Personnel performance assessment in information systems outsourcing environments

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Abstract

Purpose   The aim of this paper is to present a tool which uses semantic technologies for personnel performance and workplace learning assessment in outsourced information technology environments.

Design/methodology/approach   The paper presents the tool from a technical perspective and introduces a use case that depicts the main features related to human resource management issues.

Findings   Semantic technologies enable the monitoring of personnel throughout all of the phases of the management of outsourcing, basing itself on established communication standards used in leading business management tools and recent outsourcing efforts. This monitoring provides to human resource management issues an integrated approach to assess both employee performance and learning outcomes as a result of competence evaluation.

Originality/value   The paper shows that semantic technologies can be applied to human resource management tools to bring its intrinsic characteristics to human resource management tasks including personnel and learning assessment.

Keywords Outsourcing, Semantic web, Information system outsourcing, Personnel performance assessment, Information technology

Paper type Technical paper

1. Introduction

In an environment of globalization and competition, institutions have turned to knowledge as a strategic asset that drives sustainable economic advantage (Sharma *et al.*, 2010). And as a consequence of this the development of intellectual capital of corporations represents one of the most significant challenges for today's managers and

one of the most fertile fields for business innovation, human resource management and education research (Casado-Lumbreras *et al.*, 2010). In this environment, the power of knowledge in our contemporary life has produced many new terms and concepts including: "knowledge society"; "knowledge economy", "knowledge management" and "knowledge culture" (Bakry and Alfantookh, 2010). Drucker (1998) stated that knowledge is the most significant economic resource of a post-capitalist society. As a consequence, many companies have opted for a model in which knowledge is a fundamental element of corporate and operational strategy. This has led to the formation of definitions such as knowledge intensive organizations (KOI), which, according to Starbuck (1992), are those organizations in which "knowledge plays a more important role than any other of the inputs to an organization". According to the work of Karreman *et al.* (2002), KOIs exhibit the following characteristics:

- Personnel are highly qualified and hold university qualifications or a comprehensive professional qualification.
- Products and services are complex and not standardized.
- The product, the market and staff development are regarded as significant activities within the organization.

Managerial organizations, which display characteristics of KOIs include, among others, legal services, strategic consulting companies, software engineering organizations, re-search agencies and other technology-based organizations (Hurley and Green, 2005). In such a setting, employees of software engineering companies, which are the subject of the current research, may be termed "knowledge workers", a phrase coined by Peter Drucker (1959). The growth of the Internet has provoked a change in the working environment of all employees, in particular knowledge workers. Thus, new technological capacities greatly benefit the outsourcing of the processes in the networked enterprise, which is transforming current society into an e-Society. In these societies, knowledge must present a tacit structure for sustainable advantage (Sharma *et al.*, 2010). Given this requirement, competences and competence structures for information technology (IT) professionals can be seen as enablers for the Knowledge Society, needed also of intellectual capital and competent IT workers (Hernández-López *et al.*, 2010). Human capital is particularly critical for competitiveness in high-tech sectors (Bartelsman *et al.*, 2004) and more in particular in IT sector (Trigo *et al.*, 2010). Moreover, IT has been considered fundamental for the development of productivity and knowledge-intensive products and services (Soto-Acosta *et al.*, 2010).

The key role of IT has obliged an increase in the importance of human capital in general and its evaluation. IT workers professional practice must be continually revised and improved in order to adapt workers competences' to technical innovations and soft skills to evolving markets (Casado-Lumbreras *et al.*, 2009). Moreover, IT organizations, who frequently lead the development of change based around ICT, are being asked to develop new products and services that add significant value for customers and to radically change their internal processes so that they are more cost effective (O'Sullivan and Dooley, 2010).

Taking into account that the use of competency frameworks as a basis for workplace learning initiatives is now relatively commonplace in organizations (McGuire, 2001), competency assessment can be seen as a key enabler to workplace learning assessment. Moreover, Garavan and McGuire (2001) emphasized the need to develop consensus

on definitions of competence if it is to contribute to more effective workplace learning. There is a growing awareness that recognition of adult learning cannot be restricted to learning which occurs in formal settings (Owen and Stupans, 2009) and workplace learning must be assessed in order to keep track of employees' development, no matter where they are. In outsourcing scenarios, different cultures and organizations are mixed and factors considered critical for the effectiveness of workplace learning (e.g. organizational learning culture (Rebelo and Duarte Gomes, 2011)) vary in a considerable amount. In IT picture, there are several works reporting that software engineers did not find formal courses efficient to acquire application-domain knowledge and most employees learn how to solve a problem at hand informally from peers (Johnson and Senges, 2010). In such setup, instruments that detect learning needs, learning outcomes and assess the overall performance of a worker could be a competitive advantage for the company.

In an environment supported by the Semantic Web, the aim of the tool presented in this paper is that workers in outsourcing environments, client organizations and contractors benefit from the capacities of PAIS-OUT to avail of an open environment for management and evaluation of performance in outsourcing environments. Thus, PAIS-OUT permits the monitoring of outsourced personnel development activities including formal and informal learning outcomes.

2. State of the art

This section reviews the state of the art of the solution. Thus, first, semantic web technologies, which are the cornerstones of PAIS-OUT are outlined. In the second term, a functional description of outsourcing is provided, as well as an outline of the principal initiatives which regulate the relation between the provider of the outsourcing services and the contracting organization. Finally, the principal features of the evaluation of personnel are presented.

2.1 Semantic technologies

Semantic technologies provide a consistent and reliable basis to face the challenges for data and knowledge organization, manipulation and visualization. As a result of this, the possibility of using knowledge-oriented query answering methods to exploit the benefits of semantics is a key research issue. The term "semantic web" was coined by Berners-Lee *et al.* (2001) to describe the evolution from a document-based web towards a new paradigm that includes data and information for computers to manipulate. The goals of the semantic web initiative include the integration of data from different sources in a machine processable format in order to make them accessible to computer programs and facilitating the use of data in ways that have not been thought of when the data were entered or recorded (Battré, 2008). It is agreed that semantic enrichment of resources would lead to better search results (Scheir *et al.*, 2008). In this new scenario, the challenge for the next generation of the social and semantic webs is to find the right match between what is put online and methods for doing useful reasoning with the data (Gruber, 2008).

Besides, semantic web, ontology defines a set of representational primitives with which a domain of knowledge is modelled. Ontologies (Fensel, 2002) are the technological cornerstones of the semantic web, because they provide structured vocabularies that describe a formal specification of a shared conceptualization (Gruber, 1994). The semantic

web provides an alternative solution to represent the comprehensive meaning of integrated information and promises to lead to efficient data managing by establishing a common understanding (Shadbolt *et al.*, 2006). The semantic web is about annotating information so that both computer systems and humans can process it more meaningfully (Davies *et al.*, 2007). Given its capacity to provide the meaning of information, the Semantic Web, has been identified as a valid context for knowledge management (Vossen *et al.*, 2007), being described as "a brain for humankind" (Fensel and Munsen, 2001).

Given the importance of semantic technologies in many areas (García-Crespo *et al.*, 2010a, b) and the crucial impact of workforce in IT environments, there are several works that gather both worlds. Semantic technology has been applied for project management teams construction (Gómez-Berbís *et al.*, 2008), knowledge management for software projects (Colomo-Palacios *et al.*, 2008), benchmarking personnel metrics (García-Crespo *et al.*, 2009a), technical competence assessment (Colomo-Palacios *et al.*, 2010), knowledge sharing and reuse (Lanzenberger *et al.*, 2008), assist the learning process (Naeve *et al.*, 2008) or support work assignment (Macris *et al.*, 2008) to cite some of the most recent initiatives.

In outsourcing environments, these types of initiatives for interaction using the semantic web can also be seen, however, they are significantly fewer in number. Kim *et al.* (2006) propose to use semantic web services for the automated outsourcing partnership management. García-Crespo *et al.* (2009b), in an effort which is considered the ancestor to the current work, proposed a semantics-based environment for the selection of stable partners for trustworthy innovation outsourcing processes. With the objective of extending previous proposals, this paper presents PAIS-OUT, a semantic environment based on the application of state of the art practices of personnel assessment in outsourcing environments, applicable to the lifecycle of this successful business practice. In what follows, an explanations of the functional area of PAIS-OUT will be provided.

2.2 Outsourcing

Outsourcing describes the use of external resources to execute operational tasks (Grover *et al.*, 1994). Zineldin and Bredenlow (2003) pointed out that outsourcing must not be seen merely as the firm's acquisition of products and services for the manufacture of goods and provision of services, but as a particular form of strategic alliance. In the past, the corporate activities, which were the subject of outsourcing constituted mechanical activities, or processes with low added value, however, currently many business processes are outsourced (Hoecht and Trott, 2006). The two main actors of outsourcing processes are the "outsourced" and the "outsourcer" (Saunders and Gebelt, 1997). The first, i.e. the "customer", outsources his processes, while the second, the enterprise, delivers outsourced services.

The benefits of outsourcing outlined in the literature are various: economies of scale (Zineldin and Bredenlow, 2003), reduction of operational costs (Lacity and Hirschheim, 1993), access to a skilled workforce (Kakabadse and Kakabadse, 2002), shorter lead times, in-creased flexibility and cost efficiency (Nieminen and Takala, 2006), and the ability to transform fixed costs into variable costs (Alexander and Young, 1996). On the other hand, there are other works that show risks: hidden costs (Barthelemy, 2001), supplier dependency (Alexander and Young, 1996) and loss of know-how (Doig *et al.*, 2001), to cite the most significant ones. In this scenario,

outsourcing represents an opportunity as well as a challenge to many organizations (Barden-Fuller *et al.*, 2005).

Information system (IS) outsourcing can be defined as the significant contribution made by external providers of physical and/or human resources, associated either with all components or with IT infrastructure specific components in the user's organization (Loh and Venkatraman, 1992, p. 9). Literature situates the beginning of outsourcing in1991, subsequent to the success achieved by Eastman Kodak with the outsourcing of its IS (Applegate and Montealegre, 1991) followed by other cases such as Continental Bank (Huber, 1993), and BP (Cross, 1995).

According to Faisal and Banwet (2009), the most important reason for IS outsourcing is the organizations' focus on their core competence while other reasons include controlling investments, attaining technological flexibility, reducing staffing problems and coping with the fast pace of growth in information and communications technologies. Outsourcing can also help a company get better, more state of the art services than it could afford internally, and this is a commonly stated reason for outsourcing IT (McDougall, 2004). It is important to highlight that, according to Beasley *et al.* (2009), the value impact of strategic intent on firms engaged in IS outsourcing is higher with short-term operational intent rather than for longer term strategic reasons.

Owing to these affirmations, the reasons for the adoption of outsourcing during its almost 20 years of existence have been various. Gonzalez *et al.* (2005) present a background to the literature for outsourcing reasons. A deeper view about IS outsourcing life cycle can be found in the work of Chou and Chou (2009).

The importance of outsourcing in the literature has been reflected in the efforts to extend the balance scorecard to include a fifth perspective to hold the business processes subject to outsourcing (Goyal and Metri, 2008), to establish maturity models for outsourcing relations (Gottschalk and Solli-Sæther, 2006) and in a much more advanced effort, eSourcing Capability Model (eSCM)-CL, a model of capacities for the management of the contracting of ICT staff in client organizations of services (Hefley and Loesche, 2006).

In relation to personnel in externalization environments, on some occasions, outsourcing implies the movement of the IT personnel from the client organization to the supplier organization (Lee *et al.*, 2003). There are numerous examples of individuals being involuntarily transitioned from the client organization to the service provider, a model referred to as "lift-out" (Fisher *et al.*, 2008). In these type of environments, Kessler *et al.* (1999) indicated that such movements can provoke both negative reactions from the workers due to dissatisfaction (dress code, type of employment, etc.) as well as increased satisfaction (enhanced career development).

Additionally, this option presents a major risk, and for the client organization, however, reduces the risk of lack of functional expertise in the client organization, identified by Earl (1996). This advantage entails an implicit risk at the time of contract renewal. An unsatisfied client may wish to repatriate the service, but repatriation may be very expensive, resulting in an unviable return (O'Leary, 1990). In this environment, the client organization needs to control the professional evolution of the personnel, with the double objective of reacting to a possible change in provider, with regard to changes in services or a new outsourcing contract. Thus, the client organization should know, by means of personnel performance assessment, the grade of development of the key resources involved in the outsourcing labor.

2.3 Personnel performance appraisal
The monitoring of workers stands at the heart of the employment relationship (Brown and Heywood, 2005). Thus, performance appraisal is a delicate issue (Myloni *et al.*, 2004). Cole (2001, p. 798) defines performance appraisal as a formalized, systematic assessment and discussion of an employee's performance and his/her potential and desire for development and training. Performance appraisal usually involves "evaluating performance based on the judgments and opinions of subordinates, peers, supervisors, other managers and even workers themselves" (Jackson and Schuler, 2003, p. 455). According to Curtis *et al.* (2001), the role of performance appraisal as a part of performance management is primarily to record the results of performance for use as input to decisions about adjustments to compensation, personal development planning, staffing, promotion and other workforce activities. In this way, performance appraisal is the central point for the collection of data which underlie decisions regarding the competency of human assets in their activities, requiring, on the one hand, the definition of the elements for comparison with established performance standards, and on the other hand, mechanisms put into place for the storage and exploitation of performance information.

According to Ball and Harris (1982), IS personnel evaluation is the second most critical issue of IS management. Perhaps, for this reason, the literature has discussed the difficulty of developing software systems and evaluating IT personnel in the organization for more than 40 years (Boyd *et al.*, 2007).

Personnel performance assessment in outsourcing environments presents a double challenge. On the one hand, examining Fisher *et al.* (2008) the assessment of employees working on the client site represents a common outsourcing challenge. While for the client organization, the challenge "appropriateness of hiring service-provider employees" presents itself, as well as the requirement to depend on information regarding the performance of its employees, both lifted-out and new, with the objective of guaranteeing continuity of services.

3. PAIS-OUT: internals
The main aim of the system proposed in this paper is to assist in the assessment of IT personnel in outsourcing environments. This section presents the principal characteristics of PAIS-OUT. To do so, in the first place, the architecture of PAIS-OUT is presented, in the second place, implementation issues are presented and discussed. This section concludes with a use case to illustrate the functioning of the tool in an applied scenario.

3.1 Architecture
This section presents the PAIS-OUT architecture, a three layer software architecture, which partitions the functionality of the system into graphical user interface (GUI), Business Logic and Persistence and Storage Systems level. Each level has a different functionality to deal with the various challenges the system faces by means of semantic technologies. The architecture of PAIS-OUT is a metadata-driven context-aware architecture, where each component addresses a particular software requirement. The final architectural approach is a tailor-made value-added technological solution. Components might be related to the behaviour as specified in the collaboration among those elements, turning those structural and behavioural

elements into progressively larger subsystems and the architectural style that guides this organization. The PAIS-OUT architecture is composed of the following layers:

(1) *Interface.* It is the entry point of the user interaction. It consists of a web-based interface which allows the user to either retrieve information through the Retrieval Component and the Update Component, which allows adding significant information regarding the Outsourcing and Competence requirements. It presents two modules:

- *Retrieval component.* It implements the GUI to perform partner retrieval.
- *Update component.* This module is a component responsible of updating competence descriptions of companies stored in the persistence layer.

(2) *Logic.* This layer provides cutting-edge functionalities through the following components:

- *Outsourcing knowledge base (OKB).* The OKB stores structured and knowledge aware outsourcing related projects, tasks, organizations and teams. It enables complex query mechanisms based on semantic technologies, but it is especially sensitive to competence ontologies, which can provide value-added results about companies willing to rent, or simply delegate their services in third parties.
- *Competence manager.* Enabling competence based search and description of resources is a key feature of the PAIS-OUT architecture. Both the OKB and the business rules engine (BRE) are interrelated through this component, whose formal enactments of Competences through semantic descriptions are vital for the correct processing of the information. Is responsible of dealing with competence ontology and stores information of competence evidences in the persistence layer.
- *BRE.* This engine is both a query engine which enables RDF-based queries into the semantic storage system and also a rules engine for the DOAP semantic descriptions. The BRE can work with the SPARQL Query Language for RDF, but also with raw SQL queries into the database underlying the persistence layer.

(3) *Persistence.* Both the competences ontology repository and the outsourcing ontology repository are built on a single software component, the persistence layer. This layer is based on an RDF-based repository enabling semantic querying and offering a higher abstraction layer to enable fast storage and retrieval of large amounts of RDF triples, while keeping a small footprint and a lightweight architecture approach. For the current implementation, the OpenRDF Sesame RDF storage system has been selected, as can be shown in the implementation section (Figure 1).

3.2 Implementation
The implementation of the architecture of PAIS-OUT is based on Sun Microsystems J2EE (Java to Enterprise Edition) technology. The communication of the different software components is based on the standard J2EE communication mechanisms, despite it could also be based on more decoupled frameworks such as web services.
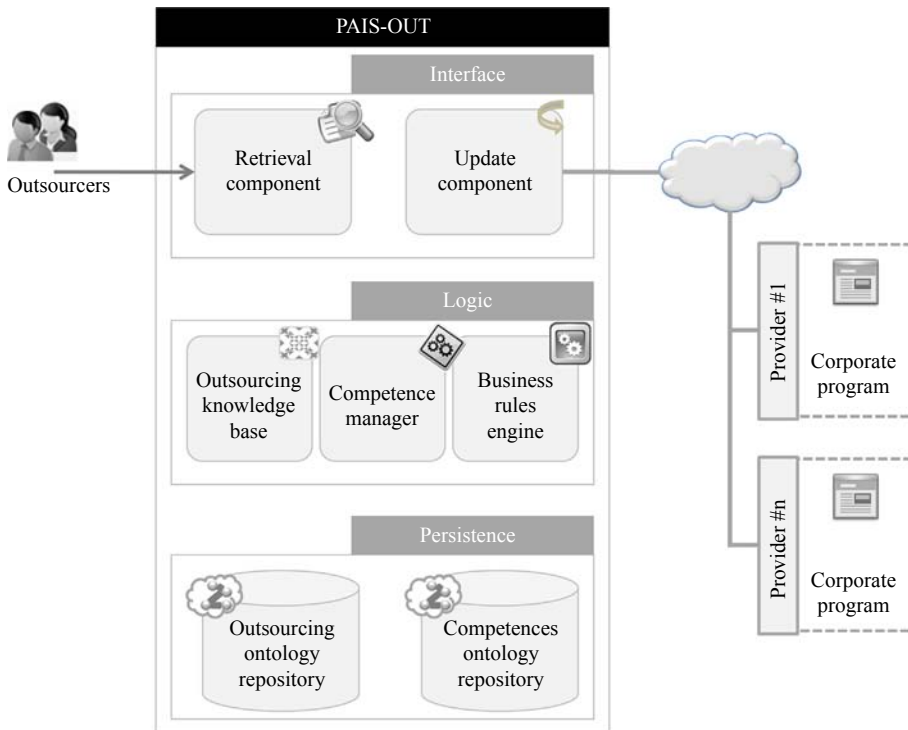
Figure 1.
PAIS OUT: architecture and interfaces

From the perspective of semantic technologies, several tools are included in PAIS-OUT. In the first term PAIS-OUT implements, the Web Ontology Language (OWL). OWL is the *de facto* semantic web standard language, has been used to represent the domain knowledge. OWL provides a formal theory for taxonomy, whereas any other semantic relationship like partonomy or topology must be manually defined and implemented. PAIS-OUT implements OWL-Description Logics (DL), since it builds on the formal foundations of DL (Baader *et al.*, 2003), a set of languages whose reasoning can be decidable. Second, the Java-based Renamed ABox and Concept Expression Reasoner (RACER) is used. RACER reasoning engine and the Jena framework are the backbone technology for the Business Logic Manager layer, the former for the reasoning and the latter for the RDF Management and SPARQL Querying. The repository has been implemented using the persistence capabilities of the Jena Semantic Web Framework over SESAME.

3.3 Use case
The use case scenario involves a company which aims to subcontract the evolution of its application for stock management. UNLOBLIM is a company located in Liverpool, UK. This company currently uses an application developed in an IBM AS-400 environment. Two years ago, the company contracted the services of a consultancy firm for the development of ICT products located in London, however, due to a crisis in the markets and the quantity of business debtors, these operations had to close. The only current

remaining application in the company which still requires migration to a modernized environment based on web services is the stock management application.

Making some enquiries, the management of UNLOBLIM ascertains that their previous provider was solely a set of businesses who sold solutions and services which they later subcontracted to companies in China or India. The management of UNLOBLIM is thus presented with two possibilities for the solutions to their problem. In the first place, they could contract development specifically for the application, and in the second place, carry out total outsourcing of its ICT processes. The managers decide to adopt the second option, namely offshore outsourcing. In order to effectively undertake the outsourcing process, UNLOBLIM implant the PAIS-OUT platform in search for companies, which fulfill the criteria for both functional and technical competences. Availing of the capacities of the tool, they search for companies, which offer outsourcing services in their business area. PAIS-OUT provides two companies, which meet company requirements. One of the companies is located in Birmingham (UK) and the other in Dublin (Ireland). Examining the search criteria, both businesses hold experience in outsourcing, and examining the information displayed by the DOAP registries, have the functionalities and technical expertise required by UNLOBLIM. From the perspective of the capacities of its workers, and given the fact that the information regarding corporate experience is significant, the company in Birmingham named OUTTOTAL results more suitable subsequent to evaluation. This initiates the outcome that UNLOBLIM choose to subcontract the services of this West Midlands company.

Thus, as part of the agreement, two employees from UNLOBLIM are transferred to Birmingham in a classic "Lift-Out" operation. Throughout the outsourcing relationship, UNLOBLIM participates in the evaluation of the performance of OUTTOTAL, by means of the users of the ICT service. The evaluation of the performance of the employees of the company is included as part of the evaluation, as well as the performance of the two employees taking part in the "Lift-Out" operation. The 360° feedback data are available to UNLOBLIM, enabling them, on the one hand, to feed PAIS-OUT's database, and on the other hand, keep up to date with the progress of the transferred workers of the "Lift-Out" operation. This fulfills their objective of maintaining control of their workers with a view to a possible employee repositioning or a change in provider.

4. Conclusions and future work

In the IT domain, corporations are adopting outsourcing and offshoring models, each time more carefully. In this environment, sharing and taking advantage of a number of information sources, tracing skills, experience and expertise in different fields can bridge the gap of knowledge integration between outsourcing actors. New forms of knowledge extraction and expert location are deeply impacting companies around the world. IT companies are facing a war for talent in which, every project must be scheduled according to the availability of resources and their competences. Having this in mind, tools that seek for competence in these kinds of organizations are seen as knowledge enablers and could be also a competitive advantage for the company.

In this work, we have presented a tool to achieve personnel performance assessment in outsourcing environments using semantic technologies. However, limitations of this work should not be ignored. The first limitation is the descriptive nature of the paper.

Therefore, a useful extension of the paper would be to carry out an empirical study of the implementation of the tool. This study will permit an analysis of its improvement in performance and the decrease in the rates of staff rotation and absenteeism in subcontracting environments. The second big limitation is the limited scope of the tool. Thus, in the first place, it is aimed to include tools, which enable automatic analysis of the competencies of the workers, based on the opinions of users expressed in Web 2.0 tools, which would be utilized internally within the organization. Finally, it is aimed to expand the system in order to collect evidences of competence of outsourced workers. These evidences of competence can be seen as the cornerstones of the evaluation, feeding the system with material in which assessment can be built. Possible sources of these data can be found among software artifacts: programs, designs, requirements, to cite the most relevant ones.

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