Asian Journal of Agricultural Extension, Economics & Sociology

38(11): 264-277, 2020; Article no.AJAEES.63859
ISSN: 2320-7027

Political Innovations for ICT Institutionalization in Benin Agricultural System

Mori W. Gouroubera[1*], Latifou Idrissou[1] and Ismail M. Moumouni[1]

[1]Laboratory of Research on Innovation for Agricultural Development, University of Parakou, Benin.

Authors' contributions

This work was carried out in collaboration among all authors. Author MWG designed the study, performed the analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors LI and IMM contributed to design the framework of this study. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2020/v38i1130475
Editor(s):
(1) Dr. Mohammad Aslam Ansari, G. B. Pant University of Agriculture & Technology, India.
Reviewers:
(1) Simantini Shasani, OUAT, India.
(2) Kapil Dev Sharma, University of Kota, India.
Complete Peer review History: http://www.sdiarticle4.com/review-history/63859

Review Article

Received 05 October 2020
Accepted 11 December 2020
Published 31 December 2020

ABSTRACT

Information and Communication Technology (ICT) plays a significant role in addressing the challenges in agriculture in many countries. However, the institutionalization of ICT in any country's agricultural system highly depends on its ICT policies. Benin's agricultural sector has undergone many policy reforms since its independence in 1960 which caused changes in the orientation of ICT usage. This article aims to analyze ICT integration policies in agriculture in Benin regarding the innovations brought to facilitate its institutionalization. Therefore, three (3) dimensions of national political innovations are explored: innovation propensity, innovation capacity and innovation practice. A qualitative approach was adopted based not only on policy documents analysis such as laws, decrees and projects/programs but also on interviews with 30 key persons involved in the sector. The results showed that: (i) ICT has long been overlooked in agricultural policies in Benin; (ii) Low propensity and capacity was noticed regarding innovation of ICT integration in agriculture from 1960 until 2014. After this period, several innovations were introduced but they are still under innovation practiced. This study shows to researchers and practitioners that high political innovation propensity in the field of ICT integration in agriculture does not guarantee its institutionalization. The three concepts –innovation propensity, innovation capacity and innovation practice are inter-linked

**Corresponding author: E-mail: gourouwm@gmail.com;*

with each other in successfully institutionalizing ICT in agricultural sector. In the case of Benin, despite the fact that several innovations have been introduced their institutionalization is lagging behind. The results are useful for ICT policies, researchers and practitioners to better understand the process of ICT integration in agricultural system.

Keywords: Benin; ICT in agriculture; institutionalization; political innovation.

1. INTRODUCTION

Information and Communication Technology (ICT) is increasingly used in development of several sectors such as agriculture, education, health, etc. and more specifically agriculture sector in many counties [1]. In Benin, from colonial period to now, agricultural sector has undergone several reforms in order to include ICT. Even though, being the mainstay of Benin economy, it faces difficulties such as poor access to information; funding which are needed to be improved [2].

Several studies carried out in different African countries gave more voice to ICT integration into agricultural system in addressing its challenges [1,2]. According to the US Agency for International Development (USAID) [3] and Food and Agricultural Organization (FAO) [1], ICT offers several platforms such as access to information, financing, training and market to farmers. The success of ICT integration in agriculture depends in some ways on the nation's policy and institutional framework. However, there are few researches published on states' digitalization policies [1]. This is the case of Benin where there is no study published to the best of our knowledge on ICT integration policies into agriculture system and their effectiveness. Meanwhile, there are continuous reforms that aim at integrating ICT into agricultural sector year after year. Successive governments have made agriculture sector their priority by initiating different policies to integrate ICT into the system. Nevertheless, the results obtained are far away from expectation. That leads to question the effectiveness of these policies. It also raises the challenges of finding adequate strategies for ICT integration into agricultural system; in other words, its institutionalization that will guarantee its sustainability. Furthermore, since 2016 in Benin, the agricultural sector has passed through major reforms than never before, especially in the digitalization of agriculture which is still lagging behind. In this context, it is important to make an analysis of ICT integration policies in agricultural sector in Benin and contribute according to FAO [1] to the availability of research results on policies concerning the use of ICT in agriculture. It will also inform practitioners as well as researchers the relationship between ICT political innovations and their institutionalization.

Considering the current context of ICT integration policies in agricultural sector, this article aims to analyze the innovativeness of Benin's government to promote the integration of ICT in agriculture. According to Sørensen and Torfing [4], political innovations are defined as intentional efforts to transform political institutions designed to strengthen the decision-making process, and the content resulting from these policies. These political innovations are essential for the development of a nation [5-7]. This analysis is based on the political theories of innovation [4,5]. It helped to conceptualize three dimensions of political innovation –innovation propensity, innovation capacity and innovation practice to explain the process of integrating ICT in agriculture in Benin.

2. RESEARCH ANALYTICAL AND METHODOLOGICAL FRAMEWORK

2.1 Political Innovation

Political innovations are defined in several ways. They are defined as changes in the political system motivated by new political ideas [8].They also represent a political mechanism, structure or process that is new to the specific polity [9]. For Sørensen [10], political innovations are defined as intentional efforts to transform political institutions designed to strengthen the decision-making process, and the content resulting from these policies. They are sort of institutional innovation because rules are changed to produce desirable outcomes [5]. Several authors argued that, political innovations are seen as means to strengthen the political system but also as strategies to reach unacknowledged interests [11]. With this regard, Political innovations in the field of ICT integration may not be in the sense of really integrating ICT in agriculture sector but rather to gain popularity for example [11].

Political innovations are characterized by three main phases [12,13]. These three phases are: (i) selecting the political innovation, which means that an idea to be selected has to compete with other promising ideas in order to get support or be financed [14]. It can be selected or not; (ii) implementing the political innovation is providing the selected idea with the required action such as budget, facilities, equipment etc. In other terms to make it work [15]. According to Fakhoury [16], the implementation of digital policies by states requires a strong administrative capacity; and (iii) connecting the political innovation to the institutional context, that is to say the selected idea has to be accepted and put into practice by beneficiaries.

These aspects of political innovation formed the basis of the present study. So, the framework for analyzing ICT integration in agriculture are based on three phases of political innovation. Political innovation is perceived as decisions, laws, decrees, strategic documents which have been initiated by the successive governments from 1960 until 2020 to facilitate the integration of ICT in agriculture. However, specific aspects of these three phases are considered in the present study. Based on these phases, three dimensions of political innovation are defined (Fig. 1). These dimensions are: (i) innovation propensity of the government which represents the number of decisions, laws, decrees, strategic documents decision taken by successive governments; (ii) innovation capacity. It represents the actions taken to facilitate ICT integration; and (iii) innovation practice –the effective usage of the idea.

2.2 ICT in Agriculture

ICT consists of Information and Communication Technologies including devices, networks, services and applications in internet age. It also includes telephones, mobile phones, television, radio and satellites [17].

2.3 Methodology

The present study took into consideration wide variety of legal documents related to ICT integration policies in agriculture in Benin. These documents consist of laws, decrees, projects, programs, agricultural strategy documents and draft documents. The key documents analyzed are presented in Table 1.

Then, in-depth interviews with key persons who have an experience in agriculture sector were conducted, especially at the operational level –at Territorial Agencies for Agricultural Development (ATDA), Departmental Direction of Agriculture, Livestock and Fishery (DDAEP) and Non-Governmental Organization (NGO). A total of 30 respondents were interviewed. Most of the questions addressed to them where related to innovation capacity and innovation practice. These interviews allowed us to analyze the effectiveness of ICT implementation measures. Websites were consulted mainly that of the Ministry of Agriculture, Livestock and Fishery (MAEP) (http://agriculture.gouv.bj/) and the Ministry of Digital Economy and Communication (MENC) (https://numerique.gouv.bj/). The documents collected were analyzed in a qualitative, diachronic manner from 1960 to July 2020 taking into account the analytical framework in Fig 1. Ten (10) main intervention approaches were identified. In each approach, a set of tools is highlighted. Each approach is guided by an intervention principle that may or not give much interest to ICT integration. For each approach, the type of ICT is indicated. Their level of valorization was also assessed. They were classified into three (3) categories – high, moderate or low. The classification was based on the perception of the key actors interviewed and also the implementation documents consulted.

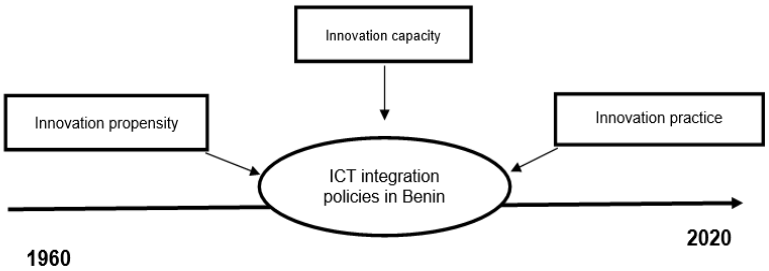

Fig. 1. Analytical framework
(Source: The author)

Table 1. List of main documents and websites consulted

Nature	Object	Aspects of ICT approached	Period
Political document	Rural development politic declaration letter (LDPDR)	It encouraged the use of radio	1991
Political document	Rural development politic declaration (DPDR)	It encouraged the use of communal radios	2000
Political document	Rural development blueprint (SDDR)	It encouraged the use of communal radios	2000
Plan	Operational strategic plan (PSO)	It encouraged the use of communal radios	2000
Decree	Decree no 2001-097 of February 20, 2001 related to chambers of agriculture creation	Empowered agricultural stakeholders in defending their interests such as ICT inclusion in the system	2001
Decree	Decree no 2006-069 which enabled Benin to set up Post and Telecommunications Regulatory Authority.	Turned ICT environment more attractive	2006
Diagnostic study	"Livre blanc" on agricultural advisory in Benin	Gave an overall understanding of agricultural approaches used over time and how ICT were taken into consideration	2007
Diagnostic study	Telecommunication sector performance study	Revealed difficulties confronted and action to be taken	2007
Diagnostic study	ICT companies in Benin	Revealed how ICT companies operates in Benin	2010
Plan	Agricultural Sector Strategic Recovery Plan (PSRSA)	Initiated actions to be taken in agricultural system in order to include ICT in it	2011
Plan	National Strategy for Agricultural and Rural Training (SNFAR)	Promote ICT in agricultural training	2014
Law	Law no 2014-22 of September 30, 2014 related to digital broadcasting in Benin Republic	Regulated ICT usage	2014
Law	Law no 2014-14 of July 9, 2014 related to the use of ICT in Benin.	Regulated ICT usage	2014
Law	Law no 2015-07 of March 20, 2015 on the Information and Communication Code	Regulated ICT usage	2015
Law	Law no 2016-17 of October 04, 2016 on the strengthening of agricultural chambers	Empowered stakeholders in defending their right including ICT usage	2016
Program	Government Action Program (PAG) 2016-2021	Initiated projects to promote ICT usage in agriculture	2016
Plan	Strategic Plan for Agricultural Sector (PDSA) 2025 and National Agricultural Investment Plan and food and nutrition security (PNIASAN 2017-2021)	Recognized ICT to be the backbone of agricultural sector. So, e-agriculture is recommended. Some amount of money was also voted to support the initiative	2017
Plan	Agricultural sector program framework	Set a framework to promote agriculture base on ICT	2017
Law	Law no 2017-20 of April 20, 2018 on Digital Code in the Republic of Benin	Regulated ICT usage	2017
Decree	Decree no 2018-256 of 20 June, 2018	Regulated ICT usage	2018

Nature	Object	Aspects of ICT approached	Period
	approving the National Radio Frequency Plan in the Republic of Benin		
Decree	Decree no 2018-280 of 04 July, 2018 related to management methods and distribution for digital dividend fund in the Republic of Benin	Regulated ICT usage	2018
Plan	Agricultural advisory national strategy (SNCA 2) 2019-2025	Promoted e-extension	2018
Diagnostic study	Digital technologies in agricultural sector and rural areas	Set pathways to improve agricultural sector using ICT	2019
Project	Agricultural diversification support project (PADA)	Supported many project in agriculture sector which promote in some ways the use of ICT	2019
Plan	National strategy for e-agriculture in Benin 2020-2024	Promoted e-agriculture	2019
Website of MAEP	http://agriculture.gouv.bj/	In charge of agricultural sector. So, different initiative were taken to promote ICT in agriculture the ministry.	-
Website of MENC	https://numerique.gouv.bj/	In charge of ICT development in Benin not only in agriculture but also in other sectors.	-

Source: the author

The participation in the two editions of "*Salon des TIC*" for agriculture initiated in Benin to promote ICT in Agriculture allowed to enrich the data. The first edition was held on September 26, 2018 at University of Parakou, Benin. The second edition was on November 13, 2019 held at National University of Agriculture, Porto-Novo, Benin. It gathered researchers, public, private organizations and the members of MAEP.

3. RESULTS

3.1 Historical Analysis of ICT Integration Policies into Agricultural Sector in Benin

Benin has undergone several reforms since its independence in 1960. The level of ICT usage in agriculture has been changing over time due to the technological revolution in agriculture across the world. The analysis of Table 2 shows that Benin went through different approaches in implementing agricultural policies since 1960 until 2020. Each approach valued specific ICT. Indeed, we noted that the most valued ICT by these approaches for a long time were radios. Over time other ICT were integrated into the system (phones, video projectors, exchange platforms, tablets, smartphones, drones, GPS etc.). However, their utilization remains focused on extension workers' level.

3.2 Analysis of ICT Policies, Institutions, Projects / Programs in Benin

3.2.1. ICT policies

In Benin, in recent decades, there are several reforms in order improve ICT utilization. So, there is a strong desire of Benin government to regulate this sector. That has started around 2000 with telephone companies' emergence and the increasing use of the internet nationwide. It led to adopt several decrees and laws regulating ICT usage in Benin. These laws and decrees are:

- The first step leading to the adoption of several laws and decrees was Benin's initiative to join United Nations Development Program (UNDP). This membership encouraged the adoption of a number of decrees and other initiatives.
- The first initiatives led in March 2000 to the adoption of a plan reducing constraints and other administrative burdens. So, conditions about ICT utilization started being favorable. Thus, ICT imported equipment were granted tax exemption. The plan was called "Benin Information and Communication Infrastructure Development Plan".

- Decree no.2006-069 on March 1, 2006, which enabled Benin to adopt a regulatory authority for posts and telecommunications.
- From 2016, with the current government, several other decrees were adopted: the decree no.2018-256 on June 20, 2018 approving the National Radio Frequency Plan in the Republic of Benin and the decree no.2018-280 on July 04, 2018 related to management methods and distribution for digital dividend fund in the Republic of Benin
- We also have a number of laws adopted: law no.2014-22 on September 30, 2014 related to digital broadcasting in the Republic of Benin; law no.2015-07 of March 20, 2015 on the Information and Communication Code; law no.2017-20 of April 20, 2018 on the digital code in the Republic of Benin. These laws are adopted to better regulate the ICT environment in Benin.

The analysis of these different decisions taken highlights that, Benin government has made considerable effort in terms of regulation to support ICT integration in agriculture, especially in the last decade. From this analysis, three main periods were distinguished which can also be associated with the evolution of ICT in Africa as follow: (i) a period of lack of ICT regulation until 2000 even though Benin was the first country in West Africa to get connected to the Internet in 1995 [18]; (ii) a period of awareness of ICT. This period was marked by the adoption of several decrees and laws in order to comply with the global trend. Benin is one of the last countries to

Table 2. Approaches and ICT used over time

Approches	Definition	Type of ICT used	Level of valorization	Period
Sector based approach	It is focused on promoting a specific sector using a top-down approach	Radio	High	1960
Training and Visit	Top-down approach based on mass agricultural extension and demonstration plot as the main tool	Radio	High	1986
Village Level farmer Approach (APNV)	More participative approach than the previous ones. It aimed at involving farmers but still remained low that led to other approaches	Radio	Moderate	1996
Farmer to farmer approach	Endogenous approach based on the dynamization of farmers' organizations. Farmers get knowledge through mutual exchange.	Radio	Moderate	1998
Advisory services to family farm	This approach helped famers to decide for themselves considering the whole farm	Radio, GPS	Moderate	1998
Farmers Field School	It is an approach based on certain principles of the APNV to induce farmers to adhere to agro-ecological principles. Local knowledge is valued.	Radios, phone, TV and GPS	Moderate	2000
Demand pull approach	Farmers themselves initiate their requests and choose the appropriate approach.	Radios, phone, TV and GPS	High	2004
''Faire-Faire'' approach	It is a multi-stakeholder approach based on valorization of potential value chains of each territory at national level. The government intervenes through service providers (Fait-Faire approach)	Radio, phones, projectors, exchange platforms, tablets, smartphones, drones, GPS	Low	2017

Source: the author

have a regulatory authority in the field of ICT even though it was the first to get connected to the internet in West Africa. Though, these various decisions are not accompanied with concrete actions in order to let the country to catch up with the delay on ICT usage in agriculture. Thus, from 2016 to 2020, several other decisions followed, which is qualified as (iii) a take-off stage concerning the regulation of ICT in Benin. From 2016 until 2020, several regulatory measures are taken for the take-off of ICT in Benin. However, there is a weakness in this regulation regarding ICT integration in agriculture. The measures taken are general and less attention is paid on developing some mechanism to truly integrate ICT in agriculture.

3.2.2 ICT management institutions

Several institutions and services are contributing to the emergence of ICT in the Republic of Benin. The Ministry of Agriculture, Livestock and Fishery (MAEP) is the one responsible for the agricultural sector in Benin. In order to improve ICT usage, the ministry has adapted the Department of Information Technology and Pre-archiving (DIP) in 2016 into Department of Information Systems (DSI) for a strong consideration of ICT in Agriculture. Pilot projects have also been carried out in the field of extension (e-extension) using radio broadcasts and video projection sessions. These pilot projects also focused on market information systems with the development of OWODARA SIM –a platform set up to get people informed about agricultural product prices. Another example is ESOKO platform which is a multi-sector communication platform for knowledge sharing. Other platforms have also been set up, namely the platform for the coordination and management of public and private interventions in the agricultural sector (PCGIPP-SA); the AKVO Flow system for digital collection of information, the establishment of a national postal alert system (SyNAM) and the e-Voucher which helps producers find agricultural inputs. Most of these platforms that we can praise are not working after the pilot phase.

There are also other institutions facilitating the integration of ICT in agriculture as follow:

In 2000, the government had adopted the decree on the creation of a commission responsible for developing, implementing and monitoring ICT policies in Benin (Benin Commission for Information Technology (CBI)).

Creation of an Agency for the Management of New Information and Communication Technologies (AGENTIC) in 2001. AGENTIC's mission was to create suitable conditions to the implementation of projects and programs related to ICT development.

Creation of chambers of agriculture by decree no.2001-097 on February 20, 2001. These same chambers are also instituted to make them more autonomous and sustainable by the law no.2016-17 on October 04, 2016. Their mission is to represent the actors involved in agricultural system mainly farmers and to defend their interests before the State.

Creation of a Ministry of Communication and Promotion of New Technologies (MCPTN) in 2001.

Creation of new agencies according to the law no.2014-14 on July 9, 2014 regarding ICT utilization in Benin. These agencies support ICT development. Among these agencies there are: Benin Agency for Universal Service of Electronic Communications and Post (ABSU-CEP). It managed the fund for electronic communications and post services. It was created on December 30, 2013; Benin Agency for Information and Communication Technologies (ABETIC); The National Commission for Migration from Analog to Digital (CNMAN); the Information Services and Systems Agency (ASSI) and the Digital Development Agency (ADN) are also among these agencies.

Ministry of Digital Economy and Communication (MENC) created in 2016 in order to make Benin a digital service platform in West Africa to increase the economic growth and social inclusion through six (6) main projects (presented in the following point).

3.2.3 Projects / programs and strategic documents promoting the use of ICT in agriculture in Benin

There are several projects / programs and strategic documents that promote the use of ICT in agriculture. These documents and projects/programs are:

- In February 2003, Benin adopted the National Policy and ICT Strategies document which recognized ICT as a tool to develop sectors that are struggling to take off.

- In 2011, Benin adopted the Strategic Recovery Plan for the Agricultural Sector (PSRSA) accompanied by other documents such as: the Institutional Framework for the implementation of the PSRSA / PNIA, the Strategic Orientation Note for the development of agricultural sector, the Programmatic Framework and the Guidance Note for the Public-Private Partnership. ICT was mentioned to be relevant in improving agricultural sector.
- The National Strategy for Agricultural and Rural Training (SNFAR) was adopted in 2014. It raises the need to include ICT in agricultural training.
- The Government Action Program (PAG) 2016-2021 adopted in 2016 contains a set of projects related to the development of ICT in agriculture. Among the 45 projects in the PAG, six (6) are related to the development of digital. These six projects are: high /very high speed Internet; Digital Terrestrial Television; Smart administration; Generalization of e-Commerce; Generalization of digital technology through education and training; Digital content.
- In 2017, several documents have been adopted as follow: the programmatic framework document for the agricultural sector, the Strategic Plan for the Development of the Agricultural Sector (PSDSA-2025) and the National Plan for Agricultural Investments and Food and Nutritional Security (PNIASAN) 2017-2021. These documents emphasize on the necessity to include ICT in agricultural advisory system. E-agriculture is identified to be the backbone of Benin agricultural development. Therefore, an amount of 1,834,944,560 CFA (around 3,163,697 dollars US) is planned to finance ICT initiatives during the period 2018-2020.
- Agricultural Advisory National Strategy (SNCA 2) 2019-2025 which emphasized on the promotion of e-extension.
- In 2019, the National Strategy for e-Agriculture in Benin 2020-2024 was adopted to promote the integration of ICT in agriculture.

It is noted that several documents, projects are adopted to integrate ICT in agriculture in Benin. Despite that, ICT institutionalization level is very low. The government is still struggling to put into practice all the decision taken. Currently, the most successful ICT being used are limited to radio and telephone broadcasting. It is true that tools such as farmers learning video, smartphones, various platforms are emerging but it is obvious that there is still lot to be done in that matter. The ability of the government to implement the various innovations initiated is still weak.

3.2.4 Place of start-ups in agricultural digitalization

Many start-ups related to e-agriculture are being developed especially by youth in Benin. These different initiatives are encouraged by organizing annually “Salon des TIC” for agriculture. It is on its second edition in 2019. The first edition was held in September, 2018 at University of Parakou, Benin and its second edition in November, 2019 at National University of Ketou, Benin. It allows all participants especially youth to promote their innovation on ICT integration in agriculture system. It is an international event which brought not only innovators from Benin but also start-ups from other African countries and around the world. During the second edition over 24 start-ups were presented regarding ICT integration in agriculture as a solution to address today’s challenges that Benin agriculture is facing (see Table 3).

3.3 Innovations in ICT Integration Policies in Benin Agricultural System

3.3.1 Innovation propensity and capacity

The innovation propensity and capacity of Benin government in terms of ICT integration in agriculture is seen here as the various initiatives –laws, decrees, projects, programs, strategy documents, institutions set up and measures – make budget, facilities, available, taken to facilitate in an innovative way ICT utilization. The analysis of fig 2 shows that during the 2000s, reforms in the use of ICT were almost absent. That is to say very few budget were granted to ICT development compare with other sectors in the same time. This low innovation propensity and capacity of ICT integration in agriculture can be explained by the fact that ICT was not a priority of the government during this period. No attention were paid to ICT. From our survey, 98 % of the respondents recognized that Benin successive governments had completely forgotten that we have to integrate ICT in agriculture in order to improve the sector. After 2000 until 2014, several initiatives are taken. However, these initiatives concerned macro

Table 3. List of start-ups operating in the field of agriculture in Benin

Start-ups	Description
Zoom agro	Agricultural Newspaper in Benin
Vartlab-Benin	Software that allows sharing crops production requirements based on their characteristics and production preferences.
Biogaz Bénin Sarl	Technical innovation (biogas technology)
Afrique Cereagro	AppRice is an intelligent assistant which makes it possible to inform, make forecasts and especially to alert farmers during an unfavorable climatic conditions.
JINUKUN SARL	BtoC is an e-commerce platform for marketing agricultural products from local farms and agrifoods.
ADIYEABA	Adiyeaba is a connected and automatic incubator to increase poultry production in rural areas.
AgriYara	Online sales platform for agricultural products.
Art Creativity	A system called AgriDroneFlow which detects areas infected with insects in the fields, detects the level of humidity in each area of the field and estimates the agricultural yield of the fields before harvest.
FreshFeed	Inform pastoralists on the resources of the transhumance zones using GPS system.
GLESSI	Agricultural information spreading magazine.
Apiservices Monde	"ApisLabTech" digital platform for the promotion of beekeeping in Africa. It is a platform that offers training and support in beekeeping and the e-commerce of beekeeping products worldwide
PrecisAgriC2I Startup	It is a solution that solves the problems of agricultural land management, poor water management and soil fertilization to face climate change.
Souba	It is a solar electronic device equipped with several sensors (Ph, Temperature and Oxygen) which makes possible to feed optimally, automatically and autonomously fish.
Epouvantail Connecté	System that simulates human presence to deter pest animals from devastating the farm.
SocialFarming Bénin	Agricultural advisory and extension through the use of ICT
CGA (Agricultural Management Advisor)	Promotes precision agriculture using drones to monitor, collect data, images, temperature etc. It also helps to control pest, spread fertilizer and irrigate.
DisrupTech	Platform that helps to take decision about when to sow, fertilize or haverst one's production. It also helps to master simple techniques to restore soil fertilization.
Fenou Industries	Online platform for the provision of suitable biodegradable packaging for agricultural products.
Ile Sacre	Promotes rural agricultural entrepreneurs by promoting their products through a marketing platform.
Agriyouth	African agricultural entrepreneurship promotion platform for the integration of young people in agriculture.
Clean Energy for Africa (CEF Africa)	Project to transform organic waste from the agricultural and agro-transformation sectors of Benin into ecological charcoal briquettes.
TIC AGRO business	TIC-Agro Business Center (TIC-ABC) is a Social enterprise that promote ICT in agriculture by providing farmers with web and mobile solutions, animation tools (card games), videos as well as voice messages all in local languages.
ISADA-Consulting	It is a project that aims at spreading agricultural information in rural areas using farmers learning videos
Afrique-learning	Training platform very applied and dedicated to youth of West Africa. More than 60 courses, mainly in the agriculture sector, are given free of charge.

Source: Data obtained during the participation in the 1st and 2nd edition of "salon des TIC" held respectively at University of Parakou, Benin, September 2018 and at National University of Agriculture, Porto-Novo, Benin, November 2019

reforms of ICT regulation in Benin since the emphasis was not on the integration of ICT on a particular sector. So, agriculture continues to suffer from this absence of measures taken to integrate ICT in it. The policies were aimed more at macro reforms because Benin was even one of the last countries in West Africa in this matter. From 2014, we noted a high propensity of the government to innovate by initiating plenty of reforms regarding ICT integration in agriculture. Thus, several laws, decrees and strategic documents are adopted. During this same period, ICT promotion agencies were created. MAEP being aware of the seriousness of the issue has also created a Department of Information Systems (DSI) to increase the integration of ICT in agriculture. Several other pilot projects have been initiated. During this same period, Benin adopted a national 2020-2024 e-agriculture strategy. An amount of 3,163,697 dollars US is granted to support this initiative. Though, the government has to do much to make it work as it seems like no resource is allocated to ICT usage considering what is happening in the field. In the same sense, one of the respondents –an agent of ATDA said

> "…*right now, the laws and decrees about ICT usage in agriculture are coming like rain* (to mean many*) but in practice it is like pouring water behind the jar*…"

That was to mean that the use of ICT in public sector is not effective as such. Nevertheless, there is this strong willingness of the government to change the sector. The question now is to find appropriate way to make it work. It demands time and effective strategies.

Apart from these different initiatives, we noted the emergence of start-ups to promote ICT in agriculture mainly by youth. Twenty four start-up holders participated in the "salon des TIC" for agriculture. During the second edition, all participants had the opportunity to attend to a meeting with the head of the Direction of Innovations Quality and Entrepreneurship Training (DQIFE) in 2019 who was the representative of the minister of agriculture. The meeting was to discuss about challenges that are facing youth in developing their start-ups. There were many challenges enumerated during the meeting. Most of the participants emphasized on the lack of support from the government financially, technically and organizationally. One of the participants –the manager of TIC AGRO BUSINESS –a start-up said

> *"We face a lot of problems operating in Benin. Sometimes, it is like to give up, but I believe one day it will work. The government does almost nothing to encourage young people….there is no such an organized center to back up us. There are many barriers from the government too. Even this current event we know how it is organized. One thing I want is to think deeply about what is going on in Benin in terms of ICT for agriculture*…"

So, urgent actions are needed to change things up. ICT integration in agriculture requires to gather all actors of the system to make it work.

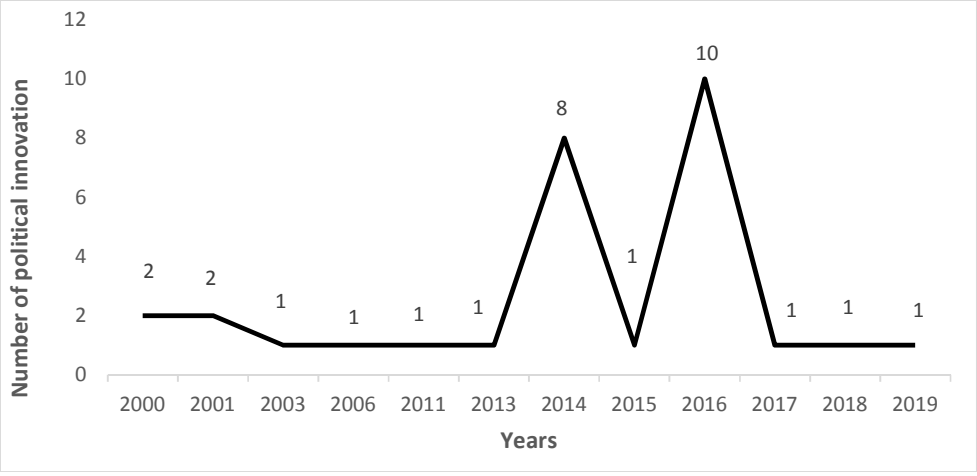

Fig. 2. Political innovations to integrate ICT in agriculture in Benin (source: the author)

3.3.2 Innovation practice

The innovation practice is analyzed through the consideration of how well the decisions taken are put into practice. The analysis of the projects and programs implemented as well as the institutions in charge of agriculture in Benin show that ICT usage is not effective as such at operational level. The various regulatory decisions taken around the 2000s to modernize agriculture sector, were not sufficient to integrate ICT. We noted that after independence in 1960 until 2014, ICT usage in agriculture sector was limited to the dissemination of agricultural information through radios and telephones. That was the case of the Program for the Development of the Agricultural Sector Phase II (PADSA II) which through its component supporting Private Agricultural Sector (CASPA) used radio broadcasts to disseminate agricultural information. Other tools such as GPS for precision agriculture, especially in the cotton sector, and computers are used by decentralized structures in charge of agriculture. From 2014, we noted a proliferation of decisions through the adoption of several strategic documents related to the use of ICT in agriculture. Reforms at MAEP have also made it possible to set up a system encouraging the use of ICT. Pilot projects and several other initiatives are being taken such as e-consulting, market information systems. At the operational level, we still noted that certain projects/programs are not accompanied by concrete actions (fig 3). At the level of Territorial Agencies for Agricultural Development (ATDA) for example, actions concerning e-extension are not effective. There is also a weak coordination between the two ministries –MAEP –in charge of agriculture and MENC –in charge of ICT in Benin. Indeed, the fundamental question which arises and which is also a concern among the actors of the system is this: which of the two ministries leads projects relating to the use of ICT in agriculture? Even if at first sight it seems obvious that this falls within the competence of the MENC it can cause problems in terms of practicality and performance considering how heavy the administrative processes could be.

4. DISCUSSION

Benin agricultural sector has undergone several reforms since 1960 until now. These various reforms were more focused on the development of agricultural extension approaches –sector based approach, Training and Visit, Village Level farmer Approach (APNV), farmer to farmer approach, advisory services to family farm, Farmers Field School, demand pull approach and “Faire-Faire” approach. However, just after 2000 Benin government has adopted several decrees, laws and strategic documents to create suitable conditions for ICT emergence. According to Affougnon [19], ICT sector in Benin is been characterized by an absence of legal and institutional framework. Most of the decisions taken were not turned into concrete action. In addition, the reforms did not take into consideration the agricultural sector until 2000. The government's innovation propensity remained very low or even absent for a long time. According to Adjidonou et al. [20], the institutional arrangements regarding the use of ICT in Benin were only intentional statements. It is worst particularly in agricultural sector compare with the health sector for instance. This same observation is made by Fakhoury [16], and FAO [1]. According to their findings, the success of ICT depends on the sector and in many countries agricultural sector is lagging behind. Several strategic documents or diagnostic studies in Benin have highlighted this low integration of ICT [17,19]. Like in agriculture sector, Adjidonou et al. [20] found the same

Periods	**1960** ⟷	**2014 2020** ⟷
Political innovation Characteristics	Low innovation propensity, capacity and practice	High innovation propensity and low innovation capacity and practice
	Few ICT regulatory policies in agriculture. The few initiatives taken .were on paper	Examples of initiatives: creation of DSI at MAEP; MENC, e-extension; start-ups; national e-agriculture strategy etc;

Fig. 3. Innovation propensity, capacity and practice of Benin government in integrating ICT in agriculture

result in education sector. They found that significant effort has to be made in education sector in terms of ICT integration. That is also true in agricultural sector. Although, all sector is concerned, that of agriculture is acute. Education and health get more privilege regarding ICT usage [1]. Strong policies and institutional frameworks are essential to foster digitization. Even if Benin government is trying its best to regulate ICT and integrate it in agriculture there is still a huge gap between these policies and the reality. Bako and Moumouni [21] mentioned this gap between policies and their implementation in Benin in natural resources management. According to Fakhoury [16], the implementation and success of digital programs require strong administrative capacity. In order to institutionalize ICT in agricultural sector, Benin's government has to build up its institutional framework.

The results found also raise the debate about the link of political innovation and the adoption or the institutionalization of the actions taken. It is clear that high innovation propensity of a government in ICT integration in agriculture does not imply high innovation capacities or practice that are the core condition of their institutionalization. The three concepts –innovation propensity, capacity and practice are linked to successfully institutionalize ICT in agricultural sector. The case of Benin is an example. This effort must necessarily involve youth who are developing e-agriculture start-ups. For FAO [1], young people play an important role in e-agriculture. They have often benefited from digital literacy and have therefore developed the capacity to find innovative solutions.

5. CONCLUSION

The study shows that Benin passed through several reforms since 1960 until now to improve its agricultural sector. Despite these reforms, the integration of ICT in agriculture –their institutionalization is not effective. ICT has not been a concern of different agricultural policies. The successive governments tried to bring political innovative ideas through laws, decrees, projects, programs and strategic documents but have shown a low capacity to modernize agriculture using ICT. Right after the 2000s, new set of laws, decrees, strategic documents are adopted to face the challenges of e-agriculture. These various decisions remained also intentions because the agricultural sector continues to suffer from this low integration of ICT.

From 2014, there was a strong will of the government to revolutionize agriculture. Therefore, many political innovations are introduced. This resulted in the initiation of several pilot projects such as the development of OWODARA SIM platform to inform farmers about agricultural product prices, ESOKO platform which is a multi-sector communication platform to share knowledge. By the same token, others platform –PCGIPP-SA, AKVO Flow system, SyNAM and e-Voucher are also created. Apart from these projects, MAEP has created a department to deal especially with ICT integration in agriculture. Benin has also adopted a national strategy for e-Agriculture. All these actions show a high innovation propensity of current government to offer solutions for integrating ICT in agriculture.

Benin political innovation analysis clearly shows how the three concepts –innovation propensity, capacity and practice are linked to successfully institutionalize ICT in agricultural sector. Addressing agricultural challenges in terms of ICT institutionalization –integration in agriculture sector requires a whole consideration of how the decisions are made, what means are necessary and most importantly how to make it connected with the reality –the beneficiaries. We have argued that the institutionalization of ICT in agricultural system in Benin is now suffering from a low innovation capacity and practice. That highlights that the key condition for ICT institutionalization in agricultural sector is more linked to the bottom of the system –the final users. One of the easiest ways to study government political innovations is its effect on the targeted population. Because with high innovation propensity or to some extent innovation capacity, a nation may fail to get them institutionalized. We also argued that in the specific case of ICT integration much attention should be paid to youth. They represent the backbone of ICT integration in agriculture

ACKNOWLEDGEMENT

This research was supported by the international non-profit association access agriculture that promotes agroecological principles and rural entrepreneurship through farmers to farmers videos.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. FAO. Technologies numériques dans le secteur agricole et dans les zones rurales. Organisation des Nations Unies pour l'alimentation et l'agriculture, Rome; 2019. Accessed 18 March 2020. Available:https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwjOo7Olsd3nAhXB2aQKHSnJA6kQFjAAegQIBRAB&url=http%3A%2F%2Fwww.fao.org%2F3%2Fca4887fr%2Fca4887fr.pdf&usg=AOvVaw1EnXTOr3JQIHpk2SM3WM1r
2. MAEP. Stratégie nationale pour l'e-Agriculture au Bénin 2020-2024. 2019;57. Accessed 8 February 2020. Available:https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwiX4rv7v93nAhVkQRUIHdVIDMIQFjAAegQIAxAB&url=http%3A%2F%2Fwww.fao.org%2Ffsnforum%2Fsites%2Fdefault%2Ffiles%2Fdiscussions%2Fcontributions%2FStrat%25C3%25A9gie%2520nationale%2520e-Agriculture%2520Benin%252025-08-2019.pdf&usg=AOvVaw1K9j82vN7Wus8NJdSgL12L
3. USAID. Digital farmer profile: Reimagining Smallholder Agriculture. Washington D.C.: USAID; 2018.
4. Sørensen E, Torfing J. Enhancing Collaborative Innovation in the Public Sector. Administration & Society. 2011;43(8):842–868. DOI: 10.1177/0095399711418768
5. Bekkers V, Edelenbos J, Steijn B. Innovation in the Public Sector. Linking Capacity and Leadership. Basingstoke: Palgrave Macmillan; 2011.
6. Borins S. Encouraging Innovation in the Public Sector.Journal of Intellectual. 2011;2(3):310–319.
7. Eggers B, Singh S. The Public Innovators Playbook. Washington, DC: Harvard Kennedy School of Government; 200.
8. Meijer A, Van der Veer R, Faber A, and Penning de Vries J. Political innovation as ideal and strategy: the case of aleatoric democracy in the City of Utrecht, Public Management Review. 2017;19(1):20-36. DOI: 10.1080/14719037.2016.1200666
9. Walker JL. The diffusion of innovations among the American States. American Political Science Review. 1969;63:880–899. DOI:10.2307/1954434.
10. Sørensen E. Political innovations: Innovations in political institutions, Processes and Outputs. Public Management Review; 2016. DOI:10.1080/14719037.2016.1200661
11. Stone D. Policy Paradox: The Art of Political Decision Making. New York: W. W. Norton; 1997.
12. Osborne SP, Brown L. Managing Change and Innovation in Public Service Organizations. Milton Park: Routledge; 2005.
13. Meijer AJ. From Hero-innovators to distributed heroism: An in-depth analysis of the role of individuals in public sector innovation. Public Management Review. 2014;16(2):199–216. DOI:10.1080/14719037.2013.806575.
14. Morabito MS. The adoption of police innovation: The role of the political environment. Policing: An International Journal of Police Strategies & Management. 2008;31(3):466–484. DOI:10.1108/13639510810895812
15. Meijer A, Van der Veer R, Faber A, Penning de Vries J. Political innovation as ideal and strategy: the case of aleatoric democracy in the City of Utrecht, Public Management Review. 2017;19:1, 20-36. DOI: 10.1080/14719037.2016.1200666
16. Fakhoury R. Digital government isn't working in the developing world; 2018. Accessed 21 February 2020. Available:https://theconversation.com/digital-government-isnt-working-in-the-developing-world-heres-why-94737
17. MAEP. Stratégie nationale pour l'e-Agriculture au Bénin 2020-2024. 2019;57.
18. Farrell G, Shafika I. Survey of ICT and Education in Africa: A Summary Report, Based on 53 Country Surveys. Washington, DC: infoDev / World Bank; 2007. Available: http://www.infoDev.org/en/Publication.353.html
19. Affougnon B. État des lieux des télécommunications au Bénin pour un engagement plus structurant (Rapport National). 2009;22.
20. Adjibodou A, Biaou A et Noudogbessi T. Quelle durabilité pour les TIC dans l'éducation au Bénin? In K. Toure, T.M.S. Tchombe, et T. Karsenti (Eds.), ICT and Changing Mindsets in Education. Bamenda, Cameroon: Langaa; Bamako; 2008. Mali: ERNWACA / ROCARE.

21. Boko I, Moumouni MI. Do natural resource management policies ensure environmental justice in Benin? Asian Journal of Agricultural Extension, Economics & Sociology. 2019;37(2):1-11. Article no.AJAEES.53050

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/63859