Factors Affecting Co-creation of Modern Horticultural Technologies and Practices in Southwest Nigeria: An Empirical Analysis

MASTER THESIS

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Executive Summary

Over the years, the horticultural industry has seen growing awareness and implementation of more recent and modern technology and practices to achieve better results and increase efficiency, especially in farming. For developing countries like Nigeria, the horticultural sector needs to act quickly to meet growing food demands and overcome the many limitations in the industry. This is because there is a high failure rate due to different climatic and farming conditions when implemented directly in Nigeria with no altercations. To overcome this, co-creation has been proposed as a solution whereby the local farmers are given the opportunity to come up with and realize working solutions befitting their environment. This research thesis aims to explore the realistic applicability of factors that affect horticultural technology co-creation with local farmers in southwest Nigeria. An in-depth literature review to identify relevant and applicable frameworks on co-creation is carried out.

The nature of co-creation is an interactive process in which the manner of engagement by each and all actors involved determines its success. It is a participatory behaviour which is divided into four behavioural subcategories: Information seeking, information sharing, responsible behaviour, and personal interaction. The Ability, Motivation, and Opportunity (AMO) framework explains the behaviour of co-creation by local farmers. The framework illustrates the moderating role of ability (skills and capabilities required for the performance of the behaviour) and opportunity (contextual and situational constraints) on the motivation-behaviour relationship. Primarily, willingness to co-create is determined by the ability dimension as individuals are more likely to confidently co-create if they are sure they have something concrete to contribute. An adapted framework is formulated which defines the strengthening role of seven ability factors, namely: consumer expertise, semantic knowledge, social network, trust, time effort and financial resources to the four behavioural subcategories of co-creation. To determine the real-life applicability of these seven ability factors in the consideration to partake in co-creation, thirteen industry actors were contacted. Amongst these were seven local farmers operating in the southwest states of Oyo, Ogun, and Lagos. They partook in semi-structured phone interviews to gather data. The interviewees consisted of farmers, high-level officials of farmer cooperatives, and agro-business owners with experience in training programs either as participants and/or trainers. The ability factors were used as the baseline for narrative analysis and combined with inductive thematic analysis of the information gathered from the interviewees.

The findings of this research thesis validated the formulated adapted AMO framework, by showing that the ability factors are in fact measured by local farmers in considerations to participate in co-creation programs. It also provides new insights which suggest that the ability factors do not have as much effect on the personal interaction and responsible behaviour of local farmer participants in co-creation as they do on information sharing and seeking behaviours. This suggest that new ability factors that do affect these behaviours could still be added within the adapted AMO framework. Finally, the findings brings focus to the possible adverse effect of curiosity-driven participants on the ability to co-create, which is a new consideration for literature that could be further investigated in future research.

Contents

Chapter 1. Introduction

The importance of effective horticultural practices is well known and understood widely within the industry. It is now even more important as the population of the world is growing and with the consequent high food demand. While all countries will need to step up their efforts to meet their growing needs, some need to do more than others.

Horticultural practices and technological advancements like vertical farming are the trends right now, especially with the focus on sustainability and efficiency management. Leading these efforts is the Dutch horticultural sector, which over the years has amassed immense knowledge and skills within the field (Dons & Bino, 2008). Similar to most developing nations especially in Africa, the horticultural sector in Nigeria is plagued by poor infrastructure, a lack of or inadequate research and development (R&D), insufficient public investment and the low efficiency of the government which has stunted its growth and transition to better and modern technologies/practises which improve on efficiency and work flow speed (Eicher, 2003; Kevin et al., 2018). The horticultural sector has been identified as one of the focal sectors in the Multi-Annual Country Strategy of the Netherlands government in Nigeria, contributing to the Sustainable Development Goals.

Most Nigerian horticulture producers are small-scale farmers (also referred to as smallholder farmers) who produce the majority of food consumed within the country (Anderson, 2017; Kroesen & Ndegwah, 2019). In recent years, the sector has seen increasing use of some of the most common and widespread modern simple horticultural solutions, technologies, and practices like greenhouses, chemical fertilizers, pesticides etc. (Kroesen & Ndegwah, 2019). However, it has also been noticed that most smallholder farmers discontinue the use of these technologies due to several factors. The issue of financial costs of energy and maintaining these technologies has been identified as one major factor leading to this trend (Korthals Altes & van Rij, 2013). Yet, it does not completely explain the decision to discontinue use as there is an increasing availability of more frugal versions (use of affordable plastic coverings as coverings in greenhouses instead of expensive façade materials like glass) of the technologies (Kroesen & Ndegwah, 2019). Or even the development of new low economy market-specific technologies like the African Market Garden (AMG) which is a holistic horticultural production system for small producers (Woltering et al., 2011). Albeit this new direction into more relevant frugal technical solutions is a positive development in ensuring effective aid, however, there is still a call for even better solutions that are tailor-made not only to financial and economic conditions but also consider regional conditions. (Eicher, 2003) emphasizes the need to fall back on regionalism rather than the shift to nationalism as the organizational model for agricultural and horticultural research. And although it was referring to sub-regions in Africa, the logic behind it is still relevant in this case as the diversity within Nigeria in terms of climate alone for instance between the northeast and southwest can be significant in determining which technologies can be adopted and which not. Therefore, returning to more regionally focused programs will encourage relevant technology spill-ins and specialized human capital training centres among other benefits.

There is also a push for partnership and collaboration at the grass root level, i.e., between smallholder farmers and aid providers (Agricultural Technology Providers (ATP), NGOs, Foreign institutes etc.). This many argue is even more important to establish due to the social nature through which these smallholder farmers operate, their conservative mindset and the

cognitive biases held within such groups (Delre et al., 2007; Kroesen & Ndegwah, 2019). (Mgendi et al., 2019) reports how the arrival of new technologies is often met with resistance as the agricultural knowledge system is built on long-standing, ingrained, and hard-to-change cognitive, social, and institutional processes. Addressing the group and ensuring proper knowledge sharing within the cluster is thus paramount as innovation decisions are usually made based on personal experience and information shared with other smallholders (Kasmire et al., 2012). Through this, these local stakeholders should learn to appreciate the benefits, and thus will mobilize resources to guard the project and ensure continuity (Mgendi et al., 2019).

The farmers understand better what their struggles as well as needs are due to the cultural and localized context within which they operate (Stuiver et al., 2004). As a result, will understand what will work and not when presented with the opportunity to develop their solution (Pretty et al., 2011). This is where the concept of co-creation becomes relevant and critical to ensure adoption, proper management, and long-term continuity. To co-create is to create something jointly or with one or more others (Merriam-Webster.com dictionary, 2022). When collaborating parties create value together, their interaction within that process results in co-creation (Grönroos & Voima, 2013). Jayashankar et al. (2020) explain how the co-creation process derives value-in-use for farmers, especially the epistemological value-in-use is especially important here as it relates to how farmers perceive and appreciate the value they create. This appreciation and other emotions like pride, coupled with feelings of ownership are said to be some important factors that could help explain why farmers may choose to adopt or continue using a technology (Jayashankar et al., 2020). Extant literature shows the concept of co-creation within the practice and interaction between all stakeholders in creating horticultural technologies and practices for the African market (Gilioli et al., 2014). This is evident in the work by Mitcham et al. (2013) which describes five large-scale Horticulture advancing projects undertaken by the Horticulture Collaborative Research Support Program (HORT CRSP) in Africa (mainly Sub-Saharan Africa) of which none actively involved co-creation. While new practices in aid development have moved in the right direction by ensuring a medium to a high level of participation by the local community, the farmers and other stakeholders, the underlying issue remains that the solution is not fitted to their conditions.

1.1 Research Objective

Allowing the local farmers the opportunity to come up with and realize a solution befitting themselves as they know more about their environment. Therefore, the direction of purely knowledge transfer and imitation of horticultural practices and technologies directly into the Nigerian context will likely in the long run fail or not result in effective results as initially predicted or planned. It is thus paramount to look towards co-creation and analyse how to facilitate knowledge exchange and collaboration between local farmers and co-creation program facilitators to bring about the right type of change and growth to the sector.

The main objective of this research is to determine the factors affecting the co-creation of better fitting modern horticultural technologies and practices by including smallholder farmers in Southwest Nigeria in the process. The research will explore the social aspects of the interaction of the farmers with the technology providers and other stakeholders, looking into how the co-creation process could be established. Overall, the research aims to improve the horticultural practice through improvement of agricultural/horticultural co-creation programs allowing for development of more suitable and fitting innovations that are useful to the local actors. This may eventually lead to better economic and food security through knowledge exchange,

technology co-creation and collaboration with local parties. By doing this, this thesis seeks to bridge the literature gap as highlighted by Vargo et al. (2018) which recognised the inappropriate distinction of the producer-consumer relationship and calls for more research into value co-creation in other social disciplines like socio-technical context for better advancement of value-cocreation.

1.2 Research Questions

The main research question to be answered is:

What are the actual factors affecting horticultural technology co-creation with local farmers in Southwest Nigeria?

To answer the main research question, the following sub-questions will be answered during this research:

1. *How will co-creation affect modern practices and technology uptake in Nigeria?*
2. *What behaviour should smallholder farmers exhibit to co-create with technology providers?*
3. *What are the most critical factors influencing smallholder farmers' willingness to co-create?*
4. *What changes need to be made to help facilitate co-creation between the smallholder farmers and technology providers?*

1.3 Research Approach

This thesis follows an exploratory research approach. Using this approach is relevant in this case because, while an increasing amount of research has been done in the field of co-creation as well as factors affecting it, it is important to research these factors within a realistic social context (Bonnemaizon & Batat, 2011; Vargo et al., 2018). This exploratory approach allows for discovering new insights to better define, and better understand the boundaries and applicability of the already defined factors affecting co-creation in the context of local farmers in southwest Nigeria. To do this, an in-depth literature review to identify relevant and applicable frameworks on co-creation is carried out, followed by semi-structured phone interviews of local farmers in southwest Nigeria. The interview data is later analysed using narrative and thematic content analysis to determine the resulting themes or measures.

1.4 Report Structure

The thesis report starts with an introduction of the research, defining the research problem, objective, questions, and approach. Chapter two then gives a detailed literature review on the Ability, Motivation, and Opportunity framework of consumer behaviour, including co-creation as a behaviour, identifying the ability factors and concludes with the adapted AMO framework used within the thesis. Chapter three explains the Nigerian southwest horticultural scene and the relevant actors concerning co-creation with local farmers. The methodology for further field research with the local farmers using phone interviews, who the target audience are, the questioning approach as well as data analysis method is given in chapter four. The results of these interviews and a discussion of these results are presented in chapter five. Finally, chapter six concludes the research paper, highlighting the implications, limitations, and recommendations for future research.

Chapter 2. Literature Review

This thesis seeks to explore the behaviour of farmers in co-creation. As a result, this literature review explores and finds a fitting framework for explaining human behaviour amongst extant literature. Here the concept of co-creation as behaviour is examined, what constitutes such behaviour and how it relates to existing frameworks on behaviour.

2.1 The Behaviour that is Co-creation

The nature of co-creation is an interactive process in which the manner of engagement by each and all actors involved determines its success. This manner of conduct by actors defines their behaviour towards the co-creation process and is quite indicative of their willingness to participate in the process to analyse this co-creation behaviour. The whole point of co-creation is to involve the perspective of the consumer in determining the proper end product fitting the needs and wants of the consumer. Therefore, the participation of the consumer in the process is vital. This participative behaviour is therefore indispensable for the co-creation session to be deemed successful. Vega-Vázquez et al. (2015) and Yi & Gong (2012) divide this participatory behaviour into four subcategories as follows:

1. **Information-seeking behaviour**: Information-seeking behaviour sees an individual engaging in a process to gather the information he/she deems important, but they are lacking. This need to bridge the gap in their information database motivates the activities, manner and steps they take to do so (Koja-Odongo & Mostert, 2013). This behaviour is especially necessary within a co-creation process as the consumers actively, passively, and even unintentionally seek ideas and best alternatives to the current service/product offering to match their wants and needs (Koja-Odongo & Mostert, 2013). They do this by consulting fellow consumers, observing their environment, and even carrying out actual research (field or academic) (Gordon et al., 2020; Koja-Odongo & Mostert, 2013). This behaviour allows them to remain up to date with the industry, the other actors, their role and importance of that role and the information they contribute to the process. Thus, consumers exhibiting this behaviour maintain a sort of leverage within the network of actors involved in the process.

2. **Information sharing behaviour**: The consumer participating in co-creation aims to ensure a customized solution to their problem. The consumer must therefore make known their perspective and understanding of that problem for the end product to accurately represent their wants and needs (Etgar, 2008). The consumer that understands this must behave accordingly by sharing that information with other actors in the co-creation process. Albeit understanding its significance, consumers are also wary of sharing knowledge as it comes with risks such as privacy violations or opportunistic behaviour by other participating actors who withhold valuable information while using the exposed information to their advantage (Dijk, 2020). Nevertheless, information sharing shows cooperation which establishes trust and transparency between participants.

3. **Responsible behaviour**: The risks associated actors encounter and are subject to when co-creating can be controlled through responsible behaviour on all sides. Responsible behaviour is thus shown by following guidelines, policies, rules and regulations that are both formally and informally (implied) instated (Yi & Gong, 2012). This behaviour shows

that the actor understands their responsibility and respect for others (Vega-Vázquez et al., 2015).

4. **Personal interaction**: This refers to actively engaging other actors and developing an interpersonal relationship. Making connections and affiliations with each other through courtesy, friendliness and respect will foster a more intimate atmosphere within the co-creation group (Yi & Gong, 2012). This social and congenial environment increases the actor's will to co-create with other actors as they can easily view it as working with friends for mutual benefit rather than a business transaction.

From the descriptions of these four participatory behaviours, some connections between them are noticeable. For instance, an actor who follows the rules and is more cordial in their approach can more easily develop strong interpersonal relations with other actors. This same actor would then be more likely to succeed in attaining information when in search of it as the other actors would be more willing to share their knowledge and information with him/her. Therefore, determining factors enhancing and influencing these behaviours are sure to encourage participation in the co-creation process.

2.2 Frameworks of Behaviour

Over time, several conceptual models and frameworks have been formulated to explain what leads to the performance of behaviour in different contexts. This includes both planned and unplanned behaviour. Considering that for an individual or group to exhibit the behaviour of co-creation, they must make a reasoned decision and are willing to do so, hence it falls under planned behaviour. Some theories like the Theory of Planned Behaviour (TPB) model and its antecedent the Theory of Reasoned Action (TRA) model posit that the intention of an individual determines whether or not they perform a behaviour (Ajzen, 1991; Ajzen & Fishbein, 1980). These theories evaluate the attitudes toward a particular behaviour based on social norms present within the person's context. However, attitudes are hard to measure due to difficulty in conceptualizing the construct (Ryan & Carr, 2010). This coupled with the overall low explanatory power and other construct issues of the parent theoretical model (Hughes, 2007), this paper will be adopting the Ability, Motivation and Opportunity (AMO) model as a conceptual model which was formulated to address the issues with the previous models. The AMO model is an appropriate and valuable lens that better explains actor behaviour in a joint problem-solving process like co-creation (Aarikka-Stenroos & Jaakkola, 2012).

2.2.1 The Ability, Motivation and Opportunity (AMO) Framework

The Ability, Motivation, and Opportunity (AMO) model is an integrated theoretical model which explains behaviour through psychological and situational constructs. The model is constructed on 3 main concepts, Ability - the skills and capabilities required for the performance of the behaviour (Hughes, 2007). These include knowledge sharing capabilities, possession and access to resources, skills and knowledge and proficiency in performing the tasks under one's control. Motivation - the drives, wishes, urges, or desires which initiate the sequence of events known as behaviour. It shows the readiness to partake in information processing. And Opportunity - the contextual and situational constraints relevant to the performance of the behaviour (Hughes, 2007). These could be time constraints and various forms of distraction taking away from the focus on a particular topic.

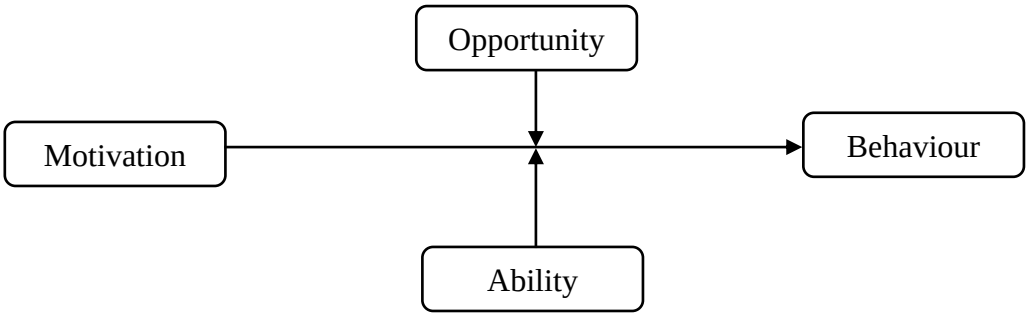

Figure 1: AMO Framework (Hughes, 2007)

The moderating role of ability and opportunity on the motivation-behaviour relationship as shown in the AMO framework in Figure 1 means that while the presence of desire towards something results in a certain behaviour, the propensity to the realization of that behaviour is dependent on the capacity and contextual environment at hand.

In the context of co-creation between foreign enterprises and the local populace in developing countries like Nigeria, viewing this interaction through the AMO lens will prove useful especially in explaining the willingness to participate in co-creation. Benzing & Chu (2009) in their paper explored motivational factors influencing entrepreneurs in Nigeria, Kenya, and Ghana, which encompassed processes like co-creation and reported that Nigerian entrepreneurs are motivated primarily by push factors. These are factors that result in a desire to increase their income, improve their standard of living and overall retrenchment due to economic difficulty. These strong motivational factors have been a long-standing reality in Nigeria and thus it has culminated in an unwavering motivation to better their situation. Furthermore, local farmers especially at the grassroots level usually operate as a collective in farmer groups, thus upholding group decisions and having a shared collective goal (Bettiga et al., 2018). This results in a strong sense of collective efficacy (Krapež Trošt et al., 2016). Therefore, when farmer groups chose to participate in programs, they will join with strong motivations as the decision would have been thoroughly considered and agreed upon by the members. As a result, due to the aforementioned nature of farmer groups as well as the already innate strong push factors present, the motivational dimension of AMO is in a sense already covered and will not be the focus of this paper.

Similarly, the opportunity dimension which represents the situational constraints on the farmers most especially those of time and access to resources (Bettiga et al., 2018) is also covered and will not be the focus of this thesis. This is taking into consideration that the majority of co-creation or similar programs are planned and managed by relatively large organizations, who then take responsibility for announcing and reaching out to relevant local farmers to participate. This thus decreases the uncertainty and influence on the choice to willingly participate in co-creation. Therefore, the opportunity dimension is not as interesting when viewed through the lens of the local farmer.

On the other hand, the ability dimension for participation in co-creation is a primary determinant of willingness to co-create (Bettiga et al., 2018). The reasoning that was given was that those willing to co-create are more likely to confidently do so if they are sure they have something concrete to contribute. Bonnemaizon & Batat (2011) explains the idea of the ability to co-create by looking at the concept of the ‘competent consumer’. The competent consumer is one who when participating in co-creation, must possess the skills and knowledge about the

subject matter to exchange know-how with the other actors and participants. Hallahan (2000) pushes this notion further, stating that high-ability or knowledgeable individuals can more efficiently and schematically process information than novices or low-ability individuals. This means that in a knowledge-intensive process like co-creation, congregating consumers with high ability in the subject area creates an ideal environment leading to successful results of the co-creation process. On the other hand, a mixture of both high and relatively lower ability consumers is more realistic and thus one must look to seek ways in which consumer ability can be enhanced. Looking towards ability factors is one such way to influence the skills and knowledge to engage in knowledge exchange leading to co-creation. This thesis therefore focuses on the ability factors and their importance on willingness of local farmers to co-create and create tailor made horticultural solutions with other actors. The ability factors are explained further in the next section.

2.3 The ability factors influencing co-creation

The definition of factors adopted here is that of Akolk et al. (1992) which defines factors as anything introduced into a situation, that then contributes to the outcome or, influences the result and whose effect needs to be evaluated carefully. Taking this definition would mean only factors that are tangible and external, excluding more internal and intangible factors like psychological factors.

What co-creation is according to Frow et al. (2011) is

> "An interactive process, involving at least two willing resource integrating actors, which are engaged in a specific form(s) of mutually beneficial collaboration, resulting in value creation for those actors".

This means the core of co-creation is in the interaction between two or more actors in the form of engagement leading to collaboration to create value(Frow et al., 2011; Ramaswamy & Ozcan, 2018). This means the ability to co-create would naturally depend on the skills and capabilities of the involved actors to interact or specifically to collaborate properly. How much the involved actors participate in the interaction is a great indicator of the level of success of the co-creation process. As a consequence of lower participation, shows a level of detachment and unappreciation of the co-creation process itself by the participants (Kaur et al., 2015). In this case, it is a collaborative level of participation, which involves a high level of contribution on the part of the consumer (the local farmer) with their ideas and to select the components that should be incorporated into a new product offering (O'hern & Rindfleisch, 2010). Within this interactive sphere, an exchange is or needs to be facilitated. This exchange could be in a more discrete form like a monetary exchange or more relational (focusses on people) like in knowledge exchange (Fontenot & Wilson, 1997).

The relational exchange focuses on people and thus is more appropriate for the subject matter of this research, therefore will be the only interactive exchange to be considered further. Resource integration as from the definition of Frow et al. (2011) is one such relational exchange necessary for co-creation. It is the ability consumers have to employ their available resources to enhance their own consumption experience (Kaur et al., 2015). Aarikka-Stenroos & Jaakkola (2012) in their paper six lists consumer resources, namely information on consumer needs and context, some level of industry expertise, production material, time, effort, and financial resources.

The knowledge and skills customers possess relating to their situation or the industry are referred to as **consumer expertise** and it is defined as the capacity of the consumer to understand the subject matter, i.e., the processes necessary for the conception and implementation of innovation (Etgar, 2008; Merz et al., 2018). To be able to share their consumer expertise and knowledge to achieve co-creation, consumers first need to have an understanding of a mutual language, in other words, **semantic knowledge** of terms, words, phrases and sentences are both linguistically and contextually (Bagheri et al., 2019; Evans & Wolf, 2005). This more or less means that the parties are able to communicate and understand the same language, not just a lingua franca but a professional language, which is specific to a certain profession or field and acts as the currency of industry-specific collaborations (Evans & Wolf, 2005).

Another influencing factor is the type of relationship each consumer has within their **social network** of stakeholders, that is their access to, social ties and role within the dynamic network will determine their willingness or even permissibility to contribute to the process (Merz et al., 2018; Opata et al., 2019). Lastly, **trust** is a crucial factor between actors as then they can divulge the right information without fear of opportunistic behaviour of other actors within the network (Bagheri et al., 2019; Evans & Wolf, 2005).

The consumer also needs access to production materials, which are existing solutions, technology, and materials needed which in this case can be provided by the tech suppliers or organizers of the training program. **Time** is also an important factor repeatedly mentioned within this literature, where the authors point out that the willingness of consumers to commit completely or partially to co-create is naturally dependent on their availability to participate. The **effort** the consumer puts into the process could also be seen as a proactive approach taken by the consumer to ensure the success of the process (Krapež Trošt et al., 2016). Finally, **financial resources** are the financial assets the consumer has to expend on the program expenses like registration/participation fees or other fees required to access or take part in the co-creation process and developed solution. Possession of all these resources in and of itself is a factor influencing participation in co-creation, as actors only engage when they know they have what it takes to contribute.

2.4 Conclusion

In the literature review, an adapted AMO framework is formulated which focuses on the relationship of ability with behaviour and will be used within this paper. This adapted framework (see Figure 2) takes into consideration the seven ability factors namely consumer expertise, semantic knowledge, social network, trust, time effort and financial resources and defines a moderating relationship of these factors to the ability construct of the AMO framework. This, therefore, means that the ability factors help strengthen the ability to co-create or in other words the likelihood to exhibit the four co-creation behaviours.

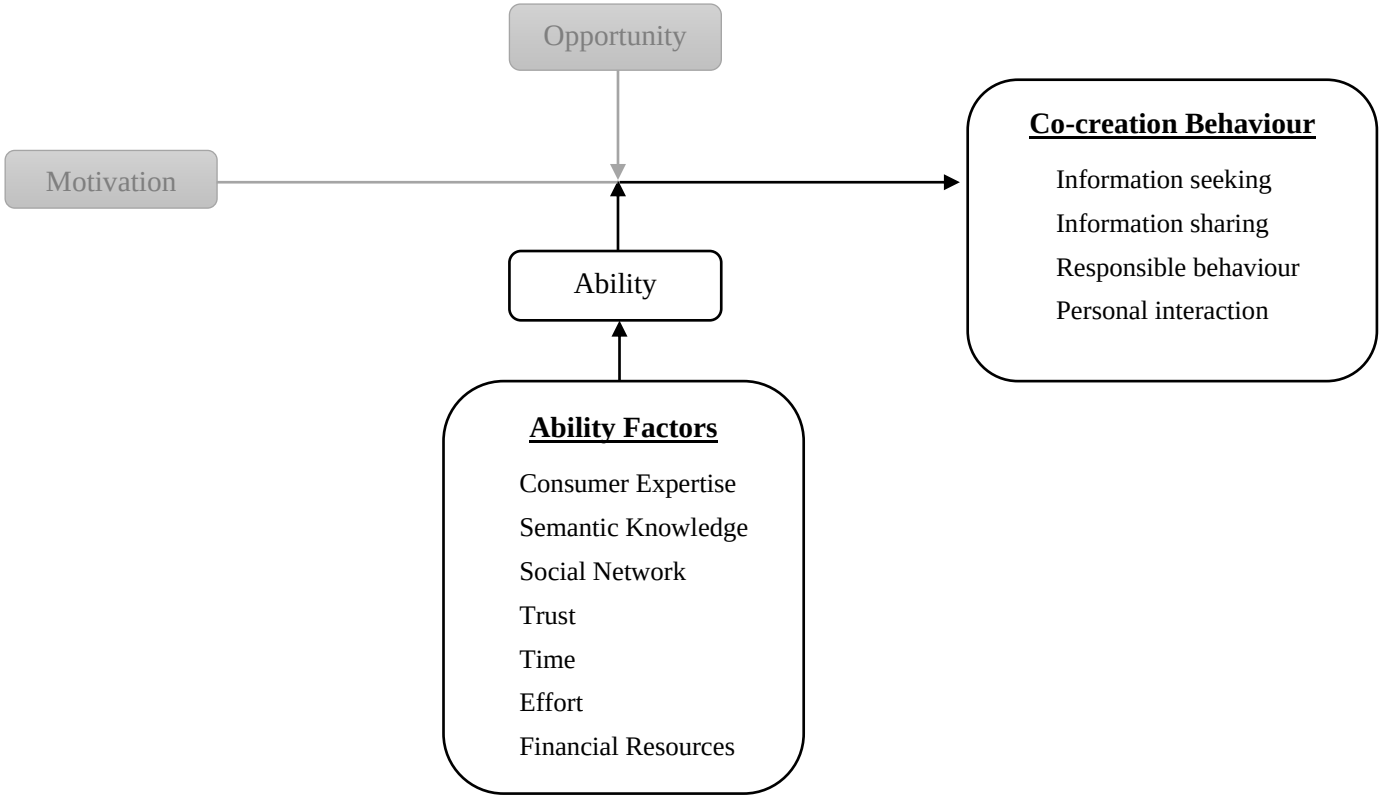

Figure 2: Adapted AMO Framework

Chapter 3. Modern Technology in Nigerian Southwest horticulture

In more recent years, focus and effort have been put into developing the horticultural sector in the Southwest of Nigeria to reduce dependency on the north and imported goods, as well as reduce food product waste. It is no secret that most research and developments in Nigerian horticulture and agriculture have been focused on the Northern states like Kano and Kaduna, mainly due to better climate conditions, fewer pest attacks etc (Korthals Altes & van Rij, 2013). As a result, a lot of products get spoiled and wasted during the long-distance covered to transport the food from north to south, usually in poor storage and travelling conditions. Such issues coupled with the rising rate of population growth and consequently food demand have most likely driven the need for horticultural advancement within the region.

Dijkxhoorn et al. (2021) report a wide age range of the southwest farmer demographic with many being well-educated and tech-savvy youths, unlike the more aged demographic in the north. This provides the opportunity for the adoption of modern technology and practices which improve on efficiency and speed of old technology from local innovations created by the people within the region or country. The demographic can as well adopt innovations from around the world, provided by foreign technology suppliers. This is especially prominent when looking at the rise of greenhouse technology adoption within the region. While it works for some, for a lot of others failure is the reality as these greenhouses are modelled from other countries with different climate conditions unlike the mostly hot and humid climate of Nigeria. These greenhouses often struggle with lack of ventilation and frequently battle soil-borne diseases like bacterial wilt for tomatoes (Van den Broek et al., 2021).

To overcome such issues, training programs such as the Tailor-Made Training Plus (TMT+) project planned by the Orange Knowledge Programme (OKP) of the Netherlands Organization for internationalization in Education (Hawkins & Sobukola, 2020) and the like have and are still being organized at all levels (local to national) mostly by governmental institutions. While this is certainly a welcome intervention, a lot of these programs are focused less on horticultural commodities and valuing horticultural products, and more on agricultural field crops like maize and cassava. This could be largely attributed to the general misconception of what horticultural crops are, and them being limited to flowers and ornamental crops which are considered less essential for survival. Additionally, the effect of these programs is also limited by the inadequate experience of trainers in modern farming technologies for crop production (Van den Broek et al., 2021).

3.1 Training Programs Participants: Relevant Actors

As highlighted in the literature review, the ability of an individual that participates in the co-creation programs is of great importance. This section, therefore, describes the relevant actors likely to participate in these programs by defining their characteristics and their goals concerning similar programs (e.g. Training programs). This gives a better understanding of how the ability factors may affect them.

To identify the relevant local actors most commonly involved in programs aimed at developing agriculture/horticulture as well as their roles within the industry, preliminary interviews with three industry experts were carried out (see Appendix B for a description of experts). Based on the information provided, 3 main actors were identified as possible participants in these programs.

1. Local farmer groups (Agricultural Cooperatives):

The agricultural cooperative is a collective of farmers that come together, pooling their resources into any areas the collective deems as important towards achieving their common goal (s). These cooperatives usually consist of members living/working in close geographical proximity to one another, allowing for easier communication and access to each other. This means the demographic of these cooperatives would most likely have uniform characteristics in terms of education, practices, and farming concerns. As a result, a typical farmer's cooperative originating from a small rural settlement would naturally consist of farmers living within that area. The hierarchy within such cooperatives usually sees the most farmers with vast networks and influence and knowledge of the industry (formal/informal horticultural education) as the official/unofficial head. Consequently, they gain tacit knowledge, become more learned in the industry practices, and are informed on opportunities and resource availability in the industry. These high-level officials thus hold considerable power in the selection of participants and representatives in the event where a training opportunity pops up. Nevertheless, the dynamic of such farmer groups involves a system of democracy with a 'one man one vote system'. Thus, usually, every member is free to go for any opportunity presented to the cooperative and is only ever constrained when the number of participants is limited thus the high-level officials choose those best suited to join, learn, and pass on the knowledge to the non-attending members.

2. Universities:

Most Universities seek to create and establish close relations with their local communities, especially with those that they can have a direct impact on like farmers. Their reasoning for doing so could range from attracting more students, and helping the local communities to even compliance with government policies. Nigerian universities in general are undergoing a shift in focus from more traditional theoretical-based education to more competency-based education which allows for mastery of courses based on a career path. These training could be provided through exclusive training programs directly in collaboration with foreign suppliers, government institutions or through private actors like HORTSON. Universities like FUNAAB which is known for its focus on agricultural education and has thus a dedicated agricultural department been among those making elaborate plans for training their students in newer agricultural practices and methods. By having students who most likely grew up and studied on the land and practices of the same farming conditions as the local farmers, they ease the transition from foreign practices and methods for easier assimilation into Nigerian farming. However, while the students have theoretical knowledge, they lack practical experience which limits their understanding and capability of fully grasping the issues faced by the local farmers in the real world. This, therefore, limits how much they can relate to the farmers and effectively co-create on problems they do not completely grasp. Moreover, some industry experts are not too optimistic about the early nor fast implementation of such plans due to the track record of delays regarding similar policies on both institutions and government levels. Moreover, the overwhelming bulk of the Universities' funding comes through the government with less than 2% coming from other sources, the inconsistency and insufficient funds Universities are challenged with will most likely see such plans put on the back burner.

Examples include the Federal College of Agricultural Produce Technology (FCAPT) at Kano which offers training, consultancy and laboratory services, and training of produce and pest

control inspectors, farmers, and industrialists, as well as training of trainers and advisory services.

Agricultural & Rural Management Training Institute (ARMTI) Ilorin aims to be the centre of excellence in agricultural and rural development management training and provides management training, consultancy and advisory services and the dissemination of agricultural and rural information.

3. Private Actors (Agro-business):

The horticultural private sector in Nigeria makes up only a small percentage of the industry, with its organization and structure of activities and actors leaving much to be desired in comparison to actors like government organizations (will be discussed later). Nevertheless, these private Actors and businesses actively seek out better solutions within the market to help them gain a competitive advantage within the market. Agro-businesses offer services for training and information transfer to all levels of stakeholders from farmers to government, universities, other organizations etc. Considering the high stakes involved for these actors to achieve this, expending resources in R&D, purchasing existing modern technology, and fitting it to their context. As well as reaching out to foreign counterparts who have what they are looking for. This high cost involved means they are more likely to carefully consider and select participants to represent them in training programs to ensure efficient use of their expended resources.

Examples include Sahel Consulting which organized a Corporate Shared Value (CSV) program involving agriculture/ nutrition undergraduates in Nigerian universities. Dizengoff Nigeria is an equipment producer (greenhouse technology, seeds, irrigation, agri-chemicals, etc.) and provides training and agricultural support to smallholder farmers, in partnership with other companies, governments, donors, NGOs, foundations, finance and microfinance institutions, schools, institutions of higher learning and research bodies. BIC Farms Concepts which is an agribusiness consulting firm, organizing a variety of short courses for undergraduate students, staff members, SMEs, interns, extension agents and farmers in technical and agribusiness topics such as hydroponics, greenhouse, and vegetable production (tomatoes, pepper, leafy vegetables), aquaculture, etc. (Hawkins & Sobukola, 2020).

Chapter 4. Methodology

For this research, an in-depth literature study into the extant literature on horticultural technologies/practices adopted in a developing country like Nigeria was carried out. For using the amassed information from the literature review, the next research phase was to evaluate the practical applicability of each ability factor (identified in chapter 2.3) in the real-life situation of agriculture/horticulture co-creation program setting in southwest Nigeria. The research approach using interviews and content analysis was chosen as the research required that the research approach must adequately consider the context of a co-creation program and the experiences of the actors. These two approaches were chosen as this is an explorative study because it seeks to investigate these practical real-life applications of ability factors in the context of southwest Nigerian farmers, which is a new unexplored territory and has not been previously studied in depth (Sekaran, 2016). This research, therefore, requires in-depth discussions with the actors to receive concrete measures of the ability factors and examples in case of occurrence in a real-life co-creation program setting. An interview approach allows for the collection of this in-depth information from actors who can then give elaborate answers within their context.

How these interviews have been conducted, the data collected, types of questions, research reliability and validity are further explained in detail in the chapter.

4.1 Interviewee Selection

To address the real-life applicability of the ability factors in a co-creation setting concerning the local actors' participation in co-creation in the horticultural industry in southwest Nigeria, the level of analysis was a local actor operating in the horticultural industry of the southwest region of Nigeria. Based on the previously mentioned initial interviews carried out with three experts (see chapter 3.1) who gave detailed descriptions of the relevant actors, the best interview candidates amongst the three actors, farmer cooperative, agro-business and universities as mentioned in Chapter 3.10 are the farmer cooperative and agro-business officials. This is because they have more practical and real-life industry experience, unlike the university which is mostly theoretically focused. Based on the information from the experts, a purposive sampling approach was used to select each interviewee based on these criteria:

1. They are a member of a farmer group or agriculture-focused group (a group whose business serves or works within the agriculture sector)
2. They have been in the industry for at least 4 years to ensure they have had enough time and experience to have some depth of knowledge.
3. They must have been involved in an agriculture or horticulture focused/themed training program (of however duration) either as trainers and/or participants. And see it through till the end.

From these criteria, most of the interviewees chosen were executives and high-level officials who were most likely to have in-depth knowledge of their group/business as well as an understanding of the professional language of agriculture/horticulture. They were also actual farmers, thus having an intimate knowledge of the farming issues and situation of the area from actual life experience. The criterion of participation in training programs was chosen here in particular because it is the more common program format for information transactions between local farmers and facilitators in Nigeria. Training programs here refer to a planned sequence of activities designed to equip and develop specific skills and knowledge of individuals through

information, instruction, guidance, and practice (Bhasin, 2020). In training programs, information transfer is the focus of the transaction between participants and facilitators rather than co-creation which involves more mutual information exchange. However, they are still relevant and experience in both can be similar in that the behaviour of information seeking, sharing (mainly by the facilitators/trainers), interaction and responsible behaviour is observed.

A total number of seven interviews were carried out. This number is within the range of 5 to 50 participants for in-depth interviews for qualitative research which is recommended by a large number of articles and books (Dworkin, 2012). The final selection of interviewees included seven farmers with farms and farmer groups operating in the Southwestern states of Oyo, Ogun, and Lagos. Their contacts were gotten through industry expert 3 who was involved in and planning soilless farming training, as thus had access to former participants from their training as well as other similar training programs. Most interviewees are vegetable farmers, with some farming other crops like cassava and tomato as well. See Appendix B for the full list and description of experts and interviewees (for reasons of confidentiality, the names of the interviewees have been anonymized).

4.2 Data Collection Method

This data was collected through phone interviews with the selected participants within the relevant farmer groups. The use of interviews is ideal as it can capture more complex thoughts and perspectives of the farmers on the technologies and their impact. Particularly phone interviews as it allows for easier access to the participants irrespective of the location of the interviewees and interviewer. All interview audios will be recorded (only with the permission of the interviewee) and kept for further analysis after all interviews are conducted.

4.2.1 Interview Questions

The interview questions are based on the seven ability factors (see chapter 2.3). The questionnaire (see Appendix A) begins with a set of introduction questions, enquiring about the interviewee and their role concerning horticulture/agriculture as well as in their respective farmer groups. This is followed by sets of questions relating to one of the factors at a time (or two if applicable to both). The interview is conducted in a semi-structured manner, which allows for a flexible structure, which permits the interviewer to change the order of questions and to clarify any ambiguous or complex questions, and it also enables interviewees to answer in their language.

A scenario is painted for the interviewees, describing a hypothetical co-creation program which involves information exchange between participants and facilitators and amongst themselves as well to come up with a solution to an existing farming problem. This method ensures the interviewees understand and can differentiate a co-creation program from a regular training program where the information transaction is more one-sided. It, therefore, guides the interviewees to remain on topic and give their answers keeping in mind the painted program scenario relative to a typical training program. Another way it is made clear is by first explaining the factor to the interviewee before asking the set of questions relating to that factor. This way, there is no misunderstanding of the meaning of the factor in the context of this thesis.

The format of questioning follows an open-ended questions approach. With this approach, the answers to the questions are not simple yes or no and would require the interviewee to carefully think about their answer and give it depth. Question words like ‘how’, ‘what if’, ‘describe’, ‘explain’ etc will be used to formulate the questions to keep them open-ended. Another

advantage of open-ended questions is that intricate relationships between questions or question subjects could be uncovered as well as surprising information not previously considered.

For each ability factor, two general interview question formats were used:

I. Do/would you measure (*enter factor name*) before participation in the co-creation program? If so, how?
II. How does (*enter factor name*) affect choice of participation in the co-creation program?

The first question format (I) asks about the experience the interviewee has with the factor and by asking how ensures that they relay a real-life example of how they consider the factor before participation in a co-creation program. The second question (II) now focuses on their thoughts and perceptions on how the factor affects their choice of participation in said program irrespective of their answer to question (I) which will give even more insight into how they view the factor in general.

The question order of format (I) first before format (II) is also deliberate to avoid question order is relevant because the format (I) simply asks the interviewer their thoughts on the importance of the factor without placing any sort of prior significance on the factor. Thus, the interviewee would need to think carefully and answer from their experience concerning the factor. This prepares them for the second question as the first already establishes how important or applicable the factor is in reality. A situation where the second question is asked first could have interviewees already automatically assigning importance to the factor and trying to fit their answer to that mould.

These two question formats were formulated in collaboration with the 3 industry experts during the pilot interviews, who gave guidance and addressed the potential ambiguities to avoid poor formulation of the interview questions. A total of seven in-depth interviews were conducted with an average duration of one hour each interview. All interviews were recorded and transcribed to facilitate the subsequent analysis and result discussion.

4.3 Data Analysis

After the collection of all interview data, the data analysis was carried out. Following the suggestion of combining narrative analysis and content analysis to ensure a thorough and meaningful analysis of qualitative interview data, the data analysis is divided into two parts (Sekaran, 2016). The first part was the per interview (within case) analysis where each interview data recording is analysed and the narratives answering each interview question are extracted. The second part is the across (cross-case) interview analysis were all collected answer narratives from the first part are compared and the common themes are found.

4.3.1 Per interview analysis

For each of the seven in-depth interviews carried out, each recording of the data collected was analysed. This was done using narrative analysis in which the different topical stories the interviewees tell in answer to the interview questions are extracted. The narrative analysis is suitable for a situation where the interviewee tells a story to help interpret their lived experience to answer the question (Figgou & Pavlopoulos, 2015). Data analysis started with transcribing the relevant narratives of the recorded interviews about each factor. As interviews were guided by the interview questionnaire, in which the questions were organized per each factor,

recognizing the narratives that answer the questions relating to each factor was not difficult. These narratives for each question were collected in an excel file for each interviewee

An example of a narrative taken out of the answer given by interviewee 2 in response to the question (Q Item 1) on the consumer expertise factor: *Do you measure training subject/field expertise before participation? If so, how?*

***Answer narrative**: "Actually, I did not get any formal education in agriculture. But growing up, my father and grandfather were farmers, so I was born into farming and learnt everything first hand… And so that has been enough for me to know the ins and out of the industry…. And because of all the knowledge I have gained overtime, when I join these programs, I can even interact with others, and we can share the information we have"*

To summarize on how each interviewee answered the interview questions based on their own context and roles in the industry (see Appendix B for full description of interviewee qualifications).

- Interviewee 1 who is a farmer that has both participated in training programs as well as facilitated training programs himself. He gave a nuanced answers to all questions on the factors. He gave examples of measures of factors he used to both determine whether or not to participate in training programs, but also measures he used to determine which individuals to send for training programs. He focussed a lot on participant interest on subject area of the programs as a crucial measure, guiding factors like consumer expertise and effort.
- Interviewee 2 is a farmer that has both participated in and chosen others to go for training programs. His replies were gave both insights to what measures he uses to consider participation for himself, but also gave comparisons on how those measures translate to judging suitability of the others whom he has jurisdiction over and selects to join training programs. His answers on mainly focussed on factors of consumer expertise (particularly mentioning interest in subject area as his main driving force), semantic knowledge, effort, trust, time and financial resources.
- Interviewee 3 is a farmer who has participated in a lot of training programs. Most of his measures focussed a lot on their relevance to his current farming focus and interests. He emphasized a lot on the importance of measures in the factors relating to semantic knowledge, social network, trust and financial resources.
- Interviewee 4 who is a farmer who has participated in training programs as well as facilitated training programs himself. The narratives he gave answering the questions focussing more on the measures used and experiences with trainees' engagement in his training programs. For the factor of consumer expertise, he focussed on the trainee interest in the training programs he facilitated as the main judge for participation.
- Interviewee 5 is a farmer who has participated in a few training programs but supplied his knowledge based on the experience of his father who was also present during the interview. Most of his and his father's answers focussed on measures that emphasized on the benefits they could get from the program. Factors like semantic knowledge, time and financial resources were given the most attention, giving several examples to show how they measure them.

- Interviewee 6 is a farmer who has participated in a lot of group training programs. Their main focus was on measures on a more communal level. That is factors on measures of semantic knowledge of the facilitators, social network of the facilitators, time and trust.
- Interviewee 7 is a farmer that has organized and facilitated training programs only. His answers focused more on measures he used to judge trainee participation and who to engage on certain aspects of the training program. He also emphasized a lot on trainee interest in training subject area.

4.3.2 Across interviews analysis

To analyse across all interviews, the collected narratives from the per interview analysis are compared. The thematic content analysis method was used to analyse the data and used a systematic approach to code the data based on recurring themes and categorized them to find overarching groups of themes (Sekaran, 2016). The thematic content analysis approach is appropriate in this part of the analysis because it allows for objective analysis of the data and fits an exploratory research type.

The ability factors stand as the criteria guiding the identification of themes relevant to this research within the collected interview data. This means that for each answer narrative, the theme and codes are extracted within the portion of the narrative that relates to or talks about how the interviewee measures the factor when considering participation in the co-creation program. Hence, using inductive coding which is a bottom-up coding approach, the themes are built up to the main overarching themes by analysing the group of narratives answering the same questions across all seven interviews. Accordingly, the themes and sub-overarching themes and sub-themes become the measures of the factors in consideration of participating in co-creation.

Table 1 shows an example how the themes were extracted from excerpts of the narrative answers of interviewees to interview question 'Q Item 1' (see Appendix A) which is addressing the factor of consumer expertise

Table 1: Collected answer narratives to Q item 1 from all interviewees

Interviewee number	Collected answer narratives to Q item 1
Interviewee 1	*If my program focus is on a subject that has to do with my background in the farm, then I go*
Interviewee 2	*I was born into farming and learnt everything first hand… And because of all the knowledge I have gained overtime, when I join these programs, I can even interact with others, and we can share the information we have*
Interviewee 3	*I have attended previous trainings in the same area, so I stick to that to get better acquainted*
Interviewee 4	*As long as the program subject is in the same field of my farm and knowledge of what I know*
Interviewee 5	*My father has been farming for a long time and now we go together. I have my own farm now, so I know what I am talking about when I talk to others in the industry*
Interviewee 6	*I have found my focus areas in farming now, so I try to go for opportunities that will help me in that area*
Interviewee 7	*Send the trainee with a background and history in the same subject area as in the program*

These answer narratives were coded as ‘Experience in the subject area (farming)’ because it encapsulates the interviewees' answer that their garnered past and/or current experience represents their expertise in the subject area of farming, agriculture and/or horticulture. The rest of the extracted themes for all the questions are presented in Table 2 in the results chapter.

4.4 Research Reliability and Validity

This section describes the reliability and validity to gauge the quality of the research thesis approach. The following strategies were used to ensure reliability, construct, internal, and external validity.

- **Reliability** : how can the research method can give consistent results when done multiple times.

  To ensure the reliability of the research, the following strategies were used:

  a. An initial pilot interview with 3 industry experts was carried out to ensure the relevant and right individuals are targeted for this interview.
  b. A well-structured data collection process as defined in the interview protocol was followed.
  c. Selection criteria interviewee selections were defined and used.
  d. Clear descriptions and qualifications of all seven of the interviewees were provided.
  e. Data collection and data analysis processes were documented in a case database.
  f. Consistent data analysis for both per interview and across interview analysis was utilized.

- **Construct validity:** Evidence supporting the interviewees accurately accesses the research theory or investigated constructs

  a. The scenario of a co-creation program setting was described, and they were reminded of it reiteratively to ensure they remain on topic and give their answers keeping in mind the painted program scenario relative to a typical training program they are used to.

  b. The factors are also explained to the interviewee before asking the set of questions relating to that factor. This way, there is no misunderstanding of the meaning of the factor in the context of this thesis.

  c. Triangulation of sources: Two different data sources were used, in this case, the local farmers as cooperative members and as agro-business executives. By using more than one type of data source, minimising inadequacies found in one-source data as multiple sources confirm the same data.

- **Internal validity:** The extent to which observed results represent the truth in the population being studied (interviewees)

    a. Member checking: this strategy was employed during the data collection (interview) where the interviewer repeats the interviewees' answers and/or summarizes their answers after they answer each question. This is to confirm and to ensure they can clarify what their intentions were, correct errors, and provide additional information if necessary.

- **External validity:** The extent to which the results are generalizable to other similar situations, groups or events.

    a. A purposive sampling method based on criteria was used for selecting the interviewees. This means that the results obtained can be generalizable to similar local farmer populations.

    b. Audit trail: the description of the steps taken for the research project and accurately documenting it. These audio recordings or the raw interview data have all been stored and accessible if required. Similarly, all data analysis parts (per interview and across interview) have been collected in one excel file and can be retrieved if requested.

Chapter 5. Results

This chapter presents the results from the across-interview analysis of the interview data. The themes identified are presented as measures and sub-measures (specific aspect of the measure that is referred to by the interviewees' narrative answers) of the ability factors in Table 2. The third column defines and explains what these measures mean. The fourth column gives the co-creation behaviour (s) that the measure (or sub-measure only for those with sub-measures) affects. This is determined by analysing and interpreting what behaviour the individual would exhibit in the co-creation setting when in possession of the aforementioned measure and otherwise. Finally, the last column gives the number of interviewees whose answers the respective measures were identified.

Table 2: Coded interview results

Factors	Measure Type	Description	Affected Behaviour	Number of Interviewees
Consumer Expertise				
Measure 1	Experience in the subject area	Past or current experience in program subject area	Information Sharing	7
Measure 2	Inquisitive	A curiosity or strong desire to learn and acquire knowledge	-	
Sub-measure	Epistemic curiosity	The chance to acquire new knowledge on possibly better practices and opportunities around a subject area of interest	Information Seeking	4
Semantic Knowledge				
Measure 1	Trainer communication skills	The ability of trainers to share the information and ideas effectively	-	
Sub-measure	Communicating at appropriate farmer intellectual level	Ability to communicate and share information at an appropriate intellectual level for better understanding and exchange	Information Seeking, Information Sharing	7
Measure 2	Experience in the subject area	Past or current experience in the program subject area with substantial results to show for it	Information Sharing	7
Social Network				
Measure 1	Societal impact	Contribution to positive change to societal challenges	-	
Sub-measure 1	Societal involvement of facilitators	Actual demonstrable contribution facilitators have made in societal benefits	Information Sharing	3
Sub-measure 2	Social influence of other participants	Other farmer participants with substantial success in the program subject area, thus can influence the opinions and beliefs of other participants	Information Seeking, Personal Interaction	3
Measure 2	Being a team player	Prioritizing the achievement of the group goal rather than the individual goal	Personal Interaction, Information Sharing, Information Seeking, Responsible Behaviour	7

Trust				
Measure 1	Judging reputation	Judgement to engage based on past/current widespread opinions on their industry reputation	Information Seeking, Information Sharing	7
Measure 2	Trainer communication skills	The ability of trainers to share the information and ideas effectively	-	
Sub-measure	Communicating at appropriate farmer intellectual level	Ability to communicate and share information at an appropriate intellectual level for better understanding and exchange	Information Seeking	7
Time				
Measure	Clash with the farming season	How program schedule clashes with the approaching farm harvesting or planting period	Information Seeking	7
Effort				
Measure	Program relevance	Applicability of the program to solving the real pressing farmer issues at hand	Information Seeking, Personal Interaction	7
Financial Resources				
Measure	Individual participation expenses	Participation expenses like travel, food etc paid individually that are not covered by program subsidies or group funds	Information Seeking, Information Sharing	7

The following section interprets the measures obtained from the across interview analysis using the adapted AMO framework to identify the underlying co-creation behaviours that are affected as presented in Table 2.

- **Consumer Expertise**

From Table 2 above, the factor of consumer expertise is seen to be considered by the program participants through past or current experience in the program subject area. According to all of the interviewees, their ability to participate is heightened if they already have past experiences within that subject field. The experience usually comes from a long history of farming within the family and thus growing up within such an environment would mean having gained a lot of knowledge and expertise. Most of the interviewees also noted their lack of formal agricultural education, claiming that tacit knowledge and lived experiences are more relevant and ensure competitiveness within the field than general knowledge obtained through formal education. Experience could contribute to the information-sharing behaviour as the unique knowledge held by these participants from their lived experiences will be key in their confidence to share with others.

Curiosity or inquisitiveness of a potential participant and more specifically epistemic curiosity is the other theme shared by some interviewees as a driving force in improving their ability. Epistemic curiosity is to be seeking new knowledge by mainly being driven by an interest in a subject area. While one could argue that having mere interest does not guarantee to have any knowledge within that subject, it can be relevant as the motivation to pursue and seek knowledge. Interviewees thus see curiosity and interest in the subject area as key in strengthening their ability to co-create as it drives them to seek relevant information.

- **Semantic Knowledge**

The importance of semantic knowledge was emphasized by all interviewees. While all mentioned that similar to consumer expertise, having past or current lived experience within a subject field would guarantee a level of comfort in communicating and dealing with actors in the field. Thus, having the same effect on information-sharing behaviour. The interviewees also conceptualized semantic knowledge outwardly toward the program facilitators themselves. By considering if these trainers will communicate and exchange information at an appropriate intellectual level for ease of understanding for the participants (farmers). Their ability to co-create is jeopardized because they will not be inclined to seek information if there is no mutual understanding of subject terms and language. Similarly, information sharing will be hindered as the participant will be less willing to cooperate if they perceive there is no two-way exchange happening between them and the facilitators.

- **Social Network**

When considering social networks, the focus is placed on the societal involvement of the program facilitators themselves. A little over half of the interviewees mentioned the need to participate in programs facilitated by organizations with a demonstrable positive influence on social benefits, especially in the farming industry. This makes sense, as having an existing positive influence on society especially if it affects the farmers themselves shows care and regard for advancing the industry. Potential participants will therefore more readily share information with such organizations when invited for a co-creating session.

Moreover, the interviewees believe that actual possession of a sizeable social network is not a prerequisite for participation. Nevertheless, some point out that the availability of an individual (s) with such a network, who also has industry credit in the form of successful farming exploits in the subject area could foster information exchange. This includes both information seeking and sharing. They point out that such individuals are most likely to have more knowledge or be better guided through their exploits and success, thus attracting participants to interact with them.

This ties in with the last theme, which is the notion of being a team player. The position of the team player as someone who prioritizes achieving the group goal (in this case creating a solution) by willingly contributing is essential. It affects all four behaviours as being a team player will entail following the rules (responsible behaviour), willingly sharing information and seeking more information not known to them by having personal interactions with other actors.

- **Trust**

The interviewees strongly expressed their consideration of trust as a factor, which is to no surprise as the prospect of trusting the wrong individuals with one's resources could be detrimental. As a result, the theme of judgement based on past or current reputation is used to determine whether or not to engage in information exchange (seeking and sharing information). This judgement is on both the facilitators usually when considering joining the program and once entered, the judgment shifts to evaluating the other participants. As a result, judgment on reputation encompasses a vast range of sub-themes including and not limited to societal involvement, societal influence (themes already covered), political involvement etc.

Adding to that, the second theme on trust which looks at the facilitator's ability to communicate at the appropriate intellectual level of the farmer could also be considered a sub-theme of judging the reputation of the facilitators. The theme as already explained under the factor of semantic knowledge affects the seeking and sharing of information due to a lack of shared understanding between farmers and program facilitators.

Both themes under trust are projected externally by the interviewees as they consider others' suitability to be interacted with. For the most part, people do not judge or consider their suitability to be trusted.

- **Time**

Timing in farming is critical, especially during planting and harvest periods. As a result, all the interviewees considered the proximity of a program's timing to these two farming seasons. This determines their availability to participate, or at least partially in the program. Considering planting seasons for different crops vary, and some of these interviewees farm more than one type of crop, it is thus difficult to determine what time might be best to attend a training program. Thus, most of the interviewees also indicated they coupled the consideration of time with the relevance of the program to solve an immediate or pressing farming need. The proximity to the farming season is also important here as then the earlier a program opportunity is made known to the farmers, the easier it is to schedule for and make way for participation. Taking all these into account, each farmer's situation may also differ as some have helpers and might have more expendable time on their hands. While others may not have helpers or even if they do, still prioritize the farming season meaning they sacrifice seeking information from the program.

- **Effort**

According to the interviewees, the determinant of the amount of effort put into active participation is the relevance of the program to solving their most current or pressing issue (s). The key word here is current, as although many might join because they face those issues in real life, some may have just slight interest (as discussed under the consumer expertise result) in the overarching subject of the program and thus have less rooted conviction to put the effort in. This is especially true if as the program progresses, it veers off into territories they are less interested in. Their willingness to seek information or make personal interactions could thus dwindle due to the program becoming less and less relevant.

- **Financial Resources**

The consideration of financial resources in other words financial obligations on the individual participants is one that was greatly emphasized. Potential participants must consider the logistics of the share of the financial load they have to carry to participate. This includes travel, food, accommodation (if it is a several days program, or far from their homes) etc. Although such programs are a lot of times subsidized either by the government or covered by the farmer groups (cooperatives) as they target smallholder farmers who usually have humble earnings. Nevertheless, all interviewees agreed that financial resources are a deal breaker for whether or not they participate. Therefore, affects their will to seek and share information through the program.

To summarize, from the empirical result analysis, the information sharing and seeking behaviour appears to be the most affected of the four co-creation behaviours, with only 2 measures affecting personal interaction and one measure affecting responsible behaviour (see chapter 3.1 for the description of the co-creation behaviours). This could imply that the ability factors have less effect on the personal interaction and responsible behaviour of the local farmers in co-creation. This suggests that two things, either 1) the local farmers are more concerned on who they share and receive information from. And the reliability of information it is, as they focus most of their measures on that aspect of participation. 2) the farmers might consider measures that affect the personal interaction and responsible behaviour but are not considered in relation to these seven ability factors analysed in this research.

The second implication could impact the adapted AMO framework and suggests that new ability factors could be considered that effectively moderate the relationship between ability and co-creation behaviours of personal interaction and responsible behaviour of local farmers in southwest Nigeria. For example, Akolk et al. (1992) describes the factor of shared focus (common goal) amongst participants in co-creation which they try to form personal relations with and accordingly act responsibly to maintain said relationship (Baumann et al., 2015).

Chapter 6. General Discussion

The discussion will consist of 4 parts. The first part of the discussion focuses on the individual measures of the factors obtained from the empirical results and compared with evidence from extant literature on their representativeness in actually measuring the corresponding factor. The second and third part discusses the managerial and theoretical or research implications. And the last part discusses the limitations and direction of possible future research.

Experience

An individual's experience in a certain field or subject could be a good judge of expertise within that field or subject. Potential participants could employ knowledge gained from prior experience (whether in co-creation programs in general or the subject focus of the program) to form their intention to join or not to join. Nevertheless, having knowledge diversity allows for innovative thinking and applying knowledge from different areas to come up with unique solutions (Venkatesh et al., 2003).

Experience is defined as the number of years a technology user has been using the technology in general (Venkatesh et al., 2003). What constitutes enough experience is however not stipulated nor all round agreed upon (Venkatesh et al., 2003). For some that might require many years within the industry, while for others that might mean just a handful of years or even months. Nevertheless, operating and acting longer within a field implies having more experience and in turn, more knowledge to exchange. Stuiver et al. (2004) in their paper explain how knowledge, especially for farmers, is experiential and in part implicit. Overall, experience confers greater ability upon individuals which inadvertently affects outcomes or in this case exhibits the behaviour of co-creation (Venkatesh et al., 2003).

Epistemic curiosity

The curiosity-driven participant is more likely drawn to the product (technology) or subject area rather than the idea of a solution or problem to solve, focussing on the opportunity to experience or test the product (Füller, 2010). The notion of curiosity particularly epistemic curiosity (seeking new knowledge about a subject of interest) being mentioned by the interviewees as a driving force leading to co-creation could be attributed to them interpreting a co-creation setting as similar to a training setting. This is because the core idea or the goal of a training program is to impart new knowledge to its participants. Curiosity is thus taken as a form of intrinsic motivation (i.e., doing for inherent satisfaction or internal rewards) which fosters active learning and spontaneous exploration (Oudeyer et al., 2016). The curious individual shows interest in a subject area trying to fill gaps and/or errors in knowledge, attracted to the novelty or intermediate complexity of the subject area (Oudeyer et al., 2016).

Such participants would be considered low-ability individuals when viewing it in the light of the ‘competent consumer’ context (Hallahan, 2000). Their contribution to the co-creation process is constrained because they cannot easily retrieve nor have easy accessibility to topic-relevant knowledge from memory as they do not frequently make use of the knowledge (Hallahan, 2000).

On the other hand, individuals driven by intrinsic motivation are also considered highly qualified to co-create due to them exhibiting more knowledgeable and creative personalities (Füller, 2010).

Trainer communication skills

The need to localize knowledge within the specific setting of the audience it is being conveyed is important, especially for farmers (Stuiver et al., 2004). This is because farmer's knowledge incorporates outside knowledge (science, formal education language) but that is applied within local conditions which reflect the actual use of the terms in real situations (Stuiver et al., 2004). For trainers, this communication skill should be a must to ensure the effective transfer of knowledge. In a co-creation setting, there is no trainer rather both facilitating firm/organization and consumers are on equal ground as partners to impart as well as gain knowledge. The core of the co-creation process lies in the interaction of these parties involving dialogue and open access to information (Prahalad & Ramaswamy, 2004). The key word here is dialogue which is one of the building blocks of interactions (Prahalad & Ramaswamy, 2004) and involves deep engagement through conversations between the parties. It implies for dialogue to occur mutual understanding on either actor's part would have been established.

Judgement of reputation, Societal influence of facilitators and Social Influence of other participants

For better understanding, the notion of the societal influence of facilitators, the social influence of other participants and the judging of the reputation of program facilitators and other participants will be discussed together. The idea behind this grouping is that the first two, societal and social influence are both measures of reputation on the organization level and individual level respectively. Looking from the perspective of the potential participant, it seems reputation takes the form of an assessment of worth (Fombrun, 2012). For the interviewees who ask the question, is so and so who is facilitating the program or participating in the program worth my attention? They look towards the reputation of that individual or organization to judge their worth to place their trust in them, especially in a co-creation setting where information flows freely and thus reputation rather than reciprocity becomes the basis for trust (Evans & Wolf, 2005). Therefore, reputation here can be defined as the aggregation of perceptions about an individual or organization (Barnett et al., 2006; Fombrun, 2012).

To judge this reputation, interviewees point to the societal influence of the program facilitators and the social influence of the other participants. Both societal and social influence pertains to social impact, with the former being at the organization level and the latter relating to the individual level (Hasa, 2020). Barnett et al. (2006) in their review explain how judging reputation through social impact is one of the three most common ways of judging corporate reputation. Consumers look particularly at the impact made within the social areas that affect them or interest them, or simply 'reference- group specific' reputation (Fombrun, 2012). This implies that an organization may have a good overall reputation on average, but participants may still be reluctant to join a program hosted by an organization that has an unfavourable or unimpressive reputation within the field/industry they are particularly interested in.

Similarly, involving individuals who have social credit within the relevant field/industry of interest in a co-creation program could influence other potential participants' willingness to join. Venkatesh et al. (2003) explain this social influence through social factors, whereby a person's perception of something is influenced by his internalization of the subject culture and specific interpersonal relations he has with others in a social situation. Or simply put, social Influence reflects the effect of a referee's opinion on the behaviour of an individual (Zhou, 2011). In other words, the potential participant trusts that these influential individuals would lead them to good opportunities based on their past or current reputation of success within the relevant field/industry.

Being a Team player

A good team player is someone who puts the team's goal over their personal goals and works towards achieving it. A good team member is cooperative and tries to maximize the beneficial outcome for both themselves and others i.e., they are prosocial (Driskell et al., 2006). Considering the interactive nature of co-creation which requires full collaboration between all parties involved, being a good team player would result in easier dialogue opportunities and a free flow of information exchange (Greenwald & Leavitt, 1984). Greenwald & Leavitt (1984) also highlights the effect on trust as being a cooperative player shows others that they are held on equal grounds with the player, therefore, eliciting the same attitude towards the person as well. This implies cooperation breeds cooperation, and Driskell et al. (2006) add to this by stating that exhibiting competitive or individualistic behaviours could elicit competitive behaviours from others as well. This implies that involving participants that are poor team players may also affect the other team players negatively, hindering their co-creative behaviours especially those of information sharing and interpersonal behaviours.

Program relevance

The relevance of a program or the applicability to the current pressing issues faced by an individual according to the empirical results dictates whether or not they put effort into the co-creative process. Greenwald & Leavitt (1984) identified four principles audiences use to control their involvement in processing messages. The second lowest level, Top-down (concept-driven) processing identifies the relevance or importance of the message to the individual and determines whether to give attention to processing the message further or otherwise. This top-down processing level is preceded by the lowest level of bottom-up (data-driven) processing involving basic low-level analysis to identify significant messages. This implies that judgment based on relevance only happens after initial involvement (no matter how little) has been established. This could explain why interviewees implied difficulty in predicting how much effort they will put into activities in the program beforehand without having entered the program and had a feel of the activities planned.

Clash with the farming season

As the saying goes, 'time is money', and for the interviewees who are farmers, time spent on the farm cultivating the crops is their most valuable currency. The period that is the farming season (including the growing period through the harvest period) varies depending on the type of crop and soil temperature which is affected by the climate and topography of an area (Jain & The Editors of Encyclopedia Britannica, 1998). For example, the tomato

is considered the biggest horticultural crop in terms of crop cultivation interest by most farmers in Nigeria due to its high-profit yield and large customer base (consumed all over Nigeria). The tomato farming season in southwest Nigeria is concentrated in the wet (rainy) season which is between March and November (J.F. Ajayi et al., 2019). Tomato farming in the south of Nigeria is also riddled with a high incidence of pests and diseases due to the high humidity of the tropical climate, requiring rapt attention and care from the farmers (S.O. et al., 2002). Moreover, to ensure all-year-round profit, most farmers are also cultivating other plants, thus farming season could very well be throughout the year (Van den Broek et al., 2021). This is means farmers are most likely busy all year round, thus time management is thus crucial when planning programs targeting farmers directly or those who work for or with them.

Time is therefore an important resource for farmers, and depending on the level of involvement required for participation in the co-creation program, their time will be allocated according to whichever activity they deem most relevant (Greenwald & Leavitt, 1984). This implies that if the co-creation program is focussing on finding solutions to a very pressing and relevant farmer issue, it could still attract interested farmers despite the program falling within the farming season. For instance co-creation program focused on improving soilless farming practices thereby allowing the cultivation of tomatoes outside the normal farming season, increasing yearly turnover. Such a crucial program could see many farmers finding alternative ways (e.g., finding a substitute to take over some farm activities) to ensure they can participate in the program.

Individual participation expenses

Literature focussing on the financial aspect concerning the participation of consumers in co-creation has been generally within the confines of financial rewards and incentives to motivate participation (Bagheri et al., 2019). However, this research focused on another aspect which is the effect of financial responsibility on potential participants. In terms of direct program participation expenses, potential participants consider if a participation fee is required and if so, who covers it.

Additionally, there are indirect costs which could include travelling costs if the program is carried out on location, and one has to travel to the venue or online participation which would then require internet data costs. Other indirect costs are food costs and accommodation costs for when the program runs for multiple days, or the venue is too far away for the participants to return to their residence after ending daily planned program activities. As some interviewees pointed out, all or some percentage of these expenses (direct or indirect) could be covered by the farmer group cooperative budget, the firm they are representing, subsidized by the government or even the program facilitating organization as part of the program package deal.

The idea of participation fees and other indirect expenses for training programs (as is the experience of the interviewees) makes sense to the participant in the sense that they understand that the facilitators are providing a service to the participants and that they provide monetary compensation for that service. Co-creation on the other hand sees benefits for all parties involved, with the participants gaining a solution to their problems and the facilitators gaining useful practical knowledge and possibly better product. This implies that participants view their involvement in co-creation as adding value and may

even expect financial rewards to help incentivise them to participate (Aarikka-Stenroos & Jaakkola, 2012).

Overall, it is observed from the individual discussions on each measure of each factor, that all measures are representative as actual measures to judge on their respective ability factors. The exception here is epistemological curiosity which has conflicting pieces of evidence from literature, with Oudeyer et al. (2016) stating curiosity-driven participants as having a high ability to co-create and the other the complete opposite of what Hallahan (2000) suggests. This may suggest an equal likelihood chance of either case. This is risky as in the case where the curiosity-driven participant has the low ability, then they are taking valuable space for which another more suited individual could have contributed to the success of the process.

The next sections will focus on the implications of these findings on theory and practical management.

6.1 Managerial Implications

For the management of organizations that facilitate co-creation programs, they should be aware of participant considerations for participation. The result of this thesis implies that local farmers are not always concerned with their actual knowledge of the subject area to contribute to a co-creation setting. But could be driven by pure interest and taking a chance at an opportunity to learn. Managers should therefore consider setting knowledge or experience as conditions for participation. One way to do this is by targeting participants who operate within the subject area of the program, for instance, for a co-creation program aiming to develop and implement greenhouse technology in southwest Nigeria, program managers could target and invite farmers with at least a few years of experience with greenhouse farms in the region.

Moreover, the management should ensure their organization have a good history and reputation within the industry. Or to at least partner with an organization with such characteristics to ensure they can be attractive options for local farmers to consider participating in their programs.

Lastly, co-creation programs could be planned in phases, and the progress evaluated as well as participants. Doing this may highlight weak areas in need of improvement thereby allowing for the inclusion of more suitable participants at different stages of the process.

6.2 Theoretical Implications

This research thesis contributes to and increases the explanatory power of the Ability, Motivation, and Opportunity (AMO) framework as it identifies and expands on the framework by adding ability factors to further explain the relationship between the constructs of ability and behaviour (Hughes, 2007). It also adds insight into the effectiveness of ability factors as well as suggests new ability factors could be considered that effectively moderate the relationship between ability and co-creation behaviours of personal interaction and responsible behaviour aspect of co-creation behaviour. Lastly, it adds to the extant literature investigating behaviours in Information Systems (IS) which may involve subject populations outside the firm, particularly horticultural technology consumers.

The empirical results have given more insight into the measures farmers use to measure their willingness to join and/or interact with other actors in a co-creation setting. The new findings on the possible conflict epistemological curiosity of participants may have on the co-creation process is a new consideration for literature. Particularly, this opens the floor to question how

practical it is to use curiosity as criteria to judge suitability of potential participants in co-creation.

Overall, this research contributes to the extant literature on the study of technology co-creation within a socio-technical context by exploring co-creation in the context of local farmers' participation in technology co-creation in southwest Nigeria. It, therefore, gives insight into possible focus areas to consider when organizing co-creation activities incorporating a higher level of field knowledge from farmers in horticultural technology solutions development.

6.3 Limitations and Future Research

This research thesis has potential limitations. First off, the research approximates the experience and considerations of local farmers to join training programs to the reality of participant considerations for joining a co-creation program. This is not necessarily accurate as training programs mostly involve knowledge and/or skills transfer from the trainers to the participants, thus do not encourage two-way mutual knowledge exchange as is the requirement for co-creation. However, the results are still relevant when considering that training programs are the usual knowledge and skills development program formats that local farmers in Nigeria experience. Therefore, when encountering a new and unfamiliar program format as co-creation, these same farmer demographics are more likely to project similar considerations of training program participation for participation in co-creation.

Secondly, the answers and opinions retrieved from the interviewee sample might not be completely representative of the larger population of local southwest farmers. This is because (1) a relatively small sample size of seven local farmers was interviewed and (2) the demographic of interviewees consisted of mostly farmers who are well-educated (in western education) and are high-level officials within their farmer groups. In reality, this type of demographic makes up only a third of the larger local farmer population and may have different considerations concerning financial resources and consumer expertise especially. On the other hand, there is not much disparity in terms of general issues faced by the entire population nor the form of training programs they are all exposed to. Lastly, the research data does not give a complete and holistic perspective on the co-creation process as it focuses only on local farmers as actors not including the perspective of other actors and stakeholders like the program facilitators, the technology suppliers etc.

Future research could focus on the following areas;

- Considering more program initiatives introducing co-creation as a learning and development tool to be implemented in the horticultural sector in Nigeria, this opens the floor to conduct longitudinal research on this thesis topic, taking data from individuals and groups with real experience in co-creation in southwest Nigeria.
- Conducting a more holistic research involving all levels of stakeholders from technology suppliers to facilitators etc.
- Conducting empirical research focused on curiosity-driven local farmers who have only interest in the program subject of actual co-creation settings and their ability to co-create in comparison to those with actual experience/knowledge.

Chapter 7. Conclusion

This research paper sought to investigate the actual factors affecting horticultural technology co-creation with local farmers in southwest Nigeria. To co-create actors should exhibit information sharing, seeking, personal interaction and responsible behaviours. Through an exploratory research approach, an adapted Ability, Motivation, and Opportunity (AMO) framework which includes the ability factors (consumer expertise, semantic knowledge, social network, trust, time, effort, and financial resources) moderate the ability to co-creation relationship and thus were found to have the most critical effect on the behaviour of local farmers in co-creation.

In the empirical research phase of this research, the ability factors that have real-life applicability in the consideration to join a co-creation program were evaluated through interviews of seven local farmers in southwest Nigeria. Based on a well-structured data collection and analysis process, all seven ability factors were evaluated based on actual examples of measures used by the interviewees to judge their ability to participate in co-creation. Although the sample is small it offers good insights, demonstrating how all seven ability factors had practical measures which suggests that the ability factors do have a realistic effect on the ability to co-create, which in turn affects the behaviour of local farmers in co-creation.

The research findings provide new insights which suggest that the ability factors do not have as much effect on the personal interaction and responsible behaviour of local farmer participants in co-creation as they do on information sharing and seeking behaviours. This suggest that new ability factors that do affect these behaviours could still be added within the adapted AMO framework. Finally, the findings brings focus to the possible adverse effect of curiosity-driven participants on the ability to co-create, which is a new consideration for literature that could be further investigated in future research.

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Appendix A : Interview Questionnaire

Table 3: Interview Questionnaire

Number	Question	Influencing Factor
Intro Q1	Who are you and what is your role in relation to horticulture?	
Intro Q2	What is your role in your cooperative?	
Intro Q3	Has your cooperative or you been involved in training programs for horticulture? If so, what was your role in that choice?	
Intro Q4	How is your selection process for training participants?	
Intro Q5	How do you measure the readiness or qualification for participation in a training?	
Intro Q6	What are some challenges experienced in choosing right candidate for participation?	
Relating to Ability factors		
Q Item 1	Do you measure training subject/field expertise before participation? If so, how?	Consumer expertise
Q Item 2	How does expertise on training subject/ industry affect choice of participation?	Consumer expertise
Q Item 3	Do you measure semantic knowledge? If so, how?	Semantic knowledge
Q Item 4	How does level of comfort in communicating actors within the relevant subject field affect choice to participate?	Semantic knowledge
Q Item 5	How does the availability of actors with vast social connections in the relevant industry network affect choice of participation?	Social network
Q Item 6	Do you measure propensity to build and get involved in social networking during participation? If so, how?	Social network
Q Item 7	Do you measure likelihood to be and to trust the other participating actors within program? If so, how?	Trust
Q Item 8	How does trust for what information one has to divulge to others affect choice of active participation?	Trust
Q Item 9	How does trust for who the information is being shared with (other participants) affect choice of active participation?	Trust, Social network
Q Item 10	Do you measure time availability to participate? If so, how?	Time
Q Item 11	what about a program affects the choice to cancel all other schedules that may interrupt its progress?	Time
Q Item 12	How does program timing affect choice of participation?	Time
Q Item 13	Do you measure potential to give all effort in program? If so, how?	Effort (Proactive approach)
Q Item 14	what about a program affects the choice to put all effort required to succeed in the goals?	Effort (Proactive approach)
Q Item 15	Do you measure financial capability to join program? If so, how?	Financial resources
Q Item 16	How does financial obligations for participation affect choice of participation?	Financial resources

Appendix B : List of Experts and Interviewees

Table 4: Background information on experts and interviewees

Name	Background	Involvement in training	Farmer group/ Agro-business
Expert 1	President of the Agri-business	-	Nigeria Agribusiness Group (NABG), Federal Capital Territory Abuja
Expert 2	Co-founder of Agri-business, Agrobusiness consultant	-	Prime Agro seeds, Edo state
Expert 3/ Interviewee 1	Farmer, Founder of Agro-business, Agrobusiness consultant, Trainer in farm produce and business development	Participant, Trainer	Eweko concept Agro-business, Lagos state
Interviewee 2	Farmer, Head of farmer cooperative	Participant, Selects participants	Evergreen cooperative, Ogun state
Interviewee 3	Farmer, Member of farmers' cooperative	Participant	Great Minds cooperative, Ogun state
Interviewee 4	Farmer, Founder of farmers' cooperative	Participant, Trainer	Kobape axis vegetable cluster, Ogun state
Interviewee 5	Farmer, Member of farmers' cooperative	Participant	Olounje Lagba cooperative, Oyo state
Interviewee 6	Farmer, Head of farmer cooperative	Participant	Ere Agbe cooperative, Oyo state
Interviewee 7	Farmer, Team leader and Trainer in soilless farming practices	Trainer	Eupepsia Place ltd, Lagos state