

Broadening Access to e-Government via TV

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Abstract— Due to financial crisis faced by many countries, speeding up the administrative reformation of the public sector is necessary. In this light, a number of governments' initiatives are focusing on offering alternative ways to citizens to access their services. As TV is one of the means with the highest penetration among citizens, TV-government has to be studied extensively as a low cost service delivery. Therefore, this paper studies the use of the TV for providing an alternative access way to electronic government services. In particular, it presents a pilot electronic government platform, which uses TV as a service delivery channel for Greek agricultural stakeholders. Especially in Greece, delivering TV-government access can contribute to reducing red tape and reorganizing the public sector.

Keywords- *electronic government; TV-government; service delivery; agricultural stakeholders*

I. INTRODUCTION

The electronic government (e-government) despite the short time of its appearance has gained a prominent place, becoming the core reform strategy for the public administration [1]. On the other hand, the European financial crisis has highlighted problems in many countries, not only in economies but also in the public administration, making the administrative reform comprises a top priority. Greece is an example where much of the financial problems are due to inherent weaknesses and pathologies of the public sector [2]. The development of e-government services can contribute towards an effective and efficient public administration.

In order to achieve the objectives and benefits of e-government, among others, governments make efforts to provide to citizens universal access to relevant services. The European Union (EU) emphasizes on equal access to e-government services and has taken important decisions to achieve "inclusive e-government" [3]. In practice, however, access to e-government services is limited to those who have access to technology and have the skills to use it [4], resulting in the isolation of vulnerable social groups such as the elderly, disabled, pensioners or people in remote and disadvantaged areas. In many countries, it has been observed that there is a gap between the technologies and media used by the public administration for providing e-government services and those the citizens prefer. While there is a plethora of affordable and widespread among citizens means, such as the television (TV) and mobile phones, usually the service provision is achieved via personal computers (PCs) connected to the Internet [5]. On

the other hand, the EU has set a target to increase the use of e-government services, reaching 50% of EU citizens by 2015 [6].

According to United Nations [7], multichannel public service delivery is a significant topic on the research and political agenda. This is due to the advantages it offers to citizens and public administration, such as increasing equal access, participation and inclusion; and contributing to sustainable and better quality services. Multichannel service delivery allows citizens to interact with public agencies with their preferred channels, namely traditional channels (telephone or post) and digital channels (Web, mobile or public access points). Public agencies can make use of all available digital channels to facilitate higher penetration of e-government and to achieve efficiency and effectiveness in public service delivery. However, less attention has been given to the TV [8, 9]. Particularly, TV is a very user friendly means proved by the diverse group of its users, including agricultural stakeholders, elderly, poorly educated and disabled. Apart from the youth who are familiar with digital technology, TV appeals to people of all ages and backgrounds and becomes more valuable for those who do not know how to use a PC. Therefore, the digital TV is an important means of providing services to citizens of these cases.

In this light, the paper describes the use of the TV for providing an alternative access way to e-government services for Greek agricultural stakeholders. The integration of the proposed access way to an e-government platform is presented. The rest of the paper is structured as follows: section 2 gives an overview of e-government emerging concepts. Section 3 presents the opportunities of digital interactive TV as a service delivery channel for e-government, as well as real cases. Section 4 presents the deployment of AgroMedia, a platform with a TV access channel that extends a pilot e-government system from authors' previous work [10]. It is based on a framework including a usage scenario, a technical scenario and an evaluation. The usage scenario provides the necessary information for estimating the delivery means of e-services preferred by Greek agricultural stakeholders. The technical scenario regards a technical solution based on the usage scenario, and the implementation of a number of services in AgroMedia for agricultural stakeholders. Then, the services are evaluated based on the innovative concept of the Living Labs. Lastly, the conclusions of the study are given.

II. E-GOVERNMENT

For some years now, in order to strengthen users and respond better to their needs, public agencies have entered into a phase of organizational change driven by e-government. E-government can serve governments as a driver and enabler for better citizen communication and engagement, internal reorganization and social welfare. However, in [4] it is stated that the use of e-government services is limited to those who have access to technology and possess the necessary skills to utilize them. It refers to the application of modern information and communication technologies by governments to the full range of government functions (e.g. service delivery, policymaking and implementation, citizen participation in democratic processes), concerning not only the relations with citizens and businesses, but also internal operations of individual administrative bodies, as well as the relations between them [11].

There have been proposed several definitions for e-government. Some of them list the sectors that e-government affects or its implementation areas. Other definitions are an expression of its scope and vision, emphasizing in the redirection of the citizens', businesses' and public administrations' needs or in the benefits of increasing public administration efficiency, reducing costs and providing high availability of services [12]. Others focus on the technology used, the transformation of government services, the relationships developed among those involved in the provision of government services or policy. An important factor differentiating the definitions of e-government is the perspective and objectives of the body providing the definition (e.g. public agency). In any case, this differentiation has to do with the dynamic nature of e-government [13] and the need for responding to emerging needs as e-government evolves. Generally, the concept of e-government is multidimensional and complex, and requires a broad perspective for determining it and accomplishing a successful strategy and implementation [14].

Gradually more concepts emerge related to e-government. Below, we propose some important ones, along with representative definitions.

- *Mobile government (m-government)*: refers to the use of mobile and wireless communication technologies for the provision of information and services by governments to their citizens and businesses [15, 16].
- *Ubiquitous government (u-government)*: regards new types of transactions that can take place anywhere and anytime via various devices through the use of networks and applications and are based on ubiquitous presence technologies [17].
- *Television government (TV-government)*: refers to a wide range of services, which have social mission and are provided by public agencies through digital TV (satellite, terrestrial, cable, and broadband) and Internet Protocol TV (IPTV) [18]. TV-government is a subset of e-government comprising an alternative way for delivering public services and information.

- *Transformative/transformational (t-government)*: concerns changing the basis of how government works [19, 20].
- *Geo-government (g-government)*: refers to the use of geographic information system technology and global positioning systems for providing government services, which are usually unified with Internet [21, 22].

It should be noted that the m-government, u-government, TV-government and g-government are considered as subsets of e-government [21, 23, 24, 25].

III. DIGITAL TV AND TV-GOVERNMENT

TV is one of the most powerful means of communication established in every household, with high penetration rates in many countries reaching 100%. Traditionally, the TV was not an interactive medium while it carried the same message and content irrespective of who is watching. The TV content was provided either by broadcast or storage media (e.g. video tapes, DVD, VCD). Therefore, enterprises that activate in the area of TV have tried to provide to TV viewers the capability to interact with the program they watch [26, 27]. This effort has resulted into the generation of TV interactivity. The term interactive TV, generally known as iTV, describes a number of techniques allowing viewers to interact with TV content as they view it [28, 29].

Interactivity varies from low (TV on/off, volume, changing channels) to moderate (simple movies on demand without player controls) and high interactivity in which TV viewer affects the program being watched. In the context of interaction, the viewer should be able to return information to the broadcaster. Such functions are executed in the receiver (i.e. set-top box) that provides the interaction. A set-top box is considered as a device that connects a TV and an external source of signal, and transforms the signal into content displayed on the TV screen [30]. The above mentioned solutions were offering limited content since these are designed and offered only by TV enterprises [31]. Moreover, in the case of high interactivity, viewers can participate in games, complete questionnaires, vote, make purchases and select the movie they want to watch (i.e. download and control the movie locally) [32]. Obviously, the most important source of digital content, the Internet, was not accessible by a set-top box. In addition, it must be noted that the services offered by TV enterprises are usually on subscription.

However, in the past few years there has been an explosion in the number of users accessing the Internet via different desktop and handheld devices like notebooks, workstations, personal digital assistants (PDA) and Internet-ready mobile phones. Also, many TV enterprises are broadcasting their programs through the Internet and as a consequence many users are accessing broadcasted TV programs using the abovementioned devices. Today, the use of TV and remote controls for accessing and browsing the Internet presents much interest. Trends in media convergence refer to the creation of a new medium combining the operations of the TV and a personal computer (PC), since both would be able to do the job of the other [33, 34]. Obviously, the Internet brings a wide

range of capabilities to the TV device, such as viewing Web pages, e-mail, chat, text, graphics, video and voice messaging [35].

Recently, manufacturers incorporated technologies in TV that allow the access to the Internet, namely Smart TV. However the most of them do not offer the ability to affect (install/remove/upgrade) the hosted software. Lately introduced set-top box integrated well known operating systems (e.g. android) and the most of the applications that come with them. But, the most important improvement is the capability to connect to Internet (wired and/or wireless) and therefore access and surf the Web. The remote control of the set-top box is used as mouse pointer or as a key selector from a virtual keyboard presented on the screen. Obviously, these new capabilities will push the Web to new adaptations such as the pages that are specialized for mobile phones.

Pagani and Pasinetti [18], refer to TV-government as a wide spectrum of services, which have social and ethical mission and are provided by public agencies through digital TV (satellite, cable, broadband). In literature, paradigms of use of digital TV for e-government service delivery are few. The British, Italian, Scandinavian and Korean governments have already used it for the provision of general and specialized information, as well as for the communication with citizens mainly through e-mail. In the following paragraphs two representative examples using TV-government services are described.

In the United Kingdom, the action “Looking Local” [36], originally started as DigiTV in 2004, is the national portal for local government, providing interactive public services for a wide range of needs (e.g. housing, health, job search, latest news, traffic, local information and advice) through interactive television, mobile phones and kiosks with touch screen. Nowadays, “Looking Local” hosts over 120 local authorities, housing associations and health organizations. In addition, it has collaborations with national public sector bodies, voluntary organizations, strategic players and digital delivery providers. It has an increasing popularity and according to the latest published statistics (i.e. for 2012) it had more than 30 million hits as part of more than 1,600,000 sessions [36]. The particular action provides public services through the television channel Sky and Virgin and terrestrial TV with the broadband decoder Freeview. This means that over 55% of households - approximately 14 million homes across the United Kingdom - have real-time access to e-government services.

The Kirklees Council in England [37] is a representative case. The website of the municipality provided limited benefits for the residents and the city council was interested in the provision of e-services via interactive digital TV and the action “Looking Local”. The result was that through digital TV more people have access to services and information electronically through the website called “InTouch Kirklees”. However, the service had a greater impact on those citizens who are isolated from the community. This also applies to those who are elderly or have mobility problems or those who do not have a computer at home or have difficulty in using the services of the municipality because of childcare or other commitment or are

skeptical on new technologies. In Kirklees regions, which are located in disadvantaged areas, the adoption of digital TV is greater. Also, the content of services is offered in simple language because many of the users have a low level of education.

The main reasons for using the action of the “Looking Local”, which is an additional channel on the Internet, are: (a) providing universal electronic access to citizens, particularly those without Internet access or PC skills; (b) providing services at no extra cost (apart from the subscription for digital TV); (c) providing services 24 hours a day, 7 days a week; (d) increasing social and digital inclusion by making use of the familiar technology of TV; (e) building trust and increasing citizen participation; and (f) promoting community cohesion. It has to be noted that the City of Kirklees also provides the service “InTouch Kirklees” as a mobile application.

Since 2005, the Korean government has started to establish and provide various public services through IPTV, concerning digital TV services over Internet Protocol (IP). IPTV services include commercial grade multicasting TV, video on demand (VoD), triple play, voice over IP (VoIP), and Web/email access. The subscribers of the so called TV e-government system can pay taxes; print out public documents; receive information regarding public services; participate in questionnaires concerning central and local governments’ policies; check survey results in real time and enjoy a wide range of content for women, children and the elderly. Korea has announced the extension of public services via Smart TV. By 2015, in Seoul approximately one million households will use Smart TV, which represents about three million people, estimated as 30 percent of the population [38].

IV. TV-GOVERNMENT ACCESS: A GREEK CASE

This section presents the deployment and evaluation of the AgroMedia platform, providing services via TV channel. It has to be noted that the design and deployment of these services have been based on a descriptive framework presented in previous authors’ work [23]. In specific, the particular framework involves three stages: (a) the usage scenario presents the current status of Internet access in Greece, Greek farmers’ needs for using electronic services (e-services) and identifies the ways of accessing them; (b) the technical scenario regards a technical solution (i.e. system, platform) for the provision of these services and its implementation; and (c) the evaluation of the solution based on the concept of the Living Labs. The usage scenario, the technical scenario and the evaluation are described in detail in subsections A, B and C respectively.

A. Background

The majority of Greek regions show a significant increase in Internet access and connections. However, they are still below the EU average as far as the share of regular Internet users and annual average growth are concerned [39]. All households possess phone (92.7%) and TV (99.7%) [40]. The risk factors of information technology exclusion are the following: (a) age: people of 55-74 years old; (b) educational level: people that have not completed any education level or

low levels of education (high school or lower technical schools); and (c) employment status: people unemployed, retired or non-economically active. In Greece, 30% of the households face at least two of the aforementioned risk factors.

Of all households 53% acquires a PC and about 46% has access to the Internet, 89% of which has broadband connection. The main reasons for not acquiring Internet access at home are that citizens do not consider the information provided in the Internet useful/ interesting (34%) and they do not have the appropriate skills for using the Internet (33%). It has to be noted that through the years, although in terms of absolute numbers, the number of households not having the appropriate skills is decreasing, its percentage as one of the main reasons for not accessing the Internet from home is increasing. This fact is considered predictable, since the information in the Internet is continuously augmenting and including various and specialized subjects [23].

Farmers are a population group that particularly suffers from the digital exclusion, deriving from different attributes, namely age, low education, low income and low technology access. The average farmer is more than 45 years old and self-employed, and has elementary education and income that continuously decreases within the last decade. Previous survey of the authors [23] has shown that Greek farmers are not well acquainted with the Internet notion and the use of a PC. Moreover, the majority uses a mobile phone and a TV. The lack of PC skills and the ignorance of the English language are among the significant reasons for not using the Internet. Moreover, from those using the Internet a major part encounters problems in finding useful information via the Internet. In addition, farmers have stressed the need for public services that are user friendly, ubiquitous and require less time to access and transact.

Another survey by the authors [41] has identified the tendency of using a PC, a mobile phone and TV by Greek farmers for receiving information services. In the context of the research, personal interviews with a sample of Greek farmers have been conducted. Regarding the frequency of TV use for receiving information, the research has shown that is very extensive and far ahead in comparison to the PC and mobile phone. Concerning the ease of use of the aforementioned technologies, all farmers rank the TV first, then the mobile phone and last the PC. Nonetheless, about half of the sample has no knowledge at all and only 36% are acquainted with the Teletext service. Great interest has been observed in receiving information for specialized agricultural subjects, mostly focusing on the ability of selecting relevant videos and documents. The Greek Ministry of Agriculture offers several e-government services for farmers, but farmers don't know how to use them. Concerning their preference on the means they would use in the future for accessing the Internet, farmers rank the TV first, then the mobile phone and last the PC. Taking into account the aforementioned, using TV for the provision of e-services comprises an alternative, flexible and direct solution.

Particularly in the current financial environment in Greece, and taking into account that in 2012, agricultural income in Greece has been decreased by 2% [42], TV could be a

promising solution for agricultural stakeholders. From one side, public agencies cannot afford investing in new systems/platforms; and from the other side citizens cannot afford paying for new devices for accessing e-government services.

B. AgroMedia Deployment via TV

The deployment of TV user access through AgroMedia combines two systems, namely MediaPortal and AgroPortal for multimedia and e-government services, respectively. MediaPortal (www.team-mediaportal.com) is multimedia open source software. Plugins allow MediaPortal to perform several tasks, from browsing the Internet to watching TV and listening to music. Moreover, it uses its own TV-server to allow setting up one central server. All TV related tasks are handled by the server and streamed over the network and users can watch live or recorded TV, schedule recordings, view and search data over the network.

The AgroPortal is a pilot Web-based information system for the provision of online information and e-services for Greek agricultural stakeholders that has been presented in authors' previous work [10, 23]. The AgroPortal server hosts and serves e-government services for the following users: the PC/tablet user connects to the server and uses the e-government services via an Internet browser; and the mobile phone (SMS) user receives to his/her mobile phone SMS messages with informative content. This user has the ability to reply with an SMS either for requiring additional information or for applying for a specific service. In the following the design and the implementation of TV user access is described. The design of the TV access is realized by three layers as follows:

- The *data storage layer* in which data are stored and organized. The particular layer has been implemented using SQL Server 2005 Express, an embeddable version of SQL Server 2005 that is free, easy-to-use and lightweight.
- The *application layer* that has been based on MediaPortal, which transforms a device into an advanced multimedia center/home theater PC. It supports listening to music and radio stations, watching and recording videos and DVDs and watching, programming, recording and storing of TV programs. It offers a variety of characteristics that can be extended through the use of plugins that are developed by the user/developer community. Among others it supports: TV: analog TV, digital TV (DVB-C, DVB-T, DVB-S), Internet TV (record, view, pause, rewind), High-Definition Television-HDTV and Dolby Digital/AC-3; radio: FM, DVB and Internet radio; Web browser; video (divx, mpeg, matroska etc.) and photos; Really Simple Syndication (RSS); and weather forecasting.
- The *presentation layer* presents to the TV user the content in appropriate format so as to be viewed and navigated using a remote control and virtual keyboard.

In our approach the TV user connects to the AgroMedia platform (Figure 1) through an Internet ready set-top box. Appropriate but simple configurations make the user able to browse and use the e-government services. In other words the user downloads and installs the system for TV access to the device and once installed the system provides access to resources (e.g. reading news, completing forms) according to specified configuration, using a remote control and a virtual keyboard appearing on the TV screen. It must be noted that the set-top box is operated by an operating system (e.g. android) that allows the installation of software applications. Obviously, such capabilities also provided by a PC connected to the TV (e.g. Home Theater PC-HTPC) as well as by recent TV models that host software applications.



Figure 1. The AgroMedia platform

In the AgroMedia platform the user connects to the PC or the set-top box with the TV and browses the provided services that have been classified into six categories, as follows.

- **Web browsing:** The user has the ability to browse the Internet using the remote control as a pointing selection, as well as a text input device. A collection of related links for agricultural government agencies, organizations and institution is provided.
- **News:** The user can be informed for current news and events through RSS feeds. A list of feeds is provided regarding topics on particular agricultural fields (conventional agriculture, organic farming and cattle breeding, fishery and agro-tourism). The user has the ability of adding or excluding RSS feeds.
- **Transactional services:** The user can download and/or complete online and submit official papers (e.g. forms, applications) such as: apply for subsidy, request

certification of occupation, and request the issuing of agricultural vehicle permission.

- **Live TV/radio:** The user can watch TV channels and listen to radio stations that are broadcasted over the Internet. A collection of TV channels and radio stations is provided, categorized according to government or agricultural content. The user has the ability of adding or excluding channels and stations.
- **Education and training:** Currently the user can view educational photos and videos. In particular, the educational resources have been categorized by agricultural fields. Photos regard arboriculture (i.e. diseases, lopping, new varieties) and videos concern cattle breeding, fishery, conventional agriculture, organic agriculture, agro-tourism, agro-manufacture, integrated management and agricultural consulting are provided. Various ways are provided to the user to sort (e.g. by date, size) and view (e.g. small icons, list) the educational content. Additionally, any educational content stored in any data storage means (e.g. hard disk, DVD) can be viewed.
- **Weather forecast:** A detailed weather forecast for the Greek agricultural areas is provided. A forecast for the current day and four-day forecast are provided with the highest and lowest temperatures, UV index, wind and humidity.

Figures 2 and 3 illustrate the user interface and agricultural news respectively. The aforementioned services are provided in Greek. For the successful implementation of the TV user access the following technical issues have been addressed, such as how device-independent content is managed, how it is delivered to different channels with their own processing and display characteristics, how the system handles channel-switching, how it maintains a consistent state when requests are issued and transactions carried out through different channels. It must be noted that an essential attribute of the system is the capability of personalizing the system characteristics. In addition, the system gives the ability of using a variety of remote controls (e.g. Streamzap, MCE, Red-Eye, WinLIRC, Hauppauge, and FireDTV). The proposed system uses the Microsoft MCE remote control for Windows XP.

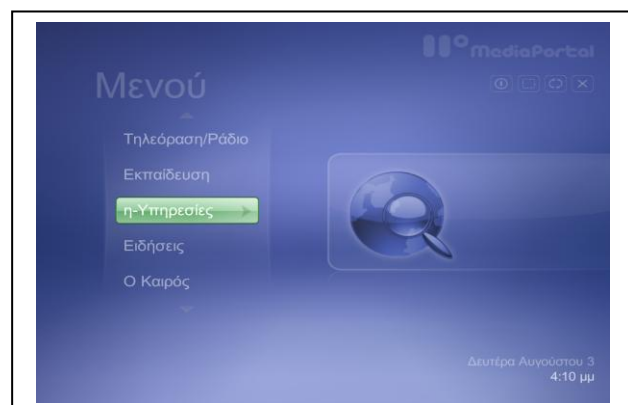


Figure 2. The TV user interface

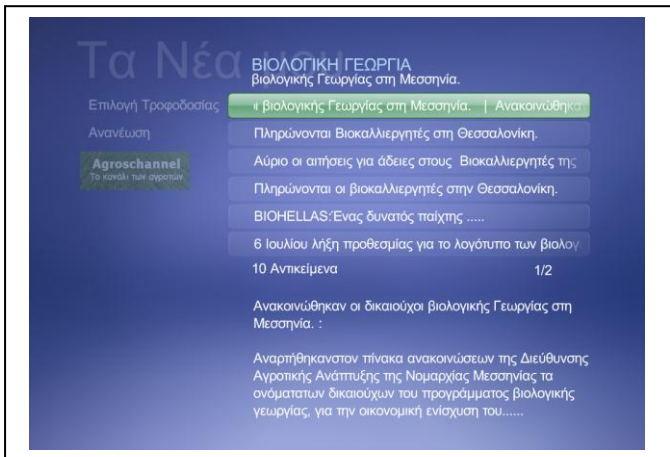


Figure 3. Agricultural news

C. AgroMedia Evaluation

In this section, the evaluation process of the AgroMedia services via TV and its results are presented. The evaluation process has been based on the concept of Living Labs and the way they are used in the context of a three year European project, the Rural Inclusion (www.rural-inclusion.eu). A Living Lab refers to a systematic user co-creation approach integrating research and innovation processes. It is considered as a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts [43]. The key concept behind the organization of a Living Lab is that the user should be involved in the innovation process all the time. Involving the users can enable public agencies to provide services closer to the users' needs and circumstances without having to create a new market, because the market is already there. The user can contribute with ideas, experiences and knowledge from daily life and interactions with the products, services and applications. The Living Lab sessions allow providing direct tutoring on system and gathering insights from direct interaction from targeted users by the means of discussions and of hands-on sessions. Observation of the behavior of the users provides information about the use of the system, the obstacles towards its use, and how to improve its usability.

More specifically, the evaluation of the AgroMedia has taken place at the Karditsa County in a Living Lab in 2011. Personal interviews have been conducted to a sample consisting of: (a) cattle breeders, and (b) public servants of the Center of Genetic Improvement of Animals, which is an institution of the Greek Ministry of Agriculture. Thus, the evaluation covers both users and service providers. In this context, a questionnaire has been used, divided into two sections. The first section regards general information of the participant (e.g. main occupation, age, educational level). The second section regards the evaluation of access channels and provided services in terms of importance, quality, effectiveness, cost, speed, transparency and user satisfaction,

ease of use, structure of information, advantages and disadvantages and future development of new services.

As far as the provided services are concerned, Web browsing, education and training, transactional services, and the weather forecast are considered as the most important. The provided content is certified and updated. The provided services are well structured. In comparison to the traditional services, almost all Living Lab participants agree that the provided services are money saving, faster and transparent. The cattle breeders have stated that using the particular services saves man hours and reduces visits to public agencies. All services provide satisfaction, except for the Live TV/Radio which is considered as average. The operation of the AgroMedia is considered as simple. The most substantial advantages of the platform are easiness and direct use, as well as the ability of receiving information anytime. The cost of the PC is considerable by the cattle breeders due to the financial crisis. Moreover, they have denoted that in the future the platform should include more specialized information for cattle-breeding and training services for farm deployment/amendment plans.

The employees of the Karditsa public agencies believe that the transactional services and weather forecast have the highest effectiveness but all services are faster and more transparent than the traditional ones. Average was the satisfaction for all services. The use of the platform is simple, especially through the remote control, and the structure of the content is characterized as quite helpful, as there is immediacy in accessing specialized information. The employees have evinced that the platform can contribute to the reduction of the administrative burdens of their public agency, particularly today when public organizations are facing crucial problems threatening their operation.

It has to be noted that the overall impression from both groups, cattle breeders and public servants, is that the system could be characterized as low-skill. The use of a remote control comprises an essential advantage for facilitating the accessibility to services, since it is very user friendly especially for farmers that are not familiarized with a PC. Obviously, input capabilities of remote controls differ from standard PC input devices (i.e. keyboard and mouse) [44]. Therefore, browsing the Internet using a remote control has different user interface design requirements. Web page layout, navigation, colors and fonts have to take into account pointing selection patterns and resolution of TV screens.

V. CONCLUSIONS

In the current Greek financial crisis, expanding e-government access for citizens can contribute to reducing red tape and reorganizing the public sector. In this context, this paper focuses on the deployment of a TV access channel. It has presented a new low-cost way for delivering e-government services to Greek agricultural stakeholders, for finding information; videos and educational content as well performing transactions with public agencies. The stakeholders have the possibility to access and navigate the Internet using a remote control either for pointing selection (i.e. mouse) or for text

input (i.e. keyboard). The evaluation of the services by the cattle breeders and public servants has taken place mainly based on the Living Lab notion. The first results are encouraging showing that the AgroMedia runs smoothly. Although it has been developed for research purposes, in fact it may be operated by a non-profit organization or a third party, such as a local agricultural public agency.

Future work regards the study of other vulnerable groups, such as unemployed, poor, immigrants and elderly, since the citizens should choose the means for accessing e-government services, according to their needs and circumstances. In addition, it is crucial to study the organizational interactions among stakeholders in order to finally propose a well established framework for multichannel e-government.

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