.39 sec</td>
<td>84.93 sec</td>
<td>434.41 sec</td>
<td>---</td>
</tr>
</tbody>
</table>

**Figure 7. Gaze duration chart**

Further analysis on the learner profile such as learning style, tiredness, confusion can also be performed once the data are set. For example a learner with a strong visual memory but weaker verbal processing will spend more time on the picture rather than the text. Once the learner’s learning method is identified, the educational content is adapted to provide mainly
images and video, rather than text, and thus increasing the efficiency of the learning process.

When learner logs in, the results from the parameters analysis block are saved in the database. Every time when the user starts a course, his behavior is recorded in the database. This includes when the course is started, which page the learner had visited and how long she/he spends on each area. This data is combined with eye movement to get a fine-grained user profile.

4 Conclusion

Eye-movement analysis does appear to be a promising new tool for evaluating learners' behavior. This technology can provide many benefits to e-learning, such as facilitating adaptive and personalized learning. Even though the cost of an advanced eye tracking system is still high, in a couple of years the rapid technical progress may come with low-cost solutions and accurate eye tracking systems.

Our main goal is to create a system for analyzing the behavior of learners that can be used in online learning platforms to improve the learning situation by placing the learner at the center of the learning process. After we talked in our first paper about using learner personal data, and his statistics of interaction with the system and with the available educational tools (quiz, forum, wiki, chat...), and also using data from the client's machine extracted from web server to analyze learner behavior (I. El Haddioui & Khaldi 2010), we introduced in this paper, the use of eye tracking technology that allows us to determine learner's interest and emotions.

We have now collected almost all the data needed to create our system that will regroup learners in profiles according to their behavior on the platform. The next step is to submit this data to a psychic and pedagogical analysis, and then extract from this data the features of each learner's profile.
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A Descriptive Communication Competency Model Corresponding to Specialized Communication Function

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Abstract. While communication competency is the key for business success, its ambiguity remains an issue that has not been yet resolved. This paper proposes a structural descriptive model for specialized communication competency. The model does not rely on an unformed structure and texts of sentences. Based on verb analysis from the standpoint of ontology, this framework suggests ways to identify verbs relevant to communication that have slightly different meanings. Through a case study, this model was verified and it became possible to catch and express an essential feature of communication competency.

Keywords: Communication Competency, Descriptive Model, Expression of Function, Action Verb Analysis

1 Background and Problem Development

While almost all workforces have longed for “coherency”, “sympathism” and “open communications” in the workplace (Goleman 2000), a lack of communication and a lack of skills lead to problems in the workplace and school. There are a lot of studies and guidelines for communication, but these cannot achieve effective and practical improvements in assessment and training. Because the concepts and criteria of communication skills addressed in these documents are still vague, it is difficult for stakeholders
to reach a mutual understanding. For instance, people who speak a lot without thinking deeply receive more attention and a higher evaluation from their stakeholders than people who speak little and with deep and logical thinking. As a result, it is hard for the former to notice his wrong communication method and style.

At the present, several studies and projects have developed common guidelines or inventories. Spencer & Spencer (1993) developed a competency dictionary which was generally adaptable in the business domain, including several competencies relevant to communication, such as “teamwork competency”, “impact and influence competency” and so on. Each competency was defined by an explanation and behavioral criteria in the document. But as these explanations were written in the text as natural language, there remained vagueness in the document. Because of this, these competencies were understood subjectively.

Moreover, these kinds of documents are written in a manner and structure for the definition of each competency. Therefore, in only reading the document, we should be able to grasp its content. The social skills inventory (SSI) by Riggio (1986), which integrated various communication concepts, had measurement items for each one. But items were also written in the text as a behavioral list, and these were attributed to no specific structure or model for communication. In the same way, we cannot understand these models without reading the sentences covering the items. Such points show that there is a limit to performing modeling in text only. Moreover, almost all competency dictionaries are defined by their respective uniform modeling methodology, even SSI, a specialized method for communication competency has not considered alternative models yet.

Both verb and object are indispensable to describe definitions, behavioral criteria, and measuring items for competency modeling. PAS 1093 (Stracke 2009) also pointed out the importance of verb expression. Even if it is defined by expression of function (Hirata & Brown 2008) without verb classification or ontology, it remains ambiguousness. On the other hand, it is also difficult to adapt general verbs conventionally treated by research of verb classification by Puquette (2007). Therefore, a specialized competency model and verb classification system would be useful to building a competency model in order to understand the meaning of competency, and to use it effectively in assessment and training without depending only on natural language.
2 Purpose

This paper proposes a descriptive model of competency related to communication, which enables a clear definition. A framework for verbs that can clearly describe things in more detail and which is feasible to practical situations is also proposed. This will be helpful to provide a common understanding for assessment and training.

3 Method

Competencies related to communication were analyzed from five viewpoints: 1) essential function of competency, 2) information sending/receiving form, 3) meta function (management) to competency, 4) communication information entity, and 5) detailed function and verb-analysis. By giving priority to these five viewpoints, it may become possible to grasp an essential feature of communication competency, and to select and combine the appropriate competency for practical situations.

3.1. Essential function of competency

When the concepts regarding human performance such as competency, skill, and task are defined by action then it might represent the identity itself. The most basic expression is the act formed through a verb. In academic psychology, researchers tried to clarify the general factors of human function, then they express this using verbs, such as "writing", "speaking" and “calculating” etc. (e.g. Eysenck 1979). In addition, job analysis researchers defined a minimum task using both verb and object. Tasks were recommended to be defined more clearly and in a more detailed fashion accompanied by modifiers (SkillsNET 2006). Recently, the basic function of ability is defined by actionVerb and object in the research of competency modeling (Janssen, Hermans, Berlanga & Koper 2008; Stracke 2011).

3.2. Information sending/receiving form

As the aspect of sending and receiving is the basic concept of communication, it has not been handled differently from “speaking” or “listening” in existing communication skill and IQ research. For instance,
"speaking fluency" and "listening" were dealt with as typical abilities. The problem is what these ability expressions only focus on one-way communication, and communication in business does not work out in only one way. For instance, behavioral descriptions are below A and B by "relationship-building" competency in the Spencer's competency dictionary. Both of the verbs indicated need two-way communication at the same time. To express both sending and receiving is necessary for competency model.

A: to share personal information to create a common ground or mutuality
B: to anticipate the effect of an action or other detail on people's image...

3.3. Meta function (management) to competency

According to the situation, people have to change their performance. And they need to combine several competencies by the minute. There is a following description in "directiveness" competency (DIR-C) in the Spencer’s. This sentence of definition indicated two points, 1) if DIR-C rises with the combination of “Achievement-valuing” competency, it can be more effective. 2) DIR-C occurs in specific situations or conditions, such as lack of another skill. These reflect typical characteristics of competency, so competency flexibly executes in practice and should be managed.

C: DIR-C can be a combination of high “Achievement Orientation competency” with either a lack of skill in “Impact and influence competency (IMP-C)” or a specific situation in which use of those skills is not appropriate.

3.4. Communication information entity

Communication is classified into "verbal" and "non-verbal", which are expression forms in information sending. On the other hand, information is classified into "code" and "mode", which are information forms. Code information is information to encode completely, descriptive expressible, and to provide common understanding through processing it. For instance, number, text, computer program, and etc. Mode information leans on the receiver's interpretation, for instance feelings, attitude, atmosphere, and etc. Both aspects are considered affecters for the execution of competency. Thus
a certain communication competency might have several entity patterns, which were combinations of “verbal/non-verbal” and “code/mode”.

3.5. Verb-analysis

Considering above 3.4, a verb leads to several meanings according its object. For instance, “persuade (v)” in IMP-C accompany with several objects. In case of "result of stating in number", the verb entails [code-verbal] pattern. In the case of "idea which is behind of text", it entails [mode-verbal] pattern, and in case of "feelings", it entails [mode-nonverbal] pattern. These patterns mean that the necessity for the expression of the basic function should be more suited the realities. Therefore, it is effective to express a definition in detail according to information entity patterns by children-hierarchy. In the function attribute between parents (1st layer) and children (2nd layer), if same or similar verbs are used in both, it might lead to confusion. So function expression should use verbs elaborately. For reducing variety of verb pattern, verbs should be defined elaborately. We took up verbs that were used in the Spencer’s relevant to communication competency. Then verbs in a competency were analyzed for each, based on an ontological view for action (Mizoguchi & Hayashi 2010). Table 1 shows the result of analysis of IMP-C. 8 verbs were used for defining IMP-C. The 2 classification items were introduced by Mizoguchi etc. The items are critical views which can be divided into a 1st layer or a 2nd layer, [what to achieve (WHT)] and [how to achieve (HOT)]. WHT is a concept regarding results of achievement. HOT is a concept regarding means to results. The functions assumed as HOT were removed from the basic function as a 1st layer, and the other functions assumed as WHT were inserted to a specific function as a 2nd layer. For instance, to persuade, a tacit aim that raises others’ behavior modification is included. On the other hand, it can be said that present and discuss are means and support for behavioral modification. In that sense, it can be said that it is more appropriate to leave only persuade which becomes a purified expression of function than for present and discuss to be included in 1st layer. Other classification items were added for 2nd layer in order to specify verbs which were slightly different to each other. For instance, in general, it is difficult to distinguish similar verbs, such as express and tell.
Table 1  Verb classification concerning sending in impact and influence competency

<table>
<thead>
<tr>
<th>Classification item</th>
<th>verb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>describe</td>
</tr>
<tr>
<td>What to achieve</td>
<td>✓</td>
</tr>
<tr>
<td>How to achieve</td>
<td>x</td>
</tr>
<tr>
<td>Final content</td>
<td>✓</td>
</tr>
<tr>
<td>Addition of information</td>
<td>✓</td>
</tr>
<tr>
<td>Compulsion</td>
<td>x</td>
</tr>
<tr>
<td>Interalation</td>
<td>x</td>
</tr>
<tr>
<td>Listener’s understanding level</td>
<td>✓</td>
</tr>
<tr>
<td>Material</td>
<td>x</td>
</tr>
<tr>
<td>Talker’s emotion</td>
<td>x</td>
</tr>
<tr>
<td>Language</td>
<td>✓</td>
</tr>
</tbody>
</table>

4 Development of a Model

Reflecting the discussion of the above five viewpoints, we tried to develop a communication competency base model (CCBM; Figure1). First, the main function of competency could be described using verb and object, and modifiers were effective to express more specific function. Then the attributes regarding function were put into CCBM, “function”, “actionVerb”, “object”, and ”condition”. Through discussion in clause 3.2, the function of communication was characterized as sending and receiving. As the aspects mean an orientation of communication function, then it was set one of attributes.
In the clause 3.3, relationships of combination and condition with other competencies are one of functional orientation of a certain competency. To define the relationships, it is assumed there is an essential effect to execute appropriately in practice, i.e., in other words, management. Orientation attribute should have also “management”.

Second, the 2\textsuperscript{nd} layer defined specific contents corresponding to information entities through clause 4.5. Essential functions were defined in the 1\textsuperscript{st} layer, and the detailed function as “means” to achieve the essence function of the 1\textsuperscript{st} layer was defined in the 2\textsuperscript{nd} layer. As a result, description by the 2\textsuperscript{nd} layer could express more specific and feasible function for practical performance. However there were some problems. The first problem was the overlap with the expressions of the function of the 1\textsuperscript{st} layer. For this problem solving, CCBM described the whole concept of a certain competency in 1\textsuperscript{st} layer for general explanation and essential meaning, and described substantial actions in 2\textsuperscript{nd} layer, corresponding to real situation.
The second problem was diversity of the action pattern in a competency. As it was hard to describe the feature of competency using only the 1\textsuperscript{st} layer, so the 2\textsuperscript{nd} layer was helpful. The cause of diversity of communication was pattern of action. The communication pattern could be unified through 3 reflecting 2 viewpoints from 3 types of information entities.

5 Verification of CCBM

CCBM was verified for practical effectiveness in describing concepts and discrimination. Two competencies related to communications were picked up, "DIR-C" and "IMP-C" in the Spencer’s competency dictionary. In the comparison, 1) every verb in the document was taken up, 2) all verbs were merged and categorized into “what to achieve” verb expression, 3) all verbs were unified with object to express function, 4) verbs were classified into communication patterns based on meaning of each function, 5) verbs related to “what to achieve” were submitted to the 1\textsuperscript{st} layer verb, 6) all functions related to “how to achieve” verbs were submitted to the 2\textsuperscript{nd} layer. Additionally, there might be a difference in an actual expression of function, because the verbs were taken up for the reading of Japanese sentences.

5.1. Difference of definition between DIR-C and IMP-C of 1\textsuperscript{st} layer

The number of verbs in each competency, which comes from the main definition document, was counted. As the result, DIR-C found 3, sending 3 and receiving 0. IMP-C found 4, sending 2 and receiving 2. These results indicated the differentiation clearly between the competencies along with each feature.

5.2. Difference concerning sending in DIR-C and IMP-C of 1\textsuperscript{st} layer

The contents of function were compared with IMP-C and DIR-C (table 2). As IMP-C was submitted attitude persuade etc., the contents of IMP-C related to other’s understanding, such as to explain in detail to others and to understand others. DIR-C submitted demand of individual speaks etc., the contents of DIR-C were compulsory and strong tone. These results also indicated the differentiation clearly between the competencies along with each feature.
5.3. Comparison of functions of 2\textsuperscript{nd} layer between competencies

In 2\textsuperscript{nd} layer, the function attribute was classified by each of the 3 information entities, and it compared which IMP-C and DIR-C (Table 3). While IMP-C submitted many functions in code-verbal, mode-nonverbal functions were also found, for example, *show samples* etc. These functions could show its typical feature and detailed representation in practice, which was to improve the listener's understanding level. DIR-C was submitted *demand utter* and *give punish or reward* etc., it indicated compulsory and strong tone in practical level were more emphasized adding to immediateness and strength unilaterally.

<table>
<thead>
<tr>
<th>Function</th>
<th>Impact and influence competency</th>
<th>Defectiveness competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMP-C</td>
<td>describe(V) reason(O)</td>
<td>assertive-speak(V) individual demand (O)</td>
</tr>
<tr>
<td>IMP-C</td>
<td>describe(V) basis(O)</td>
<td>command(V) organization(O)</td>
</tr>
<tr>
<td>IMP-C</td>
<td>persuade(V) behavior modification(O)</td>
<td>direct(V) action that should be taken(O)</td>
</tr>
</tbody>
</table>

Table 2 Comparing patterns of sending function on 1\textsuperscript{st} layer

<table>
<thead>
<tr>
<th>Info. Entity</th>
<th>Impact and influence competency</th>
<th>Directiveness competency</th>
</tr>
</thead>
<tbody>
<tr>
<td>T:code</td>
<td>tell(V) result(O), tell(V) example(O), tell(V) orientation(O), tell(V) fact(O), present(V) result(O), discuss(V) result(O), present(V) orientation(O), discuss(V) orientation(O)</td>
<td>tell(V) result(O), tell(V) policy(O), tell(V) current state(O), tell(V) problem on the business(O)</td>
</tr>
<tr>
<td>E:verbal</td>
<td>convey(V) idea(O), convey(V) orientation(O), convey(V) expectation(O),</td>
<td>convey(V) idea(O), convey(V) advice(O), convey(V) desire(O), convey(V) orientation(O), utter(V) demand(O)</td>
</tr>
<tr>
<td>T:mode</td>
<td>show(V) sample(O), show(V) body language(O), express(V) emotion(O)</td>
<td>give(V) punishment or reward(O), show(V) body language(O), express(V) emotion(O)</td>
</tr>
<tr>
<td>E:nonverbal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6 Conclusion

For reducing vagueness and expressing the substance of communication competency concept, this paper proposed a specific competency model for communication. In chapter 3, five perspectives were discussed in order to formulate the model which could express essential features of communication competency. We found the following: 1) actionVerb and object were fundamental to express competency. This was same for communication competency. 2) Communication competency in business domain had 2-way communications, sending/receiving, different from general ability. 3) Communication competency needed the aspect of management, this meant flexible responses, timing and condition, which were keys for superior performance. 4) At least 3 types of communication were processed at the same time, combination code/mode and verbal/non-verbal. 5) There were a lot of verbs relevant to communication. It was hard to figure out these relevant words which were slightly different from each other, thus a subjective aspect was encompassed. In the clause 3.5, a framework to identify the meaning of communication verbs was proposed from the standpoint of ontology as a classification manner.

Reflecting on these features of communication competency, the communication competency base model (CCBM) was suggested as a descriptive model. CCBM had two layers, the 1\textsuperscript{st} layer was for general description, and the 2\textsuperscript{nd} layer was for specific meanings and substantiation of competency. With the 1\textsuperscript{st} layer, the essential function of competency could be clarified. The 1\textsuperscript{st} layer had several attributes for specifying communication competency. The orientation attribute was a property of 2-way communications; the condition attribute was a property of flexibility meeting with various conditions. The 2\textsuperscript{nd} layer could express more specific information. Each child could express 3 types of communication. In children, the verbs that were specially defined for communication could be used.

Then CCBM was verified by case study in chapter 5. Both the 1\textsuperscript{st} layer and the 2\textsuperscript{nd} layer of CCBM were significantly useful to divide similar communication competencies. Two competencies were taken up, and CCBM was examined by adapting to them. In fact, the numbers of verbs and receiving / sending were significantly different between two competencies, and the contents could identify the competencies. Hence CCBM had discriminability of competency definitions.
In summary, CCBM took a modeling way through dividing morphemes in sentence and reducing the vagueness of competency definition. This way showed an advantage rather than the text-based competency modeling dependent on natural language. In spite of uniform methodology for competency modeling, CCBM took a specialized modeling way for communication domain. It facilitated understanding not only for the comparison of general competencies, but also other communication competencies. CCBM introduced specialized verb classifications for communication competency. This approach can avoid the impression evaluation in human assessment, and thus it will provide evidence-based assessment.

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Competence Modeling and Standardization of Terminology in the Field of E-learning

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Abstract. Modeling and development of competences cover essential processes of learning and training. On the other hand, education and training focused on the use of competences in a particular subject area with some coverage of concepts and real-world objects. This coverage or scope of the domain is characterized above all through the terminology that is relevant to this subject area. As a subject area we consider E-learning, which is on a dual position in learning, education, and training (LET). On the one hand, and, above all, it is a tool for process improvement in LET, on the other — a subject for study and mastering by both teachers and students. The focus of this report is given to the streamlining and standardization of terminology in the field of E-learning. The experience of participation in the work of ISO / IEC JTC1 SC 36 (Vocabulary of E-learning, Working Group 1) as well as of development of Russian Standards for terminology in the field of IT and IT LET by Russian National Technical Committee 461 (Information and Communication Technologies in Education).
Keywords: Competence; Modeling; Learning; E-learning; Learning, Education and Training (LET); Terminology; eXtensible Markup Language (XML); XQuery; XML Data Base Management System (XML DBMS); ISO/IEC JTC1 SC36.

1. Introduction

The fundamental principle of ongoing modernization of education in Russia is moving to the new federal state educational standards (FSES) of the 3rd Generation for general (secondary schools), vocational (college), and higher (universities) education. New FSES for higher and secondary professional education have been tailored to meet the professional standards developed by employers' associations and contain detailed requirements for the competence of specialists in various fields. For example, the scope for "Information Technology" in the professional standards of competence set for 9 categories of professionals:

- Database Administrator;
- Manager of Information Technology;
- System Administrator;
- Systems Analyst;
- System Architect;
- Programmer;
- Specialist in Information Systems;
- Specialist in Information Resources;
- Sales Manager.

In contrast to the professional standards in the following FSES the main areas of bachelor's and master's degrees are determined:

- Computer Science and Engineering;
- Information Systems and Technology;
- Software Engineering.

It should be noted that substantive provisions of FSES and professional standards are not harmonized to date with each other and with basic international standards for IT. This primarily refers to the basic concepts, terms and definitions of the subject area.
In this regard, at the initiative of TC 461 in Russia the project was established to ensure the harmonization of terminology in the field of ICT for education.

A database of terms published in the international standards:
- ISO/IEC 2382-36 Glossary of IT LET;
- ISO/IEC standards in Series IT LET;
- ISO/IEC standards, containing the basic terms of IT.

On this basis, by developing national standards for IT LET, harmonization was achieved with those international standards, especially in the terminology. Subsequently, this will ensure the harmonization of requirements for the competence of specialists within these FSES and professional standards are revised every 5 years.

Given the above, in this paper, we present in this article, except for certain provisions regarding the development of competency modeling and description of work performed on the Harmonization of IT LET.

The relationship of the concepts of 'competence' and 'terminology' has a lot of angles. First of all, the term 'competence' should be defined. On one hand, the concept — the definition should take its place in the terminology of e-learning. On the other hand, e-learning terminology, vocabulary, and the boundary of the domain are subjects of competence. A specialist in this subject area should master its vocabulary and understand its limits.

2. Concept of Competence and Competence Modeling

In the literature one can find a lot of definitions of the term "competence". We consider only two of them found in the sources close to the subject of this report.

1. A competency is a characteristic of an employee that contributes to successful job performance and the achievement of organizational results. These include knowledge, skills, and abilities plus other characteristics such as values, motivation, initiative, and self-control [1].

2. Competence is the ability (that cannot be observed directly but only by activities) to adequately and successfully combine and perform necessary activities in any contexts to achieve specific tasks and objectives [2].

In our opinion, the second definition is more appropriate. It focuses on the purpose of the activity and in this sense, the two definitions are similar, because the first one determines competence as a means to achieve results
with high performance. But in addition, the second definition reveals the essence of competence as the ability to combine the necessary activities to achieve goals. Introduction of the concept of activity in the second definition is a big advantage.

But why complicate the concept? Maybe it would be better to use a simple definition of competence as the ability to properly perform the job? No, that is not the right way. In order to make Vocational Education and Training controllable, directors and managers should be able to develop the structure of each competence required and of the whole set. And this set should correspond to a particular subject area. A subject area must be described using a specific set of concepts. Therefore, one should begin by building a set of terms and their definitions. This set will not be unchanged, as it will be developed in accordance with the development of domain.

We now turn to the source [3], where an attempt is made to reveal the concept of competence, by incorporating the knowledge, skills and competences within a holistic typology of competences. Different approaches to modeling the competencies used by American, British and continental European (France, Germany and Austria) schools for human resource development are being compared. It is concluded that one-dimensional models of competence are inadequate and inferior to multidimensional ones. Functional and cognitive competences are increasingly added to the behavioral competencies in the U.S., while in the UK cognitive and behavioral competencies are included in the model of professional competence function. France, Germany, and Austria began to settle the competence problem later and initially took a more holistic approach, but with its own distinctive features. After comparing these approaches, it was concluded that a holistic model is effective in identifying combinations of competencies that are necessary for specific operations and support labor mobility.

For a general competence-based approach it is essential to develop appropriate typology of competences. This should allow to combine education and training, contribute to meeting the needs of the labor market and ensure the mobility of human resources. If competence is important for the LET, it is necessary to get its common understanding. However, despite the central role of competence, there is great uncertainty in the definition of competence and its boundaries. This uncertainty applies to a number of other important concepts in the fields LET and IT LET. In our opinion, for the successful implementation of competence-based approach it is necessary to
implement the streamlining of terminology and organization of electronic dictionaries in the above areas.

3. **Standardization of Terminology in the Field of E-Learning**

Development and putting in order of scientific and technical terminology in the Russian Federation have a long tradition. In the Soviet Union the Terminological Committee developed the basic principles for the creation of systems terminology. The Committee was a methodical organization. Committee at the beginning of its activities was headed by a renowned academician S. Chaplygin and the greatest specialist on terminology, Dr. D. Lotte. The main results of the Committee were the principles and methods of construction and ordering terms. One of the basic principles of terminology in any area of scientific or technological activities is the scientific validity of the term to be introduced to a new concept or an equivalent term of the existing concepts. In the thirties of the last century a new branch of linguistics began to develop – Terminology Science (TS). Cofounders of TS were D. Lotte of the USSR and E. Vyuster of Austria. The main TS objectives are to study special vocabulary, its typology, origin, form, content (meaning) and function as well as use, organize and create, including the creation of terminology systems, terminology databases and knowledge bases.

The streamlining the terminology is inseparably linked to the creation of systems of concepts and systems of related terms. An analysis of terminological systems shows that they have several drawbacks, including:
- Polysemy (one word has two or more values);
- Synonymy (different words to express the same concept);
- Contradiction or inconsistency of the term concept;
- Some concepts do not have terms;
- Lack of systematic approach in building terms, which should reflect the relationship of concepts/

For each area there is a specific knowledge domain; concepts are organically linked only to that area, and the terms that express specific concepts, form a terminology system of that knowledge area. Before ordering the system of terms it is necessary to carry out the ordering of the system of corresponding concepts. An important point in the process of ordering is to ensure the accuracy of the definitions of concepts, which is significantly
affected by the classification of concepts. No matter how perfect a definition is, it cannot reveal all the relevant links of the concept, while the classification helps to learn the concepts of using the relationship between them.

Relations determine and record the shape of the relationship between concepts and terms. Let us consider in more detail some groups of relations.

- For classification, allow us to classify the elements of the domain, to form classes of the elements, to establish relationships between classes and between classes and the individual elements.

- Indicative relationships credit concepts with various quality attributes and can be presented as a sequential composition of two relations: to have a sign and to have a value of an attribute. Concepts are a set of defining characteristics. The notion includes a common entity that unites the individual elements in a single class, indicative relationship are the characteristics of the concepts. We can assume that the concept is a set of specific attributes of indicative relationships.

- Quantitative relations express quantitative characteristics of the concepts and can be reduced to a composition of two relations: to have a measure and to have a measure value. In quantitative relations, a qualitative value can be given rather than a specific value of the measure.

- Comparison relationships put together two properties of a concept or a group of concepts on any indicative or quantitative relation.

- Membership relations connecting two elements belonging to a domain is not in any classification features, but only on the basis of relationship to any particular situation.

- Temporal relations define the dynamic characteristics of items such as the length of existence in time, time of occurrence, date and other temporary measures. By the time relations belong to the type of relationship: to be simultaneously used to be, to be later, the same time, overlap in time.

- Spatial relations fix the seat of some element of the domain or interrelation between elements in some space.

- Causal relations reflect causal relationships, and communication that define the purpose, motivation and preferences when making decisions.

- Instrumental relations reflect the pragmatic aspect of the most important of them: to serve, be a means to, contribute, to be a tool, to be an aid.

- Information relations present a group of relations that describe different aspects of transmission and receipt of information: to be the shipper to be the recipient, be a source of information.
• Ordinal relations describe the relatedness of the elements of the domain together: to be read, to be next, be the closest.

Most of the semantic models developed on the basis of semantic networks. This term refers to a whole class approach, which is common to use graphical charts with nodes connected by arcs. Nodes (vertices of the network) represent some of the concepts (objects, events, phenomena), and the arc - the relationship between them. Semantic models are object-oriented and provide a sufficient indication of such as coherence by implementing four types of relationships between objects: classification, aggregation, generalization and association.

The basic idea of modeling with semantic models is that the model represents the data about real objects and connections between them a direct way that facilitates access to knowledge: from the movement of certain concepts, the arcs of relations can be achieved by other concepts.

The use of semantic models allows us to provide the knowledge base of expert system knowledge on any subject area and to carry out automatic construction of semantic networks directly from the text.

The main advantages of semantic models include: presentation of the means to express constraints, a description of relations between objects, and the definition of operations on objects.

Imposing restrictions on the description of the vertices of the arcs, you can get different types of networks. If the vertices do not have their own internal structure, such networks are called simple. Otherwise, they are hierarchical networks. One of the main differences between the hierarchical semantic networks from simple is the ability to divide a network into subnets, and to establish relations not only between the peaks, but also between the spaces.

A characteristic feature of some semantic model is an integrated description of the procedural semantics and static semantics - the allowable operations on objects defined in conjunction with the definition of data structures.

With the use of semantic models can be constructed in terms of the semantic structure of the dictionary, traced the relationship and interdependence of terms. The result of the analysis of specific areas of knowledge was the conceptual map, which is a graphical display of the analysis.

The analysis was conducted over 30 national and international standards, and identified about 500 terms and definitions as in e-learning and in general in the field of information technology: a detailed semantic analysis
of terms identified linkages and interdependencies, as well as the logical structure built in the dictionary to show clearly a concept map.

<table>
<thead>
<tr>
<th>Term</th>
<th>Standard</th>
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<td>assessment</td>
<td>ISO/IEC 23988:2007</td>
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Fig. 1 Example of finding relationships between the terms among standards

The objective of the Technical Committee 461 was to prepare a harmonized version of the national standard, which is a modernization of the international standard ISO/IEC 2382-36.

To accomplish the task was necessary multidimensional analysis of the standard. To this end, a methodology was developed and applied, focused on building models of knowledge using semantic analysis techniques. A structure of terminology of the Dictionary was built and the relationship and interdependence of terms were traced. The results of the work incorporated in the knowledge base. Based on these studies at present in the TC 461 draft national standard has been developed, which is a harmonized version of the international standard ISO/IEC 2382-36.

Initially, it is necessary to determine whether data have the strict (relational) structure, or have no structure at all. The analysis has revealed that the information is structured in part, in one document are structured as part and unstructured, which is a sign of semi-structured data. That is why we apply XML (the recent de facto standard for reporting of such data) and XML DBMS.
4. Conclusion

Our research and development led to the following conclusions:

1. Competence approach in IT LET should be combined with putting in order the terminology of the domain.
2. Streamlining of terminology and creation of electronic vocabularies could be achieved by freely applying available modern technology.

As a result of the described technology, a system of information support for the systematization of terminology in the field of standardization of e-learning has been developed.

The following features were achieved:

1. Available for viewing full-text version of the standard.
2. The possibility of transition to full list of terms and definitions of the selected standard.
3. In the transition to the list of terms and definitions a window is opened for view of full list of terms of the standard. When choosing a term the definition given in the standard is opened.
4. The possibility to view a complete list of the terms of the database, sorted alphabetically. When you choose terms its definition is available to view with reference to the standard from which it was removed.
5. The mechanism of searching, building on the logic of the concept map is implemented. Search Results - list of terms. Term corresponds to the definition and the reference to the standard list of terms from which it was removed.

The result of the work is a powerful on-line dictionary with user-friendly interface. The knowledge base implemented has got all the features needed for high-quality and productive work with the terminology.
References


Towards Accurate Competence Models of Blind and Visually Impaired Users for Improved E-Learning

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**Abstract.** Blind and visually impaired (BVI) users cannot participate effectively in e-learning due to the lack of Web accessibility and usability. This hampers accurate competence models (CM)s for BVI users. We develop accurate understanding of BVI users’ problems in e-learning, which is critically needed to measure the impact of accessibility and usability problems on developing competence models for BVI users accurately. We explain our novel cognitive, user-centered, approach to develop accurate CM. Verbal protocol analysis (VPA) will model problems BVI face for e-learning tasks. Problems that hinder accessibility and usability in e-learning and impact accurate CM development for BVI are analyzed. We contribute an effective method to develop accurate CM for BVI users. With this method, organizations can utilize the unique skills of BVI in their inclusiveness efforts for multi-faceted development of a diverse human resource with unique skills and capabilities.

1 Introduction

Blind and visually impaired (BVI) users cannot participate effectively in routine Web-based activities due to Web accessibility and usability challenges. This impacts the development of accurate competence models for BVI employees. Accessibility and usability for all users in the emergent information society is critically needed for inclusiveness and effective HR development through e-learning. Emergent Web 2.0 applications including Social Networks and many current internet applications are primarily designed for visual interaction. This creates significant accessibility and usability problems for BVI users. Therefore, accurate competence models for BVI users must take into account their accessibility and usability problems. The current methods do not address this problem. In this paper, we outline an approach to understand accessibility and usability problems for BVI users and identify problems that typical BVI users face in typical e-learning environments. We argue that accurate competence models for BVI users must take into account their unique accessibility and usability challenges identified by these problems. This research provides an understanding of the nature of accessibility and usability problems for BVI users in e-learning tasks. The overarching objective is to improve the accuracy of competence modeling to develop well-trained BVI users that are better equipped to take advantage of the advances in e-learning and are not disenfranchised in the emergent information society.

BVI users interact with the Web through screen-reader software that reads the text content of pages sequentially (Leuthold, et al. 2008). This mode of interaction is characterized by constraints such as high cognitive load (Theofanos & Redish, 2003), inefficiency (Lazar, et al. 2007), and the inability to recognize graphical content. Often, ignorance or lack of knowledge about BVI Web interaction issues prevents accurate competence models for accessible and usable e-learning (Lazar, et al. 2004). While Web Content Accessibility Guidelines (WCAG) help developers and designers, conformance to WCAG is necessary but not sufficient for effective accessibility for BVI (Clark, 2006). Research that specifically examines blind users’ online experience is very scarce (Leuthold, et al. 2008). This creates a gap in literature about an understanding of where and why BVI users face problems in e-learning interaction. This understanding is necessary for accurate competence models that account for accessibility and usability problems of BVI users in e-learning.
We ask "How can we develop an accurate and in-depth understanding of the accessibility and usability needs and challenges of VI users to inform accurate competence models and support e-learning?" Our approach employs Verbal Protocol Analysis (VPA) (Ericsson and Simon, 1980) to develop mental models of BVI users' Web interaction in completing e-learning tasks. Successful completion of this research will help towards answering the larger research question "How can we use this understanding to improve the accuracy of BVI users' competence models for effective interaction with the e-learning and emergent Web 2.0 and mobile internet technologies?" We employ a novel cognitive, user-centered, task-oriented approach to address accessibility and usability problems in non-visual interaction (Babu et al., 2010). We use cognitive science theories to develop a deep understanding of the unique needs and challenges of non-visual interaction. We develop and analyze mental models of BVI users. A mental model is a person’s understanding of how a system works - it guides their actions in problem solving. Mental models remain tacit in users’ minds and take representational form as cognitive models. Accurate cognitive models are critical for accurate competence models of BVI users in e-learning. We explicate cognitive models of BVI users to develop explanatory competence models that inform normative strategies to improve e-learning interaction for BVI users.

2 Background

BVI users interact with technology in ways that are different from typical sighted users. Existing literature recognizes that e-learning technology lacks the accessibility and usability needed for effective BVI participation. Approaches to competence modeling that rely on stated, versus revealed preferences are questionable. The few studies that investigate VI users' Web experience rely on self-reported difficulties. Users often attribute usability problems to their lack of proficiency (Norman, 1988) or report positive experiences in spite of problems (Nielsen, 1993). This is particularly true for BVI users who are accustomed to lack of Web accessibility and usability (Gerber and Kirchner, 2001). Consequently, we don’t know where, how and why BVI users face difficulties in e-learning tasks.
Blind and visually impaired users

A BVI user lacks the functional vision to see information on a computer screen and operate a mouse. For BVI users, interacting with the Web is a listening activity instead of a visual activity. Screen-readers facilitate their interaction with computers and the Web (Lazar, et al. 2007). Screen readers identify and interpret textual content on a page and present this aurally through a synthetic voice. This aural presentation is serial in nature - the page is read aloud from top left to bottom right. Such unique interaction demands accessibility and usability requirements distinct from those of regular sighted users.

Accessibility and usability

Accessibility allows users access to technology functionality (Goodhue, 1986). Usability refers to how well technology conforms to users' conceptualization of performing an online task (Goodwin, 1987). It is a task-dependent cognitive construct. Technology that is not accessible is not usable; however accessibility does not guarantee usability (Di Blas et al., 2004). Effective user-system interaction requires both technical accessibility and cognitive usability (Norman, 1988).

Technology Accessibility and Usability Standards

The Web Content Accessibility Guidelines (WCAG) is the de facto standard on technology accessibility and usability for atypical interaction. It provides design principles established by the W3C Web Accessibility Initiative (WAI) in 1999. Since then, recommendations of WCAG 1.0, updated to WCAG 2.0 in December 2008 (http://trace.wisc.edu/news/archives/000255.php), are the primary guidance for developers on technology accessibility and usability (Kelly, et al. 2005). Several governments have incorporated WCAG recommendations into accessibility laws (Leuthold, 2008) that mandate that e-learning is accessible and usable for BVI users. However, WCAG compliance is necessary but not sufficient for effective accessibility and usability for the BVI (Clark, 2006).

Accessibility and usability for the BVI: A reality check

E-learning technology lacks the accessibility and usability needed by BVI users. 80% of Web sites do not meet basic accessibility requirements (Loiacono and McCoy, 2004). e-learning technology are no different.
Towards Accurate Competence Models of Blind and Visually Impaired Users for Improved E-Learning

Research shows that even with full conformance, a site presents problems and challenges for BVI users (Correani et al. 2004). Our research focuses on both the problems and challenges of BVI users in performing e-learning tasks. This is critically needed for accurate competence models that form the basis for understanding how to incorporate and include BVI users with their unique skills, perceptions and cognitions into the empowered, multi-skilled HR of the future.

3 Approach

Literature does not explain where, how and why BVI users face problems and challenges in ICT interactions. This is needed for effective competence modeling. Accurate competence modeling requires understanding users' perceptions, actions and cognitions as they interact with technology (Norman, 2001). Existing literature does not provide this insight. We take a cognitive approach to competence modeling and examine BVI users' cognition, action and perception in e-learning tasks. Extant studies try to improve interface accessibility without addressing user cognition in the task (usability). In spite of much extant research, guidelines and laws, ICT accessibility and usability remain challenging for the BVI (Mikovec et al., 2009). BVI users employ different cognitive strategies in e-learning. A contextually-situated understanding of these cognitive strategies helps understand accessibility and usability needs for BVI. We seek to inform the development of accurate competence models on e-learning accessibility and usability based on an accurate and contextually-situated understanding of BVI users' cognitive strategies in performing e-learning tasks. Literature on Mental Models (Johnson-Laird, et al., 1992), Human Problem Solving (Newell and Simon, 1972), Human-Computer Interaction (Norman, 2002; Norman, 1999; Young, 1983) and Verbal Protocol Analysis (Ericsson and Simon, 1996) provide strong appropriate theoretical foundation for our approach to understand accessibility and usability problems and challenges BVI users face in e-learning interaction. We adopt a novel user-centered, task-oriented, cognitive approach to develop competence modeling that incorporates accessibility and usability issues in e-learning for BVI users. The user-centered approach views the problem as the difficulty experienced by BVI users in interacting with e-learning. The task-oriented approach situates
a problem in the context of the goal of e-learning. The cognitive view explains how a problem or a challenge manifests in the minds of BVI users. We need to go deeper into a problem by understanding its implications on the ability of users to complete e-learning tasks, including their perceptions, cognition and actions. Our approach provides a novel method to examine the interaction between BVI users and e-learning and informs accurate competence modeling.

Existing research in Cognitive Science and Human Computer Interaction identifies VPA as an effective technique to study users problem solving and mental models in e-learning interaction (Newell & Simon, 1972; Cotton & Gresty, 2006). In VPA, participants respond orally to investigators’ probe of the internal cognition states to gather information on cognitive processes (Ericsson & Simon, 1980). Verbalizations capture participants' cognition, including their information processing in the task. Protocols are encoded by identifying the category that expresses the same information as the verbalization. Researchers trace the exact sequence of user actions, including the strategies employed, the inferences drawn from information, and memory accessed (Ericsson & Simon, 1980). Advantages of VPA include a very systematic process of data collection and results have high validity (Ericsson and Simon, 1996). VPA helps understand how people approach a task, how they understand the task environment and what they do when they encounter accessibility and usability problems (Cotton & Gresty, 2006). It provides rich data (Russo, 1978) and information value per data point (Simon, 1990).

VPA includes two kinds of verbal protocols - concurrent and retrospective. Concurrent verbal protocols are obtained by asking users to think aloud while performing a task. They contain information from short-term memory that users employ in problem-solving. Simon (1990) explains that to reduce the interference of concurrent verbalization on task performance, participants must practice talking aloud while performing a task. As a result, verbalizing becomes overt, without additional demands on processing time or capacity (Ericson & Simon, 1996). An appropriate setting to collect concurrent protocols is the Think-Aloud method of Direct Observation where participants first practice thinking aloud, and then take part in the actual study. Ericsson and Simon (1996) explained that investigators must provide explicit instructions to verbalize that are consistent with the research objective. Our research asked participants to verbalize six task aspects that captures stages of problem solving and forms the coding
scheme: goal, plan of action, actions being executed, was the goal was achieved, basis of conclusion, and next steps. Retrospective verbal protocols are obtained by asking users to reflect on their experience in completing a task. They access users’ long-term memory of the task (Ericsson & Simon, 1996) and represent complete and well-organized thoughts of the task. They reveal task-relevant information that participant may not be able to provide during problem-solving (Bouwman, 1978). Focus group interviews are feasible techniques to collect retrospective protocols. It allows gathering responses from several participants at one time (Nielsen, 1993) and provides participants an open environment to explain their perceptions (Krueger, 1988). The dynamic discussion reveals information typically not obtained in interviews. Focus groups allow for in-depth probing. Nielsen (1993) provides extensive guidance on conducting focus group interviews. Retrospective protocols identify BVI users' knowledge structures and cognitive processes (components of mental models) for ICT interaction tasks and help understand their goals, plans of action, perceptions, cognition, preferences and problems/challenges. This research will capture and analyze their concurrent and retrospective protocols in e-learning.

Our novel approach is theoretically grounded in seminal research on mental models, human-computer interaction, problem solving and VPA. It emphasizes a clear understanding of BVI users' problem solving and mental models for e-learning tasks to accurately understand and effectively address accessibility and usability problems and challenges in interacting with e-learning technology. We can accurately understand the special needs, challenges and preferences of BVI users by examining their problem solving and mental models for e-learning tasks. Our research follows this approach to develop and validate competence models that account for accessibility and usability of e-learning portals for the BVI. Individual results are omitted due to space limitations on submission. In the following section, we provide a summary of our preliminary results to help readers understand the constraints accessibility and usability issues place on accurate competence modeling for BVI users in e-learning.
4 Summary of Results and Conclusions

We examined accessibility and usability problems blind users face while performing e-learning. Our investigation was done with common e-learning task for generalizability across and beyond e-learning. Through our on-going field studies, we obtained verbal protocols of blind participants completing e-learning tasks over the Blackboard LMS (www.blackboard.com). Analysis reveals aspects of e-learning technology that present challenges for our participants in completing the e-learning task. Analysis of these problems through good Web design principles from WCAG and developers, we find online e-learning environments do not conform to accessibility and usability criteria. We develop possible remedies to reduce the accessibility and usability problems and challenges BVI users face in e-learning for accurate competence models informed with BVI user’s perspective. These help effective integration of BVI users, with their unique skills and abilities, into the mainstream human resource available to an organization.

Blind users miss questions without knowing it. The system does not make a change of question obvious to a blind user. Lack of clear feedback and cursor focus on the navigation bar, misleads the user in believing that the system state remains unchanged. BVI users have difficulty comprehending a process for answering multiple-option questions. This is because they are likely to observe inconsistent system behavior in response to their action of submitting answer from one attempt to another. The particular user action has to do with hitting the enter key on a checkbox corresponding to an answer. Blind users are likely to get confused due to the page layout in essay-type questions. Our participants had difficulty understanding how to provide a response to the short-answer question. The page design does not make the input area apparent to a blind user. The user spends extra time and effort figuring out where to type in the response. A more alarming findings suggests that a blind user faces the threat of losing the assessment altogether. We observed that when a participant used the backspace key to delete text in the input area of an essay-type question, the system expelled him completely out of the assessment and did not allow a second attempt.

Our study identifies what blind users observe and experience while interacting with online assessment environments. This understanding is necessary to create e-learning applications that meet the accessibility and usability needs of BVI users. Our study examines the thoughts, perceptions, and actions of blind users as they perform e-learning tasks. This helps us
understand how blind users think about a problem, and how they deal with it. We believe this understanding will lead to accurate competence models and to more accessible and usable e-learning applications used for the increasingly common online assessments, questionnaires and interactive forms. By including the three types of assessment question formats: multiple-choice, multiple-answer, and short-answer; we have covered the three most common methods used for user interaction in online interactive applications. These applications are used for common purposes including employee empowerment and skill-development programs that form the cornerstone of HR development efforts. Our results provide a needed cognitive framework to assess the consistency between expected and observed outcomes of user actions in performing technology-mediated tasks. This forms the basis for the needed information for accurate competence modeling for BVI users.

5 References


Cognitive Task Model and Learning Sequence Model for Cognitive Competency Modelling

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Abstract. Task analysis is an essential method for developing job standards, job descriptions and skills inventories, and as it is now, it is used for competency modeling. Cognitive task analysis methods focus on the mental processes which underlie observable behavior, but there was unclear to reflect to competency modeling and development. This study proposed a methodology to make relationship among task, activities and competency, including the cognitive task model and the learning sequence model. This sequence of the methodology provided a guide for not only job training also competency modeling and development.

Keywords: Cognitive Task analysis, Learning Steps, Experts, Cognitive Competency

1 Problem

Basically a competency concept is constructed by a set of activities. This relationship is typically derived by statistical methods, such as factor analysis. PAS 1093 pointed out the relationship between competency and activities (Christian 2009). A competency was not measurable, while activities were measurable for a competency. Hence a competency is defined or identified by activities, relevant to these activities are the criteria for a competency.
Task analysis is an essential method for developing job standards, job descriptions and skills inventories, and as it is now, it is used for competency modeling. So it is useful to make clear the relationship not only between competency and activities, but also tasks. An activity can be found and is chosen in a critical task. A competency executes a certain task. Competency in the work domain should be especially measured in practical tasks. This means task analysis is one of basic premises for building a competency model. According to Embrey (2000), task analysis techniques provide, as a minimum, a description of the observable aspects of operator behavior at various levels of detail, together with some indications of the structure of the task. These will be referred to as action oriented approaches. Other techniques focus on the mental processes which underlie observable behavior, e.g. decision making and problem solving. As cognitive tasks are critical for jobs and workplaces in the 21st century, competency should be defined in clear relationship with cognitive tasks. There are several types of cognitive task analysis methods. For instance, Vicent (1999) focused on cognitive process, and Embrey suggested a logical structure model, called IMAS, for reducing cognitive errors.

However there are three problems in method of cognitive task analysis methods. First, the relationship between cognitive task analysis and competency is not clear. Second, cognitive activities in cognitive process or subtask are excluded. Therefore, it is not considered that competency in jobs and workplaces was constructed by practical tasks and activities complexly. Third, from the two above problems, even if it can just only carry out job training, it does not provide useful information for competency development.

In addition, there are two more problems in dealing with cognitive tasks. Forth, Kanai & Kusumi (in printing) pointed out the problems for dealing with practical intelligent, for example, verbalizing, measuring, awareness, and self-evaluation. Fifth, Richard (1996) also pointed out the difficulty in distinguishing procedural knowledge and declarative knowledge in practical performance.

2 Purpose

Hirata (2002) found the features of experts: They did not only automation of procedure as procedure experts, but also performed as adaptive experts and
creative experts who made new concepts, model and did good management. However, he did not explain concrete cognitive tasks systematically. Moreover, Richard has pointed out the distinguishing procedural knowledge and declarative knowledge. However, he did not explain the method which specifies procedural knowledge concretely.

This study proposes the methodology of task analysis which promotes modeling and developing complex competency in jobs and workplaces in a final manner. Thereby, the purposes of this paper are, 1) to defined cognitive tasks in decision making and its characteristic from various viewpoints, 2) to subdivide cognitive tasks into cognitive activity levels, and 3) to make clear learning the sequences of cognitive tasks.

Five perspectives are taken up for specifying cognitive tasks. The first is cognitive process. Different cognitive processes cause behavior changes. A cognitive process is the key factor in distinguishing whether performer is superior or not. Normally superior performers take complex steps, rather than a simple one in cognitive level. The second is strategy to estimate situations and results. Superior performers choose and allocate appropriately not only physical resources but also cognitive ones through planning, doing, and seeing/regulation. The third is decision-making object and width. Considering multiple views, performers can get appropriate information and avoid risk. The fourth is regulation for cognitive tasks. It is the fact that the correct decision-making cannot be always done by superior performers, and whether a correct decision making is existing or not. In addition, decision making may change according to changing situation. Therefore, it is necessary to regulate cognitive tasks during decision making. The fifth is processing speed. Decision making as cognitive process is necessary in order to process with deep thinking in a particular instance. It is important to be able to grasp how processing works in an instance in order to understand the performance of experts.

Moreover cognitive tasks may be specified at the cognitive activity level. Practical tasks in the work domain are constructed complexly. By subdividing tasks to the minimum unit, the characteristics of competency may become clearer.

In addition, as cognitive tasks are hard to observe, trainees/students may have difficulty in learning cognitive tasks. So, the task is difficult to utilize in a real job scene. Knowledge space theory (KST) would be helpful in identifying the learning steps of cognitive process and tasks.
3 Reviews of Cognitive Tasks

Based on chapter 2, several studies regarding cognitive tasks on superior performers were taken up. Then essential factors or attributes for describing cognitive tasks were derived from them for modeling competency in the following clauses.

3.1. Cognitive process

Vicente (1999) divided cognitive process into 8 elements on her cognitive task analysis study. The 8 elements are “activation”, “observe”, “identify”, “interpret”, “evaluate performance criteria”, “define task”, “formulate proc.”, “execute”. Behavior level changes by omitting or repeating these eight elements.

3.2. Strategy in cognitive tasks

The planning model by Suchman (1987) is effective to discuss strategy in cognitive tasks. The planning model treats a plan as a sequence of actions designed to accomplish some preconceived ends. Action is a form of problem solving, where the actor's problem is to find a path from an initial state to a desired goal. Plan is a substance of strategy. Strategy reflects estimation of situation and results into plan.

3.3. Objects and width of decision making as a cognitive tasks

The tacit knowledge theory by Wagner & Strenberg (1987) is effective to discuss decision-making objects and width. They classified three contents of problem solving practical know-how, that is, whether the knowledge concerns the management of oneself, others, or one’s task. The superior performer catches only the activity near at hand and also three objects widely. Specifically, in "task", they handle not only their tasks but also the whole work, and in "others", they consider not only the others who directly relate, but also others who relate indirectly.
3.4. Regulation for cognitive tasks

Seta & Ikeda (2006) showed the importance of meta-cognition in making presentation documents. For example, the performer assumes the understanding model of the listener, and sets the explanation order, and details the document that expresses the content properly. According to Livingston (1997), Flavell, J. explains meta-cognition as consisting of both meta-cognitive knowledge (MC-knowledge) and meta-cognitive experiences or regulation (MC-activity). Meta cognitive knowledge refers to acquired knowledge about cognitive processes, knowledge that can be used to control cognitive processes. Meta cognitive strategies are sequential processes that one uses to control cognitive activities, and to ensure a cognitive goal (e.g., understanding a text) has been met. These processes help to regulate and oversee learning, and consist of planning and monitoring cognitive activities, as well as checking the outcomes of those activities.

3.5. Processing speed in cognitive tasks

A task is subdivided into minimum activities in order to reveal variety and complexity of processing. Superior performers become unconscious of activities. They handle them in an instance. Predicate argument structure analysis is effective for subdividing activity. By this analysis, tasks are subdivided into “precondition”, “purpose”, “means”, and “result (state)”. It defines activity in detail. To take a simple example, “X defeats Y” is subdivided into “precondition : Y stands”, “Means : X add power to Y”, “Means : X incline Y”, and “result : Y lies”.

4 Learning Sequence of Cognitive Tasks by KST

In chapter 3, five perspectives were pointed out to define cognitive tasks. However, competency is general concept. It is necessary to grasp a personal state in acquisition of tasks in order to develop competency in practical work domain. Based on KST, learning steps of cognitive tasks might be clarified.

KST by Albert & Steiner (2005) provides a formal model

Figure 1 Example of a Hasse diagram (adapted from Falmagne et al.,1990)
for structuring a domain of knowledge and for representing the knowledge of individuals based on prerequisite relationships. Due to mutual dependencies among the problems of a domain, from the correct solution of certain problems the mastery of other problems can be surmised. A surmised relation can be depicted by a so-called Hasse diagram (see Figure 1 for an example). In such a diagram the descending sequence of line segments indicate a surmise relationship. According to the surmise relation illustrated in Figure 1, from a correct solution to problem \( b \) the correct solution to problem \( a \) can be surmised, while the mastery of problem \( e \) implies correct answers to problems \( a, b, \) and \( c \). The surmise relation forms a quasi-order on the set \( Q \) of problems and thus restrict the number of possible knowledge states (i.e. subsets of problems) that are expected to be observable. The collection of all possible knowledge state, including the empty state \( O \) and the whole set \( Q \), constitutes the so-called knowledge structure \( K \). The knowledge structure \( K \) corresponding to the surmise relation shown in Figure 2 is given by \( K = \{O, \{a\}, \{c\}, \{a,c\}, \{a,b\}, \{a,b,c\}, \{abd\}, \{a,b,c,e\}, \{a,b,c,d\}, Q\} \)

5 Attributes to Define a Cognitive Task

Based on the five previous studies and KST, the cognitive task model was developed, and it might be helpful to specify its semantics. The following procedures were executed, 1) to pick essential elements and attributes up to specify cognitive tasks, 2) to set restrictions for each attribute for describing cognitive task objects, 3) to develop a model for cognitive task, 4) to analyze cognitive tasks in teaching based on the five perspectives, 5) to apply the tasks to the model in order to verify, 6) to analyze cognitive tasks as activity level (in detail), and define characteristics and connection of the cognitive process elements, and 7) to develop learning sequence for teaching applied KST.

5.1. Modelling cognitive task and attributes

A descriptive cognitive task model was helpful. For identifying cognitive tasks, elements and attributes were indispensable. At the first, basic information was indispensable for defining its existence and location, such as identifier, name, and explanation (figure 2). Then each cognitive process
element suggested by Vincent above was regarded as a substructure of a
cognitive task. Generally in cognitive tasks, the relations among each
element were not defined clearly. Therefore each process element should
be defined clearly in cognitive tasks. This model introduced 8 elements by
Vincent.
The strategy was influence to task execution, and gave orientation to tasks.
Cognitive tasks work in whether “planning” stage or “performance and
adjustment” stage. That means cognitive tasks were characterized by
strategy. Based on discussion in 3.3, it was considered that main target in
decision-making were three contents, that was “self”, “others” and “task” by
tacit knowledge theory. The aspects could help prevent individuals from
overlooking the wide view taken by superior performers and also to
categorize similar tasks for learning.

Figure 2  The cognitive task model

Meta-cognition aspects, discussed in 3.4, were effective to regulate
cognitive tasks. Two viewpoints in meta-cognition, MC-activity and MC-
knowledge, were set in order to regulate cognitive tasks. However meta-
cognitive was hard to define at the task level, because having various
activities in it, so the meta-cognitive attribute was set at activity level as
regulation. The task was consisted by several activities. The model also can be defined at the activity level. Discussing 3.5, the cognitive task was subdivided into minimum activities in order to recognize the sequence of automatic execution, and to reveal the effect of meta-cognition. The activity was distinguished through precondition, purpose, procedure, result, and so on by predicate argument structure analysis as type. In addition, the explanation of activity was also set.
5.2. Proof against effectiveness of the cognitive task model

The cognitive task model applied to teaching behavior that was one of intellectual behavior with higher level mental functions, in order to verify the effectiveness of above model. The tasks in teaching behavior were picked up, 22 in planning and 20 in performance. The 42 tasks were set based on the procedure of Seta’s research. Table 1 only showed a part of performance tasks, because of the limitation of this paper.

Each task was analyzed through an activity analysis framework. For example, ID7 “grasp changing” task was composed by 10 activities. These were handled during execution of the task. Each activity was specified “type” and “regulation”. (Table 2)
6 Learning Sequence of Cognitive Process

The theory of KST was adapted to cognitive process elements. Learning steps were identified as a learning sequence model, considering the relations among each task based on attribution. There were two series on cognitive process. One was based on “others management” (activate, observe, identify, and interpret). The other was based on “task management” (execute, formulate process, define task, and evaluate performance criteria). The series were evolved as an outcome of many activities and various meta-cognition. However, these two series were not independent each other. The preconditions for learning “define task” was the requirement learning all elements of others management series, “execute”, and “formulate process” beforehand. In addition, the precondition of learning “evaluate performance criteria” was the requirement learning all other cognitive process elements. Therefore, acquisition was the most difficult part but high performance was attained after acquisition.

Then, the order of learning cognitive process elements was set through cognitive tasks and activities. Taking ID7 “grasp change” task in teaching behavior, for example, as a result of resolution into activity, it was necessity to realize students’ change of understanding as “precondition”. To that end, it was necessity to observe and collect information about the behavior of others. Therefore, the precondition of “grasp change” task was required learning ID1 “inference of necessity” task, ID2 “observation of behavior” task. In other words, acquisition of “activation” and “observe” was required for learning “identify”. The connection of cognitive process elements is shown in figure 3. The learning sequence of cognitive process was enabled.

Figure 3 The Learning Sequence Model
7 Conclusion

This study proposed the methodology of task analysis, which provided several perspectives to describe its features and connections to competency modeling. It was applied to the three methods, the cognitive task model, the activity analysis framework, and the learning sequence model. The cognitive task model organizes the essential features of task from the five perspectives. The activity analysis framework was to divide into cognitive activities based on the predicate argument structure analysis. The learning sequence model was to analyze and to make a sequence clearly among cognitive process elements.

In conclusion, the methodology would be reviewed and verified through considering whichever the problems pointed out at the beginning of this paper solved or not. The cognitive task model supported the 4th problem. The model provided a schema to describe practical intelligence into task levels. Adapting to teaching behavior, it could be expressed more clearly. The activity analysis framework supported the 2nd and 5th problems. The framework was promoted to define procedural knowledge concretely in order to consider cognitive activities in cognitive process or subtask. Therefore, it was promoted to define the practical tasks which measured competency in workplaces and jobs. The learning sequence model supported the 3rd problems. The model was promoted to specify learning state of a person, and to predict what tasks will be learned. Therefore, the model leads to a guide for not only job training also competency modeling and development. Through the three methods, the 1st problem was solved. The relationship between cognitive task, activity and competency was taken into consideration.

8 References


Competence Modeling for Motivated Human Resources: A case study in a Large Indian Public Sector Enterprise

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Abstract. Human Resource (HR) professionals in Indian Public Sector Enterprises (PSEs) focus on competence modelling (CM) for the strategic advancement of the organization. A motivated workforce is a key driving force of the organization. We examine how CM of HR Professionals and organizational HR can guide strategy development to motivate the workforce. The author is involved in strategic HR planning for organizational learning in this context. We present a contextually situated and evolutionary analysis of the social, cultural and economic drivers of socio-economic change in Indian PSEs. Specifically, this paper argues that a contextually situated understanding of the HR evolution is critical input to develop suitable organizational learning platforms in the environment. This forms the analytical basis to inform decisions on e-learning and development of social communities that can institutionalize the mechanisms for continual HR development and organizational learning.

Keywords: competence modelling, Indian Public Sector, Workforce motivation

1 Introduction

Motivated personnel are influential driving forces in organizations. Intense global competition requires organizations to develop dynamic and creative strategies to use and continually grow their key organizational
resource – a motivated human resource. Competence management has strategic implications. Organizations must nurture an empowered workforce for competitive advantage, innovation, and effectiveness (Houtzagers, 1999). Individual characteristics, including cognitive, attitudinal, social and physical abilities of the workforce are significant indicators of performance and success of the organization’s human resources (McClelland, 1973). Marrelli (1998) defines competence as measurable human capabilities required to effectively meet work performance demands. Competence modelling attempts to bridge the gap between human resources, including their skills abilities and behaviours, and the ability to perform critical tasks that are needed to fulfil the needed organizational roles. Competence models are used to inform and deploy innovative approaches in HR development to motivate a workforce for competitive challenges.

Raven & Stephenson (2001) argue that individuals must demonstrate general competence in the following four areas: Meaning competence, understanding organizational and acting in accordance; Relation competence, maintaining connections with stakeholders; Learning competence, problem solving and experiential learning to improve subsequent problem solving; and Change competence – developing innovative solutions for new tasks or situations. They argue for the need to contextually situate all competence analysis in the environment where they are expected to be displayed. Therefore, the HR manager responsible for competence development needs better understanding of the personal, organizational and societal consequences of decisions. Particular attention should be given to the development and utilization of the unique competence as well as their appropriate recognition (Raven & Stephenson, 2001). DuBois (1993) takes the position that contextually situated interpretive case studies provide an appropriate learning mechanism to understand competence modelling in different domains and forms the basis for HR strategy and organizational change management. We attempt to provide such a study in this paper.

The following sections present a theoretical foundation of e-learning and employee motivation, which is the guiding objective of this research. We develop contextual analysis of HR and the challenges for HR development in a large Indian PSE. Understanding the evolving cultural, social and economic context are pre-requisite to understand the intricacies of human resource development in the Indian PSEs. This underscores the importance of the multi-faceted contextual analysis of the issues presented in this paper. The
analysis provides the basis for contextually situated competence modelling of the socio-cultural and socio-economic evolution of Indian PSEs. We discuss the emergent role of HR and HR development based on this analysis. We are in analysis stage of this on-going work and will present the case-study results.

2 Theoretical Foundations

Each learner is affected by psychological and sociological factors that comprise the e-learning environment. Research on behaviour in e-learning is used to develop theoretical foundation that provides guidance in data collection and analysis of the results to inform the development of e-learning strategies for HR planning. Eisenhardt (1989) suggests the development of theoretical foundations to guide interpretive case study research. The theoretical question explored here research is “How can we better understand the contextually situated evolution of Indian PSEs to develop competence modelling which can improve the HR managers’ ability to continually re-skill their human resource and improve the global competitiveness of the organization”?

Educational theory recognizes behaviorism as a learning theory followed by theories of cognitivism and constructivism (Mowrer and Klein, 2001). Behaviorism presents an environment for the employee to learn and is environmentally focussed. Cognitivism holds the employee as a unique organism who views the world differently from all others and processes input from her distinct perspective. Constructivism believes that people learn by finding relationships between new concepts and their current understanding. The three major areas of behaviorism, cognitivism and constructivism portray learning along a continuum based on how actively involved the learner is and has implications on the e-learning strategies for employees and their motivation – both extrinsic and intrinsic. Dowson and McInterney (2004) suggest that a range of achievement goals affect learning outcomes. Psychological theories of achievement have an impact on the environment that HR professionals nurture for employee’s to develop competence. Bandura (1977) defined outcome expectancy as estimates that particular behaviour will lead to a particular outcome. Thus, people who believe strongly in their own ability will persevere despite setbacks. The following section presents an evolutionary view of the Indian PSE as the
context for our case study. Following Raven & Stephenson (2001), this provides the basis to contextually situate the competence analysis in an understanding of the environment where it occurs. We then provide an understanding of the challenges of the role of the HR manager in this environment. We conclude this research in progress with a discussion of our approach and on-going research effort.

3 Contextual Analysis of Indian Public Sector Enterprises

Indian PSEs play a strategic role in the nation’s economic development. PSEs were developed to build infrastructure for economic development, create employment opportunities and promote balanced regional development. PSE infrastructure also spurred the growth and prosperity of private sector enterprise. The Indian government pursued phased liberalization to mitigate the negative impact of sudden economic changes and facilitate the free market transition. Culturally, PSEs carry the burden of past legacies while competing with smaller and more competitive private enterprise. Simultaneously, growing and pervasive libertarian notions question government’s role in business. They argue for government withdrawal to allow enterprises to operate independently in increasingly competitive and market oriented environments. Modern Indian PSEs’ challenge is to develop the competitive characteristics of nimble private enterprise while fulfilling social responsibilities driven by egalitarian principles. The cultural evolution of the PSE organization creates environmental forces that situate the organization in a state where both goals are often equally important, at times simultaneously. The challenge for HR in Indian PSE is to situate strategy and policy in this environment.

Care must be exercised to develop management interventions that manage employee motivations with consideration of the environment. In addition, socio-cultural nuance must be incorporated in the design of the interventions to ensure the appropriate development of culturally sensitive HR development programs. These are often the discriminating factor between successful HR interventions and one that are not well-understood and may seem ‘foreign’ in a culturally sensitive and globally aware populace. Training and competence modelling in Indian PSEs initially focussed on technical skill development as PSEs recruited unskilled labour and was done through in-house institutes. Many large PSEs have established Management
Institutes with state-of-the-art technology and in-house trainers. At different levels in the hierarchy, project and operational issue based training is provided in India and abroad. Thus competence modelling to streamline competence building and skill development is in the strategic interest of the organization.

The globally competitive environment presents paradigmatic shifts for HR development in Indian PSEs. Many PSEs were established to fulfil the well-publicized social commitment to generate employment. However, economic liberalization required PSEs to benchmark productivity and costs with their global competitors. This led to the realization that the low employment cost advantage in India would erode with the social policy of excess staffing. Hidden costs of excess labour including a lack of accountability from excess bureaucracy, over-supervision, the culture of casualness and low motivation were also recognized. This recognition drove the focus to lean and nimble organizations and the subsequent change in HR policy, from benevolent and socialist recruitment to efficiency. The largest steel Industry PSE was compelled to design innovative measures to drastically downsize, which was one of the largest downsizing interventions in India’s post economic liberalization. The steel PSE has approximately reduced its staffing levels by 50% in the last 25 years. This memory has bearing on competence modelling efforts today. The current focus on lean and nimble organizations allows large PSEs to ingeniously downsize. Faced with severe cash crises, the Steel PSE chose voluntary separation schemes with deferred payments to limit large and immediate cash outflows while maintaining a win-win situation for employees and organizations. This received a tremendous response. HR professionals counselled target employees and even their families. Organizations that competed to employ more manpower in the past designed innovative methods to become lean, in spite of labour legislation that strictly denied a hire and fire policy. Technological advances emphasized the shift to more skilled and technically qualified, managerial white collared personnel. Maturing and institutionalization of such change impacts competence modelling activities in Indian PSEs. Industrial Relations (IR) Systems used to be a dreaded word in large PSEs management. Pre-liberalization saw heavy bargaining power of trade unions when the majority of the workforce was illiterate and gullible. With liberalization, unions and workers understood the business realities and aligned to be partners-in-progress and growth. Thus, HR management could implement strategies and initiatives driven by business needs and cost
competitiveness, including downsizing and rationalization of employee benefits. With economic liberalization and efficiency drives, excessive amenities and benefits in PSEs were replaced by measures for effective employee development such as (re-)training and skill development. This provides the impetus for competence modelling in Indian PSEs.

Previous Annual Confidential Report (ACR) systems were mechanisms to promote or discipline employees and contributed little to employee motivation and performance. ACR systems focussed on personality traits and work related traits were either conspicuous by their insignificance or absence. Therefore, considerable subjectivity crept into appraisal reports. The challenge for large PSEs was to design a performance appraisal system that would effectively differentiate the performance of employees and serve as an instrument of reinforcement, positive and negative, and motivate employees to contribute to realization of organizational goals. Systemic improvements in this regard include: mutual establishment of Key Result Areas (KRAs) that are directly linked to business results; performance evaluation against these KRAs to reduce subjective evaluation; readiness assessment for future growth through potential assessment, 360 degrees performance evaluation and Balanced Scorecards. Compensation packages in PSEs were linked to hierarchical levels in the organization and undermine performance contribution. Progressive PSEs depart from this position by offering greater linkage with individual and team based performance. Individual and team excellence is increasingly recognized by PSEs through such attractive performance based reward mechanisms. This provides an environment where growth and learning is valued by the organization and is manifest in the intrinsic and extrinsic motivations of the employees.

Traditionally, career planning in PSEs follows the entrenched seniority systems while recognizing the importance of performance to groom for future leadership positions. PSEs have departed from seniority systems by identifying key positions linked to their business plans and rising executives to best fit the key positions. Well defined Career Path Models are available at entry. These provide development of multiple skills and managerial abilities through job rotation and inter-disciplinary assignments covering multiple levels in the organization, multiple locations and sites of operation and multiple functional operations. These provide transparency and instil long-term outlook for employees with options for career growth.

Traditionally, large PSEs functioned as State representatives in their manufacturing bases to serve regional development objectives through
building and maintenance of roads, schools/colleges, hospitals, peripheral development and adult literacy and education in the nearby villages. However, the motivation for such initiatives has changed. It is realized that such initiatives provide strategic gains and ensure a continuous social importance for the PSE. They become branding strategy that gets recognition worldwide and also, attracts the best talent. PSEs are uniquely positioned to take advantage of their legacies of being ‘Temples of Modern India’ and invest in Corporate Social Responsibility. Many PSEs allocate parts of net profits towards CSR and work for social improvements in areas such as Disaster Relief Management, Water Management Projects, providing Drinking Water, eradication of diseases like Tuberculosis, AIDS control. As India joins the global economy and sheds many of its former barriers, there is an interesting resurgence of its faith in its own ethos and values. Several HR thinkers and practitioners are finding meaningful application of the traditional Indian values framework in their efforts towards corporate and national renaissance. Based on Indian values, many advocate the need to significantly transform the values at the workplace.

With liberalization, HR departments integrate and derive operational plans from strategic business plans. This aligns their focus to the mission, vision, and business goals of the organization. Leading PSEs have well-defined HR Statements as the basis to develop core values and behavioural norms of employees. Communications with large employee groups occurs on continual bases to reinforce understanding and applicability of the HR Philosophy, Vision and Mission. HR is focussed more strategic roles such as managing employee commitment and motivation. The significance of establishing the desired organization culture is a recognized agent to bring in synergy in the organization. Realizing that organizational culture is relatively enduring, HR managers are striving to understand it through competence modelling tools administered by HR managers and experts.

We use the evolutionary analysis to present the HR professional in this context. This provides a necessary understanding of HR in this environment as the agent of competence modelling and enabler of the organizational changes. We trace evolution of HR managers’ role in this analysis. In the 1950’s and 60’s, the primary role of ‘labour officer’ was to ensure adequate intake of unskilled and semi-skilled workforce and lure them to plants/projects to be set up in ‘green field’ sites, ensure disciplined work and provide a comfortable work atmosphere. The 1970s saw a personnel focus where additional responsibilities included managing industrial
relations and ensuring a strong collective bargaining position, designing and managing compensation structures, performance appraisals and promotion policies, rewards and incentive systems. The HR professional in the 80’s shifted to development of the organization’s human resources with a focus on designing of training interventions for employee development, preliminary competence modelling and planning for future successions. Since the nineties, the HR professional has seen a paradigmatic shift to playing an integral role in driving business strategy. This is a consultative style of operation based on informal or formal competence modelling. The HR professional plays a primary role in ensuring and building organizational work culture, ensuring ways of increased employee commitment and motivation during this period. In order to survive and prosper in global competition, HR must facilitate the organizations to nurture learning by stimulating creativity and innovation and creating appropriate organizational cultures that foster the empowerment of its people. The primary role of the human resources function in PSEs is to prepare the organization and its workforce to continue to face change successfully. The challenges facing the HR professional include: (1) Developing a global mindset in the HR organization with a deep understanding of the new global competitive environment and its impact on people management worldwide; (2) Aligning core human resource processes and activities with the new requirements of global competition while simultaneously responding to local issues and requirements; and (3) Enhancing global competencies and capabilities within the HR function so it can become a borderless business partner in rapidly exploiting business opportunities worldwide. The author’s analysis of data and experience reveals that to pursue a vision of strategic alignment with business objectives for the HR profession future HR managers should have the following competencies: Business Driven; Research Driven; Process Sensitive; Systems Driven; Change Manager. She should display role-making behaviour, as opposed to role-taking, and have the ability to see the big picture and integrate themselves and their interventions with the business they serve. These align with the nature of competence that the HR manager must develop in order to develop such competence in the HR of the organization.
4 Summary and On-going research

In this section, we outline some bases for our on-going data collection and identify strategies for analysis. We conclude the paper with some expected conclusions and discuss implications. Using managerial motivation as a measure of behaviour an attempt will be made to identify the relative importance of employee needs and organizational environment to understand employee competence, commitment and motivation. Empirical data for this will be collected using interviews, document and strategy analysis. Academic and practitioner literature agrees that improved employee commitment leads to improved job performance as well as organizational effectiveness or at least reduce tardiness, absenteeism and turnover. We will investigate motivation and commitment of employees along these dimensions. My on-going work intends to understand employee motivation and commitment through competence models for an Indian PSEs in an interpretive case study. I identify and compare personal and situational factors that impact the employees’ motivation and organizational commitment. Indian PSEs need to identify competence models to manage employee motivation and continuously their skills. Case analysis, using the literature and analysis discussed here would involve systematic analysis of the nature of competence models that have led to improvement, probable elucidation of these models as well as lessons learnt for practice.

The Indian economy is in the race for competitiveness in the global marketplace. Economic policies influence global competitiveness through structural adjustments accompanied by strategic investment in human resource development. The economic environment impacts all stakeholders and is especially important to HR development. The policy implications at the organizational level require reassessment and strategic investment in the human resources of the organization. An organization’s HR allows an organization to harnesses and nurtures its people power. HR has undergone a paradigmatic shift from a primarily administrative function concerned with day-to-day working environments of employees to its current position with strategic implications in the organization’s effectiveness. HR must proactively anticipate trends and develop strategic responses to manage the challenges presented by change in the economic and competitive environment. We present a contextual analysis of evolutionary changes that affect the transitory role of HR in various HR sub-systems in large
manufacturing PSEs. I look forward to discussing the results of our on-going research at the conference.

5 References


A European Framework for e-Government Competences

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Abstract. The term e-government stands for an ICT enabled transformation of the public sector. New forms of collaboration and inter-organisational public service networks become feasible, to fulfil public tasks more efficiently and effectively. Even though e-government is being promoted by the EU, tangible results are rather scarce. The European Commission and the EU member countries therefore strive for a more coherent development of e-government within the EU. Nevertheless, it’s being implemented very differently in the EU member countries. One reason for this diverse development seems to be that different competences are associated with e-government in the EU member countries. This article describes the first steps of the development of an e-government competence framework. This framework is initially being developed in the COMPATeGov project with public administrations from Bulgaria, Germany, Greece, and Romania. The article sums up the first results of a literature review on e-government competences, a survey, and focus group workshops. It outlines a first set of e-government competences and concludes with a forecast of the next steps in the project, in order to validate and facilitate the results.

Keywords: E-government competences, E-government, Harmonisation, Standardisation, Competence Framework, Public Administration, Public Service Personnel, Vocational Education and Training, Bulgaria, Germany, Greece, Romania.
1 Introduction and Problem Statement

E-government can be understood as an ICT-enabled transformation of the public sector to achieve better government (type-3, -4 definition of the OECD 2003). In this respect, it is more than just online government, which reduces e-government to the online delivery of public services (type-1 definition of the OECD 2003). Instead, this broader transformational perspective takes into account, that the public sector as a whole can be reorganised by making use of information and communication technologies (ICT). ICT has the potential to rethink how public services are being produced and which actors are being involved in the process. This perspective enables for instance the separation of public services into parts which are conducted in the front office, where public services are delivered, and the back office, where they are produced. Thereby ICT facilitates new organisational models, like e.g. shared service centres, which provide a large number of agencies with a standardised service, mostly a support process in the back office (Bergeron 2003). Another example are one stop agencies, which bundle a number of different services from a variety of agencies and offer them at one location ("front office") – online or offline (Lenk 2002). With slightly different connotations, these transcending models are underlying the "joined-up" (Bogdanor 2005) and "whole-of-government" (Christensen/Laegreid 2007)-approaches.

Promoting e-government has been a major effort in the European Union (Malmö Ministerial Declaration on eGovernment 2009). Considerable effort has been undertaken to measure the implementation of e-government. Different, more or less sophisticated maturity models have been used to display the status of e-government within the European Union (e.g. the limited model in European Commission 2009; for an overview see Grönlund 2010; Gil-Garcia/Martinez-Moyano 2007). Thus depending on the specific measures, the overall results are rather scarce and very diverse in the different EU countries. Therefore, the European Commission has undertaken various initiatives (e.g. EU Services Directive) to promote e-government. The results remain selective, what can be considered problematic in the European context with a single internal market (see the Digital Single Market in European Commission 2010).

Besides the different legal frameworks and administrative traditions among the EU member countries (Pollitt/Bouckaert 2004), one obstacle constraining the implementation of a more coherent European e-
government seems to be the heterogeneous approaches to e-government in the member countries (critical of a uniform reform approach is Lenk 2006). As a consequence, there is no consistent understanding of the competences associated with e-government. Often there is not even an established understanding of e-government competences at all (Schuppan 2010).

To date, in practice, the topic is – if at all – still being addressed in a very IT-dominated fashion. The same is true for the scientific community in public management and in administrative sciences (Grönlund 2010), which often very unilaterally still perceives e-government as an IT subject (Elovaara et al. 2004; Kaiser 2004; Mundy et al. 2001). Nevertheless, in practical projects and in the everyday work of public administration, it is becoming increasingly apparent that new competences are required which go beyond the simple use of an IT application, or even IT specialist and tool knowledge (OECD 2003). A comprehensive change of competence requirements for all civil servant groups can be expected—and is already becoming apparent.

To address this problem the research questions at the core of this article asks which competences are considered e-government competences in different European countries? What differences actually exist between these countries? Which competences are specifically important from a transformational perspective on e-government?

To answer these questions, the article will be structured as follows: at the beginning, the methods employed will be briefly presented. Second, the results of a survey and workshops with e-government experts will be presented in order to determine new competences. These results will then be analysed and the necessary skills and competences structured in what can be considered a first draft of an e-government competence model. Furthermore, exemplary use-cases for an e-government competence model will be outlined. To conclude, an outlook will be given on how the results will be validated and specified in more detail.

2 Methods

Until now, e-government competences have hardly been discussed in the academic debate. Only a few academic articles addressing e-government-related competences or skills exist (e.g. Leitner 2006, Settles 2005, Schuppan 2010), and even these often lack the focus of this article. Furthermore, the question of changing and newly arising competences in
the context of e-government faces some significant challenges from practice:

- There is no agreed and established job profile for “e-government public personnel”, to which draw upon.
- The understanding of e-government in practice is at best mixed and rather incomplete
- Given the dynamics in the field of e-government and the time lag to adjust competence level, it is necessary to reflect upon future competence requirements.

Therefore, the methodology of this article employs a multi-staged methodology: Competences have been derived from a literature analysis of the scarce previous research as well as newly arising e-government structures and processes. Based on this analysis, an initial set of e-government skills and competences has been derived, which served as the basis for an online survey. This survey has been conducted among e-government experts in Bulgaria, Germany, Greece, and Romania. These countries have been chosen, since they represent a sample of diverse administrative traditions and score differently in e-government benchmarking studies (European Commission 2009). The questionnaire asked for the relevance of a skill or competence, the competence level necessary in the public sector, and the current competence level in general. The participants were asked to rate the importance of a specific skill on a four-tier scale, zero meaning a skill would not be important and three, a skill would be very important. The assessment had to be made for three different roles of public personnel: staff, mid-level management and senior management. The survey asked specifically for the competences necessary in e-government projects in order to gain an understanding of those competences required to make use of the transformative potential of e-government. Furthermore, statistical personal data was obtained from the participants at the end of the survey. Along with the survey came a glossary that provided a short definition of the item in question. The survey results have been validated and specified in more detail in workshops in the different project countries with e-government experts. These experts were either themselves public personnel or consultants from the field of e-government. The results from the survey and the workshops have been consolidated and systematised. They will receive further specification and validation in upcoming workshops and online discussions as part of a project on e-government competences, the COMPATeGov project, which is funded
by the European Commission. This project develops a European e-government competence model together with academic institutions and public administrations in Bulgaria, Germany, Greece, and Romania. The results will be used to develop an assessment tool for e-government competences, set up an online repository with relevant training materials adapted to one’s individual training needs, and design corresponding vocational education and training (VET) offers.

3 Results

Skills and Competences for the staff level

The Skills considered the most important for e-government project staff across all project countries are IT Literacy Skills, Information Processing Skills, IT Specialist Skills, Process Management Skills, and Organisational Design Skills (Fehler! Verweisquelle konnte nicht gefunden werden.). The single-country results are – except for Romania – very similar, showing that there seems to be a pretty homogeneous understanding of e-government skills for project staff.

<table>
<thead>
<tr>
<th>Skills for Project Staff</th>
<th>Bulgaria</th>
<th>Germany</th>
<th>Greece</th>
<th>Romania</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1,24</td>
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</table>

Table 1. Relevant Skills for Project Staff
The personal and social competences assessed as very important for the staff involved in e-government projects were cooperation competence, communicative competence and self-control.

**Skills and Competences for the mid-level management**

The Skills considered the most important for e-government project managers across all project countries are Project Management Skills, Process Management Skills, Organisational Design Skills, Risk Management Skills, and IT Strategy Skills. Again, there is not much of a difference between the single-country results, with at least four out of the five general top skills for project managers being identical in each country. Thus, there is a significantly homogeneous understanding of e-government skills for project managers.

<table>
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<tr>
<th>Skills for Mid-Level Managers</th>
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<th>Greece</th>
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<td>Policy Process Skills</td>
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<td>1.81</td>
<td>2.28</td>
<td>1.59</td>
<td>1.95</td>
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</tbody>
</table>

Table 2. Relevant Skills for Mid-Level Managers

Even though some of the most important skills for project managers mirror the skills considered relevant for project staff, there are significant differences, e.g. the top three skills being completely different. Furthermore, even if the skills title is identical, the associated skill levels and tasks for the different roles are not.

The personal and social competences assessed as very important for the mid-level management involved in e-government projects were
communicative competence, time-management and cooperation competence as well as leadership.

**Skills and Competences for the senior management**

The skills considered the most important for e-government senior managers across all project countries are IT Strategy Skills, Organisational Design Skills, Project Management Skills, Risk Management Skills, and Change Management Skills (*Fehler! Verweisquelle konnte nicht gefunden werden*). There is slightly more variance among the single countries, but the results nevertheless show solid consistency. At least three out of the five general top skills for project managers are mirrored in each country. Thus, there is a relative homogeneous understanding of e-government skills for senior managers.

There is a significant similarity between the most important skills for project managers and the skills considered relevant for senior managers; four out of the top five skills are identical. It was explained that the project managers are often recruited from the organisation’s management ranks. In the public sector, different from the private sector, there basically is no separate caste of project managers. The project managers in the public sector often keep their responsibilities and tasks in the hierarchical structure and/or go back to their regular occupation, after the project is finished.

<table>
<thead>
<tr>
<th>Skills for Senior Managers</th>
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<th>Greece</th>
<th>Romania</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
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<td>2.04</td>
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<td>1.53</td>
</tr>
</tbody>
</table>

*Table 3. Relevant Skills for Senior Public Managers*
The social and personal competences estimated to be the most important for senior managers responsible for e-government were communicative and cooperation competence as well as leadership.

4 Analysis

The results have shown that apart from IT-related competences a large variety of different skills and competences are estimated to be important in the context of e-government (i.e., mixed competences). Thus it becomes apparent that especially public managers involved with e-government also needs knowledge about the possible applications and opportunities of IT architecture and operational process knowledge, so as to understand coming changes and make strategic decisions. The governance-related leadership literature especially neglects this aspect, either ignoring it or assuming, more or less explicitly, that operational knowledge is not necessary for strategic skills.

The results confirm that the working level is especially affected in a way which goes beyond knowledge of IT applications. Staff at this level needs a new understanding of work processes and self-organisation skills. Project leaders face special challenges, because they must possess very profound interdisciplinary expert technical knowledge and increased social competences. Executives also require specialist knowledge—sometimes in great detail—to be able to push through projects and to ensure the necessary broader political support.

Looking toward future developments, it can be assumed that the relevance of isolated competences in IT applications will decrease, in part because human-machine interactions will continue to improve. It can be expected that technical expertise will gain in importance, because IT will become an integral, self-evident element of work in public administration. Already, every branch of public administration—security, law enforcement, social services and others—utilises IT. It is becoming clear that the change in competence requirements at issue have much less to do with digitalisation and much more to do with new procedures and processes of public administration. This also applies to executives. To date, however, there is a lack of consistent management and control concepts which address digital and spatially distributed work forms and the related competences.
Analysing the results particularly from the workshops in detail, newly arising skills and competences can be distinguished from other skills and competences, which have been prevalent in the public sector and "merely" need to be applied to e-government. We thereby differentiate between these latter, which we term generic government skills and competences on the one hand and newly arising core e-government skills and competences on the other hand.

The so-called generic government skills contain personal competences (creativity, self-control and -motivation, and time management) and social competences (leadership, cooperation and communication). These competences gain more relevance in this more networked and partly less hierarchical working environment which requires more cooperation across organisational borders. They furthermore encompass policy and legal skills (policy process, administrative law and cultures, specialised law) and change-related skills (project and change management skills and implementation competence). These latter categories are also more or less generic competences that are required in the public administration, but which are necessary in order to implement the structural changes.

Among the so-called core e-government skills which can be grouped together are the e-government management skills and competences (risk management, quality management, performance management, and contract management), e-government design skills (organisational design, process design, IS design, IT specialist, and marketing skills), eSkills (IT literacy, information processing, and media skills), and ePolicy skills (eStrategies and ePolicies, models and concepts, and information processing law). These are rather new competences that arise in the context of e-government.
Figure 1. E-Government Competence Structure

Such a systematisation of the necessary skills and competences can serve as the basis for practice and academia to design training programs and for work force planning efforts. "E-government work force planning efforts [...] offer organizations the opportunity to assess their current work force capabilities, determine future work force requirements in the context of e-government [,] and implement strategies to eliminate gaps, both current and future, between work force capabilities and work force requirements." (Armstrong 2002) Considering the challenges the public sector faces in the upcoming years, with e.g. a large part of the public work force retiring in the upcoming years and its scarce financial resources these efforts are especially necessary.
5 Summary and Outlook

Drawing on the literature, an initial set of e-government skills and competences has been assembled. These have been evaluated, complemented and specified in a survey and workshops in Bulgaria, Germany, Greece, and Romania. Comparing all these results for the different skills and competences assigned to the different roles in e-government transformation it is striking to see that even though e-government is developed quite differently in the four project countries, the necessary skills and competences are rather similar across all countries. Thus it can be stated, that a shared understanding of e-government competences does exist. These e-government competences encompass a large variety of different skills and competences (i.e., mixed competences) which go far beyond a limited set of IT-related competences.

During the next stages of the project, these e-government skills and competences will be refined and the different levels necessary will be described in more detail. Further refinement and validation will be based on the first draft of the competence model. Therefore workshops with training centres and the liable authorities at the different levels of government will be conducted and online discussions will be held with e-government experts from academia and practice. Based on these further discussions, a curriculum will be developed and pilot sessions will be conducted. Parallel activities aim at disseminating the competence model to ensure its use by public administrations within the European Union.

6 References


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