TECHNICAL REPORT

BUSINESS MODELS AND KEY SUCCESS DRIVERS OF AGTECH START-UPS

CTA

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Written by Ken Lohento and Motunrayo Sotannde
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Ken Lohento
lohento@iafric.net

Motunrayo Sotannde
motunoshy@yahoo.com

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Notes

This is an abridged version of the initial submitted report: Digital Start-ups Servicing the Agro-food Industry in West Africa: Analysis of Business Models and Key Success Drivers. Some theoretical developments, especially much of the methodological section (linking the study to the Research Onion model proposed by Saunders et al. (2009)) and other sections in the literature review, have been removed. The initial introductory chapter and the methodology chapter have been merged. Authors' personal reflective sections (relevant only for the University) and appendices have been removed as well. One graph synthetizing key success drivers for young digital agriculture start-ups has been added. Readers can contact authors or the Strathclyde Business School to access the full original version of the MBA research.

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Abbreviations

AfDB	African Development Bank
B2B	Business-to-business
B2C	Business-to-customer
B2B2C	Business-to-business-to-customer
BM	Business model
BMC	Business model canvas
BMI	Business model innovation
CTA	Technical Centre for Agricultural and Rural Cooperation ACP-EU
ECOWAS	Economic Community of West African States
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
ICT	Information and communication technology
ICT4Ag	ICT for agriculture
IITA	International Institute for Tropical Agriculture
MBA	Master of Business Administration
NGO	Non-governmental organisation
OECD	Organisation for Economic Cooperation and Development
R&D	Research and development
ROI	Return on investment

Executive summary

This interpretative phenomenological research focuses on youth-led companies offering digital services to the agro-food sector in West Africa. Youth is considered as per the African Union definition: individuals aged between 15 and 35 years old. Our research questions were to understand the business models adopted by these start-ups; how their business models and business model innovation lead to business success; other key drivers that can support the achievement of success. With this study, we aim to contribute to the limited existing body of knowledge on this nascent but growing business field in West Africa.

Twelve start-ups (anonymised in the report) from seven countries were selected following a non-probability, purposive sampling technique, from finalists and winners of international competitions. We interacted with them via semi-structured interviews. The qualitative data collected were transcribed, categorised and analysed. The start-ups offer services to agro-food customers and the value chain, using tools including mobile phones, drones, e-commerce platforms. They deploy different business models, serving business-to-business (B2B) and business-to-customers (B2C) clients. Due to their nascent professional maturity, many of them face challenges (more than seasoned entrepreneurs) to achieve business success, in terms of effective services and sustainable profitability. Key findings include the observations that success depends intensely on offering diversified and bundled services, integrating digital and non-digital agricultural services. Revenues are effectively derived from businesses and supporting organisations rather than from individual farmers. The entrepreneurs should therefore target other value chain actors instead of focusing on the farmer only. Success drivers and constraints relate to funding, key partnerships, adequate team and team management, business management skills, business modelling, the policy and business environments and the social adoption of information and communication technology (ICT).

We conclude by proposing recommendations such as promoting role models; facilitating access to funding, developing effective digital agribusiness management skills (within start-up teams, in university curricula and in incubators/accelerators); promoting an enabling business environment (including adopting tax holidays for start-ups); developing effective business models, leveraging data-driven services; improving national digital infrastructures and agricultural digitalisation. Regional collaboration is an important aspect in these strategies.

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1. Introduction & Methodology

1.1. Introduction

1.1.1. Digital services for the agriculture sector in West Africa

West Africa is one of the five regions of Africa, integrating 16 countries (such as Benin, Burkina Faso, Côte d'Ivoire, Ghana, Nigeria, Senegal and Togo) out of 54 on the continent. Its predominantly youthful population (44% below 15 years old) will reach 388 million in 2020 (AfDB and FAO, 2015). Agriculture is a key social-economic sector of the region, contributing on average 35% to its gross domestic product (GDP) (AfDB and FAO, 2015) and conditioning the livelihoods of about 65% of the labour force, particularly in rural areas (ECOWAS, 2017). It includes sub-sectors such as livestock, fisheries, crop production and forestry. Its value chain involves activities pertaining to the production of agro-food products, their processing, marketing, trade and consumption. West Africa is the main regional agricultural power of Africa: it contributes to 30% of the continental agricultural GDP (ECOWAS, 2015). The Organisation for Economic Cooperation and Development (OECD) posits that agriculture is the first sector that will readily provide job opportunities to millions of African youth facing employment issues (OECD Development Centre, 2018). Agribusiness is considered as a strong avenue that fosters growth and wealth creation in Africa in general (Yumkella et al., 2011).

It is acknowledged that one of the factors contributing to the modernisation and a better performance of the agro-food industry is the adoption of digital information technologies (World Bank, 2017; Walter et al., 2017). Digital technologies currently in use in the agro-food sector include primarily the mobile phone, digital radios, satellites, drones (CTA(c), 2016) and social media platforms such as Facebook, Twitter, Instagram, etc. They have now penetrated all segments of the agricultural value chains in West Africa, from pre-production to commercialisation and consumption.

Motivated by the promises of digital tools for the modernisation of the agro-food sector, despite their limitations (World Bank, 2017) and by the business opportunities that their use could generate (Baumüller, 2015), many young software developers and entrepreneurs have entered into it (CTA(a), 2016). However, most of them are facing serious challenges to grow their businesses and offer sustainable value to the agricultural sector (Kieti and Crandall, 2013; Baumüller, 2016; CTA(a), 2016). The entrepreneurs seem to be confronted not only to difficulties relating to the business environment in which their companies operate, but also to business model challenges.

In general terms, a business model is an organisation's proposal on how to create values and achieve profit (Magretta, 2002; Afuah, 2003). The concept according to Fengyang and Ates (2017) was initially described in 1957 by Bellman et al. (1957) as a "*blueprint of business game*" based on a mathematical simulation method for business operations. Business models were initially restricted to the ICT sector where they were used as a means to map out business processes and offer new services (Doleski, 2015). An integrated business model covers and addresses many aspects of the business including different phases of production, socio-cultural, legal, technological and ecological issues needed for the consideration of a successful business venture.

In the report, we use the term start-up as defined by Eric Ries (2011): *"A start-up is a human institution designed to deliver a new product or service under conditions of extreme uncertainty"*. We recognise that this definition is not exclusive to digital companies but has been used mostly referring to them. In addition, though there is no age feature in the definition, the term is used mostly to refer to companies that are young with an ambition to achieve high growth.

1.1.2. Purpose and motivation

The purpose of our research project is to study key success drivers and the business models of young digital start-ups servicing the agro-food sector in West Africa. We would like to better understand how digital technology start-ups led by young entrepreneurs can offer more effective services. Considering the strategic importance of agriculture in this region, we would like to contribute to devising strategies relating to how it can better benefit from digital business services, for a higher performance and for increased food security and growth.

Our focus on young entrepreneurs is motivated by our wish to contribute to strategies for job creation for youth, a critical issue in African countries (African Development Bank, 2016). We have selected West Africa due the fact that little university research has been carried out so far on digital agribusiness in that region, compared to East Africa for example. We will concentrate on start-ups led by entrepreneurs aged between 18 and 35 years old, which is the age range of youth as defined by the Economic Community of West African States (ECOWAS), the main West African political bodies and the African Union, the main African governmental body (African Union, 2006).

1.1.3. Research questions

We have identified three main research questions:

- What are the business models adopted by young digital start-ups servicing the agro-food sector in West Africa?
- How do the business models and business model innovation lead to success for digital agricultural start-ups?
- What are other key drivers that can support the achievement of success by these young digital start-ups?

1.1.4. Structure of the report

After this introductory and methodological chapter, Chapter 2 will present insights from the literature on issues to be investigated by the research, particularly business models, business success and issues relating to youth entrepreneurship in agriculture in West Africa. Chapter 3 will decipher the business models of the companies selected using an adapted version of the Business Model Canvas; analyses of the relationships between these business models and success achievement will follow. Chapter 4 will concentrate on understanding the motivation, the success drivers of the entrepreneurs as well as constraints they face to achieve success. We will conclude with Chapter 5 by summarising findings and providing recommendations to relevant stakeholders. References will close the report.

1.2. Methodology

1.2.1. Sample selection

For the purpose of this study, we have decided to use the purposive sampling technique. Founders of twelve young West African digital agro-food start-ups have been interviewed. They have been selected from best young entrepreneurs identified by the Technical Centre for Agricultural and Rural Cooperation (CTA) through activities it has been implementing for more than six years. These activities were public technology competitions (called Pitch AgriHack) and a call for participation (Plug and Play) open to all young businesses offering digital technology agricultural services in the regions covered. These activities involved about 500 young businesses. The twelve participants interviewed are winners (5) or finalists (4) of the Pitch AgriHack competitions; one was a winner of another competition organised by CTA and the African Development Bank; another one was selected as participant in CTA's Plug and Play activities and also won other international awards; and the last start-up won an international competition organised by the multinational Rolex and was involved in CTA's activities as well.

Profiles of the start-ups selected

Twelve start-ups from seven West African countries were selected. Those interviewed are the main founders and CEOs of their companies and are aged between 23 and 36 years old (two founders informed later that they are 36 years old, just beyond the 35 years limit we set initially). Table 1 shows the company name (all names have been anonymised in line with research regulations of the Strathclyde University), age of the founder, country of operation, year the business was started, current number of staff and the type of business entity. All these entrepreneurs have started their businesses right from the beginning with the use of personal funds or grant money from local or international organisations and prize money awarded. Six start-ups (Sera, AcornTech, Agromarket, etc.) have their businesses registered legally as a limited liability company. At least one of them, Titan.tg from Togo, is a single person limited company; one is a sole proprietorship (Botanica) and others are like a cooperative (AgComm, etc.), Most of the companies pay around 25% corporate income tax (such as Connecticut and Sera). In contrast, two (out of four) of the Ghanaian companies interviewed declared they enjoy corporate tax holiday offered by governments to young start-ups though they pay social taxes (for staff notably). The turnover in 2018 for these start-ups varies from US$ 14,000 to beyond US$ 500,000.

All the anglophone young entrepreneurs interviewed are educated with varying university/college degrees such as computer science (Hectare, FoodRecon), agricultural science (Agromarket, Connecticut), agricultural extension and management (AcornTech), accounting and finance (MobileTrac). Also, the francophone entrepreneurs (main founders) have formal education and training varying from management, information and communication (Titan.tg), computer and application design engineering (AgComm), communication and business management (Botanica) and agronomy (Franco Sarl).

Exchanges with two experts

Two non-youth stakeholders were interviewed to understand their perspectives on the research issues.

The two experts we selected are D.A., who launched early 2000 one of the first companies that has offered digital agriculture solutions in Africa (the company is still operational), and M.B., manager of a centre that supports young entrepreneurs.

Table 1: Summary table showing details of entrepreneurs interviewed

Company	Country	Key activities of the start-up	Age range of interviewees	Start of business	Number of staff
Sera	Ghana	Facilitates delivery of animal vaccines via digital platforms	34 to 40	2016	15 permanent staff
Agromarket	Ghana	e-Commerce platform for fresh food	25 to 29	2016	6 permanent staff and 2 interns
Connecticut	Ghana	Agriculture advisory information, access to market, sells inputs using digital technologies and offers other services to value chain actors	25 to 29	2011	40 permanent and temporary staff
MobileTrac	Ghana	Facilitates access to tractors using digital tools	34 to 40	2016	7 permanent staff
Hectare	Nigeria	Rents farmlands to farmers as well as digital tools for productive activities; crowdsource funds (off and online) for farm productions	30 to 34	2017	5 permanent staff, 30+ temporary staff
AcornTech	Nigeria	Various digital services to agriculture stakeholders, including an app for advisory services; pilots an input management platform	30 to 34	2016	6 permanent staff
FoodRecon	Nigeria	e-Commerce platform selling food products at low price before end of shelf-life by collaborating with food producers	30 to 34	2016	7 full time employees, 3 part time staff and volunteers
AgComm	Senegal	e-Commerce platforms for processed food produced by women; offers other digital services	30 to 34	2014	5 staff

Titan.tg	Togo	Advisory information, marketplace, data management platform, etc.	30 to 34	2016	12 permanent staff
Amber	Burkina Faso	e-Commerce platform; agriculture learning tool using a mobile app	30 to 34	2015	7 permanent staff
Botanica	Benin	e-Commerce platform for organic agriculture products	25 to 29	2016	7 permanent staff
Franco Sarl	Côte d'Ivoire	Production management; use of drones to provide advisory services	25 to 29	2016	9 permanent and 3 part-time staff

1.2.2. Data collection and analysis techniques

Fifteen invitations were sent; twelve start-ups were available in the timeframe of the research. The list of interview questions was prepared to address our research questions and to fulfil the purpose of carrying out this research. Mostly, the questions were generated building on findings of the literature review, also addressing aspects that cannot be answered by the existing literature and the available secondary data. Questions were split into three main categories:

- Profile of the interviewee and background on the company
- Business model
- Business environment, success drivers and constraints.

Each interview took around 90 minutes. The same questions were asked to all participants to enable comparison. Before and after the interviews, we were able to consult relevant secondary data obtained from CTA to gain additional understanding of the interviewees' business operations.

A major limitation in interpretive analysis of semi-structured interviews is the precision in capturing responses (Eriksson and Kovalainen, 2008). This was overcome by using the Skype audio recorder with permission by the interviewee so as to minimise errors in the transcribed responses.

2. Literature review

We will first question the concepts of *business success* and *success drivers* (many authors refer to success factors, while talking about drivers); this will be followed by an exploration of what the business model concept embraces as well as its possible articulations. Thirdly, we will review the concept of entrepreneurship and some of its key forms relevant for this work: agripreneurship (agricultural entrepreneurship) and digital entrepreneurship in West Africa.

2.1. Business success and success drivers

2.1.1. What is success in business?

Financial indicators

From the point of view of economists and of managers, success for a business is defined exclusively, or primarily by financial indicators (Meskendahl, 2010). The most common financial indicators referred to are growth, profit and turnover (Maltz et al., 2003; Walker and Brown, 2004), while others cited include market share, market capitalisation, the number of employees and efficiency. Financial measures appear to be "hard" and consist of objective figures (Walker and Brown, 2004). Shenhar and his colleagues postulated that the prominent consideration of financial measures as success indicators was probably understandable during *"the industrial age during which single-products were generally produced…with high variable costs…*[but this] *does not fit well with today's dynamic markets, multiproduct firms, and high fixed cost environments"* (Shenhar et al., 2001).

Financial indicators are generally short term based, produced often on a quarterly basis, mainly to serve the interest of short term investors. When considering technology businesses, Dvir and Shenhar argue that for technology-based businesses, appraising success by considering financial short term indicators such as profit is usually irrelevant, as for many of these types of companies, success is achieved in the long term (Dvir and Shenhar, 1992). A good example is the online retailer Amazon. In an article with a very expressing title (*"The Amazon era: no profit, no problem"*) Markhan reminded us that after 20 years of existence and despite having a market capitalisation close to US$ 500 million, Amazon reported profits only for a couple of quarters up to November 2017 (Markhan, 2017). Therefore, profitability for technology companies is not necessarily a good success measure in the short term. The technology industry grows very quickly and experiences change very often. Constant investment is therefore needed (Dvir and Shenhar, 1992).

Non-financial indicators

The pre-eminence given to financial measures, especially to profitability, seems to stem from the assertion posited traditionally that the objective of business is profit making (Drucker, 2008). However, Drucker affirmed that claiming this is irrelevant and wrong. For him, the main objective of business is to create customers, and profit is only a "*requirement*" needed to support the business costs and keep it operational. He proposed that business objectives have to be set in key areas including financial and non-financial indicators such as human resources and social responsibility (Drucker, 2008). Shenhar and his colleagues concurred that non-financial indicators also define success (Shenhar et al., 2001). Non-financial measures may include job satisfaction, personal satisfaction, social impact, employee happiness, customer satisfaction (Maltz et al., 2003; Walker and Brown, 2004), caring about the environment and social responsibility (Drucker, 2008).

Table 2: Examples of indicators of business success (by this report's authors)

Financial	Non-financial
Efficiency	Job and personal satisfaction
Growth	Personal achievement
Profit	Pride in the job
Turnover	Flexible lifestyle
Number of employees	Balance between work and family life
Market share	Autonomy
Market capitalisation	Organisation capacity
ROI	Internal processes
Pre-tax return	Customer satisfaction
P/E ratio	Longevity

Business success can thus be defined as "*the creation or development of an economic activity that generates recurring income, generates value and increases a form of well-being for society or well-being at work for the owners, entrepreneurs and human capital, over time*" (Fassi, n.d.) – sentence translated from French. Though this definition does not mention "customer satisfaction" (one of the key measures of success referenced in the literature), it is one of the most relevant definitions of business success we have come across.

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A multidimensional concept

A conclusion from these findings is that there are many ways in which business success is defined. Walker and Brown posit that owners of lifestyle businesses consider successful business performance from non-financial perspectives (Walker and Brown, 2004), contrarily to growth-minded businesses. For the first ones, high businesses growth is not the main motive (Morrison, 2006). Several authors have developed multi-dimensional approaches of business success such as the Balanced Scorecard (Kaplan and Norton, 1996) and the Dynamic Multi-dimensional Performance Model (Maltz et al., 2003) which includes twelve potential baseline measures as illustrated by the graph below.

Financial	Market/ customer	Process	People development	Preparing for the future
Sales	Customer satisfaction index	Time to market with new products/services	Retention of top employees	Depth and quality of strategic planning
Profit margin	Customer retention rate	Quality of NPD & PM processes	Quality of leadership development	Anticipating/ preparing for unexpected changes in external environment
Revenue growth	Service quality			

Figure 1: Twelve baseline measures of business success (Maltz et al., 2003)

Shonesy and Gulbro specified that there is no generally accepted list of parameters that can help distinguish a successful from a failed business (Shonesy and Gulbro, 1998). In addition, success parameters differ per type of business (small or large, lifestyle or growth-minded, etc.).

2.1.2. Success drivers relevant for this research

A synthetic view of success for small businesses is offered by Javed Jasra and his colleagues who studied small businesses in Pakistan (Jasra et al., 2011). They suggested seven categories of "determinants" of success for small businesses displayed in the graph below:

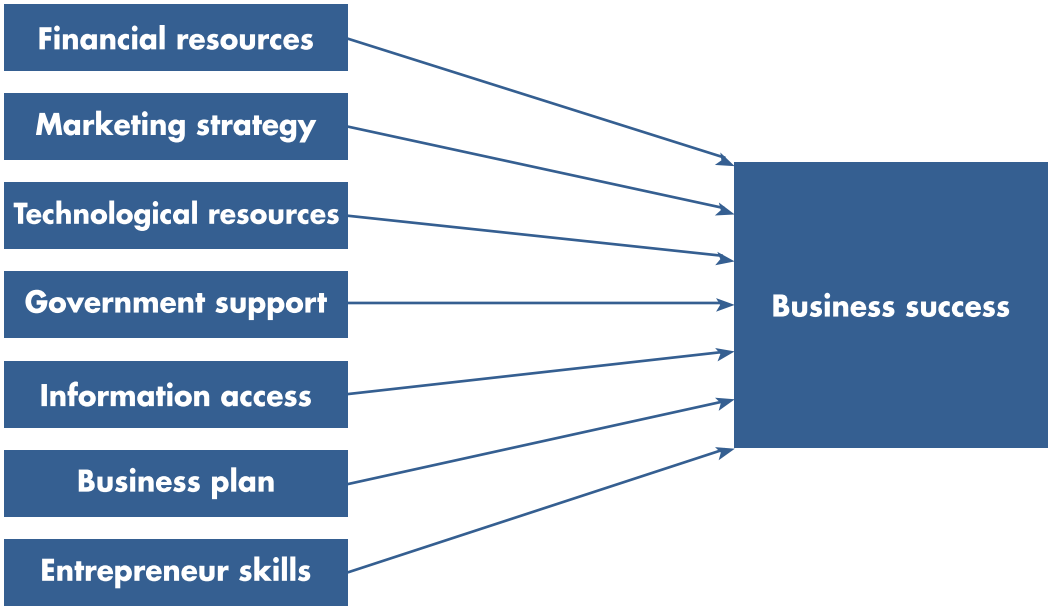

Figure 2: Success determinants for small businesses (Jasra et al., 2011)

Business plan relates to business model in this context. Another researcher identified nine critical success factors for small businesses in Pacific countries (Attahir, 1995). These factors are: good management, satisfactory government support, oversee exposure, level of education and training, personal quality and traits, prior experience in business, access to finance and initial level of investment, political affiliation, marketing factors.

These two approaches have much relevance to the West African businesses targeted. Indeed, the businesses are small, created by young entrepreneurs and the majority of them have less than five years of longevity and are operating in the least developed countries. Some of the indicators these authors highlighted (government support, entrepreneurship skills, good management, political influences) have been mentioned in many youth entrepreneurship publications targeting developing countries (CTA(a), 2016; Kieti and Crandall, 2013; Kew et al., 2015).

For the research, regarding financial indicators, we will be more concerned with the revenue generation and profitability. The companies targeted are young, not listed and many rarely capture other financial indicators.

2.2. Business models

2.2.1. The concept

Doleski (2015) defined a business model as one that "*provides a simplified representation of value creation processes, functions and interactions for creating customer value, securing competitive advantage and generating revenue*". Business models have been substantially associated with the emergence of online business (Magretta, 2002). Indeed, the growth in the use of the internet has enabled companies to develop various means of implementing different models that affect the way they respond to the changing business environment.

The concept of the business model is divided by Afuah (2003) into four main categories (Figure 3). Operations within these categories contribute to overall competitive advantage. According to Slávik and Bednár, this model lacks in the area of connecting intrinsic elements of the business as well as the external environment into a systematic flow (Slávik and Bednár, 2014).

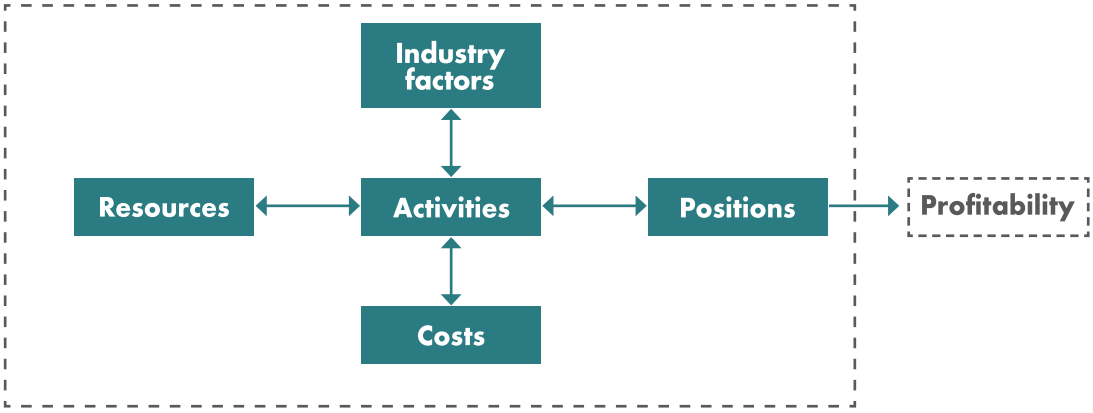

Figure 3: Components of business model by A. Afuah (Slávik and Bednár, 2014)

Johnson and his colleagues describe a profitable company as one which provides value for customers while making profit and using a business model comprising of four related elements: value for customer, profit formula, key resources and key activities (Johnson et al., 2008). A prominent principle for achieving success is the right alignment of resources, e.g. brand image, technologies with company activities, e.g. staff training and production.

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2.2.2. The Business Model Canvas

The most widely tested and used framework of analysis of business models appears to be the Business Model Canvas (BMC) developed by Osterwalder and Pigneur (Osterwalder and Pigneur, 2010). The visual representation of all components, their interconnectivity (Figure 4) and its presentation in a 1-page format are some of its key features. The BMC is described as having nine distinctive constituents as shown in the figure below (Slávik and Bednár, 2014). Other advantages of this model are the ease of use and adaptability within different industries such as Apple, Deloitte, Ericsson and government services (Osterwalder and Pigneur, 2010). We use an adaptation of this model in our study.

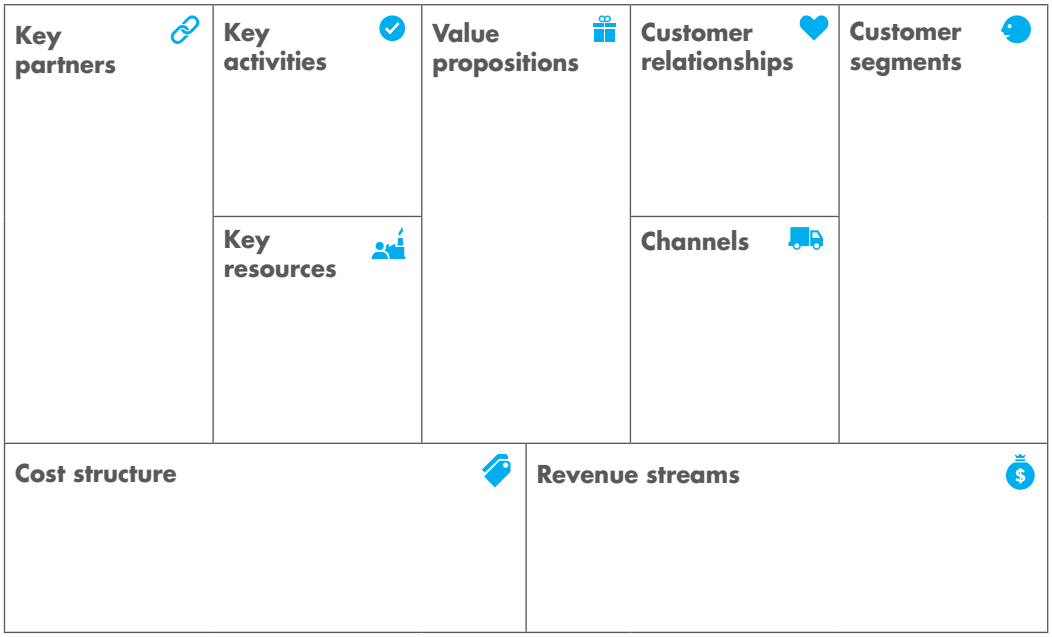

Figure 4: The visualisation tool of the BMC by Osterwalder and Pigneur (Slávik and Bednár, 2014)

a) Customer segments

Customer segments define who the target markets is or are. They may be grouped or refined into several groups based on needs, behaviour pattern, etc. For a business to remain viable, it must demonstrate the ability to satisfy the needs of the customer segment or target market it has identified. This segmentation of customers can be based on needs, distribution channel, means of communication, level of profitability and willingness to pay for variable offerings. Examples of such market segments include mass market, niche market, segmented, diversified and multi-sided markets (Osterwalder and Pigneur, 2010).

b) Value proposition

A value proposition produces a unique benefit to the customer and allows for customer loyalty. It may be represented in a variety of ways: qualitative or quantitative but with distinctive features and attributes that cannot be easily copied by competitors. A "*Unique Value Proposition is a single, clear compelling message that states why you are different and worth buying*" (Blanke, 2013). It may be characterised in the form of performance, customisation, brand, price, bespoke design, accessibility, risk reduction and convenience or usability (Osterwalder and Pigneur, 2010). Value proposition addresses the needs of a particular customer segment. This component in the BMC framework may address as well the need or problem faced by the client and for which a company develops a solution.

c) Channels

A company's channels describe the ways and manners in which it conveys and interconnects its value proposition to its customer segments. Osterwalder and Pigneur (2010) propose five different phases in which an effective channel can be fulfilled. A business can choose any means depicted in the diagram below to reach its customers or a mixture of both partner or owned channels.

d) Customer relationships

This block represents the relationships the business has with the different customer segments which could be computerised (automated services), personal, self-service, through local or online communities or a blend of one or more of these components (Osterwalder and Pigneur, 2010).

e) Revenue streams

Revenue streams depict the income received from serving each customer segment (revenue minus cost equals earnings). A business must figure out to an extent what value of services or product a customer segment is willing to pay for. Knowing this would determine the pricing strategy which could be used for each segment. Osterwalder and Pigneur (2010) provide different ways to produce revenue streams:

- Asset sale
- Usage fee
- Subscription fees
- Licensing
- Advertising
- Brokerage fees.

f) Key resources

This element of the BMC describes vital assets needed for the business to work. Every business needs key resources to generate value, reach the desired customer segment and maintain customer relationship while creating revenue. These resources may vary as a result of the sort of business, e.g. monetary (cash and credit), intellectual (brands and patents), physical assets (building, manufacturing facilities and machines) and human resources.

g) Key activities

Like with the key resources, key activities identify the vital things a business needs to do for the business to work. These are the actionable things a business must satisfy to remain viable. They are business specific and vary from business to business.

h) Key partnerships

Key partnership involves the web of suppliers and partners that the business needs to be successful. Alliances between businesses are becoming a norm in this age and time because it enables the organisation to gain more economic ground, creates better risk management by reducing uncertainty within the business and facilitates the acquirement of resources.

i) Cost structure

The cost structure describes the overall cost of running a business model. Every segment of the business model acquires a cost. While some businesses are entirely cost-driven (e.g. low-cost airlines, like Ryanair), most businesses' cost structures are found in between the two extremes of cost-driven and value-driven (Osterwalder and Pigneur, 2010). There are other features of cost structure that need to be considered in every business such as fixed costs, variable costs, economies of scale and economies of scope (Osterwalder and Pigneur, 2010).

Adaptation of the Business Model Canvas

Some authors point out that the BMC has the disadvantage of not allowing a detailed account of the business strategy or methods of emerging into a new market (Howell et al., 2018). However, considering that it has been developed as a tool that can readily describe the main aspects of the business growth engine of companies, it can be understood that it cannot cover everything.

The BMC has also been adapted by many professionals to better fit different types of businesses. Ash Maurya argued for example that this model is more relevant for more mature businesses that have already identified their business models than for young businesses that are still testing their business model hypotheses (Maurya, 2012 (a)). He proposed another framework called the Lean Canvas Model, which builds on the BMC and is composed of the following nine components: problem, customer segments, solution, value proposition, unfair advantage, key metrics, channels, costs, revenue streams. He highlighted that the "*problem*" component is a key one for young (digital) businesses, as they need to clearly identify a specific problem for which they are developing a specific solution, in order to ensure "problem/solution fit" and eventually "product/market fit" and growth (Maurya, 2012 (b)). We will take into account Ash Maurya's arguments in the adaptation of the BMC that we will use later in this report.

2.2.3. Business Model Innovation

Business model innovation (BMI) has grown consistently within the past decade within management and practitioners. Current reviews of the terminology that was once known only as business models (BMs) has emphasised its importance in today's business world including such areas as strategy management and technology (Zott et al., 2011). Many of such few available reviews refer to BMI as a means of value delivery and "capture mechanism" within a firm (Foss and Saebi, 2017). It denotes a new terminology that offers an overall view of an organisation's innovation strategy thereby improving the performance of both pioneering and established firms.

From the literature, there is a significant difference in BM and BMI as the latter has only become recognised in recent years and is less understood. The difference lies in the introduction of innovation within a business model which addresses issues such as factors that enable or limit its implementation and how the BM can be used to achieve a competitive advantage. BMI can be defined as "*designed, novel, nontrivial changes to the key elements of a firm's business model and/or the architecture linking these elements.*" (Foss and Saebi, 2017). Thus, the ability of an organisation to move quickly into innovative business models contributes to the overall success and sustainability of the firm.

BMIs are alleged to bring about higher business revenues compared with BMs (Zott et al., 2011). BMIs can be categorised into four different patterns as shown in Figure 5.

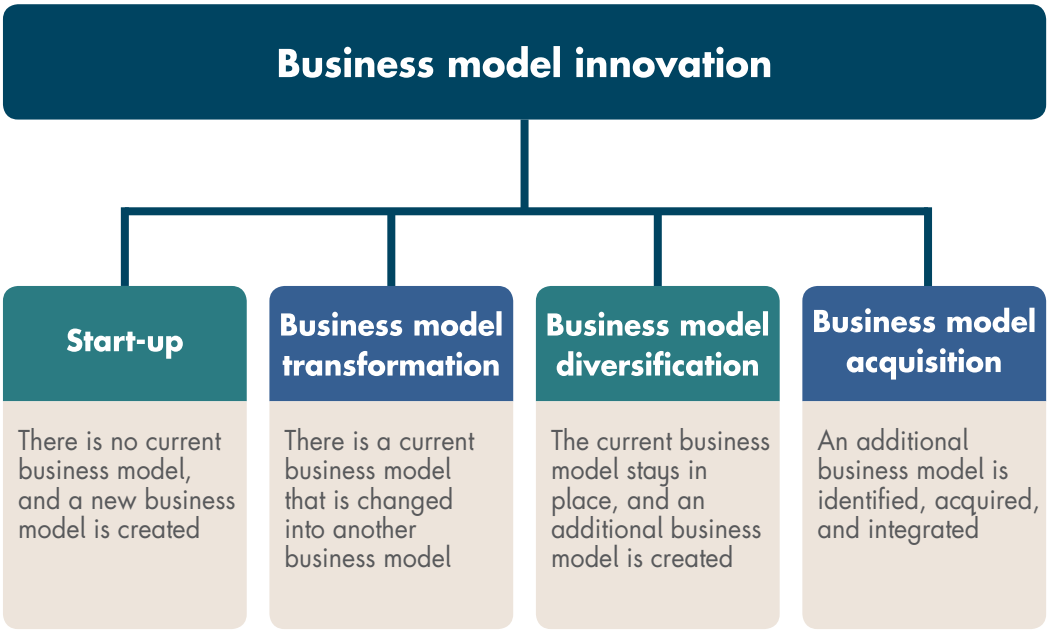

Figure 5: Phases of business model innovation (Geissdoerfer, et al., 2018)

Some authors hypothesise that at least two components in the current BM must innovatively change before we talk about business model innovation (Lindgardt et al., 2009). Therefore, Geissdoerfer et al. define business model innovation as *"the conceptualisation and implementation of new business models which can comprise the development of entirely new business models, the diversification into additional business models, the acquisition of new business models, or the transformation from one business model to another."* (Geissdoerfer et al., 2018).

It has become necessary for firms not to act autonomously but cooperatively with two or more firms and stakeholders. BM and BMI are being used as a planning tool that considers and analyses these concerted ventures in promoting value and business success (Bocken et al., 2014).

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2.3. Entrepreneurship, agripreneurship and digital entrepreneurship

2.3.1. Youth entrepreneurship in West Africa as a development strategy

The Oxford English dictionary defines an entrepreneur as a "*person who sets up a business or businesses, taking on financial risks in the hope of profit*" (Jeffrey and Dyson, 2013). A major element in this definition is the ability to take risk associated with a degree of discernment. One could argue that whilst much of the literature in recent times in countries in the north (e.g., Europe, USA) focuses on elite business entrepreneurs, many people in West Africa engage in different categories of business enterprises; they take on risks with the view of providing a reasonable income to cater first of all for their immediate families and communities (Jeffrey and Dyson, 2013).

Youth entrepreneurship in West Africa is usually a response to the difficult economic climate in the country and the inability to find skilled labour after completion of a formal degree in a higher institution (Chigunta, 2017). Young people in West Africa have been caught up in daunting unemployment and underemployment issues. While the total of unemployed and people in vulnerable jobs in West Africa is huge, youth aged between 15 and 24 years old have an employment rate 20% lower than adults' employment rate (AfDB, 2018).

Youth are also caught up in the mismatch between job ambitions and reality, and therefore many have escaped into various forms of vulnerable micro-enterprises to survive in an unbalanced economy (World Bank, 2017).

Entrepreneurship in West Africa is carried out in various business areas (Kew et al., 2015). A notable publication on women entrepreneurship in the region is a report by Langevang and Gough (2012) which highlights the hairdressing and dressmaking sectors in Ghana dominated by young entrepreneurs. Another form of entrepreneurship in Ghana that has gained support internationally (World Bank, USAID) is the Health Keepers. This form of venture encourages the youth to generate income by operating a door-to-door micro-enterprise and gaining some sort of entrepreneurial skills (Dolan and Rajak, 2016). Social relationships play a vital role in the understanding of new venture creation in Ghana and entrepreneurship is developed often in a family business perspective (Kuada, 2009).

Entrepreneurship is also very vivid in Nigeria, the first economy of Africa in terms of GDP (World Bank, 2018), and one of West Africa's greatest countries in terms of huge potential for growth (Dolan and Rajak, 2016). Unemployment and under-employment are pervasive, with more than 64 million of youth unemployed and 1.6 million under-employed (Awogbenle and Iwuamadi, 2010). The World Bank suggests that young people should make a shift from the tightly and compactly packed white-collar work to creating a means of venturing into the huge capitalist economy through the development of micro-enterprises. (World Bank, 2007). On their side, Awogbenle and Iwuamadi have observed the limitations hindering Nigerian youth employment and proposed in their study a wake-up call to orientate people particularly in the need to develop a self-employment mentality and assume

means of gaining entrepreneurial training. Similarly, the government of Nigeria has called for the engagement of entrepreneurs within the agricultural sector as a way of revitalising the economy which experienced negative growth rates recently. There is a huge opportunity for agricultural development in the country, being that 80% of the land is suitable for growing crops (Anon, 2018). Currently however, the main stigma is that agriculture is viewed by youth (and many parents) as being suitable only for illiterates or locals living within rural villages. Many believe that the integration of ICTs will make agriculture more appealing to young people (AGRA, 2015).

2.3.2. Agripreneurship

Agripreneurship is a terminology which combines agriculture and entrepreneurship. An agri-entrepreneur (agripreneur) can be defined according to Ndedi and Feussi (2017) as a person who has discovered an underserved or unserved market within the agricultural sector and pursues it despite the risks involved. The paper proposes that effective traits of an agri-entrepreneur include market orientation, creativity and leadership skills. The term has been adopted by international institutions and governments in Africa, such as the International Institute for Tropical Agriculture (IITA), one of its most active promoters, particularly through the IITA agripreneurship programme.

The concept of agripreneurship is perceived as dynamic and youthful (Ndedi and Feussi, 2017). People engaged in agripreneurship are expected to be more "entrepreneurial" (than the regular farmer), very dynamic and to be fuelled by a desire to offer innovative business services and grow their offerings. We will often use the concept "digital agripreneurs" in this study to refer to digital entrepreneurs serving the agricultural sector.

Agricultural entrepreneurs are faced with similar challenges as entrepreneurs in other sectors of the economy. They need to deal with areas of the business such as human resources, financial management and finding/using current and detailed information where necessary. Therefore, management skills required for a successful agripreneur must include risk management and be able to recognise new opportunities (McElwee, 2006).

2.3.3. Digital entrepreneurship

Understandings of the concept

The increased democratisation of the internet, the mobile phone and social media (Solis, 2011), as well as developments in data processing techniques (such as big data or artificial intelligence) and the evolutions in hardware engineering, have led to the emergence of a new kind of entrepreneurship named digital entrepreneurship (Nambisan, 2017). It may be defined as an engagement in an entrepreneurial project implemented largely in the digital space or leading to the delivery of digital artefacts. A specific form of this new entrepreneurial avenue is digital technology entrepreneurship. Giones and Bren define *digital technology entrepreneurship as* an entrepreneurial venture in which the product and services are exclusively ICT-based, meaning that the output is technological (Giones and Brem, 2017). Digital entrepreneurs who are not technology entrepreneurs just use technology as inputs.

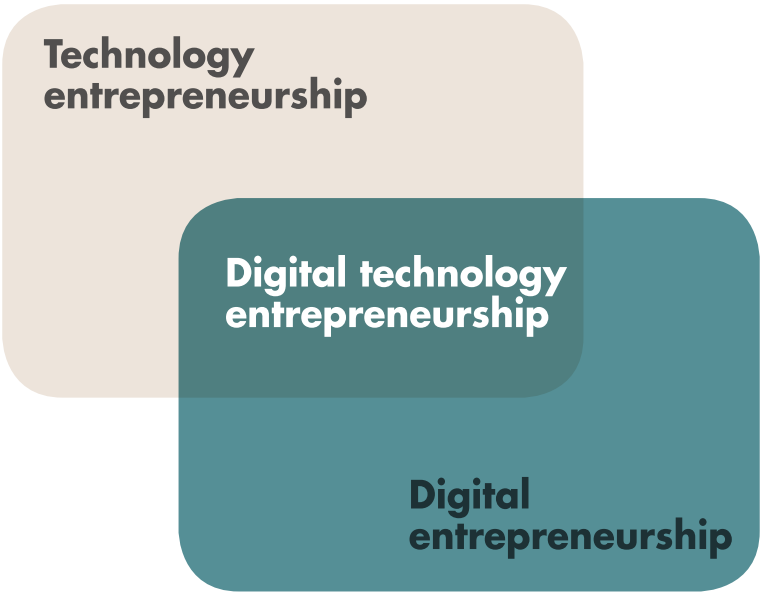

Figure 6: Distinction between technology entrepreneurship, digital entrepreneurship and digital technology entrepreneurship
Source: Giones and Brem, 2017

Technology entrepreneurship is an under-researched field at the global level, including thus in developing countries (Shane and Venkataraman, 2003).

Roja and Nastase identified several key elements of the entrepreneurial ecosystem for technology businesses, including universities, other businesses, financial service providers, markets, governments, and innovations and business development institutions such as technology incubators, accelerators and hubs (Roja and Nastase, 2014). The government's role is to facilitate the existence of an enabling business environment, while universities, innovation hubs and technology parks are the realms of the development of innovations (Jiménez and Zheng, 2018; Kieti and Crandall, 2013). Developing business management acumen in technology entrepreneurs is a critical success condition (Roja and Nastase, 2014).

This research will in majority involve digital technology entrepreneurs (specialists of digital technology) servicing the agro-food sector but also agricultural entrepreneurs that are using digital technologies innovatively to service the sector. The latter are not technology specialists.

Digital agripreneurship in Africa

Digital entrepreneurship in agriculture in Africa emerged in the early 2000s. In Senegal, for example, the company Manobi Senegal launched in September 2001 SMS-based market information services, targeting fishermen, in collaboration with the national telecom operator Sonatel (BBC, 2002). The services aimed at providing fishermen with current market information prices and trends before they sell their produce to the right buyers. Fishermen were not requested to pay for the services, but Manobi was paid commissions from Sonatel based on the communication traffic generated by the use of the service (Sylla, 2008). With the reduction of internet and mobile communication costs over the years coupled with the higher penetration of digital technologies in the agriculture sector, consumption of digital agricultural services is much more common (CTA, 2014). Therefore, entrepreneurial activities in this field have spurred, driven by young entrepreneurs encouraged by various institutions (Baumüller and Lohento, 2016).

However, many of these youth-led technology start-ups are facing serious challenges to sustain their businesses and offer sustainable value to the agricultural sector. Referring to the case of East Africa, Kieti and Crandall affirmed that *"these start-ups face issues of marketing their products to farmers, finding funding to scale their products, and ensuring they are properly meeting the needs of their end users"* (Kieti and Crandall, 2013). The start-ups are particularly facing challenges relating to how to design effective business models, which will ensure repeat customer purchase, higher revenue generation, profitability and scalability (Elliott, 2015). A fundamental issue which is a constraint the entrepreneurs have to take into account, is that farmers in most cases in Africa are poor, digitally nearly illiterate (though they can use the mobile phone), and usually unwilling to pay for information services. The effectiveness at a larger scale (past the pilot experience) of digital information services targeting agriculture is also in many cases questionable (Baumüller, 2015) and may prevent sustainable business service offerings.

In many cases, the usefulness of digital services for the farmer-customer depends on structural intrinsic challenges that the agricultural sector is facing that limit severely the effectiveness of applying digital technologies (Baumüller, 2015). Another fundamental issue undermining the development of start-up services is the weak management capacities of young entrepreneurs themselves (CTA, 2017; Roja and Nastase, 2014).

2.3.4. Supporting the development of youth entrepreneurship

In the past decade, youth entrepreneurship has been particularly drawn to lime light in the race for employment creation and economic growth in developing countries (AGRA, 2015; Kew et al., 2015). The increasing population of the youth has been seen as a huge reservoir of untapped potential and as a risk for social unrest in face of harsh economic conditions. A large variety of initiatives (such as programmes dubbed "bottom of pyramid" initiatives (Dolan and Rajak, 2016) are put in place by government parastatals, private bodies and international NGOs, at national and international levels to address youth development (AGRA, 2015; ITU, 2014; OECD, 1998). Many of these initiatives aim at preparing the youth to be aspiring business entrepreneurs in the fight against poverty and view themselves as a means of increasing the economic power within the society.

Many youth innovations are emerging such as those produced by Safi Sarvi which deals with the production of organic fertiliser in Kenya and the innovative UMT (malaria testing device) developed by some Nigerians (Ekekwe, 2016). Other examples of such cases are noted in the report by Chimub and Nayamanhindi (Chimub and Nayamanhindi, 2012) which highlights mobile phone micro-ventures of youth in Zimbabwe and another report focusing on youths in Nairobi (Kenya) who have derived a means of livelihood from recycling waste (Thieme, 2010). Some studies have looked at the promotion of youth entrepreneurship in universities materialised by the development of "student spin-off companies" (Bezerra et al., 2017).

The advent of digital technology has supported the growth of youth entrepreneurship possibilities (ITU, 2014). The use of internet, the cloud, social media and freely available software has increased the innovation process and the emergence of innovations by young entrepreneurs within the society (CTA(a), 2016).

Amongst other difficulties in entrepreneurship, the young entrepreneurs possess further challenges due to their age. These include lack of experience and professional businesses training, inability to get funding due to the lack of financial credibility and human resources (Borges et al., 2012).

Many of the studies and reports referenced above have called for support to help youth achieve successful entrepreneurship, including in the agricultural sector, as an avenue to address employment issues they are facing but also to leverage their innovations to achieve national growth. At the same time, many authors warn that not everyone can become an entrepreneur or a successful entrepreneur (Kew et al., 2015; Global Entrepreneurship Research Association, 2018). Entrepreneurial capacities may however help a youth to seek successfully employment in other entities.

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3. Business model analysis

3.1. Detailed presentation of start-ups' business models

For the analysis of the business models of the companies targeted, we will use an adaptation of the Business Model Canvas. We have included the "*problem*" component building on the observation by Ash Maurya that this element is very important for describing young businesses (Maurya, 2012 (b)), as we specified in the literature review section. The "*value proposition*" component has been kept, referring expressly to the unique value that infers competitive advantage to companies as per the definition of Blanke (Blanke, 2013). The "*customer relationships*" component will be addressed through the "*channels*" component, in line with the observation by Maurya that the path to customers (channels) gives insights on relationships a company establishes with them (Maurya, 2012 (b)). The components adapted are marked in yellow in Figure 7. We have not adopted the full Lean Canvas Model proposed by Maurya as an alternative canvas, as we believe that the "*key partnerships*" and "*key resources*" (that he removed mainly because he wanted to keep a 9-component model of the BMC) are very important for the agriculture technology start-ups we are studying.

<table>
<tr><th colspan="5">Adapted Business Model Canvas for selected digital agricultural start-ups studied</th></tr>
<tr><td rowspan="2">Key partnerships</td><td>Key activities</td><td rowspan="2">Problem(s)

~~Value proposition~~</td><td>Unique value proposition(s)

~~Customer relationships~~</td><td rowspan="2">Customer segments</td></tr>
<tr><td>Key resources</td><td>Channels

(Include as well aspects of customer relationships)</td></tr>
<tr><td colspan="3">Cost structure</td><td colspan="2">Revenue streams</td></tr>
</table>

Note: A couple of companies are not primarily specialised in digital services. We will not put emphasis on agricultural services they offer that do not depend on digital technologies.

3.1.1. Problems addressed

The companies interviewed have designed their digital services to address several types of agricultural challenges (see Table 3). These problems are common, not only to the agricultural sector in West Africa, but also to Sub-Saharan countries (AGRA, 2018).

The first three challenges addressed are the weak agricultural productivity, the lack of advisory services and the lack of access to profitable markets for farmers. These appear to be some of the most fundamental difficulties facing agriculture in West Africa (AfDB and FAO, 2015). Problems relating to weak productivity include the very limited access to mechanised services such as tractors, which MobileTrac from Ghana addresses using a digital platform.

Five companies supply solutions to the issues of limited access to quality agro-food products. Examples include Botanica, from Benin, which has as vision to promote agro-ecological products to contribute to fighting climate change adverse impacts and to promoting nutrition security:

> *In Benin, a large share of the chemical inputs, normally reserved for the cultivation of cotton, is used by the horticultural sector. In line with the Sustainable Development Goals and the ten principles of agro-ecology established by FAO, we address the problem of bad production and food supply by strengthening the resilience of smallholder farmers and by promoting healthy food consumption."*
>
> *Botanica's founder during the interview*

Women farmers are confronted with daunting problems in their agricultural practices and AgComm from Senegal has decided to concentrate their business on women, as shared by the founder:

> *We were three women who came together to develop the platform, initially for a competition. After the competition, we decided to refocus on the crucial challenges faced by women producers, especially women agro-food processors. A large share of rural women is involved in small-scale farming and in agricultural trade, but they are facing dramatic problems and weak revenues."*

Apart from supporting women producers, AgComm gives herself the vision to promote local food consumption; indeed reducing food imports, which cost Africa about 35 billion dollars annually, has been identified as a crucial continental concern (African Development Bank, 2016).

Table 3: Problems addressed by the start-ups

Company	Country	Problems addressed						
		Weak agricultural productivity	Limited access to quality agrofood products	Lack of access to inputs	Lack of access to profitable markets	Animal and post-harvest losses	Lack of advisory information and services	Weak customer data and supply chain management
Sera	Ghana			■		■	■	■
Agromarket	Ghana		■		■	■		
Connecticut	Ghana	■		■	■		■	■
MobileTrac	Ghana	■						
Hectare	Nigeria	■			■		■	
AcornTech	Nigeria	■					■	
FoodRecon	Nigeria					■		■
AgComm	Senegal		■		■			
Titan.tg	Togo	■	■		■		■	■
Amber	Burkina Faso	■	■		■		■	
Botanica	Benin		■					
Franco Sarl	Côte d'Ivoire	■					■	
Total		**7**	**5**	**2**	**6**	**3**	**7**	**4**

Four companies, including Connecticut and Titan.tg (promoter of an e-commerce platform, among others), have identified the limited use of ICT for customer data and supply chain management as an entrepreneurial opportunity.

Sera from Ghana addresses the weak access to animal vaccines for livestock farmers; this issue leads to animal diseases and deaths depriving farmers from important revenues. Its founder revealed:

> *"We realised that the animal mortality rate was really high in communities. A lot of these communities are far from towns, and getting animal health care means that they have to constantly look for the vet or the delivery provider who would be available; but most often when they call either the person lives at far distance or the person is not available."*
>
> *Sera founder*

Reducing animal and post-harvest losses is thus an important concern for some of the companies. Apart from Sera that fights animal losses, FoodRecon in Nigeria facilitates the sale of food "*approaching end of shelf-life*" to charities and households with the objective to fight hunger, malnutrition and food losses.

The last type of problem addressed is the weak access to inputs (seeds, fertilisers, pesticides, agrochemicals, animal inputs, etc.). We have considered only start-ups that manage access to inputs with the support of digital tools.

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3.1.2. Activities and services

All start-ups studied offer (or are planning to offer in the near future) non-digital agricultural services, either as their original revenue stream or as an additional revenue stream. The non-digital services include farm management, agricultural production, inputs delivery, extension services, catering services and agricultural training, all offered without any, or any substantial ICT support.

Apart from these non-digital services, various types of services are supplied by the young companies using digital platforms:

- *Market linkage services*
  (By nine companies). We refer here only to outputs market (post-production). The services offered are generally of three types. First, the use of e-commerce platforms to sell agro-food products to households and individual customers. It is an activity of AgComm in Senegal; Agromarket in Ghana; Titan.tg in Togo; Botanica in Benin; FoodRecon in Nigeria. The second type of market linkage services involves connecting agro-food producers and agro-food buyers, using digital trade platforms in this process. Titan.tg (via their activity devoted to e-commerce) supplies those services; sometimes, they aggregate commodities purchased from farmers to supply buyers. The third type of services is the collection and dissemination of market prices for specific commodities. For example, Connecticut in Ghana collects and shares agricultural commodity prices to their subscribers through their mobile phone messaging services.

- *Advisory services*
  Agricultural advisory services normally involve non-market and market-related services provided to farmers to help them successfully engage in agricultural production and achieve higher productivity. For the purpose of this research, we have not included market services in the advisory services category. Advisory services offered by start-ups include the provision of agronomic tips, weather information, etc. While these services may be delivered without the involvement of digital tools, three start-ups interviewed supply them through digital tools. Connecticut in Ghana provides weather information and agronomic tips to registered farmers in local languages through mobile phone and a vocal server. AcornTech from Nigeria has developed a mobile application used among others by a Nigerian agricultural research institution to share information to farmers. Titan.tg from Togo also disseminates weather information through vocal server or mobile phone.

- *Production machinery services*
  (Many of these services are also considered as inputs market services, however, we prefer to single them out in the framework of this analysis). Companies identified in this category provide for example tractor services for ploughing or drone services for phytosanitary diagnosis, land surveillance, land mapping and agricultural product spraying. Examples of start-ups in this category include MobileTrac that supports the management of access to tractors using particularly a mobile phone service and a digital monitoring platform. AcornTech developed a web platform (currently in stand-by) to manage access to agricultural machinery.

Table 4: Services offered by the start-ups

Company	Country	Services offered							
		Non-digital agricultural services	Market linkages services	Advisory services	Production machinery services	Inputs service delivery	Customer data and supply chain management	Financial services	Digital literacy and visibility services
Sera	Ghana								
Agromarket	Ghana								
Connecticut	Ghana								
MobileTrac	Ghana								
Hectare	Nigeria								
AcornTech	Nigeria								
FoodRecon	Nigeria								
AgComm	Senegal								
Titan.tg	Togo								
Amber	Burkina Faso								
Botanica	Benin								
Franco Sarl	Côte d'Ivoire								
Total		**9**	**9**	**3**	**4**	**3**	**3**	**2**	**5**

- *Inputs service delivery*

  Two start-ups that provide digital services through which inputs (fertilisers, pesticides, etc.) are delivered to farmers are Connecticut and Sera in Ghana. AcornTech from Nigeria is also introducing a new package of services which will "(…) *facilitate management of quality inputs supply, by leveraging technology to combat counterfeit agro inputs, ensure compliance to industry standards and provide risk covering support for smallholder farmers*." (CEO of AcornTech, Nigeria)

- *Customer data and supply chain management*

  With the increased social penetration of digital technologies, the development of the internet of things (IoT) and of artificial intelligence, data analytics have become a high-value practice that businesses leverage upon to acquire, manage and capture value from customers (Loshin and Reifer, 2013). Connecticut is capturing value from its customers' data, using them to provide other services to partners in this area. They have also developed a data management platform to assist various institutions to better manage customer data. Titan.tg has also developed such a data management platform. Sera, on their side, informed that various organisations are interested in their customers' data; the company might then offer data services in the future. A question that remains weakly addressed is how to ensure that farmers' data are protected and that farmers keep ownership of their data (Maru et al., 2018).

- *Financial services*

  Only two start-ups offer financial services powered by digital tools. Farmers in Connecticut's client base benefit from credit inputs and reimburse the costs after harvest. Botanica, which has an agro e-commerce platform, has launched an innovative payment tool which integrates a QR code.

- *Other services*

  These include ICT training, website, blog or social media account development for farmer groups and other agricultural entities. Several start-ups offer these services as additional revenue streams (AgComm, AcornTech, Agromarket, etc.). In many cases, this was not planned and does not constitute the core service the company offers.

A final observation: all start-ups investigated offer at least two types of services (on average four services), while Connecticut is the company offering the largest panel of services by "bundling" them.

3.1.3. Customer segments

Farmers (young farmers, women producers, small-scale and large-scale farmers) and institutions supporting farming (government institutions, international (rural) development institutions, NGOs, etc.) are the customers mostly serviced by the companies. Hectare targets young farmers and other youth interested in engaging in farming and collaborates with them as employees for its agricultural productions. Small-scale farmers, who made up 70% of the population in Sub-Saharan Africa and produce 80% of the food consumed (AfDB and FAO, 2015; ECOWAS, 2015) are the primary target clients of the start-ups. However, individual farmers usually struggle to pay or cannot afford services offered.

> *We did a small market research that allowed us to eventually target NGOs and associations who can pay for our services; therefore, we have decided no more to target the small-scale producers as initially planned."*
>
> *CEO of Amber, Burkina Faso*

Franco Sarl even asserted that for now, they do not have farmers or farmer organisations in their customer segments. They work directly with institutions that support farmers and farmers benefit via these organisations.

Agro-food businesses may be restaurants, supermarkets or grocery stores; they purchase agro-food products that the start-ups sell via their e-commerce platforms for example, or purchase ICT services they offer. For now, e-commerce platforms target rather high-end or middle-class citizens who can purchase goods using ICT tools (Facebook Pages, WhatsApp, etc.).

> *We target high-end customers and expatriates."*
>
> *CEO of Agromarket, Ghana*

Another category of customers is the "*individuals and households*" category. It comprises clients of e-commerce and digital marketplaces (put in place by AgComm, Titan.tg, Botanica, etc.). "*Individuals*" also represent busy professionals and other individual "*investors*" who buy shares of agricultural production budget from Hectare when a production campaign is launched. The "*other businesses*" category involves firms that sub-contract Franco Sarl when they need aerial mapping services while offering services to governments, or international institutions, or businesses and supply chain partners that need farmer data (insurance companies, banks, input dealers, etc.) from Titan.tg, Sera or Connecticut.

From another point of view, it is notable that almost all the start-ups offer services both to B2B and B2C clients.

Table 5: Customer segments

Company	Country	Customer segments							
		Farmers	Individuals and households	Farmer organisations	Agro-food businesses	Institutions supporting farming	Other businesses	B2C	B2B
Sera	Ghana								
Agromarket	Ghana								
Connecticut	Ghana								
MobileTrac	Ghana								
Hectare	Nigeria								
AcornTech	Nigeria								
FoodRecon	Nigeria								
AgComm	Senegal								
Titan.tg	Togo								
Amber	Burkina Faso								
Botanica	Benin								
Franco Sarl	Côte d'Ivoire								
Total		**8**	**7**	**3**	**6**	**8**	**3**	**12**	**11**

3.1.4. Unique value proposition

As per the BMC model (Osterwalder and Pigneur, 2010), value proposition can be gained with "*performance*", "*brand*", "*newness*", "*bundled services*", "*price*", "*risk reduction*", "*accessibility*", "*convenience*" or "*usability*". All companies claimed to have a competitive advantage with the increased "*performance*" that their digital services provide and with the "*newness*" of their digital services.

> *Not only do we provide 1000 acres farmland for production, but we have a fully serviced farm, with access to mechanisation, mentorship, access to market and the possibility to apply the right ICT tools to maximise production."*
>
> *CEO of Hectare*

The entrepreneurs, especially e-commerce platform operators, also asserted that "*accessibility*" is a value proposition as customers can acquire their products or services from their fingertips (mobile or desktop device) from wherever they are. Botanica stated that their payment system confers them a "*brand*" competitive advantage, and like Agromarket, they claimed to provide "*risk reduction*" with the sale of agro-ecological products. With their "*bundles services*" (weather, advisory and market information obtained with the sale of inputs) Connecticut gains considerable competitive advantage.

> *The value we render is in the quality of service (…) Farmers can purchase high quality and affordable inputs delivered with free messages of weather forecast, financial literacy and information on how to better utilise their crops and fertilisers."*
>
> *CEO of Connecticut*

Agromarket selected in addition "*price*" as value proposition and explained that because they bypass middlemen, they can sell at cheaper prices. AgComm also declared that they provide a "*brand*" value proposition by promoting local processed foods produced by rural women cooperatives.

3.1.5. Channels

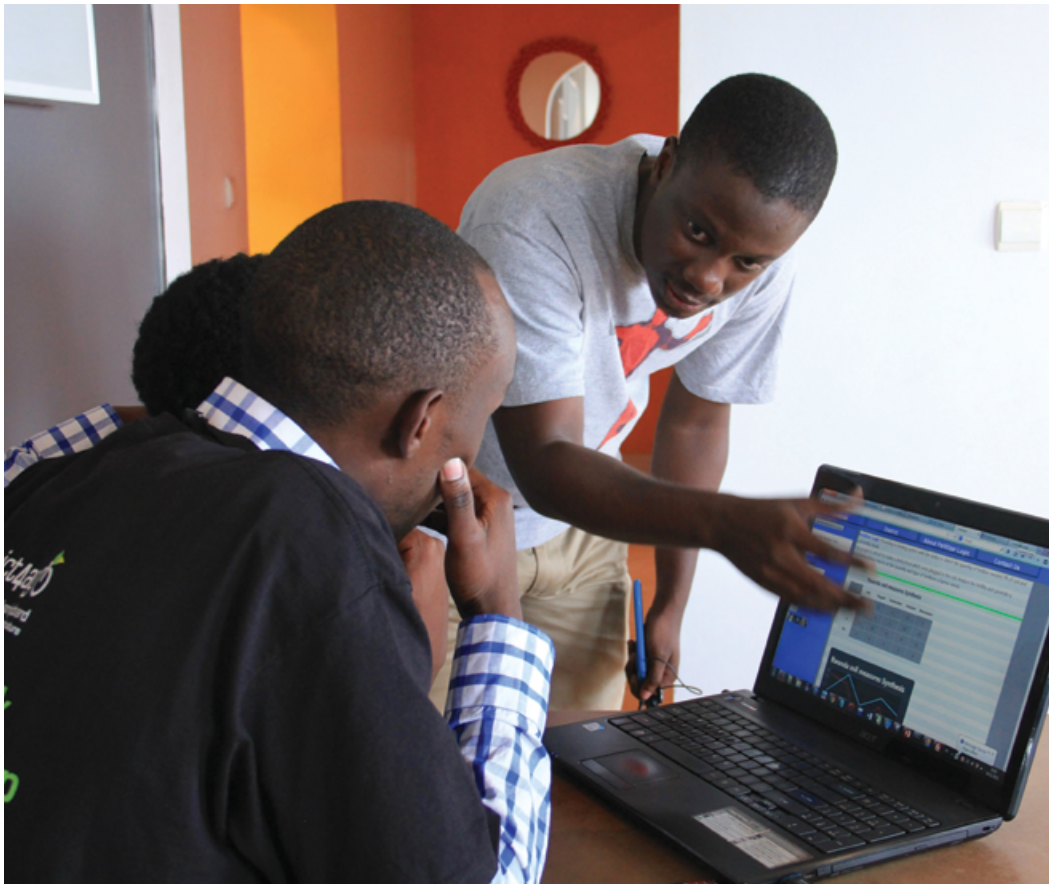
All start-ups deliver services through their offices, their physical and web sales force. Many use social media (especially Facebook, Instagram and increasingly WhatsApp), especially operators of e-commerce platforms (Agromarket, Titan.tg, AgComm, Botanica, etc.). Agromarket, Connecticut and AgComm are the three start-ups that use the most social media with their official business accounts. Most start-ups deliver services via mobile applications and messaging services.

> *We use the mobile messaging technology USSD instead of a mobile app so that the rural farmer who has just a feature phone and not a smartphone can benefit from services without hindrance."*
>
> *CEO MobileTrac*

The CEO of FoodRecon noted that mobile apps' downloads are very low generally, because of the cost of bandwidth and the weak smartphone coverage in West Africa. Therefore, they do not use their app that much.

One company (Botanica) declared that they have their own stores. Six start-ups use consistently partners as delivery channels:

- FoodRecon: customers collect the products directly at supermarkets and food producer stores
- AgComm, Agromarket, Botanica: external logistics services are used when required for delivery
- MobileTrac: they collaborate with tractor owners, who have tractor operators to carry out the harrowing, harvesting, ploughing, etc., as required.



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3.1.6. Key resources

Resources can be categorised in four categories: intellectual, human, monetary resources and physical assets. The two key resources that all the companies have are human resources (developers, agricultural specialists and other staff) and physical resources (mostly office equipment and other tools such as drones for Franco Sarl). Those who are primarily agribusinesses and who engage in agricultural production (such as Hectare and Amber) are owners of farmlands or rent them. Most of the companies declared not to have monetary resources: four out of twelve are not profitable and those who have already broken even have limited profits. Some have recently benefited from important financial resources (such as Sera that raised US$ 300,000 in 2018 or AgComm that recently obtained a US$ 100,000 grant). However, they hardly claim they have monetary resources, especially if they are not yet profitable. The intellectual resources that most start-ups have are their digital platforms, which have been copyrighted in some cases. None of them has been able to secure patents because the expensiveness of the process.

3.1.7. Cost structure

As per the BMC model (Osterwalder and Pigneur, 2010), cost structure may be characterised through the lenses of the importance of fixed or variable costs for the companies; it may also be characterised by whether the company is value-based or cost-driven.

Generally, the companies interviewed have high variable costs and low fixed costs. Fixed costs are usually related to their offices and some permanent salaries. Due to their weak turnover and profitability (eight out of twelve make profits), they operate with very tight salary costs (with several temporary staff, or undeclared staff) and low office renting costs. Physical resources to procure or maintain are limited because of the nature of the digital business.

All the start-ups interviewed are value-driven and less cost-driven. For example, the CEO of MobileTrac mentioned during the interview:

> *"We have almost no competitor in Ghana. No other mechanisation company uses ICT like us. Traditional service providers want to collaborate with us in order to earn more services and revenues. Therefore, we don't really compete on costs."*

3.1.8. Revenue streams

Revenues are generated through the sale of assets (agro-food products, animal vaccine, crop inputs, etc.) for most of the start-ups (nine out of twelve). This is followed by usage fees (use of tractors, software, drones) and licensing or renting fees (Connecticut and Titan.tg have licensed their data management platforms). Subscription models are used by three start-ups only: Hectare rents land to young farmers who then pay subscription fees; AgComm has some subscribed buyers and Botanica has a subscription model via their innovative payment card; this was a choice by the company to ensure regular and foreseeable revenues. No start-up (even the e-commerce platform operators) uses online advertising as a revenue stream. Some tried but could not find advertisers willing to pay.

Table 6: Revenue streams

Company	Country	Revenue streams					
		Asset sale	Usage/service fees	Subscription fees	Commissions, brokerage fees	Renting/ leasing fees	Licensing
Sera	Ghana						
Agromarket	Ghana						
Connecticut	Ghana						
MobileTrac	Ghana						
Hectare	Nigeria						
AcornTech	Nigeria						
FoodRecon	Nigeria						
AgComm	Senegal						
Titan.tg	Togo						
Amber	Burkina Faso						
Botanica	Benin						
Franco Sarl	Côte d'Ivoire						
Total		**9**	**9**	**3**	**2**	**1**	**4**

Regularly, some of the e-commerce platforms launch special discounts or organise special events to increase customer purchases. In December 2018, Agromarket launched a two-week event around Black Friday, offering interesting discounts, while AgComm regularly offers special discounts during national holidays and social events.

The median of the turnover of start-ups is around US$ 73,000, the average US$ 149,000, the minimum US$ 14,000 and the maximum is above US$ 500,000.

Revenues are generated more from the institutions, cooperatives and businesses rather than from individual small-scale farmers.

> *"90% of our revenue comes from the food companies, exporters, the big buyers, the businesses that are working with smallholder farmers."*
>
> *Connecticut's CEO*

3.1.9. Key partnerships

In order to implement their operations, the youth companies work with various key stakeholders. These include government institutions; farmer associations and cooperatives; telecom operators; agro-food businesses; national associations and international organisations supporting agricultural development (FAO, CTA, IFAD, AfDB, IITA etc.) and logistics firms. Development organisations collaborate with all start-ups providing them with grants, consultancy services, facilitating their access to market, or offering them other support. Agro-food businesses are those they work the most with, apart from development organisations. Some start-ups have successfully engaged in partnerships with governments. For example, Titan.tg is currently supplying services to the government and financial institutions in the framework of an agricultural financial project:

> *"Our data management platform is used to identify and register farmers, which helps them access finance. Banks and insurance companies are those who pay for the services farmers benefit from."*
>
> *CEO of Titan.tg*

However, most entrepreneurs reported challenges with those stakeholders, particularly governments and telecom operators, but also sometimes international organisations and farmer organisations. These challenges will be discussed in more detail in the "constraints" section of the next chapter. Many collaborate with institutions supporting (youth) innovations such as incubators and business development services. The latter provide them with capacity building for example, but this usually happens before or in the early stage of the business launch.

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Table 7: Key partnerships

Company	Country	Key partnerships						
		Government institutions	Farmer associations and cooperatives	Telecom operators	Agro-food businesses	Associations and international organisations	Delivery/ logistics firms	Others (incubators, BDS, etc.)
Sera	Ghana							Health institutions
Agromarket	Ghana							
Connecticut	Ghana							Weather service providers
MobileTrac	Ghana							
Hectare	Nigeria							
AcornTech	Nigeria							Universities
FoodRecon	Nigeria							Education institutions
AgComm	Senegal							
Titan.tg	Togo							
Amber	Burkina Faso							
Botanica	Benin							
Franco Sarl	Côte d'Ivoire							
Total		**5**	**4**	**4**	**8**	**12**	**5**	**12**

3.2. Analysis

3.2.1. Synthetic view of the business models

As illustrated above, the companies studied are deploying different types of business models depending on variables such as services, infrastructure used, customers targeted and revenue models. A snapshot of the ontology of the business models adopted is illustrated below. Items highlighted in bold have been more cited by respondents.

Presenting the business model typology of the companies interviewed can provide a practical channel to identify and analyse them. However, we have not been able to identify in the literature a business model taxonomy for digital agribusinesses.

Paul Timmers proposed a typology of business models of companies active on the internet. It includes the following categories: *e-shop; e-procurement; e-auction; e-mall; third-party marketplace; virtual communities; value chain service provider; value-chain integrators; collaboration platforms; information brokerage; trust* and *other services* (Timmers, 1998). As per this classification, the business model types of the start-ups involved in this research could correspond to:

- Information brokerage (Titan.tg, Connecticut)
- Value chain service provider (Franco Sarl, AgComm, Hectare, Sera, MobileTrac)
- Value chain integrator (Connecticut, Titan.tg, AcornTech)
- E-shop (Agromarket, Amber, AgComm, Botanica, FoodRecon).

Some start-ups may be included in multiple categories.

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Adapted Business Model Canvas for selected digital agricultural start-ups studied

Key partnerships

- **Associations and international organisations supporting agriculture**
- **Agrofood businesses**

- Delivery/logistics firms
- Government institutions
- Telecom operators
- Farmer associations and cooperatives
- Others (incubators, BDS, etc.)

Key activities/ services

- **Non ICT-related agricultural services**
- **Market linkages (e.g., e-commerce)**
- **ICT training and other services**

- Advisory services
- Production machinery services
- Customer data and supply chain management
- Inputs service delivery
- Financial services

Key resources

- **Human resources (staff, permanent, temporary)**
- **Office and furniture**
- **Mobile app/ platforms**

- ICT copyrights
- Agriculture lands (leased/owned)
- Financial resources (investment, grants or profits, etc.)
- IT hardware

Problem(s)

- **Lack of advisory information and services**
- **Weak agricultural productivity**
- **Lack of access to profitable markets**

- Weak customer data and supply chain management
- Limited access to quality agro-food products
- Animal and post-harvest losses
- Lack of access to inputs

Value proposition(s)

- **Newness**
- **Accessibility/ convenience/ usability**
- **Risk reduction**
- **Performance**

- Brand
- Bundled services
- Price

Channels

- **Physical sales force**
- **Web force**
- **Mobile app**

- Partners
- Own store

Customer segments

- **Farmers**
- **Institutions supporting farming**
- **Individuals and households**

- Agro-food businesses (agro-dealers, supermarkets, restaurants, shops, etc.)
- Other businesses (consultancy firms, etc.)
- Farmer organisations

B2B
B2C

Cost structure

- **Value-driven** (because weak sub-sectoral competition so far, etc.)
- **Higher variable costs** (salaries and other service expenditures)

- Not cost-driven (i.e. do not for now compete on cost)
- Lower fixed costs (salaries, office rented, etc.)

Revenue streams

- **Asset sale**
- **Usage fees/fees for services**
- **Licensing**

- Subscription fees
- Commissions/brokerage fees
- Renting fees

2018 turnover between US$ 14,000 and more than US$ 500,000

Figure 8: Snapshot of business models for start-ups studied

Another classification of business models, proposed by Michael Rappa, identified the following categories: *brokerage model; advertising model; infomediary model; merchant model; manufacturer (direct) model; affiliate model; community model; subscription model* and *utility model* (Rappa, 2010). The business models of the start-ups involved in our research belong to the following categories as per this model:

- Brokerage model (Titan.tg, Connecticut, MobileTrac)
- Merchant (Agromarket, Amber, AgComm, Botanica, FoodRecon, Connecticut, Sera)
- Subscription model (Botanica, Agromarket)
- Infomediary model (Connecticut, Titan.tg)
- Manufacturer (direct) model (Hectare, MobileTrac, Franco Sarl).

Though some of these categories may be relevant to the digital agribusinesses studied, the models do not help fully in defining adequately the companies and offer too much duplication, especially the Rappa model.

We propose another framework of analysis of the business models of the companies in Table 8, leveraging three key components of the BMC (activities/services, customer segments, revenue streams).

- Mass market 1 represents a clientele composed of the general public interested in agro-food products (that they can procure goods for example via e-commerce platforms).
- Mass market 2 represents a customer segment including actors of the agro-food sector (farmers, extension agents, agro-businesses and other professionals). Mass market 2 is smaller than Mass market 1.
- As suggested by Osterwalder and Pigneur (2010), companies addressing a "*Multi-sided market*" supply two or more interdependent customer segments. For example, Connecticut supplies both farmers and agro-food businesses with different services.

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Table 8: Synthetic view of the business models of the start-ups

	Offering	Customers		Revenue streams
Company	**Activities/services offered**	**Type of market segment**	**Type of customers**	**Revenue streams**
Sera	Inputs management platform	Mass Market category 2	B2B and B2C	Asset sale
Agromarket	Market brokerage services; e-commerce platforms; digital literacy and visibility services	Mass market category 1; Mass market category 2	B2B and B2C	Asset sale; usage/service fees
Connecticut	Inputs management platform; market brokerage services; production advisory information services; customer data management services; supply chain management services; agri-financial services	Mass market category 2; Multi-sided	B2B and B2C	Asset sale; licensing; usage/service fees
MobileTrac	Production machinery management services	Niche; Multi-sided	B2B and B2C	Commission; usage fees
Hectare	Market brokerage services; production advisory information services; production machinery management services	Mass market category 1; Mass market category 2; Multi-sided	B2B and B2C	Asset sale; leasing; usage/service fees
AcornTech	Inputs management platform; production machinery management services; digital literacy and visibility services	Mass market category 2, Multi-sided	B2B and B2C	Licensing; usage/services fees
FoodRecon	Market brokerage services; e-commerce platforms; customer data management services	Mass market category 1; Multi-sided	B2B and B2C	Asset sale
AgComm	E-commerce platforms; production advisory information services; digital literacy and visibility services	Mass Market category 2; Multi-sided	B2B and B2C	Asset sale; usage/service fees; subscription
Titan.tg	Market brokerage services; e-commerce platforms; production advisory information services; customer data management services; supply chain management services; digital literacy and visibility services	Mass market category 2; Multi-sided	B2B and B2C	Asset sale; usage/service fees; licensing, commission
Amber	Market brokerage services; e-commerce platforms; digital literacy and visibility services	Mass market category 1; Mass market category 2	B2B and B2C	Asset sale; usage/service fees
Botanica	E-commerce platforms; agri-financial services	Mass market category 1	B2B and B2C	Asset sale/ subscription
Franco Sarl	Production advisory information services; production machinery management services	Mass market category 2, Multi-sided	B2B and B2C	Usage/service fees

3.2.2. Revenues are generally not generated from the individual farmer but from the value chain, businesses and supporting organisations

Many entrepreneurs have clearly specified that they do not generate revenues directly from the individual farmers, but rather from value chain actors, businesses and farmer supporting organisations. This is a crucial observation, common to most start-ups studied. This finding is actually in line with observations by different authors (Baumüller, 2015; Elliott, 2015; David-Benz et al., 2012, CTA(b), 2016; AGRA, 2016) that farmers are not generally willing, or able, to pay for digital services proposed to them. Though in many surveys, they may announce their willingness to pay, this does not translate into reality once the service is launched. Almost all start-ups proposing digital services (especially advisory services) faced that issue at the launch of their services and many changed their approaches subsequently.

> *At the beginning we wanted the producers to pay (…) but after processing data from a preliminary survey, it was realised that associations and NGOs could be a better channel for our service."*
>
> *CEO of Amber*

> *People (farmers) wanted to have these services but they were not willing to pay for it (…) We understood that individual payments by farmers does not work. What seems to work best is when other institutions bear the costs of these services."*
>
> *CEO of Titan.tg*

The two CEOs were referring to advisory services they offer (agronomic tips or weather information for Titan.tg, and a mobile learning tool on best agricultural practices for Amber). These are the services that suffer the most from this situation. As farmers may have alternative sources for advisory information (Lohento, 2003) and as they also receive free advisory services from many public institutions such as NGOs or governments (AGRA, 2016), they seem not to perceive the financial value of these start-up services. When stakeholders, especially those at the bottom of the pyramid, do not perceive this value, they will not be willing to pay (Howell et al., 2018). In many cases, farmers do not understand the value of the services due to the digital illiteracy they face in Africa in general (Kabbiria et al., 2018); many refrain from using these services because they perceive that the use of digital tools is costly. Many services are also intended to be consumed via smartphones that extremely few farmers own (Baumüller, 2015). It seems that farmers are more willing to pay for inputs and outputs market linkage services as these may lead to direct sales for them.

There are four types of organisations that generally pay for these services for farmers:

- Governments that are supporting farmers as part of their national food security strategy, and also as they have the duty to protect vulnerable citizens which many farmers are
- Well-structured farmer cooperatives that have resources such as cash crop farmer cooperatives
- National or international agricultural development organisations supporting farmers and promoting food security
- National or international agribusiness off-takers that source commodities from farmer members of their supply chains and with whom they engage in contract farming (AGRA, 2016; World Bank, 2017).

Value capture can thus better be enabled when start-ups target the value chain and supporting institutions (Howell et al., 2018; AGRA, 2016). Many start-ups have learned this through the hard way by facing failures (see quote from Titan.tg above and CTA(b), 2016; CTA(a), 2016).

It is worth mentioning that some start-ups have, right from the start, understood the right customer segment they have to address to generate consistently revenues. Franco Sarl from Côte d'Ivoire with their drone services have not targeted individual farmers, but rather consulting firms engaged in rural or farming projects funded by government or donors, large cash crop producer organisations that can pay, and individual landlords interested in mapping services. It is also worth mentioning that some digital services such as e-commerce platforms do not target farmers but rather the middle to high-income consumers, nationals or expatriates, restaurants, shops (see services offered by Agromarket, FoodRecon, AgComm, Botanica and Hectare). In these cases, revenues are generated more easily, though profitability may be constrained by other issues.

3.2.3. Financial success depends on offering digital and non-digital bundled services

In several publications such as CTA(a) (2016) most youth-led companies introduced were offering only one service. For the fact that the companies studied are youth-led and because the business sector is new, there could have been an expectation that most of them would offer only one service. However, in our study, we have found out that just two businesses out of twelve are offering only one service (Agromarket (e-commerce platform) and Sera (delivery of animal vaccines)). All the others have at least two different offerings. This observation might be an illustration that there is a growing maturity of digital agribusinesses in the region.

In fact, our sample is composed of companies that have achieved some success, as they have been finalists or winners of international competitions. Apart from developing their initial products, they have understood that they still have the capacity to develop other product(s) or have identified other customer needs that they have decided to serve. This observation is fully in line with suggestions by David-Benz and her colleagues when they studied market information systems in Africa, and recommended that there was a need to "*strengthen the impacts of the information by supplying complementary services to market stakeholders*" (David-Benz et al., 2012) – citation translated from French.

Bundling services that farmers are willing to pay with others that they would not readily purchase seems to be a good strategy. It is the strategy adopted by Connecticut when they offer free advisory information via mobile phone and a voice server to farmers who register and purchase inputs from them. Thus, by integrating non-digital service(s) that farmers can easily purchase with digital offering(s) of which value they may not be prepared to purchase, a company can capture value more easily from farmers. In addition, Connecticut provides additional services such as credit inputs, which can help them generate more value.

One of the experts we interviewed confirmed the effectiveness of this approach of integrating digital and non-digital services, by becoming a value chain player, and recommended that young digital innovators serving the agricultural sector should open their minds:

> *Especially from the younger generation, there is a confusion between the digital expertise and agricultural expertise. What is needed is to strengthen the agricultural sector, not to offer a digital service. The supply side is dominated by digital expertise as if digital technologies determine the agricultural environment and performance. Digital technologies are not an end by themselves."*
>
> *D.A.*

Many of the start-ups studied have understood this, such as Connecticut:

> *I wish I knew from the early stage not to only think technology. I was only thinking engineer for one year, and that didn't help us (...) Software is just one tool in the box, and I am open to use any other tool."*
>
> *Connecticut CEO*

AgComm has also decided to broaden their identity by referring to their business as "*a digital platform for agriculture*" and no more primarily as an e-commerce platform.

It is worth noting that offering multi-sided or diversified services, thereby becoming a value chain player, can only work effectively if the young company has enough capabilities to fulfil the work implied.

3.2.4. Constant unplanned business model innovation

A clear pattern that has emerged from this research is that business models of the majority of the start-ups are constantly changing, either because product market fit has failed leading to lack of adoption of the solution:

> *It must be said that we tried many models that did not work."*
>
> *CEO of Titan.tg*

or because new business opportunities have emerged.

From our interactions with the start-ups, seven sources of opportunities framed their business model innovations: customers, business partners, employees, relatives, literature, R&D, and internal knowledge of the founders.

> *First, feedback from farmers themselves can make us change our business model. Number two is also internal evaluations of our performance (…) One thing that was helpful was also the internet; we learned the lean start-up methodology. We also changed part of our business model after interactions with other start-ups during the CTA AgriHack programme in 2016."*
>
> *Sera*

> *We do a lot of research and development."*
>
> *CEO of Franco Sarl*

Franco Sarl was the only start-up which indicated that they have a dedicated budget for R&D.

> *We met a professional of the irrigation sector; he was the one who told us that there was a real interest for our technology in this sector; then we started going into this market."*
>
> *CEO of Franco Sarl*

Many of the start-ups seem not to implement this change consciously, because they are young entrepreneurs with budding businesses or because their business management capabilities and resources are limited. Business model innovation is critical and could be a source of competitive advantage and higher revenue generation as is well apprehended (Foss and Saebi, 2017; Zott et al., 2011). As per the model suggested by Geissdoerfer and his colleagues (Geissdoerfer et al., 2018), the start-ups involved in our research have been engaged in the first three phases of business model innovation dubbed *start-up, business model transformation* and *business model diversification*. None of them has engaged in business model acquisition (certainly because they are youth businesses with limited financial means).

We hypothesise that business models of most of the companies are also changing regularly because the ICT4Ag sector is still nascent in West Africa. New digital technology, or processes enabled by digitalisation emerge regularly (such as the use of drones in agriculture), and young entrepreneurs who are eagerly and constantly on the lookout of economic opportunities are tempted to shift perspectives and supply services around these new possibilities.

3.2.5. Other observations

We would like to mention that we were interested in identifying if there was a direct relationship between a specific business model and the financial success (in terms of assured revenue generation and eventually profit) of a young company. However, we could not conclude within this study. For example, the profitable start-ups are not necessarily offering the same services (using the same tools), or using the same revenue model, or targeting the same market segment (see Table 8). Multiplicities of factors seem to intervene and this would require further research.

Another observation is that a couple of start-ups (Connecticut, Sera, Titan.tg) have identified data management (customer data and supply chain data) as a new revenue stream or a business model design element which can help them not only better know and serve their customers but also, as relevant, offer new services to other value chain players. Data analytics can help in undertaking credit scoring (based on registered farmers' data) and facilitate access to finance for farmers; facilitate index-based insurance for farmers; facilitate food traceability, etc. (Maru et al., 2018). Many companies may derive revenues from these services in the future.

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4. Business success drivers and constraints

4.1. Entrepreneurial motivations

Before discussing the concept of success and success drivers as outlined by the entrepreneurs interviewed, we present their motivations to start to the business.

Motivation is a complex notion that differs from one individual to another and determines the behavioural attributes of an entrepreneur (Carsrud and Brännback, 2011). Our findings show that the motivations for the participants of this study starting their businesses varied. It did not necessarily come from studying degree courses in school or from receiving formal training and education in computer science or agriculture. Most of them declared that they have been motivated by the need to help farmers find solutions for the difficulties and lack of revenues they are facing. For example, Agromarket, which started in 2016 and is currently operating in three cities in Ghana, mentioned that his motivation is:

> *"To help the farmers sell their produce and cut down on losses, and also to help consumers get fresh farm produce at their doorsteps."*

Some of these entrepreneurs have started their businesses based on challenges their parents faced as smallholder farmers and have developed means to meet these challenges. AcornTech noted:

> *"My parents are farmers so the initiative started as a result of problems they faced when I was growing up. I decided to pursue a career in agripreneurship with an insight into ICT as a solution."*

These findings on motivation are in line with a research by Santos and colleagues who identified a four-dimensional view of entrepreneurial potential. These are: entrepreneurial motivations, management competencies, psychological competencies and social competencies (Santos et al., 2010). A study by Baum et al. (2001) highlighted the importance of entrepreneurial motivation as a great contributor to the success of a new start-up. There are several factors including social and human capital as well as economic factors that influence the decision of an individual to become an entrepreneur (Davidson and Honing, 2003). An article studying the different theories surrounding entrepreneurship introduces six theories, including: economic entrepreneurship, psychological entrepreneurship, sociological entrepreneurship, anthropological entrepreneurship, opportunity-based entrepreneurship and resource-based entrepreneurship theories (Simpeh, 2011). These theories help explain the motivation of entrepreneurs and factors that enhance entrepreneurship.

Economic theory (classical, neoclassical etc.), epitomised by the desire to make a living out of this engagement, appears to be at the basis of entrepreneurship for all the entrepreneurs interviewed, even though this may not be from the beginning of their businesses. As explained in the literature review, employment challenges faced by youth in Africa have forced many of them to engage in entrepreneurship; this has also led governments and international institutions to develop programmes to support them (Dolan and Rajak, 2016). An example of a start-up motivated by economic theories (Brice and Nelson, 2008) is FoodRecon:

> *Initially, we just notified NGOs working around feeding programmes of where they could get nearly expired food supplies. This later morphed into a business with a revenue generating model called FoodRecon."*

Similarly, Franco Sarl noted that their motivation for starting the business was the identification of a gap in the market. The CEO stated during the interview that:

> *(…) people often buy 40 hectares or 50 hectares of land and do not know what to do about it; hence the development of the business idea."*

Sociological and anthropological theories also explain the motivations of almost all start-ups interviewed. Many of them wanted to help solve the acute problems faced by farmers who are sometimes their parents. For example, AgComm attested that:

> *(…) the motivation was derived from developing an application to meet the Millennium Development Goals, targeting poverty and hunger reduction, in the framework of a competition we took part in; although we didn't win the contest, the entrepreneurial idea was born."*

Psychological factors, such as the need for personal achievement, have also guided many start-ups.

In general, the business founders showed motivations based on a combination of more than one theory. When facing challenges to transform their business idea into profitable ventures, some of them pointed to the inexistence or lack of successful role models in this business segment in Africa, which could have further motivated them and provided them with insights on profitability avenues. This lack might be due to the novelty of this business segment in West Africa and even at the international level.

4.2. Definition of business success

The definition of success varies amongst the young entrepreneurs despite some similarities. They defined it both in financial and non-financial terms, in line with the literature review. Usually, each of them named several variables as success elements.

4.2.1. Non-financial indicators

a) Longevity and viability

Three of the twelve start-ups indicated they define success in terms of their survival and viability after 3-5 years in operation. This approach could be seen as viewing success in terms of business longevity or survival, which is critical for young companies as they have a high failure rate (Fatoki, 2013; Cope, 2011). For Botanica from Benin, success will lie in the fact that they would still be in operation after some years. The founder indicated that:

> *"We are not yet successful, not yet; after five years if we are still there, then we will be successful."*

A third entrepreneur, Amber, declared:

> *"I think we can say we are successful if after five years we are viable. We are in our third year, and we think we will hold on."*

By viability, the start-ups meant profitability. However, the definition of profit was not clear. While some consider grants they receive as revenues, others do not, or do it on a case-by-case basis. This would require further research.

b) Offering effective services

Many start-ups defined success in terms of the effective services they can offer to customers. Agromarket for example declared:

> *"The ambition of the business is to help farmers. We are impacting these farmers by selling and cutting down their losses, thereby increasing their return on investment on their farming activities. This is success for us."*

Similarly, success in business for Connecticut is:

> *The ability to build a product that people want, delivering on a value that has been promised. This is a key instrument that drives the success of our company."*

This concept of success is shared by Sera form Ghana and others as well. Sera for example described success as being able to offer effective services and products to identified problems faced by farmers with resources available.

c) Achieving planned outputs and results

Another definition of success not directly linked to finances is the achievement of planned key performance indicators (KPI). In this line of thought, MobileTrac stated the following:

> *I would say our business is successful when MobileTrac is being recognised as first brand in Ghana and is in contract with 2,455 tractors to help farmers in the next three years."*

AcornTech, from Nigeria stated that:

> *Success for me is to be able to push our new input package of services, as a platform used by 60% of farmers, clear counterfeit goods off the markets and help smallholder farmers get access to free insurance."*

Another company, Hectare stated:

> *The business is successful as it is now because of the yield we get from our farm; therefore, we will be able to deliver on our promise to investors. The measure of success is in our yield of production. Currently in Nigeria the yield of maize is between 2-3 tonnes of maize but we are getting between 5-7 tonnes/hectare with the use of a controlled environment."*

4.2.2. Financial indicators: revenues and profits

Other young entrepreneurs defined success in terms of their financial performance in relation with revenue generation and profit. For the founder of Franco Sarl from Côte d'Ivoire, success is thus based on profit, the turnover that is generated from the business, the growth in the size of the market and customer satisfaction. Simply put, he stipulated:

> *In my opinion, success is all about financial performance and reputation for the company."*

Similarly, AgComm identified success as the growth in the number of customers acquired over the years. She noted during the interview that:

> *I think we have achieved success because, at the beginning, we were not sure that working on the internet with agricultural processors would succeed. But it worked; in addition, the number of our customers is increasing every year."*

It has to be noted that no company refers to more specific financial success indicators (for example specific percentage of profit, ROI, or pre-tax return). This might be illustrative of young profiles of the companies and of their level of maturity in financial management.

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4.3. Success drivers of the start-ups

We have identified eight types of success drivers that we introduce and discuss in the sections below.

Table 9: Key success drivers mentioned by the start-ups

Company	Key success drivers							
	Access to funding/ finance	Adequate team and team management	Adequate ICT infrastructure and resources	Adequate agriculture infrastructure and resources	Effective solutions, business models	Good business systems and processes	Brand and reputation	Key partnerships
Sera	■	■			■			■
Agromarket			■		■			■
Connecticut	■	■			■	■		
MobileTrac			■	■	■		■	■
Hectare			■	■				■
AcornTech	■							
FoodRecon		■	■					■
AgComm	■	■			■	■		
Titan.tg	■	■						
Amber					■			
Botanica		■	■	■			■	
Franco Sarl						■	■	■
Total	**5**	**6**	**5**	**3**	**6**	**3**	**3**	**6**

4.3.1. Funding/finance

Funding/finance was identified as a success driver and its lack as a constraint. While its availability was mentioned by six companies as success factor, eleven companies referred to its lack as constraint. We will discuss it in the constraints section below to avoid repetition.

4.3.2. Adequate team and team management

Having a capable and committed team is critical according to many start-ups. Amber noted that:

> *(…) the team is a very good factor that drives the success of the business especially if it is dynamic and motivated (…)"*

A very positive experience is made by Connecticut to address this staff issue. They have launched a fellowship programme, accessible to young students (from Ghana and beyond) as interns, as well as for skilful international young professionals and volunteers interested in supporting a young impactful African company. They sometimes pay stipends to those interns or contribute to housing expenditures (not all businesses in Ghana pay stipends to interns). The cofounders of the companies who have developed that strategy are convinced that motivated and trained interns may become great staff or ambassadors, which will help them create a long lasting impactful "*generational business*".

The founder interviewed declared:

> *The team makes all the difference (...) That's my prayers every day, to keep attracting the best people and key empowering the best people (...) I want this to become a movement (…) It is beyond a one-man thing because no one person can build a generational business."*

Our expert M.B. added other elements regarding the team:

> *Resilience, in order to face the many challenges of agtech business for young entrepreneurs and openness to the external world are success factors co-founders and their teams should develop."*

Other insights are provided in the constraints section below, highlighting staff-related challenges that the start-ups faced.

4.3.3. Adequate business processes

Establishing sound business processes is critical for business success. Connecticut from Ghana informed that:

> *"Most young companies do not put systems in place, like an HR system, financial system, culture system (…) If you don't do that you can't keep the best people or attract the best people (…) and you can't attract big capital (…) We don't talk about that often."*

Creating sound business systems means as well putting in place effective corporate governance structures, particularly a formal management board that operates effectively. We noted that all companies interviewed do not have a functioning formal board.

Other start-ups such as Agromarket have been implementing lean management processes (Ries, 2011) and they find it very effective. They highlight that young businesses should know how to innovate and identify effective solutions immediately as problems appear. According to the founder of Agromarket, using lean processes by cutting down operating costs helps their business achieve success.

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4.3.4. Effective solutions and business models

The young entrepreneurs are conscious that developing effective solutions that the farmers and agricultural stakeholders are willing to pay for and adopting sound and sustainable business models are very important success drivers.

AcornTech mentioned that having a structured business model will help for the success of the business:

> *Attending a business course has enlightened me with the need of developing a well-structured business model, the right systems and structures for the business as well as creating a board to assist in decision making processes."*

The importance of effective business models has been substantively discussed in the previous chapter.

4.3.5. Key partnerships

Key partnership was one of the most important drivers mentioned by the companies. This can be understood as they are young and need support. The importance of key partners was also discussed in the key partnership component of the business model section in the previous chapter.

4.3.6. Adequate ICT infrastructures and resources

This issue has been raised both as a success driver and as a constraint (its lack), with more emphasis on its consideration as a constraint. We will therefore discuss it rather in the constraints section below.

4.3.7. Adequate agricultural infrastructure and resources

A couple of companies mentioned that adequate agricultural infrastructure and resources was an important success driver. These were companies that rely a lot on these resources to deliver their digital services such as Hectare (engaged in actual farming), MobileTrac (facilitating the renting of tractors) and Botanica (engaged in agricultural production).

4.3.8. Brand and reputation

A final success driver mentioned by three start-ups was brand and reputation, as specified by founders of companies such as Franco Sarl and MobileTrac. The latter declared:

> *I would say our business is successful when MobileTrac is being recognised as first brand in Ghana."*

Details on drivers mentioned by the companies are indicated in the table below.

Table 10: Summary table showing the key drivers for success

Company	Country	Key drivers for success mentioned (non-exhaustive list per company)
Sera	Ghana	• Team • Good organisational management • Endorsement and validation from key institutional partners • Financial viability
Agromarket	Ghana	• ICT availability and ICT innovation • Key partnership • Running lean processes
Connecticut	Ghana	• A great team and talented people • Money • Innovation based on experience and knowledge of the sector • Effective business models
MobileTrac	Ghana	• Use of modern tools and ICT-enabled mechanisation • Brand recognition • Partnership with tractor owners
Hectare	Nigeria	• Adequate agricultural production • Access to technology • Access to finance
AcornTech	Nigeria	• Access to funds • Well-structured business models
FoodRecon	Nigeria	• Leveraging technology to keep operational costs as low as possible • Giving autonomy to employees • Turning customers into partners
AgComm	Senegal	• Having a workable and market-ready solution/effective business models • The team and its motivation • Availability of mentors and counsellors • Finances
Titan.tg	Togo	• Courage and determination • Perseverance • Collaboration from key partners, notably government and farmers organisations
Amber	Burkina Faso	• Team and team motivation • Training • Financial support
Botanica	Benin	• Team (finance, technical and human resources team) • Adequate technical equipment (cold storage for agri-products, computer equipment)
Franco Sarl	Côte d'Ivoire	• Professional partners and network • Collaboration of key public institutions and institutions in charge of agriculture

Taking into account insights from entrepreneurs, secondary data and the literature, we understand that the key success drivers of the digital entrepreneurs can be restructured as presented in the graph below.

Figure 9: Key success drivers for the digital agtech start-ups

4.4. Constraints faced by the start-ups

We have identified six major categories of constraints that we are presenting and will be discussing in the subsequent paragraphs.

Table 11: Key constraints of businesses interviewed

Companies	Key constraints					
	Funding/finance	Lack of trained, committed personnel	High taxes and unfavourable policy environment	Lack of ecosystem support	Weak social ICT adoption	Business model challenges
Sera						
Agromarket						
Connecticut						
MobileTrac						
Hectare						
AcornTech						
FoodRecon						
AgComm						
Titan.tg						
Amber						
Botanica						
Franco Sarl						
Total	**11**	**4**	**9**	**8**	**6**	**5**

4.4.1. Lack of finance/funding

While funding was cited as a success driver, its lack was conversely referred to as a constraint common to eleven businesses out of twelve. Agromarket noted that funding has always been a difficult issue in expanding their business, although they have received grants from organisations such as CTA and the Tony Elumelu Foundation. Funding is needed not only to start the business but also to grow it. Connecticut stated:

> *We have been fortunate to be one of the first in this line of business in West Africa but to excel we need more funds and money."*

However, it has been difficult for the young entrepreneurs to secure loans from banks and other financial institutions as in their opinion banks ask for important collaterals or charge very high interest rates which, they argue, they cannot afford. According to start-ups, they would pay credit rates between 10 and 30%, the higher rates being practised by micro-finance institutions. Whilst some of the companies have received financial support from NGOs and international organisations, winning competitions and awards from reputable organisations such as Rolex, they are not optimistic about how banks consider them in the current state of affairs. As highlighted by Hectare of Nigeria, referring to the ICT for agriculture business, there will always be a "*trust issue about their market*" when they attempt to secure resources from banks.

From another point of view, many international investors interested in African ventures are able to provide huge level investments and try to find businesses that could deserve that level of amount. Some start-ups, such as the founder of AcornTech, warn that, while funding is necessary, many West African start-ups especially in this field do not need for now millions of dollars. In his words:

> *Investors should be aware that many companies are not building another Facebook or another PayPal. Many start-ups cannot manage or digest too large funding."*

It is worth specifying that another company, Connecticut, noted that companies at growth stage do need high investment that they are not benefiting from:

> *Beyond the fifty thousand, hundred thousand and two hundred fifty thousand US dollars of awards and grants, when you build a company for several years, you need one million, two million dollars (...) You need big money to build a big company to do great things well. Very few people are writing these cheques for Africans, for young businesses."*
>
> *Founder of Connecticut*

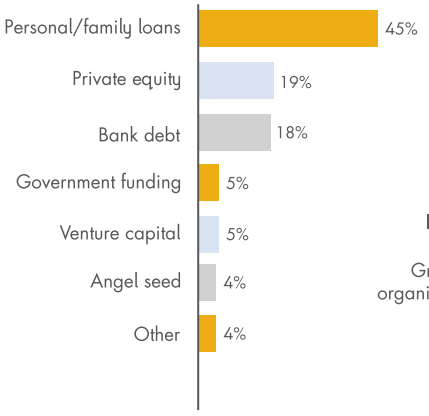
Some start-ups are aware that there are some limitations at their own level that cause reluctances of financial institutions, in particular banks, to give them credits. Young agtech start-ups, according to AgComm, have not been able to raise finances in Senegal because they do not yet have a mature, profitable business model or because they have a weak financial culture. She specified that many start-up founders do not have a good financial background or do not understand the language of venture capitals, which prevents them from accessing funding.

In fact, financial performance has always been a major subject surrounding African small and medium companies according to the literature. One of the hypotheses proposed by Hansen (2016) when studying African enterprise performance was that:

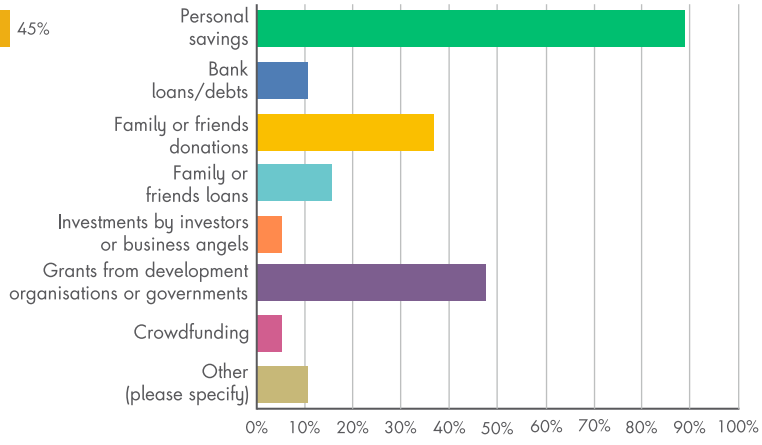
> *(…) financial performance will generally be relatively low among African SMEs [small- and medium-sized enterprises] and they will be struggling to grow."*

The literature also helps to understand why start-ups have challenges to raise capital. A survey of 582 entrepreneurs in six Sub-Saharan countries (including Nigeria and Ghana) by the international non-profit organisation Omidyar Network revealed that most entrepreneurs fund their companies with personal savings or family loans (Omidyar Network, 2013).

Table 12: Source of funding for African companies



Source: (Omidyar Network, 2013) – Based on a survey of 582 entrepreneurs from six African countries including Ghana and Nigeria



Source: Unpublished report from CTA – Extracts of results of a survey of 25 finalists entrepreneurs (coming from various countries) of CTA's Pitch AgriHack West Africa competition in 2017

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These observations are in line with some unpublished findings by CTA. In 2017, the organisation surveyed the 25 finalists of its Pitch AgriHack West Africa competition: while 86.96% responded that they fund their ventures via personal savings and 39.13% fund them through grants, only 8.7% got funding from banks and 13.04% from equity investments.

Worth mentioning as well is that, according to a publication by the World Bank, many investors do not consider ICT as a high return investment sector in many African countries (The World Bank, 2014). At the same time, African banks usually shy away from funding the agricultural sector due to its uncertainties (Dalberg Global Development Advisors, 2016). Digital agribusiness companies might therefore be facing challenges from those two angles to raise capital, the more so as this business sector is novel and seems hardly apprehended by financial institutions.

Table 13: Summary table showing the key constraints to success

Company	Country	Details on some key constraints mentioned (non-exhaustive list per company)
Sera	Ghana	• Attracting talent • Funding • On boarding and retaining farmers more cheaply • Lack of full support in getting importation licence for vaccines • High tax rates
Agromarket	Ghana	• Not enough bikes for delivery (constraints in the channel of distribution) • Reduction in the production of seasonal produce (e.g. strawberries)
Connecticut	Ghana	• Fund and money to buy vehicles, motorbikes and equipment • Lack of support from government and public institutions, who could include them in the value chain in the framework of big donor projects • High taxes
MobileTrac	Ghana	• Adoption of technology and internet availability • Trained tractor operators and availability of tractors • Access to finance to scale up • Human resources
Hectare	Nigeria	• Trust issues about the market because it is an upcoming company • Finance and getting funding • Mentorships in the area of agriculture are difficult to find in Nigeria • Getting the right tools and mechanisation • Struggling at the moment with current team regarding technical know-how
AcornTech	Nigeria	• Access to business information, knowledge on how to run an agribusiness • Lack of incubators with knowledge in ICT for agriculture; law specialists • Access to grants, funding • Getting the right team
FoodRecon	Nigeria	• Talent gap • Access to good capital and finance
AgComm	Senegal	• Weak knowledge on ICT4Ag/e-commerce by consumers and government • Logistics (accuracy of customer addresses during deliveries) • Difficulty in defining a business model that supports growth and scaling up • Low start-up support in AgTech (absence of specialised incubators) • Access to finance
Titan.tg	Togo	• Excess fees by mobile phone operators • Lack of cooperation from institutional bodies (state and NGOs) • Funding and access to finance for scaling up
Amber	Burkina Faso	• Lack of funding and high level of government tax (27%) • Difficulty to negotiate deals with strategic partners (e.g., mobile network providers) • High level of illiteracy amongst the e-commerce customers
Botanica	Benin	• Internet connection very bad • Finance • Custom taxes; cannot import some equipment easily
Franco Sarl	Côte d'Ivoire	• Lack of support for start-ups • Corporate tax of 25% of profit • Lack of support from public institutions

4.4.2. Lack of trained and committed personnel

The availability of trained and committed staff was identified as a success driver and discussed above. Its lack has been creating constraints for many start-ups.

Indeed, the youth businesses were generally initiated by one or two enthusiast innovators, sometimes when they were still completing their university studies. In the first years of the entrepreneurial venture, they struggled to find committed and skilled teams as in most cases the companies do not yet have financial resources or sufficient resources. Convincing other young professionals, who at the same time are looking for immediate economic opportunities, that the business idea will be eventually fruitful, has therefore been challenging.

> *I struggled a lot to convince people to join me (…) It has been impossible to recruit highly skilled people that we need because we can't pay them."*

admitted the founder of Titan.tg.

Even after the first couple of years of revenues, most businesses do not have enough means to recruit highly relevant technical skills.

Agcomm informed:

> *At the beginning you can only pay the minimum for salaries. You do not have the means to pay an accountant. You need software engineers, but you cannot afford that and thus remain limited in the value you deliver."*

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4.4.3. Unfavourable policy environment

This was an important issue as nine out of twelve companies raised it. Four key sub-items were highlighted: high taxation for start-ups, negative political influences, lack of good governance of public resources and lack of policies favouring better interactions among players in the ICT for agriculture business environment. As a matter of fact, the business climate in West Africa is among the least favourable in the world as illustrated in the 2019 edition of the Doing Business Report (World Bank, 2018). In that reference publication of the World Bank, 14 out of 16 West African countries are in the third tier of performance ranking (190 countries were assessed).

Table 14: Data excerpted from the Doing Business Report (2019)

Economy	Global rank	Rank in West Africa	Getting electricity	Getting credit	Paying taxes	Enforcing contracts	Resolving insolvency
Ghana	114	1st	86	73	115	116	160
Côte d'Ivoire	122	2nd	143	44	175	106	80
Cabo Verde	131	3rd	155	134	77	45	168
Togo	137	4th	105	144	172	137	86
Senegal	141	5th	127	144	171	142	94
Niger	143	6th	162	144	161	119	114
Mali	145	7th	159	144	165	159	97
Nigeria	146	8th	171	12	157	92	149
Mauritania	148	9th	151	144	178	72	168
Gambia, The	149	10th	160	134	169	117	128
Burkina Faso	151	11th	181	144	153	165	107
Guinea	152	12th	146	144	181	118	116
Benin	153	13th	176	144	176	171	110
Sierra Leone	163	14th	178	161	88	105	161
Liberia	174	15th	172	112	67	175	111
Guinea-Bissau	175	16th	180	144	154	169	168

The CEO of Connecticut noted:

> *The government usually gets grants from IMF, the World Bank, etc., to implement agriculture projects. They do all this often without the start-ups (...) Imagine if they collaborate with the start-ups, even in a small way (...) I don't want big money, just include me in the project, in the supply chain."*

4.4.4. Lack of ecosystem support

The lack of ecosystem support has been identified as a four-fold issue in our study:

- Lack of support from public agricultural players and governments who can facilitate the inclusion of the young entrepreneurs in the agribusiness supply chain (this was also discussed above)
- Lack of support from competent incubators that can provide effective ICT4Ag mentorship and coaching
- Lack of support from big agribusinesses players. Sera's founder, for example, informed about challenges he has been facing to collaborate with institutions involved in governing or managing animal health; he believed they do not trust them because they are a young business
- Difficulty to collaborate with mobile network operators when start-ups wish to build on their platform to deliver services to customers.

Regarding this last point, the founder of Titan.tg revealed:

> *(…) the first constraint for me is the mobile operators at home; they ignore your business model and impose high rates that we can barely afford (…) this greatly impacts negatively our prospects for growth."*

This view is seconded by Amber's CEO who stated that:

> *(…) there is the difficulty to negotiate and mobilise key partners including mobile networks (…) When we want to use their platform to disseminate information via USSD, they claim 80% of the profit, which is not fair."*

4.4.5. Weak availability and social adoption of ICTs

This issue relates on the one hand to the digital illiteracy among farmers and other agricultural stakeholders and on the other hand, to the cost of technology and the poor digital technology infrastructure in most West African countries (weak availability of broadband connectivity and weak coverage and reliability of telecommunications, especially in rural areas). The internet connectivity situation and challenges faced can be illustrated by figures in the table below.

Table 15: Internet and Facebook statistics in West Africa (Miniwatts Marketing Group, 2018)

	Population (2018 est.)	Internet users 31-Dec-2017	Penetration (% population)	Facebook subscribers 31-Dec-2017
Benin	11,458,674	3,801,758	33.10%	920,000
Burkina Faso	19,751,651	3,704,265	18.80%	840,000
Cabo Verde	553,335	265,972	48.10%	240,000
Côte d'Ivoire	24,905,843	6,318,355	26.30%	3,800,000
Gambia	2,163,765	392,277	18.10%	310,000
Ghana	29,463,643	10,110,000	34.30%	4,900,000
Guinea	13,052,608	1,602,485	12.30%	1,500,000
Guinea-Bissau	1,907,268	120,000	6.30%	110,000
Liberia	4,853,516	395,063	8.10%	330, 000
Mali	19,107,706	12,480,176	65.30%	1,500,000
Mauritania	4,540,068	810,000	17.80%	770,000
Niger	22,311,375	951,548	4.30%	440,000
Nigeria	195,875,237	98,391,456	50.20%	17,000,000
Senegal	16,294,270	9,749,527	59.80%	2,900,000
Sierra Leone	7,719,729	902,462	11.70%	450,000
Togo	7,990,926	899,956	11.30%	560,000
Average for West Africa			**26.61%**	
TOTAL AFRICA	**1,287,914,329**	**453,329,534**	**35,20%**	**177,005,700**
Europe	**827,650,849**	**704,833,752**	**85,20%**	**340,891,620**
WORLD TOTAL	**7,634,758,428**	**4,156,932,140**	**54,40%**	**2,119,060,152**

This table shows that end 2017, West African countries had an average internet penetration of 26.61%, while this statistic stood at 85.20% for Europe (Miniwatts Marketing Group, 2018). The situation is worse in rural areas (Chick et al., 2010) where farmers in particular reside. Electric power supply is also erratic. These poor technological environments do not favour the development of a customer base for the young digital companies, as noted by Agcomm.

4.4.6. Business model challenges

Business model design has been substantively discussed in the previous chapter. Many start-ups informed that they are still facing challenges to design effective business models. Usually they lack support in that domain and regret particularly the lack of specialised incubators and accelerators or knowledgeable mentors. This lack might be due to the nascent character of the digital agribusiness sub-sector in West Africa.

The business climate factors (government policies/legislation, politics, etc.) may play a vital role in the continued existence or success of a new business (Simpeh, 2011). For example, although the Ghanaian government has introduced a holiday tax for start-ups within the first three years of operation (Entsie, 2018), some Ghanaian start-ups interviewed mentioned that there is lack of clarity on conditions of benefits of this opportunity and some are thus still paying these taxes.

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5. Conclusions & Recommendations

5.1. Conclusions

5.1.1. Key findings

This study sets out to study the drivers of business success for young digital start-ups targeting the agro-food sector in West Africa. Business success is considered here as the offer of effective services to the targeted customers, resulting in accumulation of sales, profits and continued business operation. Also as discussed in the literature review section, we considered success both from a financial and non-financial indicator point of view. We focused our research on West Africa, one of the African regions in which the agro-food sector is prominent but where little research on this topic has been carried out so far. We targeted start-ups led by young entrepreneurs aged between 18 and 35 years old, the youth age range as defined by ECOWAS and the African Union.

We identified three main research questions at the beginning of this study.

Due to limitations in timeframe, we undertook an inductive interpretative research, with analysis of case studies. Our sampling technique followed the purposive sampling proposed by Saunders et al. (2009). It was composed of twelve start-ups coming from six West African countries (successful winners or finalists of international competitions). We collected primary data through interviews. We also had access to some secondary data on the interviewees collected by CTA, an international organisation that identified the start-ups. This gave us more information about the twelve participants before the scheduled interview.

To investigate the first research question, an adapted version of the BMC model developed by Osterwalder and Pigneur (Osterwalder and Pigneur, 2010) was used. Nine components of the business operations of the companies have thus been investigated: problem addressed, activities/services, customer segments, value proposition, channels, revenue streams, key resources, cost structure, key partnerships. The companies operate different business models. The main problems they strive to address are the lack of advisory services, the weak agricultural productivity, as well as the lack of access to profitable markets in the region. Some of them are addressing the weak customer data and supply chain management issues, the limited access to quality agro-food products, or animal and post-harvest losses. They are thus offering a variety of services including agricultural advisory services (via mobile phone or voice server), market linkage services (facilitation of purchase of agricultural inputs, sale of agro-food product via e-commerce platforms, etc.), agricultural production machinery services (use of drones, tractor leasing, etc.), in different agriculture sub-sectors (crop and animal production mainly). Most of them offer at least two services, including sometimes general services such as ICT training of agricultural actors. They supply services to various agricultural customer segments, from young farmers to more mature farmers, farmer organisations, governments, agro-dealers, etc. Most of them are thus servicing simultaneously businesses and directly the customers. Revenues are made via assets sales, usage or licensing fees. Most companies are value-driven and seem not to be cost-driven just because competition is generally weak in their business segment.

Regarding the second research question, some of our main findings are as follows. Revenues for digital services are not generated from the individual farmer but from supporting organisations, the value chain and donors. Farmers are either not willing or unable to pay for the services: sometimes they do not see its value, sometimes because of digital illiteracy or they claim that they do not have the resources to pay for them. Thus, many of the companies studied struggled in the first years of their operations to generate revenues when they mainly target individual farmers. They have eventually understood that targeting institutions was a better strategy to generate revenues and achieve profitability (which eight out of twelve start-ups have reached).

Success also depends on offering multiple and bundled services; more particularly, it has appeared that start-ups have to integrate digital and non-digital agricultural services, in order to become a value chain player. Some of them have therefore understood that focusing on digital has been a bad strategy and they are increasingly offering a variety of services to address various needs of the farmers and agricultural stakeholders. This approach is yielding benefits and is recommended by D.A., one of our experts. Data-driven services are emerging and can also yield important values.

Partly due to the immaturity of their model and a lack of experience in business management, unplanned business model innovation occurs. We also noted that owners with an agricultural background are increasingly getting involved in digital agribusiness services, which seems to lead to increased effectiveness in services offered.

We have identified eight main drivers that help to achieve success, including: availability of funding, adequate team and team management, key partnerships, adequate ICT and agricultural infrastructure and resources, effective solutions and business models, effective business systems and processes and brand/reputation.

The policy environment is generally not very enabling for the young entrepreneurs, high taxes being important constraints. However, the lack of access to funding is the major challenge they face. They also struggle to find or pay for committed and qualified staff and to interact with key institutional players including mobile network operators.

5.1.2. Limitations

This research was started in September 2018 with the interviews taking up roughly five weeks of the time due to postponements and the festive period. More time needs to be invested in this type of research to cover a large number of participants, at national or regional level, if generalisation of findings is an objective. Our sample is not representative; it covers only seven countries in West Africa out of sixteen. In each country, it was not possible to define or identify the most successful digital agripreneur to interview them. We have not covered two agricultural sub-sectors (forestry and fisheries). One entrepreneur serving the fisheries sector that we identified was not available to join the project. We acknowledge therefore that our findings cannot be generalised to all digital agripreneurs in West Africa.

5.1.3. Future work

It will be useful to further investigate our finding that in most cases, individual farmers do not pay for the digital services and that institutions (including farmer cooperatives) actually pay for farmers. The configuration, functioning and effectiveness of these relationships could be studied. It would also be useful to further investigate the relationship between business models and profitability for the young start-ups. We could not conclude on this issue in this research. We however noticed for example that certain types of services have helped companies generate more easily revenues (which is important for young entrepreneurs).

These include:

- services that provide immediate and visible outputs for farmers and agricultural stakeholders (such as drone services offered by Franco Sarl and market linkages services offered by Agromarket, Agcomm and Connecticut), especially when there is little or no competition
- traditional agricultural services that just leverage digital technologies to be supplied such as inputs delivery services offered by Connecticut.

Conversely, services that deliver exclusively information (such as advisory information) face more challenges. The business environment, including the actual capabilities of the companies to offer those services also influence financial success as implied in the business success and constraints chapter. More research will be necessary on these hypotheses.

This is a new area of study, therefore future work could be done using both qualitative and quantitative techniques across a wider range of participants for a more holistic view. Specific research could focus on precise services, such as drone operations, agro e-commerce trade, etc.

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5.2. Recommendations

The recommendations we propose are based on our understanding of issues confronted by these young entrepreneurs and their businesses, key insights from the literature review and our interviews with two experts. They are addressed to the young entrepreneurs themselves, governments, national ecosystem actors as well as to international organisations supporting digital agripreneurship.

5.2.1. Promoting role models to enhance motivation

All the participants interviewed expressed their motivation for starting their businesses, showing generally a combination of reasons. Some have also pointed the lack of successful digital agribusiness role models in West Africa, which could have further inspired them. The impact of having role models, who could even act as mentors for young entrepreneurs, cannot be over-emphasised (Clutterbuck, 2004). This is particularly important in the agricultural sector in African countries. Indeed, the sector has a negative image and young people usually shy away from it (AGRA, 2015). Digitalisation, which has a better image than agriculture, provides a good opportunity to build on role models to encourage youth to innovate for the sector and capture economic opportunities (CTA(a), 2016). Cull proposed that having a role model in business or a mentor-client relationship has a positive impact in creating success for young entrepreneurs irrespective of the business sector (Cull, 2006). Factors that create success in the mentoring process as indicated by Hall (2003) include: proper matching of mentors to youth entrepreneurs, continuous training and regularity of contact. Similarly, a more recent study looking at the interaction between role models and entrepreneurial intentions indicated the importance of having a role model pre-start-up and post-start-up (Bosma et al., 2012).

We therefore recommend promoting promising or successful digital agribusiness entrepreneurs who can inspire other young entrepreneurs.

5.2.2. Facilitating access to funding

Almost all companies interviewed cited weak access to funding as a barrier to business launch and growth. To overcome this undermining challenge, there is a crucial need for substantial support from the government, investors and other institutions. While early-stage or pre-revenue start-ups need mostly start-up financing, many entrepreneurs such as those interviewed need rather growth financing. The lack of growth financing can maintain them in the "*death valley*" where they stagnate before eventually dying.

Governments and relevant stakeholders can encourage banks to provide loans at better rates and if needed, develop de-risking schemes that can motivate these service providers to fund youth. Governments are in addition requested to either put in place innovation funds for digital agribusinesses or to plan relevant benefits for digital agribusiness when those funds exist. Moreover, improved governance should be at the foundation of the management of these funds, and adequate follow-up with winning entrepreneurs ensured.

There is also need of more African investors and private businesses that can fund entrepreneurs.

Agricultural and other development organisations often provide grants to young entrepreneurs. As recommended by many entrepreneurs, these organisations should not put too many constraints on conditions of access to these funds.

Finally, it is capital to remember that, as revealed by the report by the Omidyar Network, while many entrepreneurs claim that they lack access to funding, many investors or supporting institutions consider that many young businesses are not sustainable (Omidyar Network, 2013) and that the entrepreneurs have a strong deficit in accounting and financial management. This implies that entrepreneurs need to improve their investment readiness capabilities. Governments as well as organisations that have interest in them should support them in this area.

5.2.3. Ensuring effective digital agribusiness management

Digital agripreneurship requires acumen in at least three domains: agriculture, digital technology and business management. Gaps in at least one of these areas have effected most of the young entrepreneurs studied. Young software developers usually lack knowledge of the agricultural sector (Baumüller, 2016; Baumüller and Lohento, 2016), while young business owners with an agricultural background lack understanding of digital technologies. Business management capacity is limited at the level of many young entrepreneurs. One of the experts that we interviewed, D.A, stated that many young software developers investing digital agricultural service provision hardly know the agricultural sector and design ineffective solutions. Founders of digital agribusinesses need therefore to ensure that either they have good capacity in these areas and/or recruit team members with adequate capacity. They should also facilitate capacity development for their staff when needed in these areas. Gaps that need to be addressed include accounting and financial management literacy.

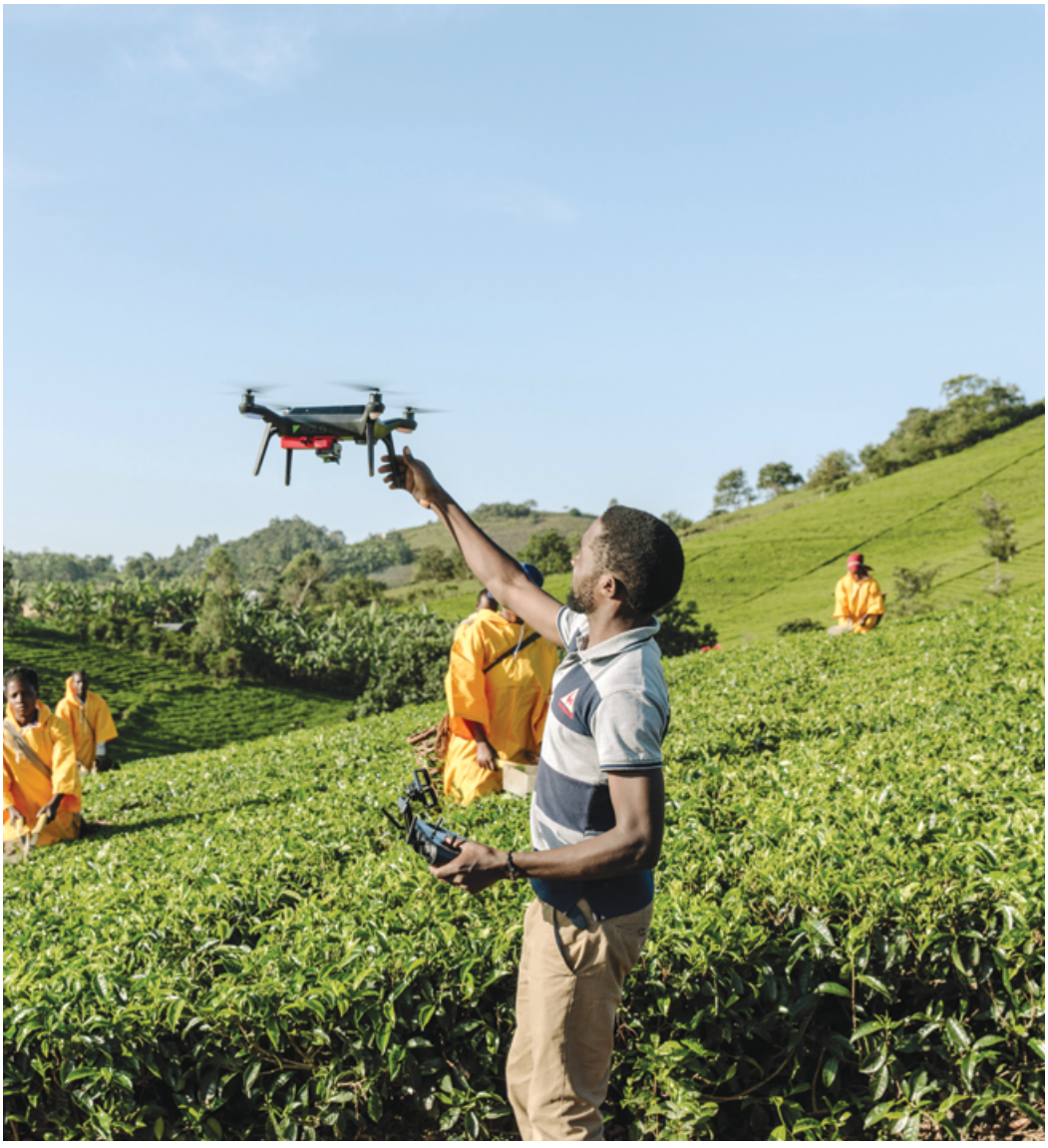
Many products that are developed currently lack innovations and value add, which hindrances their success. For example, too many agro-e-commerce platforms are launched in the same market, using basic existing plug-ins with no customised algorithms, which could help generate a comparative advantage.

Lean management and lean start-up technics (Ries, 2011) need to be better adopted by the businesses. Among others, young companies should adopt systematically the "Build-Measure-Learn" feedback loop principle in service design, avoid focusing on vanity metrics (Ries, 2011).

One channel through which the needed capacities can be acquired is the educational system. But these institutions are criticised for not adequately preparing students for entry in the job market (Baumüller, 2016). University training curricula should then be updated to include industry hands-on knowledge. Agricultural faculties should include some digital agribusiness knowledge in their curricula, while computer schools and universities should create thematic specialities, such as digital agribusiness, which can be embraced by software developers.

Another capacity building channel that should be developed is collaboration between agripreneurs, at national level (e.g. Yeesal Agrihub in Senegal) and regional level (e.g. the AfricaGoesDigital involving drone operators).

Technology hubs, incubators or accelerators can facilitate capacity building of young entrepreneurs (Jiménez and Zheng, 2018; Littlewooda and Wilkister, 2018; Talbot, 2012). However, there is lack of specialised capacity in these institutions as well. As indicated by our second expert, M.B., responsible of an incubator, these institutions are getting better organised, under the leadership of their organisation AfriLab. It will be useful that governments and development stakeholders support these organisations to acquire digital agribusiness capacity and facilitate as well collaboration between digital and agricultural incubators.



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5.2.4. Promoting an enabling business environment

While many West African governments depend on fiscal revenues, young entrepreneurs recommend that they create a fiscal environment more supportive of youth entrepreneurs. The example of Ghana, which has instituted a tax holiday for young businesses, can serve as model. In some countries, even when incentives exist, there is lack of transparency and information on their conditions of access as noted by Sera. Public authorities should thus avoid leaving the impression that political acquaintance is a key criterion for benefiting from these incentives.

Establishing public-private-partnerships involving effective young digital businesses is another avenue to enable their growth. Titan.tg and our expert D.A. encourage governments to involve the national private sector in their projects. Many entrepreneurs recommend that policies should be put in place to guarantee that no player unfairly exploits their dominant position. Sometimes, local businesses feel that they face unfair competition when competing with the foreign organisations operational in West African countries. Governments are encouraged to enable favourable frameworks for negotiation between mobile network operators (which can provide much value to entrepreneurs) and the young companies. There is also a fear that ownership of the most promising young digital companies might be captured eventually by international investors and businesses. Governments should consider these elements as well in their policy strategies.

Easing the protection of digital innovations of young innovators is also crucially needed. Finally, young entrepreneurs should learn how to better collaborate with all ecosystem players, including by remaining conscious of the values and needs of these stakeholders.

5.2.5. Designing innovative and effective business models

Weaknesses in business model innovations and the central importance of a business model as a success factor have been largely discussed in previous sections. Practices that have proven more successful include bundling services (for example advisory services and market linkages services), becoming a value chain player by bundling if appropriate, non-digital and digital agricultural services. Designing B2B or B2B2C services (business-to-business-to-customer services) appears a good strategy to generate revenues, as individual farmers usually are not in a position or willing to pay for digital agro information services (Baumüller, 2016; AGRA, 2016). Data analytics and data-driven services have emerged as strong value capture channels (Loshin and Reifer, 2013; CTA, 2018) and entrepreneurs should learn to develop digital agribusiness services that leverage data while protecting customers' data. A revenue model that has proven its effectiveness for some start-ups is the subscription model, though customers adopt it only if the company offers reliable services.

Services need to be designed taking into account customers' needs and environment. Thus, young innovators should not develop, for example, a solution based on smartphones for farmers they target if they do not own smartphones or cannot afford bandwidth costs.

Institutions supporting youth development should also continuously assist digital agripreneurs to raise their capacities in business modelling.

5.2.6. Developing team commitment and retention

Many entrepreneurs mentioned to have faced uncommitted staff, leading sometimes to loss of capabilities. An option experimented successfully by Connecticut to enhance employee engagement is to create a strong sense of belonging and ownership of the firm. Means of achievement of this include providing public acknowledgement and effective visibility opportunities to the staff, while providing them with capacity building options and even equity when relevant. As the young start-ups are challenged by limited financial returns, leveraging non-monetary and intrinsic rewards can yield commitment.

5.2.7. Improving the digital infrastructure and agricultural digitalisation

The most important constraint that digital entrepreneurship faces might be the weak digitalisation of the agricultural sector, especially farmers' digital illiteracy and the poor rural connectivity, despite progress achieved (Acker, 2011; Baumüller, 2015; Kabbiria et al., 2018). This weakness is a strong impediment for the development of the market that digital entrepreneurs want to serve. There is also a weak understanding of digitalisation opportunities at the level of other agricultural stakeholders, including public actors who can support youth.

While connectivity is progressing in Africa in general, rural areas where most farmers reside are still lagging behind (Chick et al., 2010; GSMA, 2018).

Therefore, governments and telecom operators should accelerate strategies aiming at boosting broadband connectivity, rural connectivity and affordability of digital tools. We also advise that e-agriculture strategies are developed or adequately implemented, at national and regional levels. Capacities of all agricultural stakeholders should finally be raised and effective use cases promoted.

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Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA)

P.O. Box 380
6700 AJ Wageningen
The Netherlands
www.cta.int