ELECTRONIC COLLABORATION NETWORKS IN THE CULTURAL HERITAGE DOMAIN: THE ERMIONE PROJECT

Euripidis Loukis, Konstantinos Pazalos, Fotini Michailidou

Abstract: Organizations during the last decade tend to form more and more various types of inter-organizational networks in order to produce complex products and services by combining their resources and capabilities. In the public sector two basic types of inter-organizational collaboration networks are gradually formed: Government-to-Government (G2G) collaboration networks and Public Private Partnerships (PPPs). This paper analyses the basic objectives, research directions and methodologies of the ERMIONE (E-Learning Resource Management Service for InterOperability Networks in the European Cultural Heritage Domain) project; the basic objective of this project is to create (up to the level of pilots), study, evaluate and market validate an eRM (e-learning Resource Management) service, which offers an electronic environment that facilitates and supports both G2G collaborations and PPPs in the cultural heritage domain. In particular, it will support the collaborative development, promotion and delivery of composite digital content and e-courses concerning the European cultural heritage, through collaboration among many public and private cultural heritage institutions (e.g. museums, galleries, libraries, archives, etc.), educational institutions (e.g. Universities), commercial promotion companies, ICT companies, etc., from all over Europe. Furthermore, it will offer to learners, teachers and researchers, who are interested in digital content and e-courses concerning the European cultural heritage, an 'electronic-one-stop-shop' and an asynchronous e-learning environment. Special emphasis is laid on the description of the multi-stakeholder methodology we have developed for the evaluation of this service, which is based on an extension of the Technology Acceptance Model (TAM)

Keywords: inter-organizational networks, Government-to-Government (G2G) collaboration, Public Private Partnerships (PPPs), cultural heritage, e-learning, evaluation

University of Aegean, Karlovasi, 83200, Samos, Greece, eloukis@aegean.gr, kpaz@aegean.gr

1. Introduction

In the last decade organizations tend to form more and more various types of inter-organizational networks in order to produce and deliver complex products and services in an efficient and effective manner by combining their resources and capabilities. For this reason there is a growing research interest in studying these inter-organizational networks and understanding various aspects of them, such as their formation, their impact, their critical success factors, their electronic support, etc. ([1] - [7]). In the public sector are gradually formed two basic types of inter-organizational networks: the Government-to-Government (G2G) collaboration networks and the Public Private Partnerships (PPPs). The G2G collaboration networks ([3], [4]) consist of several public organizations of various administrative levels (e.g. municipalities, prefectures, regional administrations, central government organizations, etc.) sharing a common interest or objective, usually concerning the design and/or implementation of a public policy, the management of difficult social, economic, or environmental problems, or the production and/or delivery of a public service. The PPPs ([5] - [7]) are a more complex type of inter-organizational networks, consisting of both public and private organizations, aiming at the collaborative development and/or operation of infrastructures, or at the production and/or delivery of public services or other desired useful outcomes of public interest; in some circumstances, PPPs, if properly managed, can provide a good alternative model for producing and delivering public services, both 'traditional' public services and 'electronic' ones (i.e. public services delivered through electronic channels, such as the Internet, or other fixed or mobile network infrastructures). The electronic facilitation and support of these two basic types of inter-organizational networks which are gradually appearing in the modern public administration is an important challenge.

In this direction our paper presents the basic objectives, research directions and methodologies of the ERMIONE (E-Learning Resource Management Service for InterOperability Networks in the European Cultural Heritage Domain) project, which is implemented as part of the eTEN Program of the European Union. This project aims at the electronic support of both G2G collaborations and PPPs in the cultural heritage domain for the development, promotion and delivery of composite digital content and e-courses; also, it aims at offering to learners, teachers and researchers, who are interested in digital content and e-courses concerning the European cultural heritage, an 'electronic-one-stop-shop' and an asynchronous e-learning environment. Taking into account the importance for Europe of its rich and diverse cultural heritage, which constitutes its basic competitive advantage, and at the same time the high fragmentation of both the supply of and the demand for European cultural heritage services and products, such an eRM service can be highly valuable. In the next sections of this paper, after outlining the background and the objectives of this project, are described the functional architecture of the environment the whole service is based on, and the methodology of this project, with particular emphasis on the multi-stakeholder methodology we have developed for the evaluation of this service.

2. Background

According to the 'Convention concerning the Protection of the World Cultural and Natural Heritage' [8], which is the most important international treaty in the area of cultural heritage, and has been adopted by the UNESCO (whc.unesco.org/en/about/) General Conference (Paris, 16th October 1972), cultural heritage includes 'monuments (architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of outstanding universal

value from the point of view of history, art or science), groups of buildings (groups of separate or connected buildings, which, because of their architecture, their homogeneity or their place in the landscape, are of outstanding universal value from the point of view of history, art or science) and sites (works of man or the combined works of nature and man, and areas including archaeological sites which are of outstanding universal value from the historical, aesthetic, ethnological or anthropological point of view)'. Subsequently the concept of cultural heritage has been broadened and includes also the 'intangible cultural heritage', which according to UNESCO [9] is defined as 'the practices, representations, expressions, as well as the knowledge and skills, that communities, groups and, in some cases, individuals recognise as part of their cultural heritage' (manifested inter alia in the following domains: oral traditions and expressions, including language as a vehicle of the intangible cultural heritage, performing arts, social practices, rituals and festive events, knowledge and practices concerning nature and the universe, traditional craftsmanship)'. The European Union regards the protection and management of the rich and diverse European cultural heritage, which constitutes its basic competitive advantage, as a highly significant issue, both as a factor of economic development and as a vehicle of cultural identity. In this direction the article 151 of the Treaty stipulates that the Community must support and supplement action by the Member States in order to conserve and safeguard cultural heritage of European significance; this article has been the legal basis of many subsequent actions (e.g. studies, programmes) taken by the European Commission in the cultural heritage domain [10].

Information and Communication Technologies (ICTs) offer tremendous capabilities for improving all the functions of cultural heritage management. According to the 'DigiCult Report' of the Directorate-General for the Information Society of the European Union [11], the digitisation of cultural heritage resources opens new opportunities for reaching much wider audiences (since it removes the need for physical presence at the museum or archaeological site where a specific cultural resource is located), and for offering them enhanced and attractive interactive cultural heritage products, services and experiences. Another conclusion of this report is that the most important application area for these digital cultural heritage services and products will be for education purposes, even though significant demand is expected for recreation purposes as well. However, in the same report it is also emphasized that in order to produce highly valuable services for these audiences at reasonable costs, extensive co-operation and co-ordination between cultural heritage institutions will be required and combination of their cultural heritage resources. Taking advantage of these technological capabilities cultural heritage institutions (museums, galleries, libraries, archives, etc.) are gradually transformed into 'hybrid institutions', which have to manage both 'real' (material) and digital cultural heritage resources, and based on them to offer high quality 'traditional' and digital cultural heritage services and products. However, both the supply of such services and products (by numerous geographically dispersed museums, galleries, libraries, archives, etc.) and the demand for them (by numerous geographically dispersed cultural and educational organizations and individual consumers) are highly fragmented. This fragmentation and also the lack of co-operations and partnerships in the European cultural heritage domains are major barriers to the full exploitation of the above opportunities.

Electronic marketplaces, according to the literature ([12] - [14]), can significantly improve the functionality and the efficiency of markets characterized by high levels of fragmentation of supply and demand, while they can also support the collaboration among their participants for the design, production and delivery of new products and services (e-collaboration). Such an approach can prove to be very useful in the European cultural heritage domain, especially if it is combined with e-learning, which according to the relevant literature (e.g. [15] - [17]), can

offer significant advantages: improved quality of education (e.g. through increased use of multimedia educational content including images, audio, video, etc.), increased 'learner centricity' and personalization capabilities, capability to reach wider audiences (overcoming time/place constraints), easy and low cost of update of the educational content, cost reductions, alleviation of capacity constraints, etc. For the above reasons the design of the electronic environment and the services of the ERMIONE project, which are described in the following section, has been based on these three concepts: e-marketplaces, e-collaboration and e-learning.

3. Project Objectives

In this direction the ERMIONE project (www.ermione-edu.org), which is part of the eTEN Program of the European Union (with a total budget of 2,088,304 Euro and a duration of 18 months), aims at the initial development (up to the level of pilots), study (including the identification of critical success factors and barriers), evaluation and market validation of an eRM (e-learning Resource Management) service, which offers an electronic environment that supports both G2G collaborations and PPPs in the cultural heritage domain. In particular, it will support the collaborative development, promotion and delivery of composite digital content and e-courses concerning the European cultural heritage, through collaboration among a network of public and private cultural heritage institutions possessing valuable content (e.g. museums, galleries, libraries, archives, etc.), educational institutions (e.g. Universities), commercial promotion companies, ICT companies, etc., from all over Europe. Additionally it will offer to learners, teachers and researchers, who are interested in digital content and e-courses concerning the European cultural heritage, an 'electronic-one-stop-shop' and an asynchronous e-learning environment. Also it will enable teachers (at all levels of education) to build specialised and highly customised e-courses concerning European cultural heritage using content from multiple cultural heritage institutions and e-courses from multiple cultural and educational institutions, and to teach these customised e-courses to mixed pan-European virtual classes without limitations of time, place and pace; these mixed groups will be able to follow multicultural education programmes and make comparative studies, based on an enhanced access to a wide variety of European cultural heritage content and e-courses, and share their views and experiences through electronic consultations (e.g. through forums, chats, etc.). A 'technology provider' company will be responsible for the development, operation and administration of the electronic environment-platform this service will be based on. Commercial companies will be responsible for promoting and selling the service to interested organizations (e.g. Universities) or persons. The whole value chain for the production of this service is shown in Figure 1.

Figure 1: Value chain of the eRM service of ERMIONE project

For achieving the above objectives the ERMIONE project consortium includes all the abovementioned kinds of organizations: content providers (Fratelli Alinari (www.alinari.it), Tilde (www.tilde.lv) and the Head Office of the State Archives of Poland (www.archiwa.gov.pl)), higher education institutions (University of the Aegean (www.aegean.gr) and Katholieke Universiteit Leuven (www.kuleuven.ac.be)), one technology provider (European Dynamics (www.eurodyn.com)), and two service enablers (Fondazione IARD (www.fondazioneiard.org) -project coordinator- and Atos Origin (www.atosorigin.es)).

4. Functional Architecture

In Figure 2 we can see the functional architecture of the electronic environment-platform this service will be based on. It is has a hierarchical structure and consists of three levels: the 'Site', the 'Community' and the 'Course' level. The 'Site level' is only accessible by 'platform administrators', who will set up the 'communities'; each community corresponds either to an educational institution, e.g. a University (as shown in Figure 2), or to a cultural heritage institution providing digital content. In particular, a community can correspond to:
- a cultural heritage institution (content provider), such as a museum, a gallery, a library, an archives, etc., which uploads on the platform its digital content, in order to be used directly by the clients of the ERMIONE service (organizations or persons), or for the development of composite digital content and e-courses in collaboration with other cultural heritage and educational institutions,
- an educational institution (e-courses provider), which uploads on the platform e-courses it has developed concerning European cultural heritage, in general using digital content from the above content providers and e-courses developed by other educational institutions, in order to be used by the clients of the ERMIONE service (organizations or persons),
- a client educational institution (consumer), which builds and operates on the platform its own specialised and customised e-courses concerning European cultural heritage, using the above content and e-courses which are uploaded on the platform.

The 'Community level', will be accessible by the 'community administrators', each of them being responsible for the upload and set-up of packages of digital content and/or e-courses for one community. Finally the management and operation of individual e-courses and packages of digital content will be performed at the 'Courses level'; at this level eight basic tools will be provided: web content manager, documents manager, courses manager, group manager, search engine, calendar, forum and e-mail. This level will be accessible by the simple users of the platform, such as the 'e-course coordinators' (instructors) and 'e-course attendants' (students), albeit with different access rights.

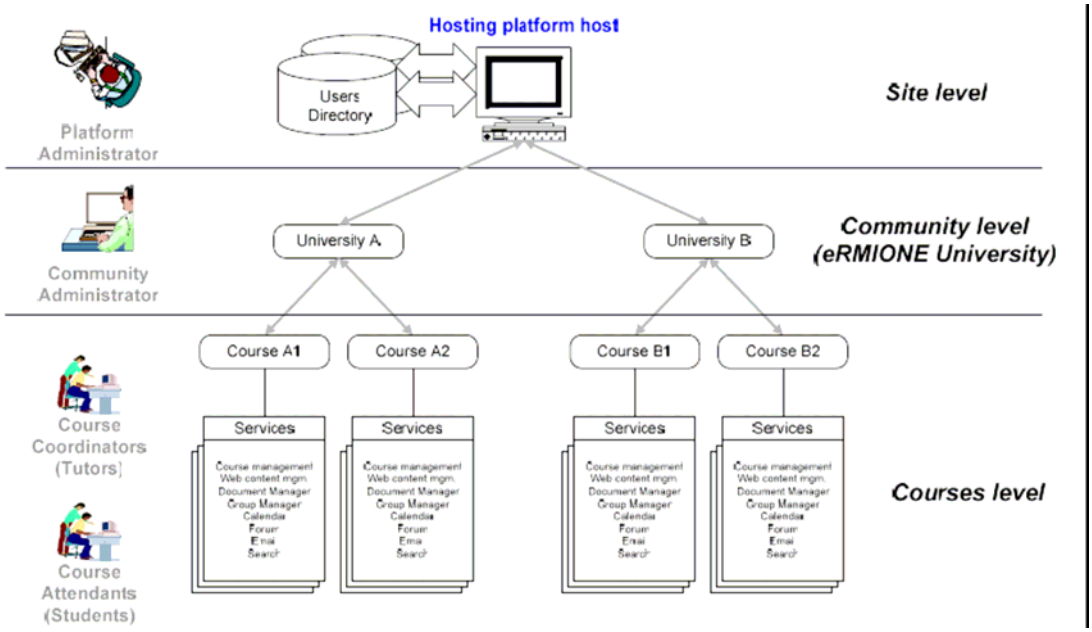

Figure 2: ERMIONE Functional Architecture

We can see that this functional architecture offers to each group of stakeholders of this service (cultural heritage institutions acting as digital content providers, educational institutions acting as e-courses providers, client educational institutions acting as consumers, individual

teachers and learners) a separate electronic space and all the tools they required in order to play their corresponding roles in the service production value chain (shown in Figure 1); also it enables each stakeholder to access and use resources (digital content and e-courses) from other stakeholders, according to the agreements among these stakeholders, which will be 'translated' into corresponding permissions that will be granted to them by the access control system of the platform. Additionally the platform enables the electronic interaction among these stakeholders, e.g. through forums, chats or e-mails, as well as the collaborative development of new composite digital content and e-courses by combining their resources and capabilities. This functional architecture of the platform offers enhanced scalability and extensibility; also, its hierarchical but flexible structure enables clear role allocations. For all the above reasons the ERMIONE service that will be based on this platform can efficiently facilitate and support G2G collaborations and PPPs in the cultural heritage domain.

5. Methodology

As stated in the Introduction, the main focus of the ERMIONE project is to study, evaluate and market validate in 'real-life' conditions the whole business model (which according to [18] includes the value proposition, the value production architecture and the economic model) of this eRM service, which has been described in the previous section; important objectives are to examine the market response to this service, to assess to what extent it meets potential users' needs, to identify its main barriers and propose possible solutions, and also to create the foundations for the full scale deployment of this service at a pan-European level. In order to accomplish the above objectives the following tasks will be carried out:
I) Market analysis: Initially a preliminary version of the business plan of this service will be developed, based on market analysis in the five countries participating in the project (namely Belgium, Greece, Italy, Latvia, Poland and Spain). This preliminary version of the business plan will be then constantly updated and refined during the whole lifetime of the project, based on the results and the conclusions of the following pilots and market validations.
II) Validation of the service/business model through pilots: A number of pilots will be initially set-up, in which e-courses will be developed in the area of cultural heritage by the two Universities of the project consortium, using digital content that will be provided by the three content providers of the project consortium. Then the market validation will start, with users accessing the service (including the above e-courses and digital content) and evaluating various dimensions of it, according to a methodology that is described later in this section. This evaluation will take place in two phases: the 'Intensive Test' (in depth evaluation by a smaller sample of about 150 persons from the organizations of the project consortium, including 120 students from the two Universities) and the 'Wide Test' (evaluation in less depth by a larger sample of about 1000 persons from other organizations not participating in the project consortium; these persons will make a shorter use of the service and answer a smaller questionnaire).
III) Evaluation and development of the final deployment and business plan: Finally all the information collected in the previous tasks will be analysed and evaluated, in order to validate the whole business model of this service and the feasibility of its full scale deployment in the European market, and also develop the final version of its business plan.

For the evaluation of this service we have developed a 'multi-stakeholder evaluation methodology' for both formative and summative purposes; it includes one component (evaluation method) for each group of stakeholders of the service (cultural heritage institutions, educational institutions - e-courses providers, client educational institutions - consumers, individual teachers and learners), which includes evaluations of: a) the capabilities and the resources offered to them, such as functionality, content, support by

instructor, etc.(efficiency evaluation), b) the effectiveness of the service for them, i.e. how much the service contributes to the accomplishment of their business-level objectives (efficiency evaluation). In the remaining part of this section the most important component of this evaluation methodology is presented: the method for the evaluation of the service by the individual learners. The theoretical foundations of this evaluation method are the basic constructs and conclusions of: i) the information systems success research (e.g. [19]), ii) technology acceptance models -related research (e.g. [20], [21]), iii) the traditional education evaluation research (e.g. [22]), and iv) the e-learning evaluation and critical success factors research (e.g. [23], [24], [25]). The basic structure of the method is shown in Figure 3.

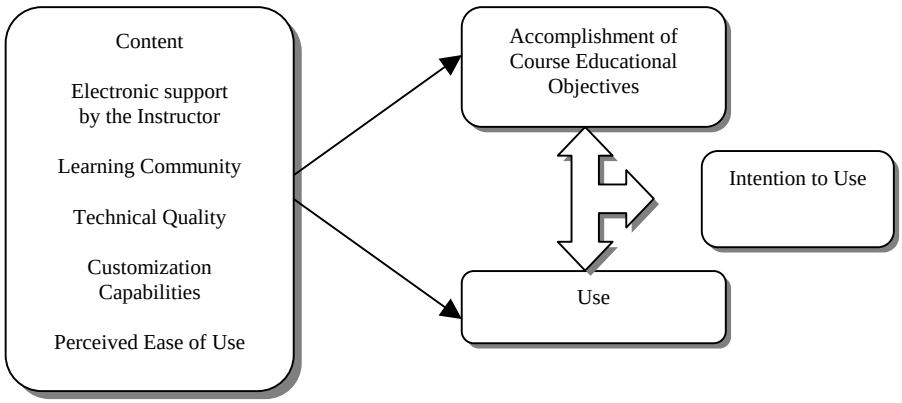

Figure 3: Method for evaluation of the service by the learners.

We can see that it includes, at a first level, evaluation of the basic e-learning capabilities and resources offered to the e-learner: content, electronic support by the instructor, learning community, technical quality, customisation capabilities and perceived ease of use (efficiency evaluation). In particular: 'content' concerns the quality of the course content; 'electronic support by the instructor' concerns all aspects of instructor supportive activity in asynchronous e-learning (e.g. effort, skills, methods, motivation of e-learners, e.g.); 'learning community' concerns the capabilities offered to e-learners for interacting electronically with the colleagues and the instructor(s), so that they have a feeling of 'belonging' to a community sharing a common learning objective; 'technical quality' concerns platform availability, response speed, accessibility, technical support and problems of bugs; 'customisation capabilities' concerns one of the greatest advantages of asynchronous e-learning: the flexibility offered to the e-learner to adapt the learning process to his/her own wishes and learning style; finally 'perceived ease of use' concerns the level of effort required from the learner for using the system. For each of them a measurement instrument (set of questions) has been designed based on the relevant literature and theory. From the variables corresponding to the questions of each measurement instrument one factor (or even more one factors if required) will be synthesized using exploratory factor analysis. At a second level, as we can see in Figure 3, this evaluation method includes one direct and two indirect evaluations of the effectiveness of the service from the viewpoint of the e-learner: the extent of perceived accomplishment of the educational objectives (ACEO) (direct evaluation of service effectiveness), the extent of use of the platform by him/her and his/her intention to use the system again in the future (indirect evaluations of service effectiveness); for each of them a measurement instrument (set of questions) has been designed, based on the relevant literature and theory, e.g. the instrument for measuring the extent of perceived ACEO has been based on Bloom's taxonomy of educational objectives [26].

Evaluation data will be collected using a questionnaire based on this evaluation methodology, which are going to be processed in the following ways: a) from the variables corresponding to

the questions which evaluate the capabilities and the resources offered to the learner and his/her perceived extent of ACEO, we are going to synthesize a global satisfaction index using methods of exploratory factor analysis (wider and more complete than the one proposed in [25]), which will be useful for summative evaluation, b) the relations between the synthesized factors of the first and the second level will be examined; the initial hypotheses concerning these relations are shown as arrows in Figure 3. These hypotheses, and in general the whole structural model shown in Figure 3, will be tested using methods of confirmatory factor analysis (LISREL). In this way we will investigate which of the service capabilities and resources offered to the learner influence more the perceived level of service effectiveness (and draw useful conclusions for the formative evaluation), and in general we will gain a better understanding of the learner value generation mechanisms. Similar are the methods for the evaluation of the service by the other stakeholder groups.

6. Conclusions

The ERMIONE project aims at the initial development (up to the level of pilots), study, evaluation and market validation of an eRM (e-learning Resource Management) service, which facilitates and supports G2G collaborations and PPPs in the European cultural heritage domain. This service is expected to be quite valuable for the formation of cultural heritage networks, consisting of cultural heritage institutions (e.g. museums, galleries, libraries, archives, etc.), educational institutions, commercial promotion companies, ICT companies, etc., from all over Europe, for the collaborative design, production and delivery of advanced composite digital content and e-courses concerning the European cultural heritage. For the evaluation of this service we have developed a methodology, which is based on an extension of the Technology Acceptance Model (TAM): the ‘perceived usefulness’ construct has been analysed into five constructs evaluating the ‘perceived usefulness’ of five basic asynchronous e-learning capabilities and resources (content, electronic support by the instructor, learning community, technical quality and customisation capabilities) and one construct evaluating the extent of accomplishment of the educational objectives; in this way, as we can see in Figure 3, the basic dependent variables of the TAM (current use and intention to use in the future) have been enriched with an additional one (the extent of accomplishment of the educational objectives), which is a direct measure of the educational value generation.

This evaluation methodology can be used for the evaluation of other e-government services as well, after some adaptations: i) the above five constructs evaluating the basic asynchronous e-learning capabilities and resources offered to the e-learner should be replaced by constructs evaluating the capabilities and resources that the specific e-government service offers to the user (citizen or enterprise), e.g. informational resources, capabilities for performing various electronic transactions, etc., and b) the accomplishment of the educational objectives construct should be replaced by constructs evaluating to what extent the service contributes to the accomplishment of their business-level objectives of the user (citizen or enterprise), e.g. reduction of time and cost of performing these transactions with the government, etc.

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