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## **Fostering Enterprise Architecture Education and Training with the Enterprise Architecture Competence Framework**

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Evangelos Kalampokis and Konstantinos Tarabanis<sup>1</sup>

**Abstract:** Enterprise Architecture (EA) implementation refers to a set of activities ultimately aiming to align business objectives with Information Technology infrastructure in an organization. EA implementation is a multidisciplinary, complicated, and endless process, hence calls for adequate education and training programs that will build highly skilled personnel (called enterprise architects) with diverse competencies. This development of domain – specific competencies is also supported by European policies on education and vocational training. To this end, the authors present the Enterprise Architecture Competence Framework (EA-CF) as a conceptual model that describes EA competencies in compliance to the European e-Competence Framework (e-CF). The authors argue that EA stakeholders can consult the framework regarding competencies they want to underpin and thus identify the corresponding skills, knowledge and attitudes that result as learning outcomes in EA courses and training programs.

### **1. Introduction**

Enterprise architecture (EA) is widely viewed as a process that “translates business vision and strategy into effective enterprise change by creating, communicating and improving the key principles and models that describe the enterprise's future state and enable its evolution”. The scope of the EA includes “the people, processes, information and technology of the enterprise, and their relationships to one another and to the external environment” (Lapkin, 2006, 9). EA implementation is a complex, multidisciplinary exercise that calls for talented, well-trained specialists (called enterprise architects) who can handle its multiple facets (organizational, technological,

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social etc.) In the literature however there is little work focusing on the competencies of enterprise architects.

This article presents the EA Competence Framework (EA-CF), which extends the European e-Competence Framework (e-CF) for Lifelong Learning. The e-CF has been proposed by the European Committee for Standardization (CEN, 2008) as a common European language for Information and Communication Technologies (ICT) competencies. The e-CF competencies' and their associated concepts' identification has been a joint effort of ICT stakeholders from business, politics and education across Europe and the framework's final results have been recognised in the Communication of the European Commission on "e-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs" (CEN, 2010).

Thus, EA – CF complies with a Europe-wide agreed reference for ICT competences for all industry skills. The framework adopts e-CF's concepts and supplements them with EA – specific concepts in order to provide a complete and in depth understanding of EA competencies and to contribute to the successful implementation of EA training and education.

## **2. EA Training**

Enterprises that endeavour to prevail in today's global economy are required to incorporate innovative technologies and business models in order to adapt to the rapidly changing environment. However, the complexity of these processes brings forth additional challenges that should be addressed and overcome. To this end, both public and private organizations have started to implement EA and exploit its ability to not only govern and facilitate decision-making processes but also to originate new business opportunities. More specifically, EA acts as a "collaborative force" between the different enterprises components (i.e. business planning, business operations, automation and technological infrastructure) and thus provides a holistic overview of the entire enterprise (Schekkerman, 2004).

However, due to the variety and complexity of information that an EA entails, its successful implementation is challenging. Hence, constant update on emerging EA - specific knowledge should be fostered via academic programs focusing on EA as well as ongoing training systems within the enterprises (Strano and Remani, 2007). Nevertheless, sole EA comprehension does not sufficiently prepare enterprise architects

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for the daily challenges and tasks they are required to address. More specifically, business, technological, management and social skills should be considered to enhance enterprise architects' ability to successfully develop and manage architectures and provide them with a significant competitive advantage within the enterprise (Steenbergen et al., 2008).

Therefore, this gradual incorporation of EA principles within organizations has led to a small number of EA academic programs and certification institutions. However, the academic institutions that include courses specializing in EA are still limited and the corresponding educational material varies, since the design and implementation of the curricula is individually decided by each institution. Hence, significant differences can be identified in the EA – related knowledge that is taught and the skills that are developed.

To this end, the modern knowledge society requires a closer co-operation between educational institutes and the professional world for the unified determination of the learning outcomes in terms of knowledge and skills that should be reached, as expressed in the Barcelona European Council (2002). According to Müller (2006), this isn't what is happening in universities right now. In contrast, universities teach strictly structured courses that passively deliver knowledge without following learning designs that will foster the development of the associated skills needed in professional life. Therefore, new learning strategies need to be set in motion that will take into consideration the labour market's needs and embed corresponding competency – based activities into existing teaching programs that will sufficiently train future employees to their highest potentials (Stoof et al., 2006; Land et al., 2009).

## **2.1 EA Training Programs**

EA training programs are usually seminars that are held by private organizations and provide EA courses with or without certification possibilities. Each program usually teaches a specific EA framework (e.g. Zachman, TOGAF etc). These seminars aim in certifying the comprehension of the EA framework's concepts and its implementation process. Apart from independent certification programs held by large Information Technology (IT) companies such as IBM, Capgemini etc (Land et al., 2009), some of the most well known training institutes and programs are as follows:

- *The Federated Enterprise Architect Certification Institute (FEACI)*

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The FEACI aims to educate enterprise architects by teaching a variety of EA frameworks, such as TOGAF, FEA(F), DoDAF etc. It comprises of two certification programs and focuses on the development of professional competencies.

- *The Open Group Certified Architect Program (Open CA)*

The Open CA (former ITAC) program aims to train IT, Business and Enterprise architects and foster the development of professional and personal competencies (i.e. skills and knowledge).

- *The Zachman Certified™ - Enterprise Architect program*

The Zachman Certified™ - Enterprise Architect program aims to educate enterprise architects by teaching the usage of the Zachman Framework. This training program focuses on the delivery of knowledge as well as the development of technical skills.

However, the aforementioned training programs do not follow EA – specific guidelines for the determination of the competencies to be fostered and the corresponding learning outcomes that should result. Therefore, the differentiated material leads to inequality between enterprise architects qualifications and a disjointed EA implementation.

## **2.2 EA Academic Programs**

Academic programs consist of EA postgraduate programs or individual graduate courses. Each EA course aims to provide adequate knowledge regarding various aspects of the domain that may be useful to future enterprise architects. A few universities provide a small sub-group of EA related courses within their departments, whereas only a handful has postgraduate programs that focus completely on EA, e.g.

- Royal Melbourne Institute of Technology. Melbourne, Australia – Master Technology (Enterprise Architecture)
- Griffith University, Australia – Master of Enterprise Architecture
- Brunel University, London, United Kingdom – Enterprise Systems Architecture

The limited amount of EA academic programs as well as the disjointed EA material taught in both academic and training programs brings forth the need for appropriate guidelines that will enable the homogenous design of EA educational material and curriculum. EA-CF can provide these guidelines, since the competences it includes are verified Europe-wide and the information regarding the skills, knowledge and attitude

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that enterprise architects need to acquire in order to successfully implement EA are identified by the experts in the EA domain.

### **3. EA-CF**

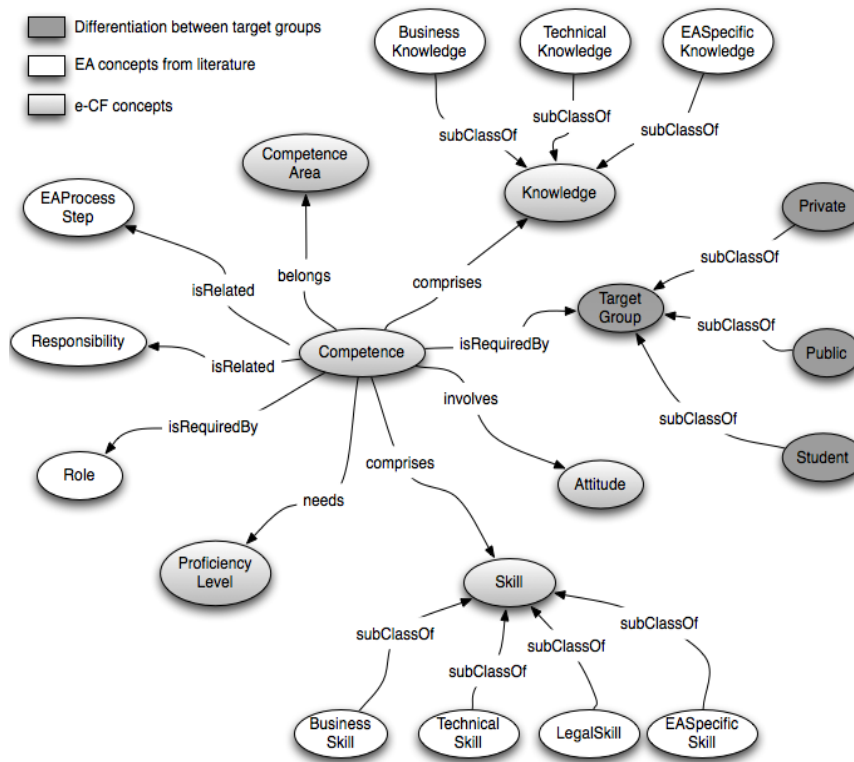
EA-CF is an extended version of the European e-CF with additional concepts that specifically characterize EA competencies. The e-CF describes the 36 prominent ICT competences that can be applied in all sectors (i.e. private, public, and academia) across Europe. According to e-CF "*Competence is a demonstrated ability to apply knowledge, skills and attitudes to achieving observable results*" (CEN, 2010, 6).

Six main concepts are included in e-CF (i.e. Competence area, Competence, Proficiency level, Skills, Knowledge and Attitude). The Skill, Knowledge and Attitude concepts can be considered as learning outcomes that are reached within educational courses and vocational training programs.

The EA – specific concepts that were identified and incorporated in e-CF led to the development of EA-CF by area experts from academia, IT sector and public sector with the XXX project co-funded by the European Union (reference to project is removed to prevent blind-review).

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**Fig. 1** The ontology depicting EA-CF's concepts

The final EA-CF was modelled as an ontology that contains 10 classes, 13 sub-classes, 127 concepts and 30 relationships (see Fig. 1), and includes only 14 out of the 36 ICT competences that are considered EA – specific. More specifically, the classes and sub – classes are as follows:

- *Competence*: The ability to apply knowledge, skills and attitudes for achieving observable results.
- *Skill*: The ability to carry out managerial or technical tasks. It includes:
  - *Business skill*
  - *Technical skill*
  - *Legal skill*
  - *EA – specific skill*.
- *Attitude*: The cognitive and relational capacity. It can also be described as personality characteristics.
- *Knowledge*: The "set of know-what" and can be described by operational descriptions. It includes:
  - *Business knowledge*

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- *Technical knowledge*
- *EA – specific knowledge.*
- *Competence area:* The identified ICT business processes (i.e. Plan, Build, Run, Enable and Manage). The areas that are considered EA – related and therefore are included in the EA- CF ontology as sub – classes of the *Competence area* class are:
  - *Enable area*
  - *Manage area*
  - *Plan area*
- *Proficiency level:* The autonomy, behaviour and context complexity of a competence.
- *Role:* The roles of an Enterprise Architect. An Enterprise Architect could act as a communicator, a leader, a manager, a modeller etc. Each role requires different sets of competencies.
- *Responsibility:* The responsibilities of an Enterprise Architect in every step of the EA development process. In meeting these responsibilities, the Enterprise Architect needs certain competencies.
- *EA process step:* The steps followed for developing an EA.
- *Target Group:* The different sectors that require EA competencies development. It includes:
  - *Private:* EA related employees related in private sector
  - *Public:* EA related employees in public sector
  - *Student:* University students taking EA relevant courses.

The EA – CF development process led to the creation of the final model, which can be obtained as ontology (OWL file) from [http://islab.uom.gr/ea\\_owl.owl](http://islab.uom.gr/ea_owl.owl).

#### **4. EA – CF and Training**

A number of frameworks have been adapted to comply with e-CF in order to “*facilitate trans-national mobility for workers and learners and contribute to meeting the requirements of supply and demand in the European labour market*” (European Commission, 2008, 6). Representative examples of good practices in extending e-CF for training reinforcement are the United Kingdom developed Skills framework for the information age (SFIA), the German Advanced IT Training System (AITTS) and the

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European Certification Model for ICT Professionals (EUCIP). All of these frameworks link their features with e-CF's concepts and are implemented in domains such as Information Technology (IT), Human Resources (HR) and Information Systems (IS) for training competencies (CEN, 2010). Similarly, EA – CF endeavours to foster training competencies specializing in the EA domain.

The profession of the enterprise architect is strongly connected with knowledge gained in higher education as well as with real – world experience gained through practice in the domain (Land et al., 2009). Therefore, all academic and training programs should incorporate competency – based learning strategies for the development of EA – specific competencies. European policies strongly support this shift in training programs, by claiming that "*education and training systems should deliver the right mix of skills, including digital and transversal key competencies*" (European Commission, 2010, 10) and that "*labour markets increasingly rely on higher skill levels and transversal competencies*" (Roy, 2010, 11).

Currently, limited research is available regarding EA training practices in the public and private sectors (Land et al., 2009). However, there are case studies that show that constant training significantly enhances enterprise architects' performance. More specifically, Aier and Schelp (2009) and Goh (2006, 126) studied the success factors of EA in the private sector and conclude that iterated training is fundamental for the enterprise's sustainable success. Additionally, Steenbergen et al (2008) researched the influential factors for EA success in both public and private sectors and concluded that training is one of the factors that determine the enterprise's EA maturity level.

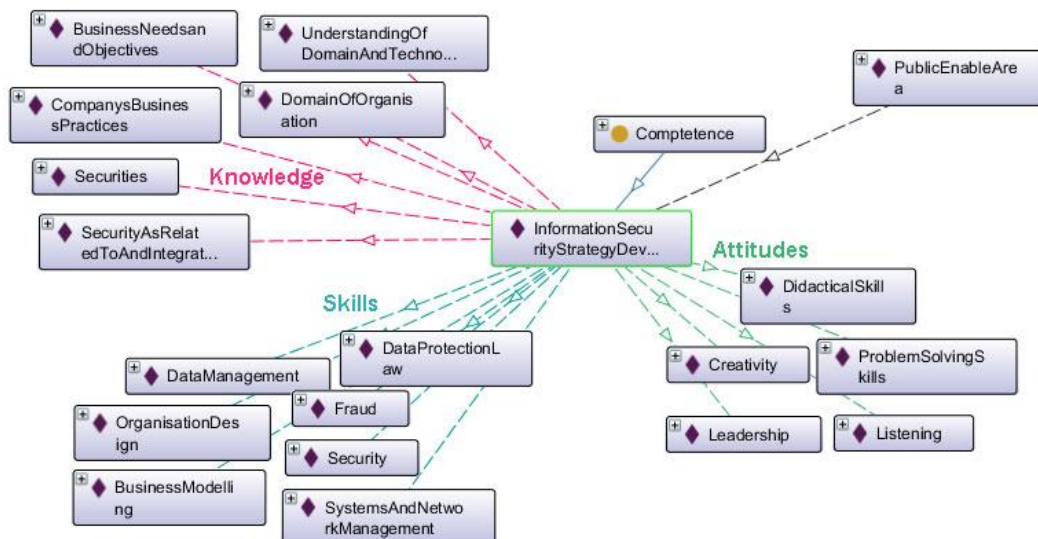
EA-CF can act as a facilitator in the training process by providing information regarding knowledge and skills that are associated with the development of EA - specific competencies. More specifically, stakeholders from public and private sectors as well as academics that require the development of a specific competence can consult the framework for the identification of the corresponding skills, knowledge and attitudes that should act as learning outcomes resulting from an EA course or a vocational training program. Moreover, they can refer to EA-CF for qualification purposes, i.e. when they need to hire enterprise architects or determine an enterprise architect's expertise level etc by identifying which knowledge, professional skills and attitudes are essential to an EA competence.

In order to better illustrate some of the frameworks uses, we present three examples:



- A public company wants to evaluate its EA team
- A private company wants to hire enterprise architects
- A university wants to develop a new course on EA

In the first example, we assume that a public company wants to evaluate its current EA team. The head of the EA department has knowledge of the competencies the team possesses and on which level. If there are competencies that are somewhat lacking compared to others, EA-CF provides information about skills, knowledge and attitudes the enterprise architects can focus on. If we assume that the lacking competence is *Information Security Strategy Development*, the head of HR can consult EA-CF and identify the corresponding concepts and instances. According to EA-CF, skills such as *Data Management*, *Business Modelling* and *Organizational Design* can assist in the development of the said competence. Moreover, the enterprise architect must acquire knowledge related to *Business Practices*, *Business Needs and Objectives*, *Domain of Organization* etc. Finally, *Creativity*, *Leadership* and *Problem Solving* are amongst the attitudes that will enhance the enterprise architect's efficiency (see Fig. 2).



**Fig. 2** The *Information Security Strategy Development* competence in the EA-CF ontology

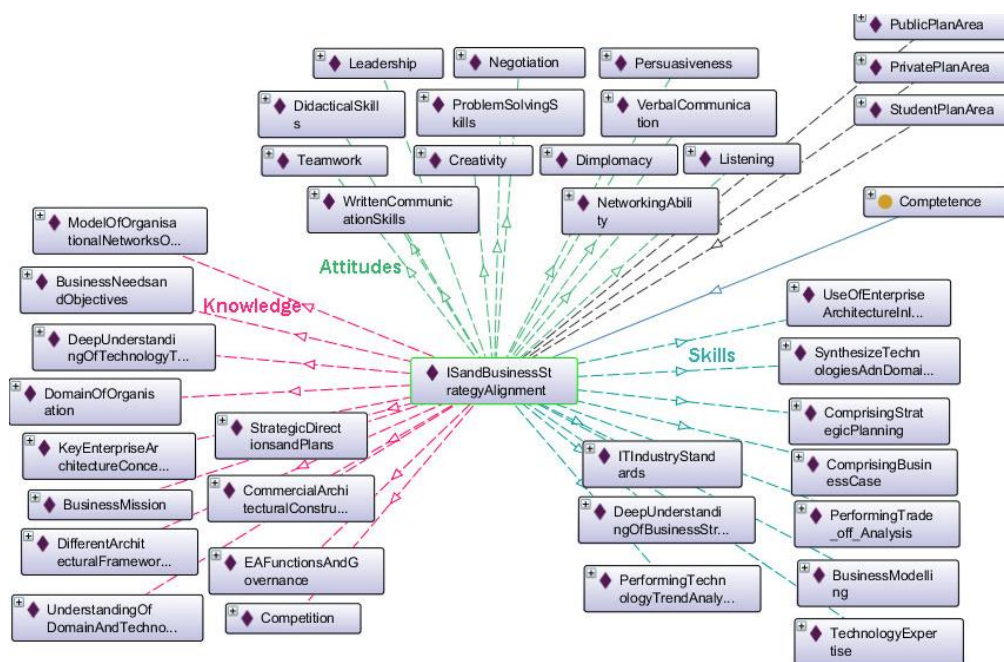
With this information in hand, the company can develop training material and activities that focus on the competence in question. More specifically, since problem solving and leadership are attitudes that need to be fostered, the public company could customize its

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training program by applying the Problem Based Learning strategy and improve the existing EA - related lectures by assigning EA – oriented tasks to the employees where they will be required to successfully solve given problems and make EA related decisions based on scientific arguments.

In the second example, we assume that a private company needs to hire qualified enterprise architects. The positions to be filled require the competence of *IS and Business Strategy Alignment* (see Fig. 3). To this end, the head of the EA department consults EA-CF in order to identify the skills and the knowledge that the potential staff must have.



**Fig. 3** The *IS and Business Strategy Alignment* competence in the EA-CF ontology

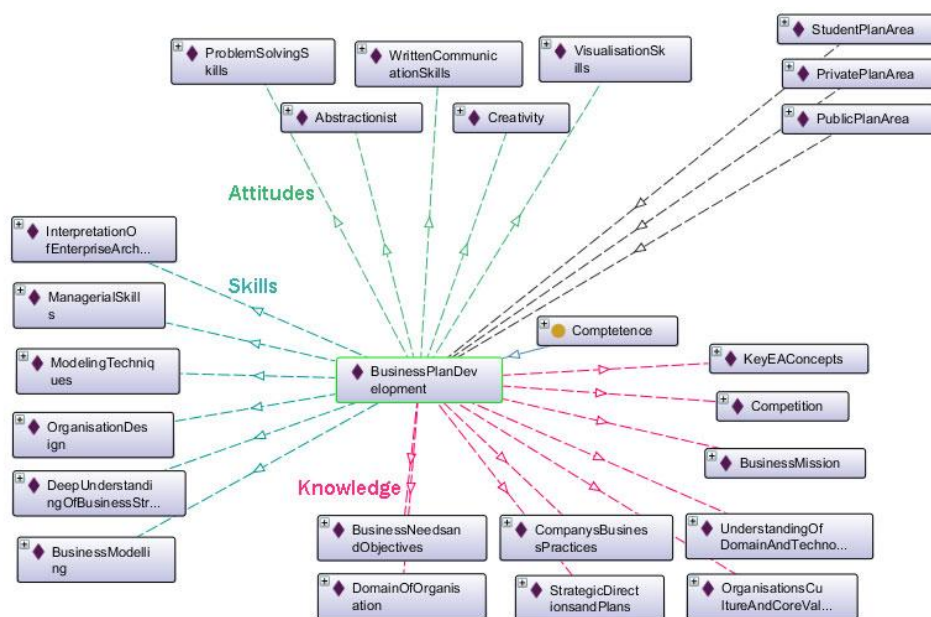
Subsequently, the position requirements in the job announcement as well as the interview questions will focus on examining the acquisition level of some or all of the skills, knowledge and attitudes retrieved from EA-CF. This is a representative example where EA-CF can capitulate on e-CF's qualification role and act as a tool for successful EA recruiting.

Finally, in the third example, we assume that a university department is interested in developing a graduate or postgraduate program in EA. To this purpose, EA-CF can depict which competencies are required to be underpinned and subsequently what knowledge, skills and attitudes the students must obtain through the courses. Different

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learning styles and strategies can be implemented accordingly for the facilitation of the learning process. For example, if *Business Plan Development* will be one of the competencies in focus (see Fig. 4), knowledge such as *Key EA Concepts* and *Strategic Directions and Plans*, skills such as *Modelling Techniques* and *Organisation Design* as well as *Creativity* and *Abstractionist* attitudes could be gained through collaborative learning strategies (e.g. Think – Pair – Share, Jigsaw, Fishbowl etc) with the incorporation of facilitating tools (e.g. Concept maps, flowcharts, flash cards, Web 2.0 communication tools etc).



**Fig. 4** The *Business Plan Development* competence in the EA-CF ontology

This way, EA-CF can foster the development of the target competencies and support the transformation of training processes into lifelong training mechanisms for EA successful implementation.

## 5. Conclusions

Successful competencies development in the private and public sector as well as in academia builds qualified present and future employees that are more adaptive to the modern society where knowledge rapidly changes and becomes out of date within a few years (Arguinis & Kraiger, 2009). This can be successfully achieved through constant training of domain – specific competencies using an established reference that complies with European standards, such as e-CF. Focusing on the EA domain, the authors

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developed EA-CF based on e-CF's concepts and elaborated on its compliance with European education and training policies as well as on its contribution to the successful implementation of EA – specific education and training programs.

EA – CF includes 14 out of the 36 ICT competencies of e-CF that were distinguished as EA – related by EA stakeholders of the private and private sector as well as academia. The framework comprises 10 concepts that effectively describe each competence, while four of those concepts are further divided into sub – categories to provide a more detailed portrayal of the competencies.

EA-CF's compatibility with e-CF ensures its compliance with European lifelong learning policies that promote the development of the identified competencies. More specifically, e-CF promotes European co-operation for enhanced education and vocational trainings that foster educational and professional mobility, by identifying and describing the competence needs for all sectors, as proposed in the Bologna Process (1999). Therefore, for example, EA-CF can provide reliable and certified information to public companies when they need to evaluate their EA team on its EA competences acquisition level. This way, the corresponding knowledge, skills and attitudes that a staff member should possess are identified and thus the companies' vocational training programs can be customized accordingly. Furthermore, universities that want to develop EA courses can identify which competencies should be fostered and gather information regarding the knowledge that should be delivered through the educational material as well as the skills and attitudes that should be developed by the students through the learning process. This also encourages educational institutions to adopt innovative and competency – based learning strategies that can sufficiently foster skills and attitudes, resulting in more student – centred EA courses.

Moreover, e-CF is consistent with the Lisbon European Council (2000) and the Copenhagen Declaration (2002) which emphasise on the need for recognition and transparency of qualifications standards, due to its description of the competencies based on the European Qualification Framework (EQF) learning outcomes – based language (European Commission, 2008). Therefore, EA stakeholders, such as private companies, can consult EA-CF for the successful employment of enterprise architects. Subsequently, their recruitment procedures can be customized so that they thoroughly evaluate the EA – CF concepts (i.e. knowledge, skills and attitudes) that are related to the required EA competences.

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Future research on EA-CF implementation in real world conditions and their evaluation with established assessment models would provide beneficial scientific data towards good practices that enable successful EA lifelong learning. A closer co-operation between academia and enterprises can lead to prolific exchange of expertise and thus to a homogenous version of EA training programs that will facilitate cross – border mobility for enterprise architects.

## References

Aier S., Schelp. J. (2009). A Reassessment of Enterprise Architecture Implementation, Dan, A., Gittler, F., Toumani, F. (Eds.): *Service-Oriented Computing. ICSOC/ServiceWave 2009 International Workshops*, Stockholm, Sweden, 23.11.2009, Springer, Berlin, LNCS 6275, 2010, pp. 35-47.

Barcelona European Council. (2002). [http://www.consilium.europa.eu/ueDocs/cms\\_Data/docs/pressData/en/ec/71025.pdf](http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/71025.pdf)  
Accessed 17 September 2011

CEN. (2010). User Guidelines for the application of the European e-Competence framework 2.0. [http://www.ecompetences.eu/site/objects/download/5999\\_EUeCF2.0userguide.pdf](http://www.ecompetences.eu/site/objects/download/5999_EUeCF2.0userguide.pdf)  
Accessed 16 September 2011.

CEN. (2008). European e-Competence Framework 1.0. – A common European framework for ICT Professionals in all industry sectors. [http://www.ecompetences.eu/site/objects/download/4756\\_EuropeaneCompetenceFramework1.0.pdf](http://www.ecompetences.eu/site/objects/download/4756_EuropeaneCompetenceFramework1.0.pdf). Accessed 21 June 2011.

Confederation of EU Rectors' Conferences and the Association of European Universities. (1999). The Bologna Declaration on the European space for higher education: an explanation. <http://ec.europa.eu/education/policies/educ/bologna/bologna.pdf> Accessed 17 September 2011.

European Commission. (2010). Youth on the Move initiative. An Agenda for new skills and jobs: A European contribution towards full employment, Strasbourg, 23.11.2010, p. 10.

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European Commission. (2008). European Qualifications Framework for Lifelong Learning. [http://ec.europa.eu/education/pub/pdf/general/eqf/broch\\_en.pdf](http://ec.europa.eu/education/pub/pdf/general/eqf/broch_en.pdf) Accessed 17 September 2011.

European Commission. (2002). The Copenhagen Declaration. [http://ec.europa.eu/education/pdf/doc125\\_en.pdf](http://ec.europa.eu/education/pdf/doc125_en.pdf) Accessed 17 September 2011.

Goh, B. (2006) Intelligent enterprises for construction: bridging the technology and knowledge gaps through innovation and education, in *Research and Practical Issues of Enterprise Information System, International Federation for Information Processing Vol. 205*, Boston, MA: Springer, 119–131.

Land, M. O., Proper, E. Waage, M., Cloo, J., & Stenghuis, C. (2009). Enterprise Architecture Creating Value by Informed Governance. Berlin: Springer-Verlang.

Lapkin, A. (2006). Gartner Defines the Term 'Enterprise Architecture.' *Research Report, Gartner Group*.

Müller,, D., (2006). StartUp in den Job das Basiswissen fu.r den erfolgreichen Berufseinstieg fu.r Ingenieure, Berlin;Offenbach: Verband der Elektrotechnik, Elektronik, Informationstechnik

Roy, S. (2010). EU Higher Education Modernization Agenda. *EURASHE Annual Conference*.

[http://www.eurashe.eu/FileLib/conferences/tallin/tallinn\\_presentations/simon\\_roy\\_tallinn\\_2010.pdf](http://www.eurashe.eu/FileLib/conferences/tallin/tallinn_presentations/simon_roy_tallinn_2010.pdf). Tallin, Estonia. Accessed 6 July 2011.

Schekkerman, J. (2004). How to survive in the jungle of enterprise architecture frameworks: creating or choosing an Enterprise Architecture framework, p.13.

Steenbergen, M. V., Berg, M., & Brinkkemper, S. (2008). A Balanced Approach to Developing the Enterprise Architecture Practice. *Enterprise Information Systems, 12*, 240-253. Springer Berlin Heidelberg. Retrieved from <http://www.springerlink.com/content/wx56j70g367t826w>

Stoof, A., Martens, R. L., & van Merrienboer, J. G. (2006). Web-based support for constructing competence maps: design and formative evaluation. *Educational Technology Research and Development, 55* (4), 347-368.

Strano, C., & Rehmani, Q. (2007). The role of the enterprise architect. *Information Systems and E-Business Management, 5*, 379–396.