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Title of the paper

Bridging the Digital Divide Through E-Governance in Agriculture

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INTRODUCTION

The prevalence of information and communications technology (ICT) and Internet use has been linked to the automation and reinvention of government (Dunleavy, et al, 2006; Hood, 1991; Heeks, 1999). It has improved public service delivery and enabled closer linkage among government, private sector, and citizens but problems of lack of physical access and limitations on the use of the Internet and ICT especially in rural poor and developing countries have persisted (Norris, 2001; Silcock, 2001). In 2016, the International Telecommunications Union (ITU) reports developing countries have now accounted for more Internet users compared to developed parts of the world[1] but Internet penetration rates or the portion of the population who are Internet users presents a huge gap with 81% in developed countries as against 40% in developing countries and 15% in least developed countries (ITU, 2016). Thus, public sector is faced with the challenge of ensuring the use of ICT and the Internet will also uphold values of equity and empowerment (Kyem & Saku, 2009; Minogue and Polidano, 1998; Norris, 2001).

This paper aims to present how e-government and ICT-related initiatives are implemented and highlight the enabling conditions that contribute to provide physical access and enhance the capability of agricultural sector stakeholders to benefit from its use. It submits evidences of the intermediate outcomes of these interventions, contributing to the body of literature which has been deemed lacking in e-government studies (Avgerou, 2010; Flor, 2006; Heeks, 1999, 2002; Holmes, 2001).

LITERATURE REVIEW

Digital Divide

Digital divide means disparity in physical access and inequalities in the use of Internet: among countries or the “global divide”; between social groups within a nation or the “social divide”; and between those who use and do not use political resources on the Internet or the “democratic divide” (Norris, 2001). It has two levels: the "accessing divide" or gaps in ownership of computers and accessing the Internet and “using divides” or the gap in how the Internet is utilized among users (Hargittai, 2001; Labucay, 2014; Norris, 2001; Zeng, 2011). Factors that contribute to these gaps are financial support (Bertot and Jaeger 2006; Korac-Kakabadse & Korac-Kakabadse, 1999; Seifert, 2003); limited ICT infrastructure and unreliable access especially in rural areas and indigenous communities (Ranerup, 1999; Moon, 2009); literacy due to digital media’s text-driven character (Johnson, Ariunaa & Britz, 2005; Korac-Kakabadse & Korac-Kakabadse, 1999; Seifert, 2003); and cultural factors such as “technophobia” especially among old people. These divides affect minorities, low income people, less educated and rural dwellers thus limiting their chances to benefit from the information age (Almarabeh & AbuAli, 2010).

In the Philippines, the digital divide is considered more of the rule than the exception since basic needs of food, clothing, and shelter are the focus and not access to ICT (de la Pena-Bandalaria, 2007; Flor, 1986; Rodriquez et al., 2011). Access divide accrues to the country’s topography; lack of infrastructure and ICT facilities; and poverty

[1] ITU reports that there are 2.5 billion Internet users in developing countries versus one billion in the developed countries in 2016.

while use divide is traced to disparities in motivation, skills and literacy (Alampay 2006, 2007; Siar, 2005; Trinidad, 2002). The issue has been persistent as Labucay (2014) found in her study of the patterns of internet access and use in the Philippines: (1) internet access in urban households is three times more than rural households; (2) upper and middle classes were more likely to have Internet access or be Internet users compared to poorer classes, and (3) those with education are ten times more likely to use the internet than those with little or no education. Additionally, the connection in ICT development and poverty is much more apparent in rural and agricultural areas where ICT users, applications and solutions are said to be minimal (Flor, 2001). Manalo, et al., (2010) found that a great majority of farmers did not know how to use the computer and could not access the Internet. These studies underscore the reality that the poor, marginalized and politically weak – who could have benefited the most out of ICT and the Internet – are least likely to have access to these services (Fountain, 2001; Norris, 2001).

ICT use and E-government in Agriculture

Despite challenges, the Internet and related technology have been considered transformational in developing rural productivity and yields (Worldbank, 2016; UN Food and Agriculture Organization, 2016) leading to more diverse livelihood resources and assets which results in higher earnings and increased productivity while also improving literacy and community integration of rural folk (Soriano, 2007). Likewise, the use of Internet has served as a tool for collaboration and empowerment by encouraging participation and expanding access to affected citizens who otherwise may not be physically present to express concerns (Kyem & Saku, 2009). However, these efforts require the public sector, among others, to provide institutional support such as ICT infrastructure, technical support and legal framework stakeholders in remote areas and marginalized groups burdened with social and economic challenges (Tipton, 2002).

The implementation of e-government is one way for information poor sectors to access and utilize ICTs and the Internet. E-government is the use of technology and internet-driven information to enhance the access to and delivery of government services to benefit citizens, businesses and public agencies (Holmes, 2001; Silcock, 2001). It is mainly provided by the state and delivered via government to government (G2G), government to business (G2B) and government to citizens (G2C) transactions (Fang, 2002). In agriculture, e-government is used to facilitate reciprocal information exchange between government, businesses and individuals to improve efficiency and provide fast, accessible and quality of agricultural information (Mahaman, et al., 2005; Ntaliani, et al., 2008; Ulman, Vostrovský and Tyrychtr, 2013). For instance, mobile communication and the Internet aid farmers, agribusinesses and public bodies in accessing and disseminating information, and decision-making using information on current market prices, transport and input costs, weather and pest advisories, and farming techniques (Aker, 2008; Gonsalvez, 2013; Mahaman, et al., 2005; Ntaliani et al., 2008; Poblet, 2011; Qiang et al., 2011). Although heralded as an effective tool for the public sector, ICT use and e-government has been challenging to assess particularly in terms of what factors contribute to its implementation and its influence in narrowing digital divide problems.

RESEARCH QUESTION AND RESEARCH FRAMEWORK

Considering the dearth in evidences of ICTs contribution to development and the challenges attributed to the digital divide especially in developing countries, the author was inspired to evaluate in depth the case of e-government in the Philippines' Department of Agriculture and ask: How has the DA's implementation of e-government and ICT-related initiatives contributed to development specifically in helping narrow the digital divide? More specifically:

1. What were the precursors and inputs necessary for DA to implemented e-government and ICT-related services?
2. What were the conditions which aided the implementation of these e-government and ICT-related activities?
3. What were the intermediate output, outcomes and impacts of e-government and ICT-related activities?

Research on ICT for development (ICT4D) is based on the principle that it has the potential to contribute to the improvement of various aspects of life – from relieving poverty to reinforcing democracy (Akman, et al., 2005; Avgerou, 2010). However, contrasting views exist on ICT4D: the progressive and disruptive transformation perspective. The former argues that investment in ICT and its effective use contributes to economic development of a nation (Mann, 2004) and that effective government can be achieved with e-government as a main tool to support efficiency, transparency, and responsiveness (UNDESA, 2015). On the other hand, the latter considers ICT-enabled development as having unequal effects on different groups of the citizenry contributing to socioeconomic transformations in which the poor, women, children, or developing countries are portrayed to be vulnerable and at risk to miss out on its benefits (Avgerou, 2010; Heeks, 1999; Wade, 2002). These contrasting perspectives have become increasingly significant in advancing the ICT4D initiatives and have necessitated authors to encourage micro or macro level evidences of ICTs contribution to development (de la Pena-Bandalaria, 2007; Heeks & Molla, 2009; Heeks, 2010).

The "ICT4D value chain" (Figure 1) by Heeks and Molla (2009) was the framework used to guide this study. It is based on a standard input-process-output framework that links together resources and processes and considers enabling and constraining factors for success leading to outcomes and possible development impacts. It focuses on the precursors and inputs for the e-government/ICT initiative (readiness); the tangible deliverables of the program (availability); the extent of utilization (uptake); and the overall impact (impact). By using this framework, it aims to provide a comprehensive view of the e-government and ICT-related programs of the DA particularly the inputs necessary, the facilitating conditions and evidences of outputs and outcomes. It assumes that ICT4D in the DA, although incremental, has a progressive impact.

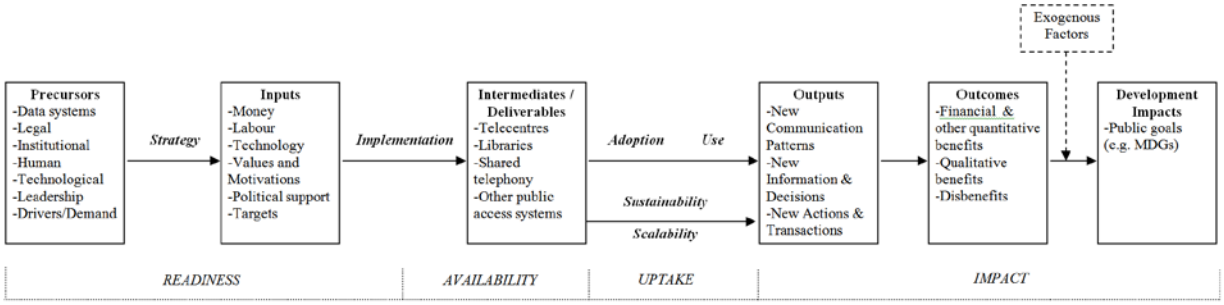


Figure 1. ICT4D Value Chain adapted from Heeks and Molla (2009)

METHODOLOGY

This descriptive case study aims to explain how DA's e-governance has helped narrow the access and use problems of using ICT. Case studies are said to be most applicable to answer research questions like "how" or "why" and if the phenomenon to be studied involves a contemporary and real-life context (Yin 2003). The context of the DA e-government was chosen since it provides a concrete link to how ICT and Internet access and use challenges were hurdled especially in the case of farmers who operate in rural areas. This study does not claim to be representative of the whole e-government system of the Philippines but offers interesting examples of how development outcomes can be achieved despite constraints characteristic in developing countries. Also, the specific agency study offers vital information on how specific interventions achieve success and could possibly be emulated (Mays & Pope, 1995; Tendler 1997; McNabb 2002).

Public documents, archival records and existing scholarly texts were reviewed. To complement this, data from Panganiban's (2016) study on e-government which used key informant interviews and open-ended questionnaires sent to key resource persons directly involved in the implementation of e-government and ICT initiatives such as ICT department and section chiefs, information officers and program managers and local extension workers. On the other hand, to gauge the impact of e-government services, self-completion questionnaires (Appendix A) were emailed to farms/farmers on the roster of the FilFARM website – a website that caters primarily to farms remotely located in remote rural areas of the country – to gather their perceptions. Response rate was low as expected returning only a total of eleven (11) out of total thirty-nine (39) possible responses but the fact that respondents replied was an indication that there is indeed access in these remote farming areas. This study also benefited from a sort of participant observation which provides an insider perspective since the author is also a government officer in one of the Bureaus of the DA. However, this may also serve as one of the study's limitation due to possible personal bias.

The organization of the paper is as follows: First, the research setting is presented by providing background of the DA and its implementation of e-government and ICT-related initiatives. Second, using the ICT4D value chain, an assessment of the precursors, enablers and constraints and the intermediate outcomes of e-government initiatives aimed at mitigating problems of access and use of ICT in agriculture are discussed. Lastly, conclusions are then offered.

RESEARCH SETTING

Philippine Agriculture and the DA

The Philippines has traditionally been an agriculture-based country with the agriculture gross value added (GVA) peaking at 31% of the gross domestic product (GDP) in 1974 (World Bank). Although agricultural performance has declined, it still accounted for 10% of the GDP in 2014 (World Bank). The sector is mainly a rural activity which comprised 30% share of the total employment but farmers' daily wage amount to only US$5 to US$6 per day (Philippine Statistics Authority, PSA). The agriculture sector not only contributes to the economy but also provides for the national food basket and supplies raw materials to industries thereby cementing its role as a key pillar of the society.

The Department of Agriculture (DA) is tasked for the nation's agricultural progress by providing policy framework, public investments, and support services in order to improve farm income and generate work opportunities. It is headed by the Secretary of Agriculture and composed of Regional Field Offices (RFOs) tasked for administration of agricultural policies and strategies. It also has bureaus responsible for promotion of specific industries and attached agencies offering policy support and specific program coordination. While the DA maintains its regional directors in the RFOs, the municipal agriculturist and extension personnel were decentralized to the management of the local mayors in the local government units (LGUs) under the Local Government Code (LGC) of 1991.

DA's general ICT functions are handled by its Information and Communication Technology Section (ICTS) which crafts ICT policies, manage agricultural databases, develop ICT applications, sustain ICT infrastructure to support DA programs and provide training, advisory regarding ICT. It hosts websites of the DA, the bureaus, RFOs and attached agencies but individual content management falls under individual agencies' responsibility.

DA ICT4D VLUE CHAIN ASSESSMENT

As mentioned above, the ICT4D value chain by Heeks and Molla (2009) draws on a standard input-process-output framework to 1) better understand the resources and processes required in implementing e-government/ICT initiatives (Readiness), 2) tangible outputs and intermediate effects (Availability); 3) the extent of utilization of the ICT technology and 4) its contribution to rural and agricultural development especially in bridging the access and usage divides.

I. Readiness

This factor considers the precursors for any e-government/ICT initiative which includes the legal framework, ICT infrastructure and leadership. Readiness also takes note of the presence or absence of inputs such as finance, human and technological resource, political support and objectives of the agency implementing e-government/ICT initiatives. It considers how government tackles advantages/disadvantages of the presence/absence of precursors and how it utilizes the inputs to produce deliverables.

Precursor 1: Legal framework for ICT

Republic Act No. 8435 or the Agriculture and Fisheries Modernization Act of 1997 (AFMA) mandated the DA to modernize the agriculture sector by improving productivity and competitiveness of farmers. It provides support for national agricultural extension system to transform the traditional resource-based agriculture industry into a technology-oriented sector while upholding equal access to resources, opportunities and support services to improve the quality of life of agricultural stakeholders (Official Gazette, 1997). The AFMA directs the establishment a National Information Network (NIN) to provide access to agriculture and fisheries data via the Internet. Other laws[2] and internal department guidelines[3] contributed to the progress of e-government and related activities but the AFMA law served as sort of a blueprint for the advancement of agricultural technology.

Precursor 2: Institutional support

Institutional support pertains to the backing provided by other government and non-government entities involved in the implementation of e-government and ICT initiatives. These came from LGUs, state colleges and universities (SCUs) and the private sector. LGUs provide physical structures to house DA's national extension and training programs carried out by agricultural extension workers (AEWs). SCUs also provide training and technical assistance but it focuses more on research, monitoring and evaluation of extension projects. SCUs also provide information support services and serve as a source of expertise. Finally, the private sector has also played a role in the implementation of the e-government and ICT-related initiatives of the DA as a service provider or a partner. They have stepped in to where DA have lacked such as in the provision of e-services or solutions partners to support the priority programs of its different agencies (see discussion on *Software Applications*).

Precursor 3: Leadership

Past DA Secretaries have supported technological development and modernization while also showing concern for social inclusion. In 1999, former Senator Edgardo Angara, the author of the AFMA, was appointed as DA Secretary and initiated the AFMA's aims of modernizing the country's agriculture and fisheries sector. Then, former DA Secretary Leonardo Montemayor followed-up on the implementation and focused on the social equity aspect by launching countrywide assistance programs. Currently, DA Secretary Emmanuel Piñol has put productivity and poverty issues as his main agricultural agenda as he pushes for the intensive use of ICT to improve productivity in the agricultural sector. For instance, one of its banner projects is an online-accessible national color-coded agriculture and fisheries map to serve as a decision-support tool to help ensure food sufficiency and security (Philippine Information Agency, 2016). Additionally, former ATI Director Asterio Saliot pronounced full support

[2] Republic Act No. 8792 or the Electronic Commerce Act mandated the use of electronic mode of transactions (Official Gazette, 2000) prompting the DA to allow the use of electronic documents in processing agriculture-related certificates and permits.

[3] An example of an internal department guideline is Department Order No. 03 series of 2007 which designated the Agricultural Training Institute (ATI) as lead agency for the provision of e-Extension services (ATI, 2007).

and underscored the significance of e-learning programs saying: “If this (e-learning) is a gamble, I have invested all my money in it.”[4]

Input 1: Financial Support

ICT development in the Philippines has failed due to funding shortages and unsustainable allocation of resources (Minges, et al., 2002). Before the establishment of the DICT in 2016, there had been no overall national government budget policy for ICT which meant that every department needed to apply for ICT funding yearly to the Department of Budget and Management (DBM). This resulted in an uncoordinated assessment of government ICT expenditures and lack of guidance in prioritizing ICT requirements.

The DA-ICTS’s funding is an example of how financial challenges[5] hamper the implementation of e-government and ICT development. DA-ICTS’s funding is sourced primarily from the Department’s national budget appropriations to support operations, personnel services, maintenance and operating expenses, and capital outlay. On paper, budget allocations for the DA-ICTS increased from 2011 to 2016 to cope up with deficiency brought about by the termination of budget support envisaged by the AFMA (Table 1). However, the budget support for the NIN was said to have never been realized and that the implementation of various e-government projects was funded under the DA’s other budget appropriations such as support from DA commodity programs (Panganiban, 2016). This indicates that financial support has been a major constraint considering that the DA-ICTS manages the overall ICT functions of the Department and its agencies nationwide.

Table 1. DA ICTS Budget Allocation

Year	ICTS budget from DA General Appropriations	National Information Network (NIN) budget allotment
2011	35,293,000	91,872,000
2012	36,245,000	92,446,000
2013	39,920,000	92,446,000
2014[6]	130,605,000	0
2015	77,592,000	0
2016	128,950,000	0

Source: DA Information and Communication Technology Section

Input 2: Human Resources

Human resource is an input which could either facilitate or constrain e-government and ICT initiatives. In the DA-ICTS, personnel are sufficient compared with the average of three ICT personnel per agency average in the Philippines (National Computer Center, 2012). It has a total complement of fifty-eight (58) personnel composed of Information Technology Officers, Information Systems Analysts, Computer

[4] Remarks from E-Learning Training, July 2008. Retrieved from http://e-extension.gov.ph/agenda/maiden-issue

[5] The national budget for general e-government in 2015 was only USD20million or a measly 0.05% of the total national budget of USD 37billion (Official Gazette, 2015).

[6] Financial support from AFMA ended in the year 2013.

Programmers, Engineer, Computer Maintenance Technologists, Electronic Communications Equipment Technician, and Communications Equipment Operators and Administrative Staff. However, as with other government agencies, recruitment of technical personnel is difficult due to comparatively higher wages offered in the private sector. Trainings and performance-based incentives were also deemed lacking thereby lessening the opportunity to entice new recruits and even convince current personnel to stay in the agency (DA ICTS, 2016). Although current number of personnel is seen as adequate to effectively maintain the systems, continuing ICT skills development is still necessary to adapt to the fast changing technology (Panganiban, 2016).

Input 3: Technology

The basic ICT infrastructure of the DA includes wide area networks (WAN) and local area networks (LANs), business continuity and disaster recovery (BCDR) system, NIN knowledge management system (Information Repository/Data Warehouse), and Remote Sensing/Geographic Information System (RS/GIS). The DA-ICTS provides back-end technical support for administrative, finance and intranet of the Department and hosts a total of 81 websites and web applications (DA ICTS, 2016). The ICTS also provides technical support for front-end services such as the SPS import clearance application, electronic inward-foreign manifest and web publication of SPS and trade related legal issuances. On the other hand, agencies and bureaus of DA also provide ICT equipment and devices as required by their own programs[7].

Input 4: Values and Motivations

The DA channels all its programs towards increasing productivity and efficiency of the agricultural sector while maintaining the affordability of food and purchasing power especially among the poor. The sector's development is therefore crucial in achieving inclusive growth and poverty reduction as well as attaining the development goals (National Economic Development Authority, 2013). To achieve these goals through modern and technology-based agriculture and fishery sector the DA is driven by an acronym they call "SMART AGRI":

1. **S**eamless interconnectivity within the DA;
2. **M**ainstreaming of ICT in Disaster Risk Reduction and Management (DRRM) and Climate Change Adaptation (CCA);
3. **A**gribusiness linkage development;
4. **R**eal-time market information exchange;
5. **T**ransparent governance through monitoring, feedback mechanisms, open communication with stakeholders and partners;
6. **A**lignment of ICT initiatives with DA core activities such as programming production and harvests schedules; facilitation of credit and financing; and better rural education and extension programs;
7. **G**eo-database management of agricultural resources and government interventions to improve farm operations;
8. **R**isk management utilizing ICT resources and services; and,

[7] For example, the Philippine Rice Information System (PRISM) of the Philippine Rice Research Institute (PhilRice) provides their own servers, laptops, smartphones and other technological devices to support the program and achieve their purpose (PhilRice, 2016).

9. **I**nteroperability of systems and applications within the DA (DA ICTS, 2016).

Input 5: Political support

Political leaders have supported the use of technology in agriculture to enhance the sector through increasing crop yields and making it disaster-resilient. Former Senator Edgardo Angara, also a former Secretary of the DA and author of the AFMA encouraged the government, academe and industry collaboration for the agricultural sector to utilize ICT in aiding farmers in their farm management (DA). The Congressional Commission on Science, Technology and Engineering (COMSTE) has petitioned for public-private partnership (PPP) in precision farming and smart agriculture through allocating funds from the national budget (Senate of the Philippines, 2012). Recently, the chair of the Senate Committee on Agriculture and Food, Senator Cynthia Villar supported crafting of policies to address the barriers to competitiveness of local farmers and fishermen specifically the improvement of farmers' access and use of technology (Senate of the Philippines, 2016). From these instances, it can be observed that there is ample political support for the advancement and use of ICT in agriculture.

II. Availability and Uptake

Availability assesses how inputs are converted to tangible deliverables in the implementation of the e-government/ICT-related program. To simplify the discussion, the uptake factor was combined in the discussion through presenting agency data. Heeks and Molla (2009) refer to uptake as the perceived adoption, use, scalability and sustainability of programs.

Farmer's Information Technology Services (FITS) Center

The Farmer's Information Technology Services (FITS) Center is an information and technology delivery service facility aimed at improving science-based information and technology access of farmers, traders, processors, entrepreneurs and other stakeholders (Magcawas, 2014). It is one of the components under the Techno Gabay Program[8] (TGP) which entails cooperation of research and development institutions, the private sector, LGUs, Non-government organizations (NGOs) and other extension service providers. TGP uses a participative approach in which AEWs and/or farmer scientists fill the intermediary role of guiding other farmers in the transfer of knowledge and technology. The TGP started with only five Farmers' Information and Technology Services (FITS) centers in 1997 but has grown to 740 FITS centers in 2010 (Magcawas, 2014). In 2012, the administration of the TGP was turned over to ATI through Executive Order 801 of 2009 to further institutionalize and encourage its adoption at the local level (Official Gazette, 2009). Under the ATI, FITS Centers aim to build an electronic and interactive bridge where farmers, fishers and other stakeholders will be able to modernize and be competitive (ATI).

Farmer's Contact Centers

In 2009, the Farmers' Contact Center (FCC) was launched by ATI to provide technical and business advisory services through voice calls and text messages. By

[8] *"Gabay"* is a Tagalog word meaning "guidance". The TGP was created originally under the Department of Science and Technology's (DOST) Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD).

using mobile phones, queries are sent in through text and a human agent replies through the support of a pool of experts. FCC collaborates with partner institutions such as the Department of Science and Technology (DOST), LGUs, SCUs and other stakeholders in agriculture and fisheries extension. It has evolved to include e-mails and other online communication such as instant messaging and online forums. Table 2 shows the increase in number of queries from 2009-2016 particularly using the Mailbox, Shoutbox, and Forum channels which are done through the ATI interactive website.

Table 2. Queries Answered through the ATI's Farmer's Contact Center[9]

Year	Text and Call Support	Mailbox/ Shoutbox/ Forum	Instant Messaging	Total
2009	2,751	197	82	3,030
2010	4,262	3,119	146	7,527
2011	4,362	5,280	231	9,873
2012	2,732	5,364	118	8,214
2013	2,128	3,539	89	5,756
2014	3,088	6,117	234	9,439
2015	6,826	7,297	419	14,542
2016	16,117	9,057	466	25,640
				84,021

Source: Agricultural Training Institute Farmer's Contact Center

Extension services through ICT use

ICT use refers to the use of information technology (IT) devices and tools (e.g. desktop and laptop computers, smartphones, and the Internet) for collecting and processing agricultural information and providing decision making support toward the achievement of agency/program goals. An innovative program in which ICT use has been effectively used is the Philippine Rice Information System (PRISM). PRISM is owned, operated and sustained by the DA through the Philippine Rice Research Institute (PhilRice) and in collaboration with the IRRI, Sarmap[10], and the DA RFOs with funding support from the DA National Rice Program and the Bureau of Agricultural Research (BAR) (PhilRice). It collects, analyzes and delivers reliable information on seasonality, area, yield and yield-reducing variables using data collected from satellites, crop models, smartphone-based surveys, statistics, and maps. Its use of location-based services allows collaborators to understand patterns and relationships of agricultural variables such as crop calendar, land practices, and precipitation data through time, thus, helps in the effective farm management. As of 2016, the PRISM program has monitored 780 fields across 16 regions, 27 provinces and 43 municipalities spanning

[9] Text and call refer to calls and messages through mobile and landline numbers of the ATI; Mailbox/ Shout box and Forum refer to the general queries received at the e-learning portal; Instant messaging refers to messages received through ATI's Facebook Account/Messenger.

[10] Synthetic Aperture Radar (SAR) is used to analyze changes in farming areas' physical properties (e.g. soil properties, roughness, moisture content, or rice growth and its evolution through time) the acquired data over time (Sarmaps).

almost 2 million hectares of rice lands in the Philippines. PhilRice has claimed that PRISM's rice production forecast has an overall accuracy of almost 90% compared with agricultural data from the PSA.

Web portal for Market Information and Linkage

The Agriculture and Fisheries Market Information System or AFMIS (http://afmis.da.gov.ph/); and FilFARM (http://filfarm.e-extension.gov.ph/index.php) are noteworthy e-services that have provided farmers and producers with up-to-date market information and linkages. AFMIS provides integrated national and local cluster-based information on commodity prices in Metro Manila and selected provincial markets through the Internet and short messaging system (SMS) on mobile phones. It also lists the roster of buyers and sellers of agricultural commodities into a database which can aid in their matching. On the other hand, FilFARM was developed for 1) farmers and producers in remote rural areas particularly in the islands of Visayas and Mindanao to advertise their farms and commodities; and 2) potential buyers to get information and interact with the farmers and producers without having to physically travel to the actual location. Although these websites have narrowed the gap in access of market information, according to DA Assistant Secretary for Agribusiness Leandro Gazmin, there is still much to be improved in terms of linking farmers/producers to credit facilities and input and technology support for farmers (Panganiban, 2016).

E-extension/E-Learning

The e-Extension program (http://e-extension.gov.ph/) of the ATI was launched in 2007 to offer online learning courses (e-learning) developed in collaboration with other DA agencies, academe, local government units, and the private sector. These e-learning programs are designed for AEWs, farmers, fishermen, rural women, youth and other stakeholders. To provide physical access, the program is provided in E-Learning Offices (ELOs) countrywide to house the e-learning initiative and provide physical access. Each ELO is equipped with basic connectivity services (computers and broadband Internet connection) and established in 18 ATI Training Centers spread across the country. It has a total of 154 courses and resources and has 45,478 total current users (E-Learning for Agriculture and Fisheries). Although e-learning basically equates to distance learning, it also has the ability to utilize blended approach in which face-to-face interaction with AEWs in ELOs or FITS centers is combined with online consulting between learners and experts. The use of local languages such as Tagalog, Cebuano, Iluko, and Hilagaynon in some of DA's e-services such as Philrice's Pinoy Rice Knowledge Bank (http://www.pinoyrice.com/) adds to the ease in understanding and utilization of information by farmers. Websites This highlights the importance of having the local language understood by the population as the medium of instruction in websites or web applications in order to effectively utilize the service provided (Kaaya, 2004).

Software applications

Software applications process data for the user and come in the form of web browsers, e-mail client, word processor, spreadsheet, database, and presentation graphics, among others (PC Mag). These applications are utilized by the DA as

decision-support tools for better agricultural management, more efficient e-extension services and offer location specific services. On the other hand, farmers could access and utilize information through the use of ICT devices and with the help of extension workers to guide them step-by-step using the aforementioned devices.

Rice Crop Manager (RCM) advisory service is one of software applications developed by DA and the International Rice Research Institute which provides rice farmers with a personalized crop and nutrient management to reduce production costs, increase yields, increase net income, and facilitate a professional extension service. It uses Global Positioning System (GPS) to trace rice fields and match inputs such as fertilizers and rice varieties to the specific field. Through text messaging, farmers are reminded of recommended farming practices and additional information from the DA. Farmers' production information and farming practices are collected and monitored to determine their actual practices during cropping season and the farmer's uptake or application of RCM recommendations (IRRI). The maintenance of farm operation records also enables farmers better negotiating position for crop insurance and loans since financing institutions can better judge the sustainability of farm operations. The collection of historical rice production data further improves the ability of government to provide future technical recommendations. Further, some trainings on RCM also included farmers' children as competent intermediary to transfer the knowledge indirectly. Even if the farmers are not directly accessing the Internet and using mobile communications, they get the information second-hand from their family members thereby benefiting from internet by proxy.

The uptake of the RCM service seems sustainable since it has significantly increased from 788 recommendations since its inception to 355,441 recommendations in 2016 (Table 3). Figure 2 also shows that most of the farmers benefiting from the service come from regions outside Greater Manila Area and nearby Southern Tagalog: Region II or the Cagayan Valley (33%); Region III or the Central Luzon; and Region I or the Ilocos Region rounding off the top three regions in terms of recommendations.

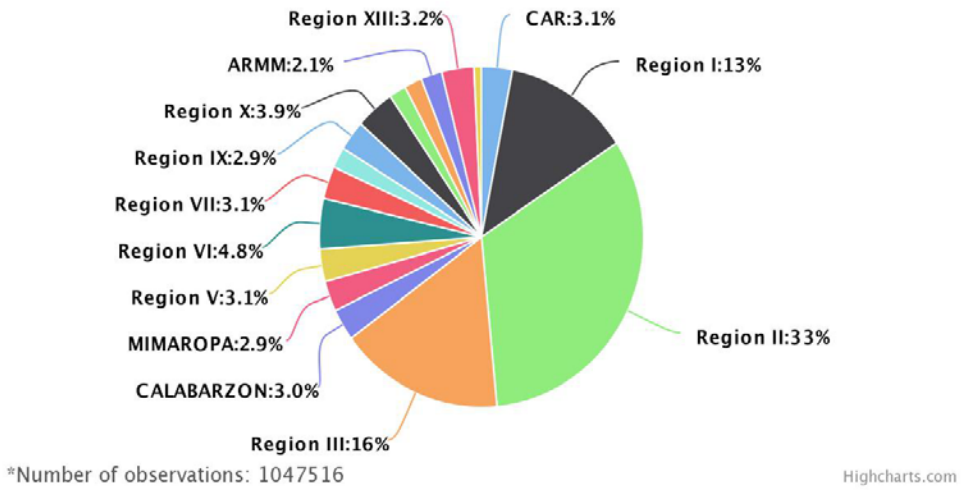
Table 3. RCM Recommendations by Year

Year	Number of Recommendations
2013	778*
2014	281600
2015	359306
2016	355414
2017	50418**
Total	1,047,516

**Covers November and December 2013 only*
***Covers January to May 1, 2017 Only*

Source: Rice Crop Manager Advisory Service

Figure 2. Percentage of RCM recommendations by Region



Source: Rice Crop Manager Advisory Service

Social media use

The emergence of social media has aided e-government initiatives by serving as an inexpensive and real-time platform to distribute information especially in situations when rapid sharing of information is of the essence (Paris, Lee & Seery, 2010; Waters & Williams, 2011). Although it was suggested that the analysis of social media use in government is still in its infancy, it has gained increased importance in terms of public-private interactions (Magro, 2012). In the DA, all of its bureaus, attached agencies, attached corporations and regional field offices have utilized social networking platforms as an alternative information dissemination channel while also serving as a venue where clients can share their user-created content and provide important feedback to the government (Panganiban, 2016). Facebook is being used by DA and its agencies to share recent news about the DA's activities, post and/or link announcements and pertinent events, and recently, broadcast important activities such as trainings and seminars through Facebook Live function. Because of social media's real-time characteristic, it has been used to communicate early warning messages and seasonal forecasts for agriculture application so that emergency response can be prepared before disaster strikes (Department of Agriculture RFO 5). User-generated content from citizens are also produced such as photos of damaged rice fields, dead livestock during disease scares uploaded in social media networks and which aids especially during post-disaster assessments. Finally, social media channel is being utilized to encourage feedback from the public so that citizens may be able to communicate with government and public officials directly without the traditional bureaucratic barriers. This gives a much more responsive, warm and personal feel which is contrary to the regular perception of an unresponsive government.

III. Impacts

This part focuses on the effect of the project/program composed of 1) outputs or the micro-level behavioral changes associated with the e-government/ICT program; 2) outcomes or the perceived benefits and 3) development impacts or the contribution of

the e-government program to development goals, and in this case, the narrowing of access and usage divides.

Outputs: Communication patterns, Linkages and Decision support

Face-to-face communication remains to be a big part of delivery of public services in agriculture as evidenced by the establishment of FITS centers in almost half of the municipalities in the country (ATI). From the FITS centers, farmers are able to physically access the Internet, receive information, education and communication (IEC) materials and receive training support from the agricultural extension workers and devolved local government personnel of the DA. Aside from serving as structures for physical access, these centers serve as a solution for farmers' technophobia affirming Holmes' (2001) assertion that these initiatives will be more successful if extension workers are there to tap the keys and click the mouse for the clients. In addition, the farmers have not only to adopted the technology but have been enabled to conveniently reach the government through contact centers, web portals and social media pages of the DA. All of these endeavors help in projecting a more responsive and citizen-centered government.

DA e-government services have afforded farmers and producers no only to communicate with the government but also opened up opportunities to link with stakeholders amidst the distance. The DA's AFMIS provides the latest price updates and linkages with a wider set of customers around the country's capital while ATI's FilFARM website provides new market opportunities and information on demand for agricultural products in far-flung rural areas such as those located in the Visayas and Mindanao regions. The AFMIS has also lessened farmers' reliance on middleman traders to quote them of commodity rates since these are already uploaded in the Internet. It also served as a way for farms to get free advertising for their farms and farm produce. Thus, they are now devoid of what they would usually lose in transportation costs, discomfort, and oft-perceived corrupt behavior by public officials through e-government.

The use of ubiquitous ICT tools such as mobile communication has also emerged as an alternative way of delivering government services to unserved farmers (Lallana 2004). The increase in the number of inquiries through the Farmers' Contact Center from 2009-2016 shows how mobile communication through text and call and the emergence of the Internet have expanded the preferred modes for getting farm advice. Newer mobile applications such as the Rice Crop Manager gives farmers location-specific and on-time information of disease diagnosis, weather forecasts, and access to crucial data for decision-making essential to producers (Ntaliani, Costopoulou & Karetsos, 2008). At the same time, these mobile applications assist government in catering their interventions more specifically to areas where these concerns emanate from and are much needed.

Outcomes: Farmers' Access and Use of the Internet and ICT through Collaboration

The ICT and e-government services of the DA, however modest, have achieved outcomes which benefited the farmers and the government itself. The FITS program has proven to be an effective mode of extension service as it was adopted as part of the national strategy explicitly stated in the Medium Term Philippine Development Plan

(NEDA). It has entailed an increase in production output, income improvement, and efficiency in farm input use (UN FAO, 2016; Magcawas, 2014; Peña & Bathan, 2016). Farmers have utilized new technology and knowledge better because these decision-support tools fit the local context. Through the RCM and PRISM, it is now easier for farmers to apply for crop loans since they have record of their farm management and operations thereby empowering them to have more control of their farming decisions and their livelihoods. Through capacity building workshops, farmers are adopting technology easier due in large part to the role of intermediaries (extension workers or even their own children and relatives). William Dar, former Secretary of Agriculture highlighted the important role of "knowledge intermediaries" in aiding rural communities to effectively learn and apply farming technologies. Although challenged because of lack of educational backgrounds, farmers are now learning through their children how they can learn and benefit from technology (Dar, 2016).

Collaboration was highlighted in several e-government and ICT efforts of the DA. This underscores the importance of innovative complementation mechanisms among national agencies, LGUs, AEWs and the farmers for them to benefit from the Information Age. Perhaps due to the lack of funding support, collaboration between the DA and private sectors developed the FITS and produced new age applications such as PRISM or RCM. As technological advances have increasingly hollowed the boundaries between the public, private sectors and other stakeholders, deeper collaboration among these actors proved crucial in achieving development impacts such as dependable physical access and sustained utilization of high-technology e-government services especially in rural areas and in farmer communities. Authors have claimed that the hierarchical structure of the government is not fit with the demands of the time, which is horizontal, networked government (Eggers 2007; Holmes 2001).

Development Impacts

The narrowing of the digital divide is a daunting challenge for any government to tackle but however incremental the evidences may seem, there are positive exemplars. The FITS program implementation was said to have improved farm productivity and profitability as well as quality of life (Peña & Bathan, 2016). Farm yields, net income and technical efficiency of FITS farmer beneficiaries were higher as compared to non-beneficiaries (Magcawas, 2014). The changes in the program beneficiaries' lives, knowledge, attitudes and skills, behavior, and economic and social conditions were also observed (Cagasan & Velasco, 2009). In addition to the reported benefits, the government also gained through improvements in field technicians' extension delivery capability through information and technology delivery services. The institutionalization of TGP/ FITS strengthened networking of research and development institutions in the agriculture, forestry and natural resources sectors in the provinces, cities and municipalities and the Mindanao region as a whole (NEDA).

As for the usage divide, the uptake of RCM shows on the surface that farmers have adopted the technology and gained benefits. PRISM has also achieved the same by going from a top-down approach to a more ground up strategy of involving LGUs and farming communities in planning and managing local information. This has led to more accurate forecasts about the processes of production and harvesting, that when linked to financing institutions, could have the potential to improve on farmer's sustainability.

Finally, to estimate whether farms in remote areas do indeed use the Internet and e-government services of the DA, the author emailed the roster of farms in the FilFARM website to inquire about the effectiveness of the said e-service. Although only 11 out of the possible 39 farms[11] replied to the self-completion questionnaire (Appendix A), majority of the replies were positive citing that although FilFARM is relatively new, it has improved their farms linkage with clients, increased information about their farms as evidenced by inquiries and farm visits, thus, also improving their farm incomes. Farm owners have also lauded the efforts of the DA and even suggested that more support for innovation is needed[12].

CONCLUSION

For citizens to participate in the Information Age, they should not only be able to physically access information but to also be knowledgeable on how to effectively use it. So have DA's e-government services reached the constituencies who need e-services the most? The answer is in the affirmative and it implemented through the provision of communal access the Internet and use ICT facilities through FITS centers and ELOs. At the same time, farmers are also trained by AEWs in order to use applications which have user-friendly interfaces and location-specific services. The emphasis on local context which is fit to the actual situations of different communities made ICT use more adoptable for rural farm folk (Heeks, 1999).

The facilitating factors that played a role in the success were the legal framework, leadership support, the use of intermediaries, and collaboration. The AFMA enabled the DA to implement agricultural modernization which set the tone for a competitive and technology-based sector accessible to all. Past DA secretaries and managers had been keen in utilizing ICT and the Internet and this hinted to the rest of the organization about the serious focus on modernization. From the bottom of the bureaucracy, intermediaries served a big role to ease farmers into adapting new technology through a blended approach. The mix traditional forms of information delivery such as face-to-face demonstration and traditional media was not be supplanted but was complemented by ICT initiatives of the government (Manalo, et al., 2010).

These efforts have resulted in an improvement of the existing patterns of communication, linkages and decision support systems. Farmers reach and interact the government through various channels and could now share user-generated content through software applications and social media. The linkages that government created through e-government services have also gained encouraging perception from stakeholders. The improvements in technology and the proliferation of user-generated media such as that of social networking sites have aided the DA in its e-governance initiatives. The agency may have finally recognized that a hierarchical approach may not be applicable anymore especially if it wants to create an impact with the stakeholders who need its services the most. These developments have been achieved in large part due to different actors working together. Collaboration with institutional partners, local actors and the farmers were vital since efforts such as FITS, PRISM and RCM would not have been achieved by government alone. Through partner agencies who know the

[11] There were 55 total farms in the roster of the FilFARM website but 16 email addresses turned out as not working.
[12] Email communication with farms registered with FilFARM website.

situation in the ground, DA was able to determine what interventions matter and what can be adapted most by their stakeholders. These collaborative relations helped government get through financial and infrastructure constraints to provide services at a cheaper or even at no cost compared to government going at it alone.

The findings of this study could point to policymakers and public administration practitioners to look deeper into the seeming shift from a top-down approach to a more grassroots oriented bottom-up approach and the importance of collaboration to create public value. Despite the physical constraints and financial limitations that face government, DA was able to innovate through collaboration of partners from private, local and international organizations to hurdle the challenges. The use of the Internet and ICT-related technology in farming is inevitable and although there are larger problems in Philippine agriculture aside from the technological - better farm-to-market roads, better public services and better governance - it is important to harness the enabling power of ICT not only in improving delivery and quality of government services especially to country's most marginalized sectors. Indeed, technological interventions alone cannot bridge the Digital Divide but it is how the technological content is made available and usable to its end user which matters most. While still needing more empirical data to support the argument if the farmers' access and effective use of information have indeed created an impact, it can be surmised that steps in the right direction have been made.

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APPENDIX A

Questionnaire on FilFARM Website

To: (Name of Farmer/Farm/Agribusiness):

Magandang araw po (Good day!). This is Glenn Panganiban from the Department of Agriculture. I am currently pursuing my graduate studies and doing a research on the impact of e-government and ICT initiatives of the DA specifically the FilFARM portal of the Agricultural Training Institute. In connection with this, I would like to ask the following questions:

1. Is the FilFARM website accessible from your farm/business operations? If no, why?
2. How do you usually connect to the website? Is it by modem, broadband internet, or mobile internet?
3. Did the FilFARM improve access to your business by your prospective clients?
4. Do you think the FilFARM helped improve your businesses' operations (e.g. lessen cost of advertising, improved information dissemination or helped increase your profits?)
5. What do you think can the government do to further improve FilFARM?
6. Are there any other suggestions that you would like to make about the ATI or DA's services in general?

I would like to request for you to kindly answer candidly. Your replies will be treated with confidentiality and would be used purely for academic purposes. Thank you very much in advance for your cooperation.

Best regards,
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