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Daedalus: An ICT Tool for Employment within the Mediterranean Basin Region

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Abstract. The latest web technologies can be instrumental in allowing the dissemination of job opportunities to under-represented groups and in making these groups aware of the job market needs and requirements This paper presents the design, architecture and functionalities of DAEDALUS, an ICT tool that provides collaborative employment services to young people from the Mediterranean basin countries involving regional entrepreneurs, ICT companies, and employment associations. Special attention is paid to the presentation of the services offered by Daedalus that assist regional administrators to monitor the current and forecast the future national and regional matching of market demands and supply needs in order to enhance the regional labor market. Challenges and shortcoming of this effort as well as future evaluation directions are highlighted.

Keywords: employment, mobility, cross-border, interoperability, collaboration, architectural design

1 Introduction

The modern European digitalized society is in the threshold of globalization where the free migration movement is one of the most essential fundamental civil rights of European citizens. The European Commission (E.C) sets as one of its most important objectives the facilitation of legal immigrants to the access of equal employment opportunities. The role of the Information and Communication Technologies (ICT) has become essential in the labor mobility and in the fight against unemployment in the European Union (EU), since ICT significantly supports the efforts of legal immigrants to seek employment in EU regions and of EU citizens to expand their search for employment outside the EU. The continuously changing face of the cyberspace is transforming the shape of the societal structure affecting all types of activities, including the employment seeking and the integration of legal immigrants.

Digitalization, however, triggers the phenomenon of social exclusion since it may lead to the low participation of disadvantaged groups such as migrants and disabled people [1]. The European society must confront this phenomenon efficiently and effectively. The E.C., acting towards the direction of bridging this digital gap, aims to create a Single European Information Space [2] in order to enhance social cohesion and support ICT initiatives that can boost employability. Moreover, since the EU labor market is also affected by the increased global connectivity, the global trends of de-localization and re-localization of services and the international monetary relations, it is in need of an innovation-based growth strategy for Europe regarding employment and inclusiveness.

Driven by this motivation, this paper presents Daedalus as a best practice example for enabling cross-border collaboration and exchange of information about career and employment opportunities in the Mediterranean basin that takes into advantage innovative ICT technologies such as the Web 2.0 [3], social networking [4], and the semantics web [5]. Daedalus engages all the relevant stakeholders (regional employers, youngsters, youth organisations, academic institutions and migration offices) having as its main objectives the posting of job vacancies seeking qualified young people that are available in the Mediterranean and EU markets, the identification of partnerships and of potential investment opportunities and the development of cross-border business plans using advanced ICT tools.

More specifically, the Daedalus integrated services consist of interactive web interfaces, interactive maps, online forms, dynamic questionnaires, Web 2.0 technologies and applications, web conferencing tools and instant messaging all of which improve the readiness of the young people to enter regional markets and create a liaison with the policy, business and scientific community in the Mediterranean area, trying to remove the digital gap from a social, technological and business perspective.

The remainder of this paper is structured as follows: Section II presents a literature review in the research fields of e-employment and e-migration at the EU level, section III presents the Daedalus notion and architecture, section IV reveals pending issues and section V provides conclusions and future research directions.

2 Literature Review

Bridging the digital gap, enhancing free movement and integrating migrants using ICT tools has been in the center of research in EU, since the global changes in the information and communication technologies [6] may allow migration to contribute to the European prosperity and growth [7]. Since the Riga declaration, the goal of reaching high levels of electronic inclusion of these groups has led to several efforts to use ICT towards this direction [8]. Since employability lies in the center of European ICT initiatives because deprivation of work is one of the most important factors leading to social exclusion [9], ICT tools that work towards this direction are of paramount importance.

The various information and communication technologies and the use of the Internet can provide useful and powerful tools in today's society [10] and they can affect the way that modern human resource planning and improvement are achieved [11]. There are several Internet innovations addressing job seekers and employers [12] that have affected the way the Labor Market operates in various ways, such as in searching for a job, in searching for an employee, in the delivery of labor services and in the way that local labor markets shape their demand [13]. Research on this field is underlying the fact that online job searches can shorten the time needed in order to find a job and they provide better outcomes in the labor market [14 [15], and [16]. Kuhn [17] has emphasized the benefits for an employer in the online search process referring to the lower search costs, the larger number of applicants for a job, the exact matching of the set prerequisites and the shorter time needed for a recruitment.

"The importance of the Internet for job procurement is increasing primarily because the three quarters of the people in the employment age are online" [18]. However, a success in the procedure of finding a job electronically is closely related with the high level of service quality that is required [19]. This kind of high quality is expected from both the employers and the employees to fulfil their reliability [20] reliability, validity, trust, responsiveness, portal aesthetics, privacy and ease-of-use goals [21]. Additionally, the quality and quantity of the job postings together with the customization of a job search are considered very important factors for successful results [22].

The need to adopt automated procedures and to integrate the available technological tools that can approach in a more holistic way the issue of employability and free movement have introduced many software tools at the EU level that provide advising and employment e-services, information and statistical data for work, study abroad and generally cross-border commuting, opportunities, search services, job vacancies, the legislation framework and legal proceedings [23], [24], [25],[26].

One of the major problems that arise within the framework of employability, is the fact that the available skills are neither monitored nor benefiting integration efforts and the enhancement of the European market competitiveness, creating negative consequences in businesses, society and economy [27]. Employers and employees may face numerous obstacles in the process of seeking employment, building partnerships, identifying synergies and specifying effective business plans at a transnational level. The need to match the existing market needs with skills availability, especially during an economic recession, is urging. The establishment of collaboration frameworks that could enable all the relevant stakeholders in the field of employment to interact and cooperate may come forward as the most fruitful approach of the technology-driven public sector reform, capable to shape a new vision where information sharing, transparency, openness and collaboration constitute the main opportunities of significant added value. Social inequalities in employment dictate the course of action towards the development of new policy and business intelligence frameworks and mechanisms [28].

Daedalus is an effective open source system that reduces the gap between the supply and the demand in the labor market by offering collaborative cloud services, guiding young residents that seek employment in the labor markets of the Mediterranean Sea Basin and stakeholders to post employment vacancies, seek qualified competitive employees and explore investment opportunities in a collaborative way.

3 Description of Daedalus

Daedalus addresses the following objectives:

- Meets the needs of young residents seeking employment in the labor markets of the Mediterranean Sea Basin by searching targeted categorized job vacancies in their own language;
- Enhances young residents' career and business opportunities by advising them in improving their business portfolio (curriculum vitae –CV-, cover letter and job interviews templates);
- Matches the qualifications and skills of job seeking individuals with existing needs in neighboring countries;
- Enables young people, entrepreneurs, ICT companies, regional and local employment associations to collaborate and build synergies.
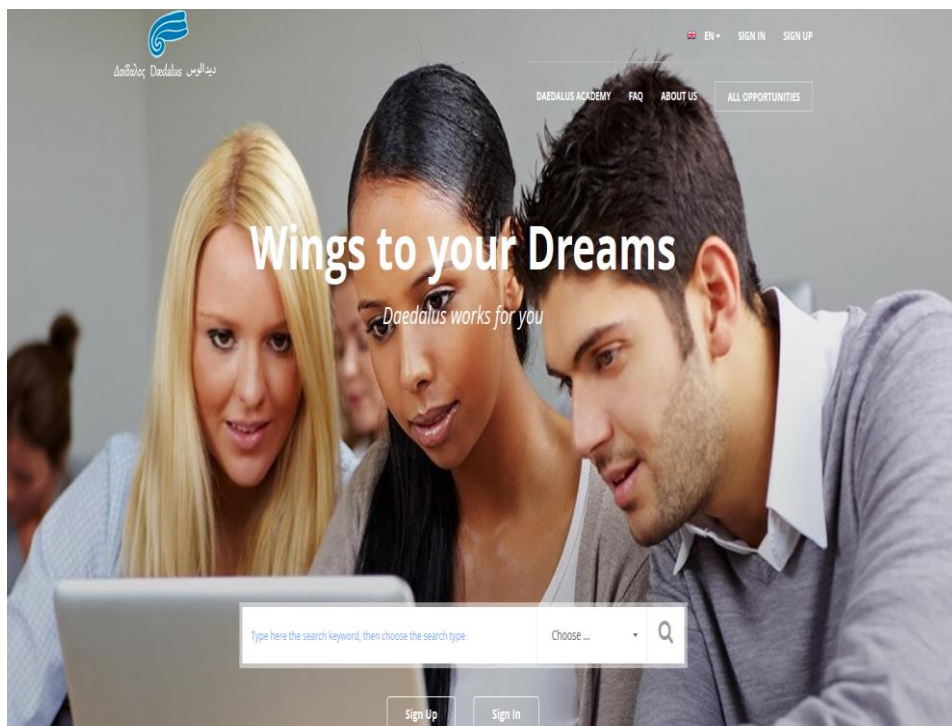
3.1   Daedalus Users

Daedalus addresses three different type of users, the opportunity seekers, the opportunity providers and the advisor:

*The Opportunity Seeker***:** EU and non-EU citizens seeking employment online, trying to match their qualifications with the existing needs of the labor market. Giovanilli [29] stated that "making the young protagonists of their own choices by providing them with practical tools for a careful self-analysis and that of the world around them, to develop the capacity for self-direction and participation in social life with a greater attention to their project of life.;   Developing skills for citizenship, which allow individuals to be active citizens in economic and social context in which they live; Increase their "employability", increasing awareness of their skills, strengths and potential of their own, buying strategies and methods to integrate successfully into the world of work".

The   Opportunity   Provider: Entrepreneurs, institutions, nongovernmental organizations (NGOs), universities, colleges and the private sector in general that can provide the opportunities for the job-seekers and capitalize on the advantages of a dynamic portal such as broader data analytics, plan management tools, web-based plan comparison and a series of functionalities that facilitate the procedures of finding an employee. An employer hires employees either in full-time jobs or in part-time ones, like as exempt employees who receive a salary for completing a whole job or hourly workers who are paid an hourly wage. The employers need to be aware and compliant with all the governmental and legislative restrictions of the country that their organization is registered.

The Advisor: A person, an institution, NGOs, universities or colleges that give advice and help the job seeker in writing a professional CV and career profile; a person who enriches the knowledge of the opportunity seeker through writing awareness articles in the employment field. The advisor needs to be aware and inform the job seekers for the realistic conditions and restrictions (legal, governmental, societal, insurance policy) for the country that he/she seeks employment. Such a supporting service in the form of articles, discussion groups and entrepreneurial advice can advance the quality of a job-providing oriented portal [30]. Information regarding the labor conditions and the type of contracts as training options may become truly helpful to people seeking for a job [31].

3.2   Daedalus Services

The services offered by   Daedalus (see Fig. 2) are classified into the following categories:

- *Public Library services*: Since Daedalus is a cross-border network that involves non-EU citizens seeking jobs in EU and vice-versa, it has integrated in its basic functional requirements a public library with all the external links leading to all the institutions of the national stakeholders that support the procedures of issuing an employment visa, recognition of skills and degrees and the legislation framework that is needed for the transition to another country. The governmental restrictions applied in the employment related issues is often a discouraging factor into working abroad and the provision, the sequencing of information, and the placement and the identification of those hyperlinks are of major importance. The clarification of citizenship/visa status for employment is one of Daedalus most important assets, facilitating the opportunity seekers wishing to migrate.

- *Profile Services*: The users can build their own CVs. The system stores all the information concerning their educational background, training, work experience and their career aiming to create an attractive image for entrepreneurs that will be able to access one's background easier and choose employees more efficiently. Moreover, the organizations and the companies can create their own profiles, present the type and the scope of their vacancies and attract efficient employees.
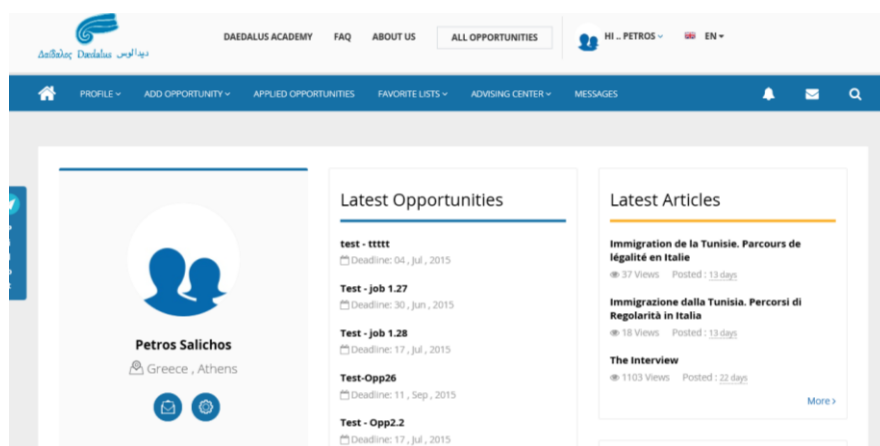

Figure 2: Daedalus Dashboard

- *Search services* that may provide access to a pool of CVs and to opportunity listings:
  - *for an opportunity provider:* Registered users and visitors may search for a job, an internship, a seminar or a scholarship. The sequence actions of this process starts when the user enters the search keyword. The system will

search about this keyword in many fields, such as in the job title, the job description and the skills.

- o *for an opportunity seeker:* Employers may filter opportunity seeker profiles based on category, qualifications, preferred salary and location. Employers can see the latest job seekers via an RSS feed link based on specific search criteria.

- o *for employment and migration documents:* Related documents (legislation, employment migration requirements/procedures/documents, guidelines) may also be found in the structured repository.

- *Application and Testing services:* An opportunity seeker has the capability to apply for a vacancy found within the system. Daedalus gives the employer an option to perform a skill test for specific candidates. The opportunity seeker will take the test upon an employer invitation to test his experience level. The employer can create a skills exam for job seekers to test their experience level. The exam may contain true or false, multiple-choice and open questions. The exam time can be time-limited. After filtering the applicants' CVs, the employer can specify a short list for interviews, and set the date and time for each applicant. The Daedalus communication tools are necessary for the necessary interaction for finding a job.

- *Advising Services:* Daedalus provides a series of helpful articles in the employment field supported by the Advisors, and an asynchronous community in an effort to create an educational interactive space with vital information related, among others, with the procedure of finding a job, creating a CV, creating a cover letter and preparing for an interview to develop a robust career advisory portal.

Daedalus follows a distributed architecture which we will describe in the next section.

3.3 The Architectural Principles of Daedalus

The architectural principles adopted by Daedalus[32] are divided into three categories. The data, the application and the technological principles. These principles ensure on one hand that the strategic objectives of the system will not be compromised and on the other hand that the use of the web portal will be maintained.
The Data Principles, such as security and privacy are integrated into all the architectural layers to preserve confidential information from unauthorized access and disclosure in order to enhance the users' trust upon Daedalus. Data are monitored by

mechanisms and categorized based on sensitivity considerations. The validity of input data is also one of Daedalus major considerations and it can be ensured by different types of data validation such as by Field Level Validation, Form Level Validation, Data Saving Validation and Search Criteria Validation.

The *Application Principles* ensure an improved efficiency and a user-friendly environment, system availability and its supporting applications and infrastructures, system performance (highest level of functionality, provision of sufficient capacity to allow the supported system to perform as required), system reliability and system manageability (administering, monitoring and managing the IT resources).

The *Technological Principles* address the Open Standards Policy, the implementation of practicable open source software and the Operating System Independence. the independence of the applications from the infrastructure allows applications to be developed, upgraded and operated in the most cost-effective and timely manner.
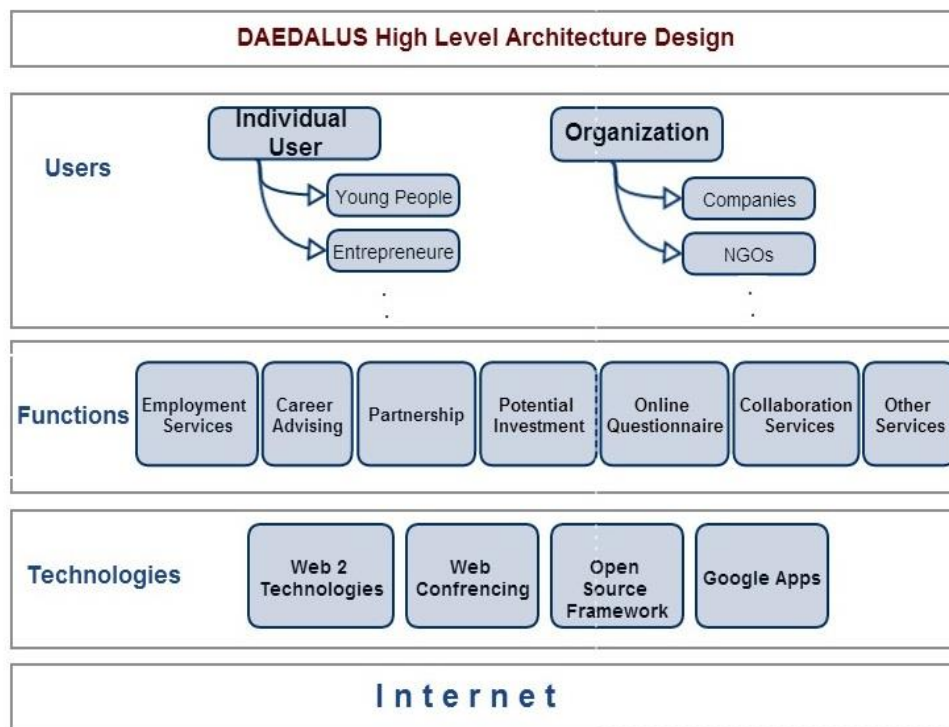

Figure 3: The high level architecture of Daedalus

Daedalus seeks to employ open-source technologies in creating solutions for its stakeholders. The adopted standards are open standards wherever practicable.

An open source approach is fundamentally more compatible with an agile approach as innovative changes can be integrated more easily.

The technologies used for the development of Daedalus system are: Grails 1as a back-end framework for JAVA,Laravel 2 for PHP, AngularJS 3 as a JavaScript framework, Twitter Bootstrap as a front-end framework, jQuery library as a DOM selector, Respond.js and html5shiv.js, Google charts and GotoMeeting API/Skype API which are the only commercial choices that the Daedalus technological partners have integrated in the development of the tool.

4   Conclusions – Future Directions

In this paper we presented Daedalus, an ICT tool which contributes towards the problem of unemployment of young people in the EU and non- EU Mediterranean region. Daedalus addresses the regularized migration, the matching of the demand and supply in the pan-European market, the integration of migrants and the labor mobility.

The delocalization and relocalization of services define a new European course of action that must be taken in order to face the new challenges that rise in the threshold of the 21st century and the digitalized society. Systems such as Daedalus combine all the necessary characteristics of a modern and collaborative platform towards this direction.

Immigration, integration and unemployment are among the EU growing problems. The recent events in the Mediterranean Sea Basin dictate the urgency to create realistic solutions that can provide job opportunities to people seeking work in the EU and Europeans to expand their employment spectrum. The internet could be the most fruitful space that can provide cross border employment services setting the ground for the new age of migration (e-migration) in the digital era.

Concerning the recommendations for further improvement, it is necessary for Daedalus to expand its use to Open Data and Interconnectivity. The legal mining of useful data, such as opportunity postings and internships from universities as well as from other portals will boost and enhance Daedalus' utility and strengthen its current status in the job-seeking market. Interconnecting with other portals, either of governmental institutions, such as of ministries providing the necessary information when it comes to moving abroad (visa information etc.) or of European websites and Observatories that are operating in the same field, may be the most important strategic step for Daedalus, in order to be established as an innovative, competitive and modern portal in the market. Moreover, a continuous evaluation of the way users perceive, use, comment and navigate through Daedalus is under way, in order to have an up-to-date, user-friendly and effective platform.

The Daedalus project has already done its first basic steps towards the creation of a fully operational platform which combines a data pool of opportunities addressed to job seekers in the Mediterranean Sea Basin (e-opportunities services) together with

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1 https://grails.org/

2 https://laravel.com/

3 https://angularjs.org/

the provision of all the necessary procedures and documents that a user should be aware of, in his efforts to work abroad. Technologically wise, the platform complies with the modern trends on the net and provides a friendly interface to the user together with some innovative services in the e-opportunities field. The most important future directions include the vision that the Daedalus system and the associated services can contribute towards the utilization and feasibility of national and European policies and Directives, especially the Employment, Immigration and Labour policies as a paradigm for regularized migration in the digital era and set a prototype for the future migration flows in the 21st century, the e-migration paradigm.

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