Use of connected objects (IoT) in the agricultural sector in Burkina Faso: approaches and perspectives

Abstract

The connected revolution is the great revolution of the early 21st century, and it involves far greater upheavals than the arrival of smartphones and tablets. "Measuring", "calculating", "monitoring", "reporting", "controlling" and finally "understanding" and "correcting" are becoming personal reflexes in the same way as branches of business activity. It's a new way of understanding the world and interacting with it that is available to today's generations. These connected technologies undoubtedly play a major role in the competitiveness of human actions in their social and organizational lives. Businesses, government departments and public services are all concerned, given the role they play in economic performance, especially in Burkina Faso, where 80% of the population are farmers and agribusiness is seeing the light of day more and more. These technologies, known as IoT, give an arrange of interconnected gadgets and sensors for the industry that collects and share information. IoT can be inserted in soil, crops, apparatus, and animals to screen temperature, stickiness, soil dampness, supplement levels, and creature behavior. Encourage, this assembled information is at that point analyzed & utilized for making educated choices around water system, fertilization, illness avoidance, and in general cultivate administration. For occasion, agriculturists can presently get to real-time information from their smartphones or tablet and screen soil conditions and edit wellbeing. Exact experiences empower productive decision-making to maximize fertilizer utilization and optimize cultivate vehicle courses.

Keywords: usage, connected objects (IoT), agriculture, digital divide, communication for development, Burkina Faso

Introduction

In the world of development, where everything is digitized through the use of information and communication technologies (ICTs), the capacity to process data, store it, make it accessible and transmit it quickly has grown enormously. The value of information is therefore very difficult to quantify and depends on a number of parameters (reliability, exclusivity, passage of time, recipient, etc.). To make the most of these means of communication, we are involved in several revolutions, such as the development of servers, which are large computers used to store and centralize data (Big data, cloud computing), the birth of nomadic technologies (smartphones, portable computers, Global Positioning Systems (GPS), which facilitate access to information at all times and in all places), and the development of major high-speed networks such as the fourth generation of mobile networks (4G) and the fifth (5G), which is currently being rolled out, using fiber optics for the rapid transfer of data. These discoveries have encouraged the linking of all the equipment (including sensors) that can use the network to facilitate the synchronization of data and contacts. This interconnection forms a mesh for transferring information and objects, also known as connected objects.

According to the International Telecommunication Union (ITU), the Internet of Things (IoT) is a global infrastructure for the information society, enabling advanced services by interconnecting objects (physical or virtual) using existing or evolving interoperable information and communication technologies [1]. And in the Internet of Things, an object from the physical world (physical object) or the information world (virtual object), which can be identified and integrated into communication networks [2].

Objects are now equipped with an embryo of intelligence that will continue to grow in complexity. Activity trackers are only the first epiphenomena of a mass revolution in which humans will have to reinvent their place in society, rethink their consumption patterns and the way they work. The technologies available to developed countries have enabled these researchers to make considerable progress in experiments such as the development of robots for precision farming and drones for managing and monitoring agricultural production.

Our research will consist of providing theoretical information on social links (Man-IoT) and a socio-cultural assessment of connected objects, before returning to the current state of research on IoT and agriculture in Burkina Faso and highlighting the importance of these objects for technological agriculture.

Methodology

Given that Burkina Faso is a developing country and that its economy is almost entirely based on agro-pastoral production, which accounts for nearly 80% of the population, our central question is how could the use of connected objects improve agriculture in Burkina Faso?

The main objective is to spread awareness about the importance of IoT in the field of agriculture. Indeed, producers and cultivators in Burkina are more illiterate and are reluctant to use technologies in their production, because they prefer traditional methods.

The answer to this central question, in line with the objectives defined, leads us to put forward a number of hypotheses, the first of which is that connected objects are 'means' appropriated by humans in their daily lives, which invites us to study what we call a 'connected object', to clarify the approach via the notions of use and appropriation, and the second being that the judicious use of connected objects is a sure factor in the development of agriculture in Burkina Faso, as prospects for producers.

This study analyzed papers from various periodicals and conference proceedings from respected scholarly sources. Most of the discoveries and methods have been used to build predictive analytics. The research project consisted of a literature evaluation that began with a search for information on agriculture and practices related to it, and was performed using some databases as IEEE, for the technological side, and Cairn and others books about the usage and appropriation of technological tools according to human sociocultural behavior. Some of the terms and phrases that were discussed were "smart farming," "IoT and agriculture," "digital fracture," "social perception of IoT," and "IoT used on agriculture domain in Burkina Faso."

The methodology adopted in this research will be more qualitative than quantitative. Qualitative research is suited to our study, as it is a set of investigative techniques that are widely used. It provides an insight into people's behavior and perceptions and enables us to study their opinions on connected objects in greater depth than in a survey. It insists on complete or 'holistic' knowledge of the social context in which the research is carried out. Social life is seen as a series of interconnected events that need to be fully described in order to reflect the reality of everyday life. It generates ideas and hypotheses that can contribute to understanding how an issue is perceived by the target population and helps to define or identify options related to the issue of connected objects. The literature review will enable us to provide researchers in the field of technology in Burkina Faso with adequate information to guide them on the state of the art and existing techniques and solutions related to IoT and agriculture, as in the case of existing projects, such as SimAgri, which is intended to be modern, and studies conducted by certain teacher-researchers showing the level of advancement of this technological insertion into agricultural production habits.

I) What do we expect by "connected object"?

Etymologically, "object" comes from the Latin "objectum" meaning "to throw, place, present in front of". The object is the tangible, perceptible, concrete thing. We can analyse it with all our measuring instruments, define it and freeze its image. This technology, which is already being adopted, is at the confluence of intelligent connectivity systems and Big Data. A connected object is a device with the ability to exchange information. It can send and receive information and communicates both with other objects and with the web directly, accessing it via the cloud, using wireless technologies, Wireless Fidelity (Wi-Fi), Bluetooth, 4G and/or 5G. These objects can take many forms, from everyday utensils (ovens, as in the case of the MaidOven, watches, televisions, vehicles, tractors, etc.) that have been given a 'connectivity' function, to novel objects. There are three types of object, depending on their functionality and the method used to manage the information. These are the communicating object, the intelligent object and the object system.

The simple version of the communicating object exchanges information with a master object or a network. It simply transmits the data it collects, without reprocessing, and allows itself to be fed by instructions, which are sent to it via the network or by the master object and which it executes. In general, it is linked to an application that enables these commands to be formulated. A sensor or a system of sensors, a connected bracelet or a wireless loudspeaker are examples of communicating objects. This is the case for robots used in agricultural production.

Intelligent objects have the capacity to reprocess or pre-process the information they connect. A smartphone or a connected watch, for example, are objects capable of capturing the direction in which a user is moving and then displaying an itinerary pointing in the right direction, based on map data. Increasingly connected, these objects are now designed to assist users and make their lives considerably easier. They don't just exchange data, they interact with consumers in ever greater detail. These days, a number of objects are being put in place, such as the intelligent oven, the Maid Oven, and GPS systems fitted to vehicles and other machinery. Trucks transporting substances (waste, goods, fuel) need to be tracked in order to be sure of the route they are taking, so that they can be traced. When such objects communicate without going through the Internet, we speak of a system of objects.

In effect, the system of objects is made up of several objects that exchange the various information they each collect, and a collective regulation effect is triggered whenever necessary. In these situations, the most promising applications for these intelligent systems are in complex and sensitive systems such as aircraft and ships. However, to enable us to assess the level of use and appropriation of these objects, we will be looking at perception and the social links that exist between people and these connected objects?

The relationship between humans and "connected objects"

Functional digital objects are objects that facilitate daily life and exchanges. Three dimensions of the digital object that makes itself felt are not dissociated in this configuration. It can therefore be a terminal (with its interfaces and data), an interface (with its data) or just data. Indeed, in the world with 4.76 billions of active social media users (examples: Facebook, WhatsApp, Youtube, Instagram, WeChat, Reddit Telegram, QQ, Tiktok, Pinterest Twitter and others) on 2023, for several reasons such as chats, job hunting or access to information in general as Kabore said [3].

For an individual, a functional digital object might be their smartphone or computer, which contain all their digital photos, files and emails stored in the cloud. As their name suggests, these objects are valued for their practical function. As a result, sentimental attachments may exist. Indeed, users have more secrets of their lives in their phones via social networks, so the object will change configuration and become a human object, as will its factors of trust, of lack if the phone is forgotten in a specific place or the fact of touching the phone every time, even when sitting down. Some people will often feel their phone vibrating in their pocket, but this is an illusion. In fact, in line with the configuration, over time individuals accumulate a multitude of digital data (generally associated with interfaces - online or offline). A mass of information (digital photos, pages of a personal blog, social network accounts) gradually becomes a reflection of a part of oneself (hence the terminology used). For example, e-mails placed end to end can be used to retrace the genesis and represent the existing relationship between two people. It should be noted that for online objects, this presentation of the self is partly standardized through the templates of interfaces such as social networking sites. Thinking in terms of data, we can talk about a collection of objects. However, the collection of data as a whole can be considered as an object in its own right, as in the case of a Facebook account or Apple products. Our results show that sentimental attachment can be linked to the quantity of data, the investment in money (the iTunes library, for example) or in time (the number of hours spent playing an online game, the time spent on the Facebook account, WhatsApps, Tiktok). This appropriation takes place gradually and more or less unconsciously.

These observations are in line with sociological and anthropological reflections on the redefinition of the concept of memory. In the eyes of sociologists and historians of the coming centuries, we will probably be the sincerest generation in history, so difficult is it for us to control the many digital traces of ourselves left on the net. Managing all our digital objects can be complex, and individuals are often overwhelmed by the scale of the task. For example, people are sometimes so overwhelmed by having to sort through thousands of digital photos that they end up giving up. An additional difficulty lies in the fact that, as in the previous configuration, legal ownership is not necessarily established, particularly if the data is linked to interfaces governed by rights of use. Since the dimensions are intertwined, the feeling of ownership initially associated with the terminal may be transferred to the data it contains. In this case, this perception is not always legally justified, particularly when the data is stored with an external service provider (in the cloud). Users' concerns then shift to the notion of data control. The notion of trust is therefore crucial. According to the research by Lobet-maris et al [4], this takes two forms: organizational trust in service providers, particularly for experts, and interpersonal trust in peers - other users in the digital community - who would report any problems. In this sense, our research makes a contribution to the body of research that stresses the importance of trust in digital uses

III. Sociocultural appreciation of “Connected Objects» in developing countries

New technologies have had difficulty being introduced in developing countries such as Burkina Faso. A number of ideologies ran counter to the benefits of this technology, which was seen more as a tool of the white man. The author S. Ouedraogo wrote: "Let technology take its course. If it's in our interest, we'll use it; if we don't need it, we'll abandon it, like tractors covered in cobwebs" [5]. Developing countries, as they say, are just emerging from rurality. Social change through the introduction of new technologies is a source of mistrust. Farmers in general are still using rudimentary methods, because as the writer Sylvestre explained in his magazine 'L'ordinateur et le djembé', "In any case, the Internet won't take my sorghum to market. It won't cure my sick tooth, or the malaria that's gnawing at me, and it won't pay off the debt I've incurred to buy fertilizer - why so much infatuation with a technology and slogans like 'Connect and you'll be saved'." [6]

Chéneau-Loquay adds that the tool is really seen differently in developing countries: technology is perceived as "being at the heart of the great maneuvers for control of markets, ideas and value systems, and will tomorrow be one of the main discriminating factors between poor and rich, both internationally and individually. In many parts of a North that is overwhelmed by concepts and models of development" [7].

The problem of transferring the Western model of technology development and application to Burkina Faso is that analyzing the processes of integration and the ways in which these technologies are used cannot be carried out according to a simple logic of transferring an imposed model in relation to which users would be mere receivers who are more consumers than actors [8].

Researchers in the human sciences have made contributions on the existing social realities of the use and appropriation of intelligent tools, connected objects or new technologies in developing countries. "The theories of use have proposed an approach to the phenomena of appropriation that is not confined to the study of the use of a technical object alone" Lacroix et al [9]. However, we still need to study how these connected tools are used, as Jauréguiberry and Prouxl [10] have argued. Other factors come into play to shed more light on the theory of usage by observing the use or rejection of an object. Social, technical and cultural factors can all play a part in the reasons for rejecting or misusing these technological tools. The digital divide in Burkina Faso, which is creating a "digital divide", is a case in point. According to A. Kiyindou,

> *"a phenomenon of polarization in relation to the universal dimension of the implementation of the 'information society', it [the digital divide] refers to the gap between those who use information and communication technologies (ICTs) for their personal or professional fulfilment and those who are not in a position to exploit them for lack of access to equipment or skills*". Kiyindou [11].

This divide exists in four dimensions: physical, cultural, methodological and social. In the physical view of the digital divide, it is more of a quantitative approach, with more emphasis on the presence or absence of the equipment or materials (we'll talk about sensors or connected technologies) needed to access and process information. The cultural divide refers to the skills required by users if they are really to take ownership of the content of online information and services, or even become the very providers of information or services, added Vendramin P.[12]. The social divide is illustrated by the risk of dropping out at both social and technological levels, because technologies can offer new ways of strengthening autonomy and contacts, in a word 'affiliation', [...] but in many cases they will reinforce the disaffection of the disaffiliated. The digital divide reinforces the social divide" Flichy [13].

There are several socio-cultural reasons for this adoption of technological equipment. The social barrier is illiteracy, which is rife in our countries. An illiterate population shows the level of the digital divide, even if solutions for implementing different communication methods are necessary.

Connected objects can play an important role for agricultural players in developing countries, both in the production phase - to ensure institutional communication and the exchange of technical information, for example - and in the production phase, through the study of soils, insecticides, fertilizers and harvesting.

II) **<u>The connected object and agriculture</u>**

III.1) The current state of digital accessibility in Burkina Faso

Private operators deployed 6001.2 km of optical fiber, while the public sector deployed 3,803 km in 2021. A wire network called resina is deployed over all cities in Burkina make easy the network access. The rollout of fiber optics and resina, and the increase in mobile network coverage rates, especially with 4G, which is expanding rapidly in Burkina, are making it easier7 for Internet users to access the Internet. An area without coverage means that a certain proportion of the population will have difficulty connecting, and therefore using, the telephone, and IoTs. Technically, it remains an obstacle to economic development according to Kabore [14].

Burkina Faso shares its telecommunications management market with three telecommunications operators, Orange, Onatel and Telecel, and more than ten internet providers. According to Arcep's market observatory, mobile telephony market data and data from the national internet and capacity leasing market show that there are more than eleven million (11,240,886) mobile subscribers and more than seventeen million (17,001,473) internet subscribers out of a total population of more than 22.1 million in 2023, according to the World Bank. The total volume of 4G traffic is more than seventy-six million (76,021,256) gigabytes. The graphs below provide details:

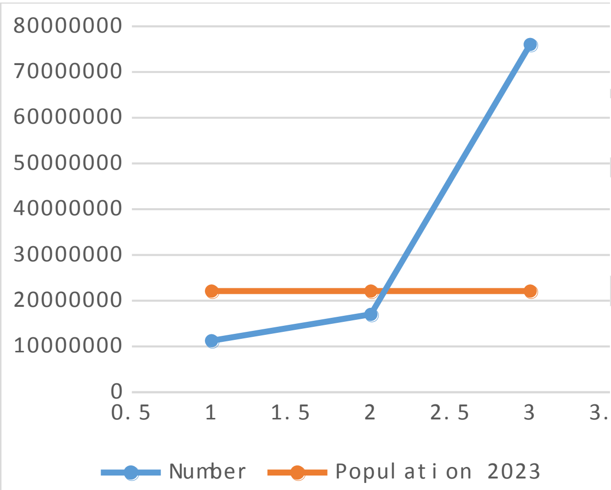

Figure1: Internet access in Burkina Faso in 2023

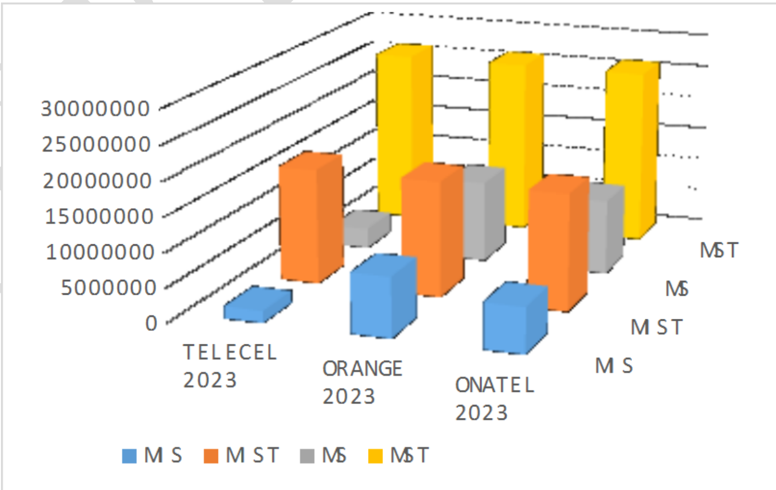

Figure2: Mobile and internet subscription according to network operators in Burkina

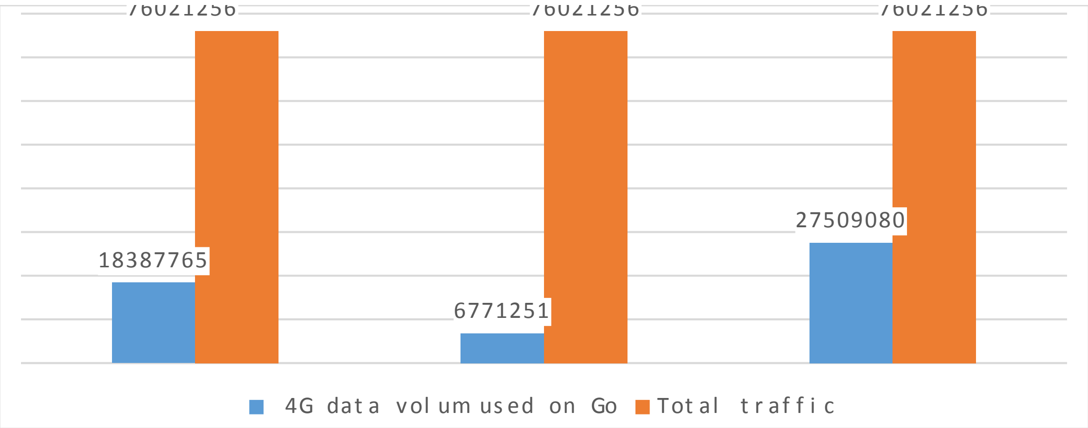

Figure3:The volume of 4G data consumed in Gigabytes on first trimester 2023

III.2) The state of the art of IoT in agriculture in Burkina Faso

Some research on the domain of ICT already done some research on how to improve the agriculture domains by making some test and studies on soils, moisture, temperature and fertilizers. About the case of precise agriculture by using IoT. Indeed, a study about the "design and development of a system for integrated aquaculture based on the Internet of Things" by Belem [15] is done and the approach proposed in this document aims at reconciling aquaculture and agriculture in a system where they are interoperable. The agriculture part consisted of collecting the moisture content of the soil. When the soil is dry, the system allows watering from the water used for aquaculture if it is no longer conducive to the proper development of the fish. The figure 5 is showing, the conception associated to this study. Other researchers worked on Design of an IoT Platform for a Precision Agriculture (PA) in Burkina Faso S. Ouedraogo [16]. Producers need to have information on the agricultural parameters of their plantations without having to be on site. The objective of this work is to propose an intelligent agriculture platform or Precision Agriculture (PA) in order to collect soil humidity, air and temperature. The final results were show that their research was carried out as part of the search for a solution for monitoring soil moisture, temperature and air humidity of a field. At the end of our research, we were able to propose a system composed of several sensor nodes which collect data and then transfer them to a processing unit. The processing unit incorporates a gateway to the exterior which allows information to be sent in the form of SMS to the user via the GSM network. We also proposed a power supply circuit allowing our system to be autonomous

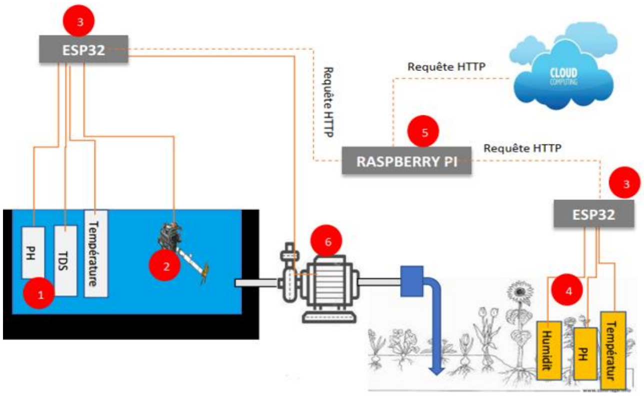

Figure 4: Architecture diagram proposed by the author (BELEM) during his design and development work of a system for integrated aquaculture based on the Internet of Things

- *Case of the project SimAgri, an existant connected system in Burkina Faso ?*

Aprossa Afrique Verte Burkina, in partnership with the Filière Karité table, is offering access to real-time information on the prices of agricultural products, enabling users to buy or sell the said products on the cereals, livestock, oilseed and market garden produce markets via the internet or their mobile phone. This is now possible with the agricultural market information system (SimAgri). The use of connected objects, such as satellite guidance systems, will help to optimize farming operations in the field. For example, it will help to reduce the number of 'players' and 'equipment' needed for certain tasks, as well as the quantities of seed and fertilizer. For SimAgri, we will be focusing on self-guidance (a guidance assistance solution) using the RTK (Real Time Kinematic) system, which is accurate to within 2cm. A hydraulic servo-control system is installed on the motorized equipment (tractor, forage harvester, etc.), which is then guided automatically by the data transmitted. The driver must still be present. The satellite transmits the position of the motorized equipment to an RTK beacon demonstrated by Khoudja [17]. This RTK beacon transmits the data to the RTK receiver with a corrected GPS signal called DGPS. The RTK receiver, located on the motorized equipment, receives the information and processes it via a console located in the cab. The beacon/receiver link is made at zone level (which makes up each department). One beacon therefore covers one zone.

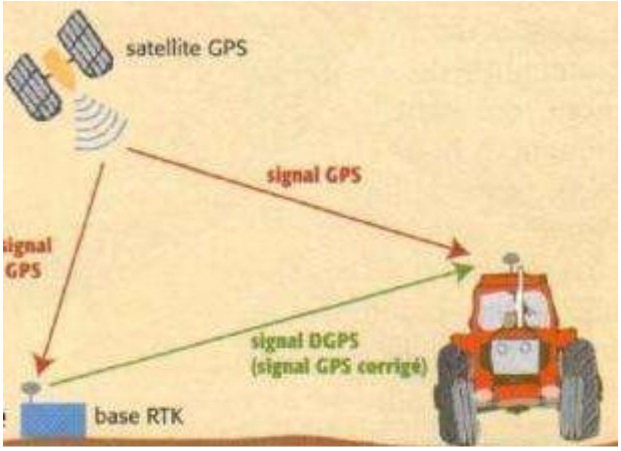

Figure 5: Illustration of existent system using RTK Khoudja [17

III.3) Understanding some of the ways in which IoT is being used in agriculture around the world and the prospects for Burkina Faso

With a population of 8.01 billion on 2023 according to the datareportal reports on digital global overview, global mobile users cover 5.44 billion, above 5.16 billion of internet users and 4.76 billion of active social media users. The latest IoT Analytics "State of IoT-Spring 2023" report shows that the number of global IoT connections grew by 18% in 2022 to 14.3 billion active IoT endpoints. In 2023, IoT Analytics expects the global number of connected IoT devices to grow another 16%, to 16.7 billion active endpoints. While 2023 growth is forecasted to be slightly lower than it was in 2022, IoT device connections are expected to continue to grow for many years to come [18]. And Silicon Lab president Matt Johnson added: "We continue to secure major greenfield design wins, even amid macro uncertainty. The IoT market has incredible potential, with thousands of new applications on the horizon" [19]. IoT-based savvy agribusiness alludes to applying IoT innovation within the agrarian division for optimized cultivating forms. It coordinating sensors, actuators, and other savvy gadgets to empower information collection, examination, and computerized decision-making in cultivating operations. The use of the IoT on the agriculture domain has many advantages as: improving data collection, optimizing the resource use, make easy the end to end control, reduce wastage and makes processes automated by providing clean environment as showed on the next figure.

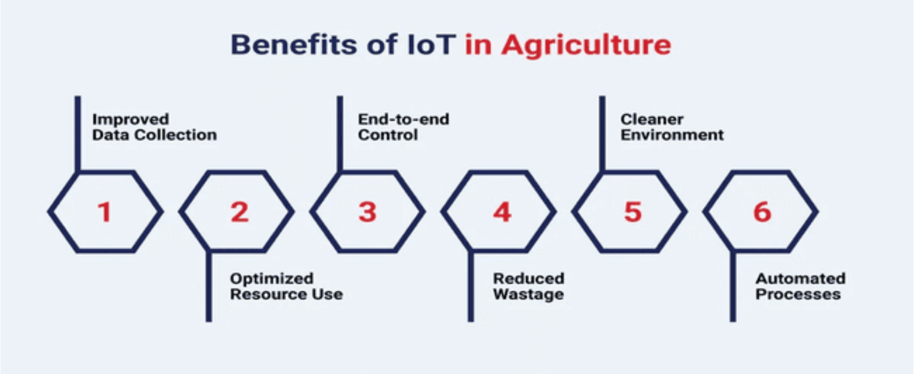

Figure 6: Illustration des avantages de IoT et Agriculture, proposé par iotsworldcongress

Many other studies around the world have been carried out to provide technical input and green solutions for the use of IoT in agriculture. Indeed, all over the world agriculture sector has evolved with the emergence of the information and communication technology. Several attempts have been made to improve the crop productivity and minimize the loss by using the modern technology [20], [21] Hence, the IoT-based smart farming has actively been in development for the last two decades, ever since the boom in wireless sensor technology. A comprehensive survey on the role of IoT in smart agriculture system has been provided by Farooq et al [22] and Ayaz et al [23]. IoT-based smart agriculture system studies have also been a popular topic amongst researchers [24]. These have been practically implemented for efficient monitoring and controlling of the agriculture systems remotely, sometimes with the option of saving data to the cloud for the benefit of other farmers working in similar domains, e.g., crops and climatic conditions. Some other concept as Internet of Underground Things (IoUT) is a new emerging concept [25]. Monitoring soil factors and climatic conditions are two major contributors to the well-being of the crops. Like IoT, it represents an internet of wireless sensors and actuators which are located below ground to monitor and control soil conditions such as moisture, nutrients, acidity, pH levels, and soil electrical conductivity. Wireless signal propagation loss and protection of sensitive electronics inside wireless sensor nodes is a challenging issue for the IoUT technology. Single- hop, wireless, underground sensor networks have been discussed in detail by Tiusanen et al [26], [27]. An IoT based system for insects detection in plants was discussed in [28]. Similarly, another IoT based system was presented in [29] in which images were processed for disease detection; while soil moisture sensor and humidity sensors were used to monitor water requirements. The research work presented in [30] describes the use of an inexpensive low altitude remote sensing platform, GreenDrone, developed for monitoring the Maize crop. The research that has already been carried out could serve as a source of ideas for researchers in Burkina Faso, with a view to guiding research into smart agriculture in the country. To illustrate this with a diagram, the position of agriculture in Burkina Faso would be agriculture 2.0, but studies are underway for the adoption of 3.0 or even 4.0, especially with the technological developments that exist today

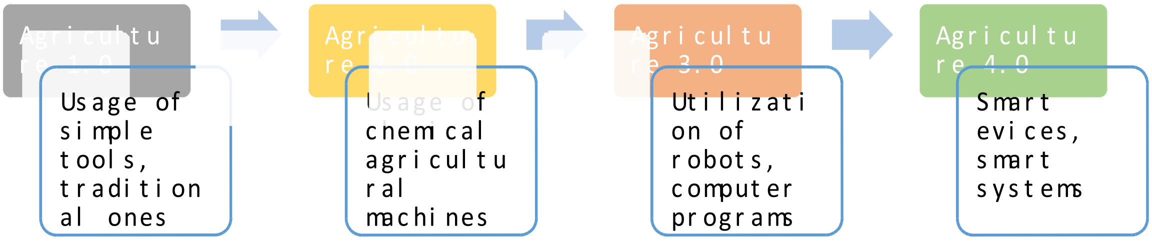

Figure 7: Evolution of agriculture according to the technologies used [31]

A technological ecosystem is superimposed on life on the farm, if we propose the adoption of agriculture 3.0 or 4.0 to producers in Burkina Faso. This ecosystem is made up of connected objects in 'conversation' or communication with each other1 . There are several Internet of Things (IoT) technologies that this equipment could carry or be used for precision farming or intelligent agriculture. These include drones, as shown in Figures 8 and 9, which can be used to increase yields, quickly inspect or measure plots of land, instantly assess damage caused by game or weather, monitor plots of land and spread fertilizer easily. Agribots are small robots designed to perform certain agricultural tasks: fertilizer injection, crop watering, laser weeding, spraying and vegetable harvesting. The square robot is a connected agricultural robot that assists market gardeners in their day-to-day work, from crop maintenance to reporting on individual plots; a hoeing robot that carries out inter-row and in-row weeding and can be used for many types of market garden crop2 Finally, gps-enabled weeding robots powered by solar energy3 and intelligent driverless tractors.

Figure 8: example of agricultural drones

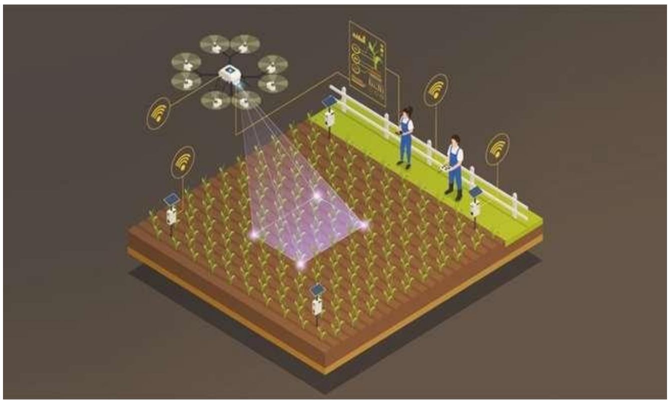

Figure 9: Smart agriculture with pesticide area management

Figure 10: case of square robots

Figure 11: Case of agribots

Figure 12: smart tractors

Before any technological adoption, factors such as energy management and communication range need to be studied. As shown in Figure13 below, Despite such potential benefits, the deployment of smart agriculture systems is still in its infancy. Indeed, an obstacle to the digitization of agriculture is the lack or limitations of Internet connectivity in many areas. In the literature, several communication protocols have been proposed, with different characteristics related to cost, coverage, power consumption, and reliability [32]. Among the available technologies RFID, NFC, BLE, Wifi, cellular generations and Low power consumption group as summarized in Fig. 13. In terms of power consumption and coverage range), low-power wide-area networks (LPWANs) represent a better solution for supporting smart agriculture requirements and one of the most adopted LPWAN technology is LoRaWAN.

Researchers recognize that digitization of farming processes and activities is an important challenge for the adoption of smart agriculture technologies [22], [33]. In particular, the major challenges to digitization in agriculture can be categorized as follows.

- Communication Issues: As we will detail later, large- scale implementations of IoT solutions require robust and secure network architectures.
- Energy Management: The power supply in devices for smart agriculture is a significant challenge and energy harvesting systems are a relevant area of research.
- Data/Device Heterogeneity: In general, the agricultural data is produced by heterogeneous sensors (soil sensors, weather sensors, trunk sensors, leaf sensors, etc.).
- Physical Deployments: Spatial deployment of devices on farms proves to be a significant challenge, especially when the entire farm needs to be monitored across a large area and with different application scenarios (soil, plants, trees, animals, etc.).
- Data Management: The difficulty of interpreting the data can be a huge barrier: indeed, numerous sensors are necessary and big data analysis could be required to better understand and forecast the unpredictability of agricultural ecosystems

- Generic Platform: To promote the adoption of smart agriculture technologies is often required to develop user friendly software platforms. The challenge here is to build a universal platform that can be easily modified to support different types of monitoring ranging from specific crop to livestock.

These challenges, together with the cost of infrastructure investment, the complexity of technologies, lack of farmers' education and training, data ownership, and privacy and security concerns, has motivated the research and development of innovative platforms, specific network technologies, and new architectures for smart agriculture [22], [33].

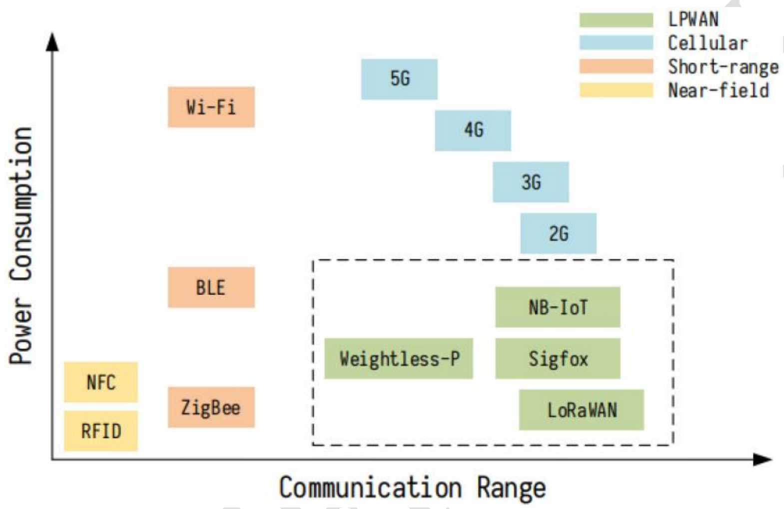

Figure 13: Classification of wireless technologies: power consumption versus communication range [34].

CONCLUSION

Burkina Faso is a developing country, but it is making great strides in the use of ICTs. However, the major difficulties associated with illiteracy and poverty in general are obstacles to the proper use of these technologies. Enormous efforts have been made (installation of optics fiber), but much remains to be done, especially in terms of the availability of connections, reducing connection charges and raising awareness of these technologies among the population. Facilities for developing RTK with SimAgri, and other research carried out by teacher researchers, could also lead to greater use of these technologies in the medium term.

About the IoT, it has the potential to convert agribusiness in numerous aspects and these are the most ones. Data collected could be collected by i) smart agriculture sensors, in this approach of cultivate administration, a key component are sensors, control frameworks, mechanical autonomy, independent vehicles, computerized equipment, variable rate innovation, movement locators, button camera, and wearable gadgets, ii) drones as ground-based and aerial-based rambles are being utilized in horticulture in arrange to improve different rural hones trim wellbeing appraisal, water system, editing, trim showering, planting, and soil and field investigation. Others types of data collecting are the livestock tracking and geo-fencing that farmers owners can use remote IoT applications to gather information with respect to the area, well-being, and wellbeing of their cattle, smart greenhouses, and predictive analytics for smart farming. Trim predication plays a key part, it makes a difference the rancher to choose future arrange with respect to the generation of the trim, its capacity, showcasing methods and chance administration.

Despite the multitude of technological solutions, the major issues surrounding usage, which have been widely examined in the information and communication sciences – particularly through contributions from the sociology of usage - have certain limitations in terms of our questioning of changes in contemporary organizations and related information and communication activities. On the one hand, if users are explicitly taken into account, it is primarily in terms of their use of tools designed by third parties. Secondly, appropriation is not approached as a process built up over time. These approaches therefore fail to identify the reflexive processes by which prescribed and observed uses interact.

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