



ICTE in Regional Development

# Architecture of a Competence-Based Human Resource Development Solution

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## Abstract

This article offers and analyses system architecture for a solution that would provide for the implementation of a competence-based human resource development based on three approaches: (1) Competences as unified evaluation criteria; (2) Automated development planning based on the lack of individual competences of employees; (3) Knowledge management and e-learning integration for human resource development.

The tasks and reciprocity of principal components of the system (competency management, development management, e-learning and knowledge management) is reviewed in the context of application. The article offers an application of the xAPI standard for gathering and accumulation of learning experience data, which allows the forming of an open system architecture. The solution is verified in practice in the work process of a study centre. The obtained results prove the reciprocity of competence management systems by using the learning event DB, and enabling integration such with external systems to provide for open architecture.

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## 1. Introduction

Competences are a popular technique for the evaluation of human resources in various organisations. They permit assessing and developing the abilities of employees that are most important for an organisation<sup>1</sup>, permit separating the best employees from the worst<sup>2</sup>, finding and attracting employees suitable for the organisation<sup>3</sup>, and linking the abilities of employees to strategic goals of an organisation<sup>1</sup>. To enable managing the competences of employees of an organisation, such must be based on credible competency management principles that are provided for by forming competency models<sup>1,4</sup> and using different competency evaluation methods<sup>1,5,6</sup>.

Typical competency management solutions are formed for individual groups of positions or are specific to the organisation. This is mainly to reduce the amount of work required to develop a new competency management model and its application on a daily basis<sup>2</sup>. As a result, it is not always easy to compare competency models with each other<sup>5</sup>. To eliminate this problem, it has been offered to form a universal competency model that is open to the needs of different organisations and, if required, can provide detailed competency accounting within an organisation<sup>7</sup>.

The offered universal competency model consists of several elements: a catalogue of competences adjustable to the needs of different organisations, which includes all the required competences, employee competency profiles, which ensure the accounting of individual competences of employees, and the competency evaluation result accounting that does not depend on the applied evaluation method<sup>7,8</sup>.

Competency evaluation results, according to the offered universal competency model, are recorded in the competency difference form that is further processed by using a competence-based human resource development solution for planning and application. Human resource development is planned by considering different organisation-specific criteria for the implementation of development solutions<sup>7,8,9</sup>.

To ensure the operation of such an universal and open competency model, it is advisable to support an IT system which would contain three essential components: competences as unified accounting and evaluation criteria, automated development planning based on the lack of individual competences of employees, an option to integrate the knowledge management of the organisation and e-learning means for the development of competences of employees<sup>7</sup>.

As a result, general principles were proposed, on the basis of which a competence-based human resource development system of the organisation would be built (see Fig. 1).

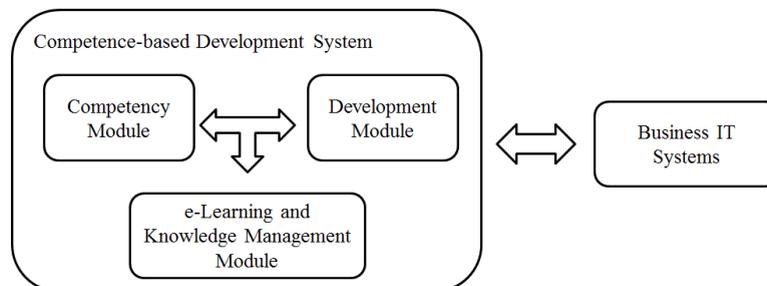


Fig. 1. Conceptual Architecture of Competence-based Development System<sup>7</sup>.

The conceptual architecture of the offered IT support system is based on competency accounting, development planning, and evaluation of development results, and modern principles of best practices in the integration of knowledge management and e-learning<sup>7,10,11,12</sup>.

## 2. Competence-Based Human Resource Development System

The practical implementation of the solution described above requires IT system support, the learning and competency management system (LCoMS). The target audience of this system are training providers (training centres) that would use it to provide targeted customer development.

LCoMS is formed by two principal blocks: Learning Management and Competency Management systems (Fig. 2). The task of the learning management system is the organisation and management of training courses and other development activities. The task of the competency management system block is a provision for competency use, reporting, and analysing functionality.

Data exchange between the principal blocks is possible directly or via the learning event database (LEDB). The LEDB is also a standardised solution to connect external business systems to LCoMS. This database aggregates learning experience events that meet the xAPI standard, which permits the detailed tracking and analysis of competency evaluations, learning activities, and development results.

The learning management system block functionality corresponds to the information system (IS) of a traditional training provider, which is focused on development/learning event management and progress support. Such a system may be already developed in the organisations, at least partially, and it may serve as a basis for the development of LCoMS. The competency management system block allows for the direct use of the competence-based approach. Its formation and introduction may take place the moment an organisation is prepared to start using a competence-based development approach.

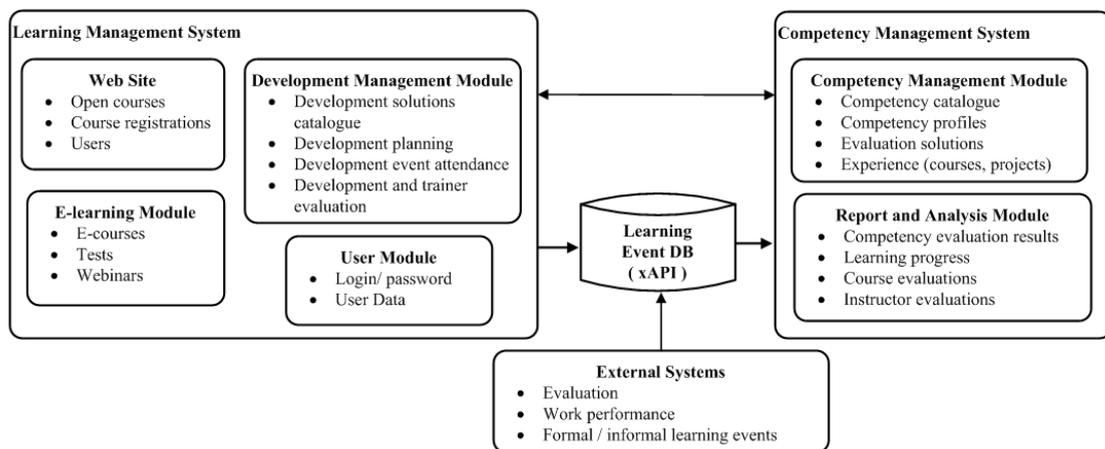


Fig. 2. Architecture of Learning and Competence Management System

### 2.1. Learning management system

The Learning Management System enables the organising and management of training courses and other development activities. This block includes a development management module, an e-learning module, a website, and a register of users.

The Development Management Module is intended for development planning and management. It includes the formation and implementation of development plans, management of development solutions, development results, and efficiency tracking. Intramural training courses, e-courses, webinars, digital materials (video, audio, documents, internet links), books, and expert consultations may serve as development solutions.

A competence-based approach permits the automated formation of individual development plans based on the lack of competency identified for each employee. Development solutions from the development solution catalogue are sought to eliminate such faults. Without a competency approach, it is necessary to form development plans manually.

Competency assessment and changes in work performance results after the implementation of development activities are used to track development efficiency. Competency assessments are received from automated competency evaluations (i.e. computerized tests). Work performance details are received from external systems by means of xAPI, which also provides for expanded analysing opportunities in the reporting module.

The e-learning module provides for the remote learning and e-learning functionality, including development, publishing and delivery of e-courses, completion of computerized tests, communication between learning participants and a tutor, obtaining assessment and feedback, and organising webinars. It is useful to ensure the functionality of this module by means of the Learning Management System (LMS) that is usually already used in organisations. It is essential for organisations to provide LMS with the functionality required for the competency approach (automated assessment) and the opportunity of its integration into general LCoMS architecture.

The website is intended to make information of the learning provider public to both customers and partners. On the website it is possible to research offered development solutions, register for learning, and plan personal development.

The user register module is intended for the storage of registered user accounts and details. The user account provides for access to all LCoMS modules, according to the roles granted in the system.

## 2.2. Competency management system

The task of the competency management system block is to ensure competency use, reporting and analysing functionality. It is formed by the competency management and report and analysis modules. The competency management module enables managing the competency glossary of the organisation, summarising the competency details of individuals, managing competency profiles, managing competency assessment solutions, and registration of assessment results.

The competency glossary summarises, in a hierarchic structure, the competences used by the organisation and their explanations. Competences from the glossary are used in the development planning module and the organisation website when describing development solutions. Descriptions of competency profiles of employees and individual competency development plans are formed of the competences.

Automated competency assessments are obtained from the e-learning module (computerised tests, scenario play, learning plays) or the external IS. The xAPI standard is used to receive data, if possible. In the event this is not possible, a data importing and mapping solution is used to register the assessments in the competency profiles. Competency assessments obtained in a non-automated manner are also summarized in the profiles by means of a data importing and mapping solution.

The report and analysis module creates the opportunity to receive summarising and detailed reports about the use of LCoMS and the results of the learning providers. Standard reports demonstrate the planned and implemented development solutions, competency assessment results, competency profiles and faults, development plans, and assessments of learning activities and tutors. Each LCoMS module provides the specific reports required on a daily basis. The report and analysis module allows to summarise details from several modules and internal databases to obtain analytical information. The system features the possibility of users developing and using new reports themselves.

## 2.3. Learning event DB

The learning event database (LEDB) is intended for storing and managing the results of LCoMS competency assessment, learning activity performance, and development events. Technically LEDB is developed as a Learning Records Store (LRS) corresponding to the requirements of the Experience API (xAPI) standard.

Business intelligence and analytics required for managing human resource development can also be provided by means of different types and structure of data; however, such a solution may be complicated and difficult to use. Upon opting for the xAPI-based data unifying solution in LCoMS, the gains are:

- Support for details of future learning events. Combining xAPI with mobile technologies may provide additional event data for analysis and new development solutions to LCoMS.

- Support for work performance details by linking LCoMS to work performance assessment IS via xAPI.
- Different types of data and integration structure by developing xAPI-based data exchange with third party IS.

#### 2.4. External IS

External systems are the IS used by the learning provider that is integrated into LCoMS and can deliver information to the learning event database. External systems are providing LCoMS with details about the competency assessment, most varied development and learning events, obtained experience, and work performance of execution results.

In the optimal scenario, external information systems are supporting the xAPI standard and can deliver data to LCoMS LEDB themselves. Currently such support is increasingly being provided in the systems intended for e-learning. To a much less extent, xAPI support is common in work execution and performance accounting systems. If it is not possible or useful to develop xAPI support in the system itself, then the following solutions are possible:

- Data import and use without xAPI. Data from the external IS is converted to the internal format of the LCoMS module and stored in the module DB, e.g., work performance results stored as competence levels in competency profiles.
- Development of a xAPI connector/ translator. A plug-in is developed for the receiving of data from the external IS in LCoMS that can translate the IS data as xAPI events and record such events in the LCoMS LEDB.
- Manual and automated obtaining of data. Manual import of data may be used in case of insignificant data volume and/or non-substantial business information.

### 3. Results and discussions

The described competence-based approach was tested in a project implemented by the learning centre, the purpose of which was assisting a socially unprotected group of residents (youths) joining the labour market. The project partner, the IT Company, offered work for call centre operators. The project activities envisaged selecting the most suitable candidates from a group of young people and performing their initial training for the performance of work duties.

There were three competences (customer service, IT skills, logical thinking) identified with several groups of skills. Competences were assessed by means of a computerised test. The obtained results of the assessment demonstrated the level of each competency and the groups of skills included therein, thus permitting selecting the group of most capable candidates. An individual development plan was developed for this group based on the lack of competences of each participant. The plan consisted of modular development solutions that envisaged a blended learning: classes moderated by a tutor in the classroom were combined with remote learning elements. It was modularity and the opportunity of choosing learning at the level of groups of skills that exactly provided for a high individualisation of training.

Training quality assessment was performed at the end of training by means of a survey. Assessment of competency improvement was performed by repeatedly completing the computerised assessment test.

The above activities were provided by the learning centre IS, which provided the LCoMS development management, e-learning, user register, competency, report, and analysing module functionality. Modules of the competence management system were implemented as prototypes. In the competency management module, competences were described in the competency glossary and the advisable competency profiles for the position of the operator were defined. Moodle LMS platform was used as the e-learning module, which provided for computerised tests for competency assessment and remote learning functionality (publishing e-learning materials, exercises, communication with the tutor). A special mapping solution was developed for a detailed assessment at the level of groups of skills that converted the results of the test into competence levels, and saved them in real competency profiles of the candidates. Specially developed reports permitted selecting a group of the strongest candidates and describing the lack of competences of each candidate.

The internal IS of the learning centre was used for development management, where the intended development solutions were described by linking them to relevant competences and groups of skills. This system does not provide

an automated formation of development plans, therefore their formation, scheduling of classes and registration of learning participants were performed manually.

The tasks of the user register module were performed by the IS developed in the learning centre internally, which provided for access to all modules, linked users to their competency profiles, learning plans, assessment tests, and remote learning classes.

Interactive e-learning modules that registered the xAPI learning events in LRS were used as the remote learning materials. This permitted tracing the learning nuances of each candidate in the report module and assessing their impact on the overall result of learning. The training assessment survey was provided for by the development management module. Analysing the results of tests performed initially and at the end of training was provided for by the report module.

No integration with external IS was performed in the implemented scenario. Using the xAPI learning events generated by the e-learning modules proves the opportunity of integrating external IS that support the xAPI standard themselves. Integration of external IS and using the work performance details to ensure development are substantial directions for the further development of the LCoMS prototype, as they will make the LCoMS architecture more open.

#### 4. Conclusion

1. The learning and competency management system performs its functions in competency management and development. Although some LCoMS elements were not implemented, the obtained results prove the opportunity for successfully using the offered solution for the purposes of employee selection and initial development.
2. Integration of LCoMS with external IS would form open system architecture that is required for obtaining extensive learning management analytical information.
3. Implementation of website functionality would provide for the closer involvement of customers in the use of LCoMS.
4. Further course of the study will involve the development of a system prototype and validation in real business environments.

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