# Fostering Social Technologies Sharing through Open Knowledge Space: A Brazilian Case Study of Knowledge Network

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**Abstract.** The paper presents a case study of ICT adoption for a Brazilian national program focused on enhancing the share of social technologies to improve socioeconomic development. The paper presents some experiences of IPTI in this field and describes the case study. The paper also presents the computational platform adopted for this experience. Finally it illustrates how the behaviour and configuration of the community can be studied with the use of social network analysis. The authors expect that this work will help other researchers in forthcoming projects and experiences of building knowledge communities and ICT adoption.

**Keywords:** Knowledge network, social technologies, web.

## 1 Introduction

Nowadays, one can say that the centrality of information and knowledge is no longer the means for the information society to generate knowledge or produce and distribute new goods and service. People now are required to understand this new paradigm as well as be active in the process. In that sense, they need to share knowledge, information, goods and services if they expect to be included in this society.

Knowledge is considered the driving factor for the economical, cultural and political growth in contemporary societies. In particular, the widespread diffusion of information and communication technologies provides societies and its different communities with tools to create, foster and disseminate knowledge. This process is independent from temporal and spatial boundaries or networked organisations and communities.

Real possibilities of collective knowledge construction are available from this new paradigm as the individual becomes the centre of the processes in which he or she is involved. The magnitude of collaborative networking has reached a new dimension. For contemporary societal trends, the notions of network and community are now vital terms. Information and communication technologies have an effect on coordination, communication and control in all societal networks and communities. In that sense,

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those characteristics also grant significant potential as well as threats for collaboration and coordination.

Then, the use of information technology under a contemporary perspective implies that the focus shifts from having access to computers or Internet to making conditions for registering, editing and publishing multimedia contents as well as enhancing the sharing and networking. The main goal is to make people aware that they are able to publish and share content in an interactive way. Content may vary from texts, hypertexts, images and music through videos. This project aims to help people understand the meaning of uploading, instead of downloading only, and to find new ways to face their socioeconomic problems.

Nevertheless, there is no defined model for building virtual knowledge communities as well as the maintenance of a high level of social capital inside those communities. Those topics constitute challenges for this area and have been the main fields of research at the *Instituto de Pesquisas em Tecnologia e Inovação* (Research in Technology and Innovation Institute - IPTI) in the past years.

The objective of this work is to share an experience about the adoption of Information and Communication Technologies (ICT) in order to support knowledge networks focused on disseminating technologies and experiences for socioeconomic development in Brazil. To achieve that, the knowledge network known as *Rede de Tecnologias Sociais* (Social Technologies Network – RTS) [1] was selected to build this use case. This use case has the potential to become a relevant study to show how such knowledge communities can be built, what are the key functionalities to increase its adoption by users, and what are the successful communication and articulation strategies that allow virtual knowledge communities to be effective and keep their values.

This paper aims to present the RTS use case describing the adoption of *Guigoh*, an Open Knowledge Space developed by IPTI to improve socio-economic development. The aspect of publishing and searching social technologies and their contextualization are emphasized. In the same fashion, the governance model adopted as an attempt to establish a high level of social capital for this virtual network is explained. The paper will explore the use of social networks' visualisation as a mechanism to illustrate how the network configures itself along the process of e-adoption.

The computational platform *Guigoh* and its functionalities will also be detailed, as well as the OPAALS project outcomes that are directly related to *Guigoh* and the RTS use case. The authors believe that this paper can be a helpful reference for forthcoming experiences of adopting virtual environments to build knowledge communities

Firstly, two of the most recent IPTI's experiences are presented, regarding projects on research and development in knowledge communities and in e-adoption as well as the RTS use case. Then, the customized virtual platform for knowledge community developed by IPTI for the RTS use case and the tools available are described. The technology adopted in the development of this computational platform is also detailed and will become available as an open source project soon. Finally, the results obtained up to now and the potential business benefits for such case of ICT adoption are shown.

## 2 Methodology

The experiment focused on knowledge sharing and was conducted by the adoption of a social network system. The methodology employed was inspired by some of IPTI‘s

previous experiences on research and ICT adoption. The most significant experience for this project was the Digital Culture project and the OPAALS project.

IPTI has acquired ample experience of e-adoption between 2004 and 2007 on behalf of the Brazilian Ministry of Culture and the United Nation Development Program (UNDP). The project *Projeto Cultura Digital* (Digital Culture Project) had the intention of encouraging people to register and share their local cultural expressions to make their community stronger and sustainable.

The plan for this project was to distribute multimedia kits, containing all hardware and software necessary for people to register, edit and publish multimedia contents, for NGOs focused on cultural projects in all Brazilian regions. Besides the multimedia kit, free broadband Internet access was also provided. To disseminate vital concepts like "sharing", "intellectual generosity" and "networking" as new approaches to foster local development, conceptual workshops were ministered to spread this information.

Apart from the concept dissemination, technical workshops were planned to train people to register and edit multimedia contents using free software. Besides sharing their contents, users could also evaluate contents published by other users, discuss and create new contents collectively, new knowledge communities, and so on. The project involved more than 500 cultural Brazilian NGOs along three years.

The experience concluded that even though the awareness workshops made technology available, the desired effect was not produced in the majority of NGOs.

The success was related to the presence of an already consolidated social basis around the community serviced by the NGO. For those situations, the technology was adequate and the activities of the NGOs could be amplified by that.

For the other NGOs, what was observed was that technology was applied in the traditional way, based solely on the consumption of information. The Digital Culture project granted IPTI an invitation to become a member of a Network of Excellence financed by the European Commission in 2006. The project Open Philosophies for Associative Autopoietic Digital Ecosystem (OPAALS), aims to exploit virtual collaborative processes as a mechanism to promote socio-economic development. The purpose is to use the Digital Culture experience as a case study.

OPAALS network joins researchers from 23 institutions and mainly from the computer, social and natural sciences. The conceptualization and development of a digital space to promote sustainable knowledge communities and a computational architecture for digital ecosystem platforms is part of the objectives of this project. Those environments are called Open Knowledge Space (OKS) and provide online collaboration as well as communication integrated to other software components developed by OPAALS. The technological architecture provides a free and decentralized model that is not dependent on server farms and guarantees data consistency. Unfortunately, due the delay on OPAALS to deliver its OKS it was not possible to exploit the Digital Culture project as a case study as IPTI's participation in this project has finished in September 2007.

In 2007 IPTI decided to implement its own OKS fully based on Web and developed in Java. The OKS developed by IPTI was named *Guigoh* that is a Brazilian species of monkey. This system incorporate a number of functionalities that allows users to create their own social network, consisting in contacts and communities, to communicate to each other by textual chat and VoIP (Voice over IP), to edit documents collectively

and to share their multimedia contents (audio, video, images and texts) by using open licenses (Creative Commons). Next, RTS organization and structure will be detailed.

## 3 RTS Structure

To understand the structure and organization of those communities, it is relevant to comprehend the constitution of RTS. Social Technologies are considered products, techniques and methodologies that are replicable and developed in interaction with local communities and that represent effective solutions for social transformation. For instance, a technique how to collect rain water in a dry region and keep it drinkable for long period is a Social Technology and certainly other dry regions have interest in applying such solution. With the aim of stimulating the sharing of Social Technologies between people and institutions in Brazil RTS was created in 2005 and now is being also adopted as a knowledge network by other Latin America countries.

RTS is sponsored by several Brazilian partners, mainly by the public sector as the Brazilian Ministry for Science and Technology. RTS unites nowadays more than 680 members, from which a few are networks themselves. They work with solutions in terms of social technologies considering twenty themes, such as water, energy, among others. The goals of RTS include stimulating the adoption of social technologies as public policies, enhancing the appropriation of social technologies by the communities and encouraging the development of new social technologies.

The adoption of *Guigoh* OKS by RTS intends to amplify the possibilities of sharing and searching of solutions by stimulating the members to publish their technologies in multimedia formats and by reinforcing the sense of knowledge community between them. Besides, RTS also aims to enrich the existent social technologies by motivating the sharing of experiences from the application and contextualization of technologies.

RTS knowledge community runs over *Guigoh* platform with few modifications. Beyond all tools from *Guigoh*, RTS is implemented with a customized interface and concepts. The main aspect of the customization was giving more relevance to the Social Technologies as well as to RTS themes, as the Social Technologies are directly referred to them. As mentioned before RTS works with solutions in twenty different themes and when users want to publish a new Social Technology they have to relate it to one of those themes. When publishing a Social Technology users have to fill a form with details about their solution and each Technology has a specific web page. Similarly, when users want to retrieve any Social Technology they can easier do it by firstly defining which theme the technology is related to. Next it will be detailed some of the customized interfaces of RTS.

First, the main webpage presented to users (Fig. 1) shows all Themes and indicates the quantity of Social Technologies that are available for each Theme. Above this the interface presents a toolbar and some main information (number of members, next commitments, among others). Below (Fig. 2) a set of users (with the option to show all users existent in the network and also a search feature) is showed and the most recent documents and conferences in the system. Finally, there is a Calendar where users can schedule meetings and other events.

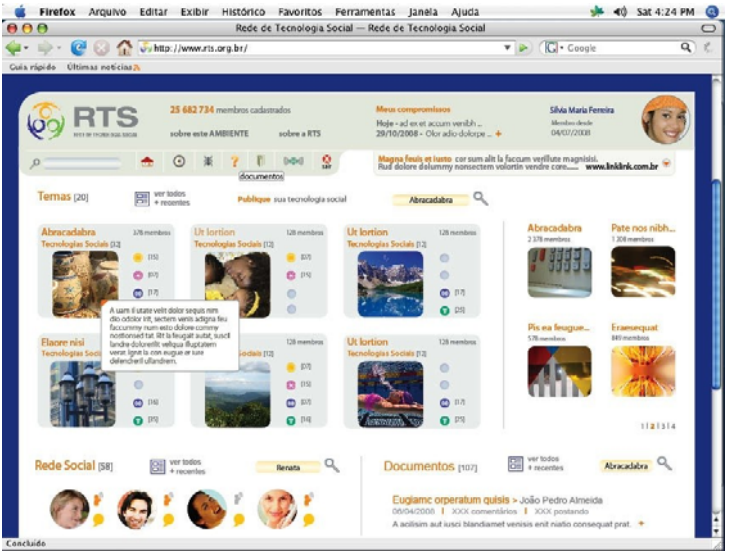


**Fig. 1.** Home page of RTS knowledge community

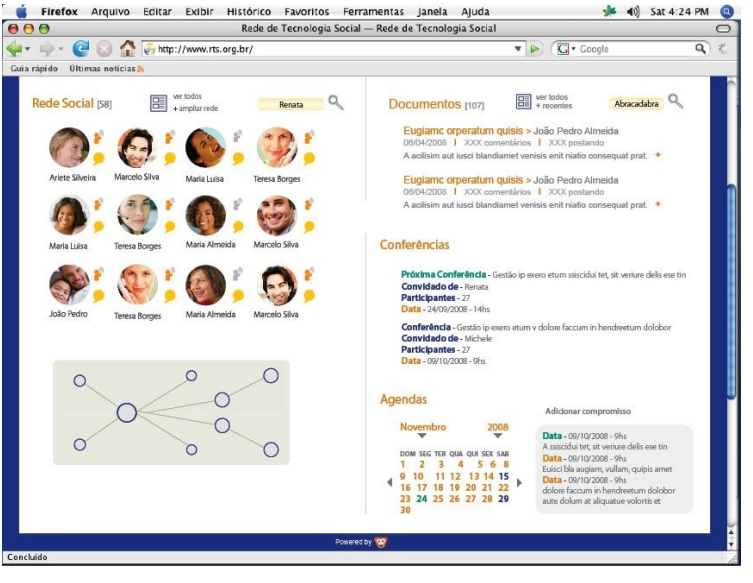


**Fig. 2.** Social Technologies area

When a specific Social Technology is clicked, its respective web page is reached (Fig. 3). In this page, all information about this Social Technology is presented, like its description, option for downloading, tags and about the author. The page includes a forum where users can make their comments about the technology and an option where users can recommend this technology to other users.


**Fig. 3.** Social Technology web page

The access to RTS knowledge community is open and free for any user which has only to register at its web site [1]. The RTS system is currently available in Portuguese and English but a Spanish version is also planned. Next, the specification of the tools developed on *Guigoh* platform is presented.

## 4 Guigoh OKS

The interface of Guigoh is designed to be easy to use and a complete environment for knowledge sharing and management. The currently version of Guigoh offers four main tools: Document Editing; Conference; Multimedia Publishing Environment; Social Network Analysis.

The Document Editing tool is used to build documents collectively. Users publish documents to the public and share it with others. All created documents are included in a group so that all users can find and access the content. In the main page of the Document Editing tool, users can see the documents that exist in the community as well as all documents this user is involved with. It is also possible to check the "Featured Docs" which consists in the most accessed documents. The most popular document can be viewed in the middle of the page. This tool was designed to promote the development of collective contents inside the OKS.

The Conference tool was developed because interaction is a key to the development of shared knowledge. This tool aims to manage conferences including participant administration, written and voice chat and whiteboard. To better understand each other and to improve interaction, different ways of communication are required. Voice chats help better and faster group coordination [2]. Besides managing their conferences, users can check their information and description. For past conferences, the system

displays a log for the messages exchanged. If the whiteboard conference mode is selected, users can edit a whiteboard by drawing, writing and including images on a canvas. The canvas editing works on shifts, and every user that wants to edit must ask for the turn.

Another tool, available for the system managers are the sociograms (social graphs). Those are graphs representing relationships in a defined context. For RTS they are designed as Java Applets and divided in three different types: contacts sociogram, containing all users and their relationships with their contacts; document sharing sociogram, indicating document sharing and collaboration between users; Social Technologies sociogram, showing the collaboration by comments in each Social Technology. This tool is used by the system administration to observe and study the community evolution and content emergence.

Sociograms also make social network analysis available on the interface. As social networks are based in Graph Theory, the graphic representation is given by a graph, where actors are vertices and the relationship between then is an edge. Social network analysis is a method used to find patterns and key elements in the community. This method is employed to study many phenomena in real world, such as the behaviour of groups of people and communities and how different populations relate to each other [3-6].

In this sense, RTS Sociograms present system users as vertices (circumferences) and the relationships as edges (lines or arrows between vertices). The size of the vertex is defined by its degree (number of relationships for the vertex). Edges can also be displayed differently (dotted or dashed line and different colours), according to the relationship type. In the same interface on the bottom, users can access centralities and other information about the network. The centralities present the top 10 users with the highest degree, closeness or betweenness centrality.

The degree centrality is defined by the number of relationships each vertex owns, the more relationships, more central is the user [4]. On the closeness centrality, the most central user is the one that can interact with others with the lowest distance [4]. On the betweenness centrality, the most central vertex is the most stressed one, it means, the one containing the highest number of shortest paths passing through this actor [4]. The technology selected to develop Guigoh as well as the the OPAALS peer to peer architecture will be explored next.

## 5 Computer Architecture

*Guigoh* is built on top of a social network system developed by IPTI team, called *Primata*. This project contains the database model and logic to manage users, communities and relationships between users. *Guigoh* is also an umbrella over other projects from IPTI, to handle features such as authentication, document editing and publishing and user interface customization. All services are accessed through the Representational State Transfer (REST) architecture. The REST technique is used to transport data over default HTTP protocol methods, such as POST and GET.

This architectural style (REST) was chosen for its scalability, ease of use and portability (does not depend on a specific programming language or operational system). The requests are responded using JSON syntax. JSON syntax is plain text based and therefore lighter than XML – which is used by more traditional web services architectures.

The entire system, including the individual tools, was implemented using the Java language, version 1.6. The advantages that Java language provides include its multi- platform environment and also the variety of free tools and libraries used in the project. The application server JBoss was chosen because it is one of the most employed application server nowadays, it is free and maintained by an active open source community.

The database chosen was PostgreSQL, also an open source project with one of the most complete database management systems nowadays. The Hibernate Framework was employed as well for the efficient database handling, table mapping and querying manipulation. Finally *Java Server Pages* (JSP) and *Asynchronous Javascript And XML* (AJAX) technologies were responsible for the interface development. The option for AJAX is considered a friendlier interface that avoids reloading and handles request in a transparent way. JSP is the native JAVA technology for web systems.

Testing was also taken into consideration and that step employed the technologies JUnit, JMock and Selenium. Those tools are used for testing and bug fixing, as well as interface test integration. All project sources used Mercurial for version control that maintains a distributed repository synchronized with the server after solving the problems, minimizing server repository corruption. For database version control, the tool Liquibase were used, handling revisions through xml files.

The repository for the source code of the *Primata* project is already setup at http://kenai.com/projects/primata and the files will be uploaded and publicly available in the next few months. The same is also true for the "umbrella" project, *Guigoh*, the conference tool (http://kenai.com/projects/muriqui/) and the p2p framework that will be used underneath *Guigoh* soon.

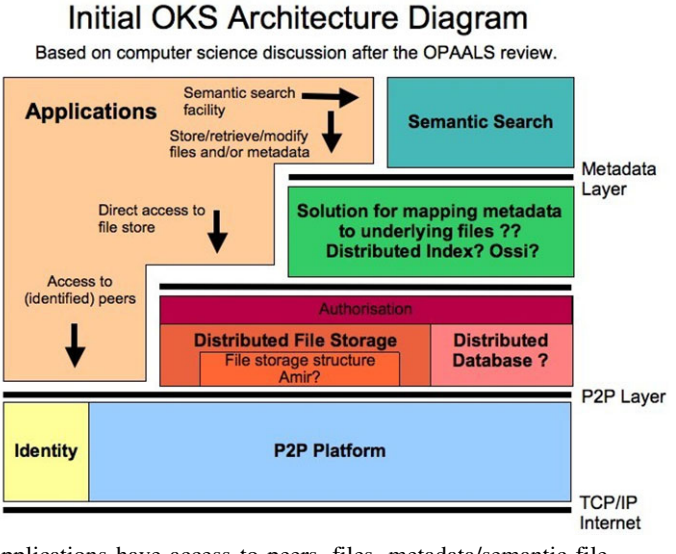


**Fig. 4.** Initial DE Architecture Diagram

As an example of an OKS *Guigoh* supports the principles and goals of Digital Ecosystems, except for the non single point of failure / control one – which is being worked on already through the p2p implementation efforts by IPTI and other partners from OPAALS DE Architecture. A DE architecture has been under development by the partners at OPAALS for a while now. Below is a diagram representing such architecture (Fig. 4).

This architecture is the one that will make the fulfilment all the requirements for a DE mentioned before possible, and also is where *Guigoh* will plug into.

## 6 Conclusions

This paper aims to present a computational system developed by IPTI to support knowledge communities as well as an introduction to a Brazilian experience of knowledge community (RTS) and its case study of e-adoption for improving socio- economic development. The RTS web environment for building a knowledge community on social technologies was developed and is freely available for users interested in publishing and/or searching for solutions to face their local problems.

The main business benefits of this project is the perspective of improving social and economical development by a process of a network stakeholders sharing their innovative solutions generated to face local problems. The RTS case itself is an experience of knowledge community which has helped several regions and communities to find solutions for their social and economical problems by face to face meetings (workshops, forums, conferences) as well as by newsletters and its web portal. In this project people that find and adopt a Social Technology are invited to share their experience of applying it, mainly describing the customizations needed in order to fit to the local conditions.

The knowledge community is now starting to be populated. As RTS is a very active knowledge network it is expected that the web environment can quickly became active. Finally, the intention of this project is that this system will be able to be adopted by open projects focused on building knowledge communities.

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