

**Indigenous Knowledge and Sustainable Development: The Case of  
Rwanda's Agricultural Sector.**

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by

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## **PLAGIARISM DECLARATION**

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## **ABSTRACT**

The need for creating sustainable and relatable development projects has placed a sharp focus on the different approaches and methods of achieving development. Traditional development approaches such as top-down theory and the bottom-up theory of development have evolved over the years whilst recent approaches such as Randomised Controlled Experiments (RCE) have also emerged with the aim of creating sustainable and more relatable development projects. All these approaches of development have had their fair share of criticism and applause in literature. The use of Indigenous Knowledge Systems (IK) as a factor of the bottom-up theory of development has been discussed as an important element of advancing the developmental agenda and creating sustainable and relatable projects. Many scholars have conducted research concerning how IK can be incorporated in development projects around the world. Despite this, much is yet to be discovered about the actual impact or lack thereof of IK as a key factor of the bottom-up theory of development in development projects. This dissertation researched the impact of Rwanda's IK as a factor in the bottom-up theory of development with a focus on Rwanda's Land Husbandry, Water Harvesting and Hillside Irrigation (LWH) project as a unit of analysis. Furthermore, the research assessed whether the Rwandan water harvesting and irrigation IK played a role in the overall project conceptualization, design and implementation and, if so, how this was incorporated in the overall project; and, finally, what role (if any) this IK played in the overall outcomes of the LWH project. A qualitative case study research of the Rwanda's Land Husbandry, Water Harvesting and Irrigation Project was conducted with in-depth questionnaires used as data collection instruments from farmers and project coordinators who were intensely involved in the design, development, implementation and monitoring of the project. Data analysis showed that most study participants agreed that the Rwandan water harvesting, and irrigation IK was incorporated in the LWH project and was a key success factor in the bottom-up theory used to implement in the LWH project. The research found that the incorporation of IK as a factor of the bottom-up theory enabled quicker adoption of the project, increased levels of accountability and responsibility over the project by project beneficiaries and an accelerated attainment of project goals and objectives.

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## **LIST OF ABBREVIATIONS**

AES Agri-Environmental Scheme

CBFM Community Based Forest Management programme

EK Ecological Knowledge

IK Indigenous Knowledge

IKS Indigenous Knowledge Systems

LHW Land Husbandry, Water Harvesting and Hillside Irrigation

RCE Randomised Controlled Experiments

SDGs Sustainable Development Goals

REDD+ Reducing Emissions from Deforestation and Forest Degradation

RWH Rainwater Harvesting

UCT GSB University of Cape Town Graduate School of Business

USAID- United State Agency for International Development

AES Agri-Environmental Scheme

Community-based Forest Management programme (CBFM)

Reducing Emissions from Deforestation and Forest Degradation (REDD+)

## Chapter 1: Introduction

Local and regional development have in recent years taken centre stage and have occupied many bilateral and multilateral discussions. Multinational agencies such as the World Bank have invested large sums of dollars in the development of areas such as tourism, environmental management, infrastructure, agriculture etc in order to assist countries to attain various developmental mandates and meet Sustainable Development Goals (SDGs). In its 2018 annual report, the World Bank Group reported that it had provided developmental related financial support to countries in the African continent amounting to \$16.5 billion, of which most was targeted on developmental focus areas such as agricultural productivity improvement projects, increasing access to reliable energy etc (World Bank Group, 2018). This places a sharp focus on methods and approaches relating to the creation of sustainable community, local and regional development.

The field of development economics has evolved over the years with a variety of approaches ascribed to development planning. Some of the approaches that have emerged in recent years are in response to the acute need to better the overall process of development. Duflo and Banerjee (2011) have lauded randomised controlled experiments (RCE) as a new era in the field of development. Deaton (2010) explained RCE as a development theory that allows developmental actors to learn as they go and thus enable them to adopt a best practice approach to development. Rodrik (2008) further outlined that through RCE development practitioners can use “hard and credible” evidence to make development related decisions and only RCE can provide such hard and credible evidence. Duflo (n.d.) further supports this by outlining that, more often, development decisions are based on fads which could easily be avoided through using the hard and credible evidence produced by RCE as a theory of development. Development agencies, such as the World Bank, through RCE, can adopt projects that have attained and yielded the desired outcomes in the various communities or areas to other areas facing similar developmental challenges (Deaton, 2010).

However, Deaton and Cartwright (2016) have criticised the approach’s inability to account for the lived realities of the communities and ignoring the cultures, indigenous knowledge, and know-how of the target communities. Rodrik (2008) further adds that RCE are usually conducted on a specific group, under specific experimental conditions and in a specific locale

which makes such evidence weak if applied in a different setting all together and thus reducing the credibility of the evidence generated through RCE.

The top-down approach is one of the earliest approaches of advancing the development process and is explained as an approach of development wherein the conceptualisation, design and implementation of a development project earmarked to advance a particular community or area is handled by a central authority without consultation or involvement of the receiving community. This approach to development is likened to an authoritarian view of development where the project recipients are viewed as subjects in the overall process with the central government and donor agencies or international experts viewed as knowing what's best for the overall development or advancement of the target community (Isidiho and Sabran, 2016). This theory of development regards community consultations, indigenous knowledge, cultures and know-how as irrelevant to the overall process of the development of such a community. Dinbabo (2003) further outlines that in a top-down approach to development, the indigenous knowledge, cultures, and know-how of the target community is regarded as primitive and is the reason why the community has not advanced.

On the other side of the spectrum of the development agenda is the bottom-up theory of development. Isidiho and Sabran (2016) explain the bottom-up theory as one that harnesses the developmental potentials of a geographic area to improve the well-being of its residents. This definition further resonates with Pike et al. (2011) who note that indigenous and endogenous development approaches have over the years gained prominence, resulting in a rise in homegrown ideas as a new pathway to local and regional development. Over the years, development scholars<sup>1</sup>, have advocated for development projects that focus on a bottom-up planning with a people-centred approach where ordinary people take charge of their own development (Dinbabo, 2003). This approach allows for the target community to participate in the overall conceptualisation, design and implementation of the project intended to advance their livelihoods. Thus, the project is formulated, designed and implemented through extensive consultations with the cultures, indigenous knowledge and know-how of the target community being incorporated in the project.

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<sup>1</sup> Roodt (2001), Penders (1996), Rahman (1991), Chambers (1992), Conyers & Hills (1990), Dodds (1986)



Escobar (2011) explains the need for development to be founded on local realities, lived experiences and past history of the residents of the target area in order for it to be enduring and effective. Ezeanya (2017) stresses this point by putting Indigenous Knowledge Systems (IKS) at the core of the bottom-up approach as a way of achieving relatable, enduring and effective development. Indigenous Knowledge (IK) is cited as a potential propellant of local and economic development as a factor of the bottom-up theory of development (Silliotte & Marzano, 2009). IK is a type of knowledge that accrues within a society over many centuries and is a critical and substantial aspect of a society's culture and technologies (Cashman & Warren, n.d.). These knowledge systems are a central apparatus of the functioning of the community. IK accrues through interaction between the community and its environment and is a problem-solving mechanism (Ogunniyi, 2013). Such knowledge is validated with the passage of time (Zinyeka, 2016) and is specific to the community in which it originates (Mistry, 2009).

In the Philippines, the Ifugao community uses a traditional forest management system called *Muyong* for forest conservation, watershed rehabilitation and as a natural regeneration strategy (Camacho et al. 2013). To manage their vast forests, a Chinese village of Zhangli uses IK. The forest is divided into different portions which are allocated to community members who are responsible for looking after the allocated portions to ensure forest and environmental preservation and protection (Juanwen, Quanxin, Jinlong (2012). In Ghana, the Dupong community uses IK for climate change management and adaptation (Opare, 2018). Zero tilling, mulching and fallow system cultivating are but a few examples of the IK that is used by the Dupong community in combating the impact of climate change. In the Sahel, some of the IK techniques used for climate change mitigation and adaptation are also used for water harvesting and irrigation within the agricultural sector.

The existence and effective operation of IK in communities where development is earmarked raises a question around whether such knowledge cannot be used to inform development projects in those communities. This research undertook to understand the Rwandan water harvesting and irrigation IK and the role (if any) that it played in the overall outcomes of the LWH development project.

Rwanda is a landlocked country within the Great Lakes region of East Africa with a very mountainous terrain. It is estimated that 90% of the country's cropland is on slopes ranging

from 5% to 55% and thus the country has been named the land of a thousand hills (Food and Agriculture Organisation of the United Nations, 2019). As a result of the mountainous terrain, land degradation and soil erosion are a critical challenge to the agricultural sector. Rwanda, like most African countries, has a vast amount of IK that communities practise in their daily lives in various sectors to deal with the challenges faced. Taremwa et al. (2017) note that farmers in Rwanda use IK in climate change management and adaptation whilst Ezeanya (2019) outlines how IK in Rwanda is also used in the education sector.

In recent years, Rwanda has implemented various development projects which were based on IK that exists within the Rwandan communities. Ezeanya (2014) notes that various projects such as the Girinka project, the Ubudehe project, etc are but a few of the projects that were designed and implemented with IK being a key factor. The Girinka project, which is based on the ancient and enduring traditional Rwandan IK of placing cow ownership as the highest manifestation of wealth, was implemented to assist families in Rwanda to lift themselves out of poverty (Ezeanya, 2014) whilst the Ubudehe programme was implemented in Rwanda rooted in the traditional IK of community co-operation and working together (Niringiye & Aye bale, 2012). In the Nyaruguru district of Rwanda, the local community makes use of traditional water harvesting methods such as small house systems to collect rainwater for livestock (Bizoza & Umutoni, 2013). This further supports the existence of effective IK within communities in Rwanda. Such IK has in recent years been used as the basis for design and implementation of successful development projects. The precedence of such success makes Rwanda the perfect setting for understanding the role (if any) IK can play as a factor of the bottom-up theory of development in creating sustainable and relatable development projects.

An understanding of the Rwandan water harvesting and irrigation IK and how this influenced the outcomes of the LWH project was obtained by focusing on four districts within which the project was implemented, namely Gatsibo, Nyanza, Rulindo and Karongi. The research focus area was carefully considered to provide coverage of Rwanda and to provide further advice relating to Rwandan IK as a factor in the bottom-up development approach in the Rwandan agricultural sector. To achieve this objective, the research endeavoured to understand the nature of consultations (if any) that occurred during the design and implementation stage of the project and whether such consultations enabled the Rwandan IK to be a key role player in the overall outcome of the LWH project. Furthermore, engagements were held with project beneficiaries (farmers) and project coordinators to understand the level of consultations that

occurred during the design and implementation phase of the project and whether IK was a factor in the overall design and implementation of the LWH. Finally, the research tried to understand whether IK played a role and, if so, what influence it had in the overall outcomes of the project. The research was conducted in an exploratory manner and focused on getting some understanding of IK in the Rwandan agricultural sector contributed (if any) in the LWH project. In addition, the research further explored whether such incorporation (if any) had any notable benefits or if no consideration was done in relation to IK in the project, what impact that had as well.

The empirical setting of interest is agriculture, particularly the water harvesting and irrigation subsectors. The research analyses the overall LWH project in Rwanda within four selected districts observed for the purposes of forming a conclusion on the influence (if any) of the water harvesting and irrigation IK on the overall outcomes of the LWH project.

### **Problem statement**

This research aims to understand the impact of IK in a development project's design and implementation making use of the Rwandan Land Husbandry, Water Harvesting and Hillside Irrigation project. Development practitioners and financing organisations want to understand and find ways to create sustainable development projects, those which Escobar (2011) refers to as relatable, enduring and effective. Briggs and Sharp (2004:664) have explained that “yet to receive much critical attention in development theory and practice is the nature of the inclusion of indigenous knowledges in development thinking”. Proponents of IK's incorporation in development, advocate for development that “takes greater account of the specificities of local conditions, draws on local knowledge of a population who have lived experience of the environments in question, and provides people with ownership of the development process” (Briggs and Sharp 2004:661). The research was exploratory in nature and sort to gain a better understanding of the would-be benefits of incorporating indigenous knowledge systems in development projects. The problem statement gives rise to the following research questions, objectives, and scope.

### **Research questions, objectives and scope**

This leads to the core research question for this research paper:

How can incorporating IK influence the overall design, implementation, and sustainability of development projects?

In answering the above core research question, the following ancillary questions arise:

- (i) What is the relationship between IK and development projects' design, implementation, and sustainability?
- (ii) How can the IK of a community be a source of relatable development projects?

The research objective is to understand the impact that IK as a factor of the bottom-up theory of development can have or the lack thereof in aiding development projects using the Rwanda water harvesting and hillside irrigation IK and the LWH project as a case study. Furthermore, the two ancillary questions seek to augment the main question by understanding whether a relationship exists between IK and development projects and whether this relationship can be used to enable relatable development.

### **Research justification**

The research extends the existing literature around the role of IK as a factor of the bottom-up theory of development in development projects. Furthermore, the research explores whether a relationship exists between the IK of a community and a development project. The existence of a relationship, whether positive or negative, will inform development agencies and their practitioners on the role of IK in development projects. This allows for actors in development economics to ensure that development projects account for lived realities (Escobar, 2011) of the target communities and are not forced down onto these communities, as proposed through the top-down approach of development. In contrast to the RCE approach, this approach allows recipients of the development project to take part in the overall development process and not simply be viewed as subjects in an experiment.

The research is of interest to development practitioners and development agencies who seek to develop and implement relatable and sustainable development projects. The research is also of interest to governments and their implementing agencies as it will enable them to gain an understanding of how to structure and develop tailor-made development projects. As such, the research will be descriptive in that it will contribute to the overall knowledge of the role of IK in development projects and is likely to uncover water harvesting and irrigation IK that may be essential to the development of the Rwandan agricultural sector.

## Research assumptions

The research does not touch on other factors of the bottom-up theory of development. The research questionnaires used to collect the research data focused on gathering data about the role of IK in the LWH project and the observed impact thereof. This research's conclusions are only based on observed IK influence as a factor of the bottom-up theory on the development project.

The research also does not speak authoritatively to the impact that other factors of the bottom-up theory of development might have on the IK as a factor, whether positive or negative. Thus, the research assumes that the influence of Rwandan water harvesting and irrigation IK on the LWH project was not impacted negatively or otherwise by other factors of the theory in designing and implementing the project.

## Research ethics

The research was conducted in accordance with the UCT GSB ethics code (UCT Commerce Faculty, 2018). The overall research was conducted in a considerate, respectful and transparent manner. All participants to the research were briefed and made aware of the research objectives and were also advised that they were at liberty to withdraw from the study at any time. The participants were also allowed access to the results from the data analysis performed. Furthermore, participants who expressed an interest were allowed access to the final submission made to UCT GSB.

## Literature review

A precursor to understanding the role of IK as a factor of the bottom-up theory of development is the understanding of the various development approaches. Isidiho and Sabran (2016) note that traditional development approaches are broadly categorised as top-down development theory and bottom-up development theory. This view is echoed by Dinbabo (2003) who explains that although the field of development studies has evolved over time, the two broad traditional approaches define the development agenda around the world. Deaton (2010) weighed in the discussions by explaining that the randomised controlled experiment (RCE) has in recent years been viewed as an alternative theory through which development projects can be based.

The most recent development theory is one which Duflo and Banerjee (2012) explain as randomised controlled experiments (RCE). Deaton (2010) explains RCE as a theory that enables and allows development to be based on prior experiences and experiments conducted in other areas. Thus, this theory takes the view that when development projects are designed and implemented around the world, those projects that yield the desired outcomes and benefit the intended communities should be replicated in other areas facing the same challenges. Duflo and Banerjee (2008) note that the RCE approach enables development projects to achieve the objectives efficiently and effectively, as such approaches have been tried and tested elsewhere, a position echoed and supported by Duflo and Chattopadhyay (2004). Duflo and Chattopadhyay (2004) argue that randomised trials of projects would generate knowledge that could be used elsewhere, an international public good. This affirms that RCEs have been identified as a more recent approach to implementing development projects.

Duflo and Banerjee (2008) explain that RCE allows for varying different elements of the development process through experimentation to provide internally valid estimates of causal effects. Duflo, Kremer and Robinson (2008a,b) further support this assertion by noting that RCE allows for learning by experimentation. Thus, each experiment conducted yields results that prompt a need to conduct further experiments to understand and learn more about the subject matter. Duflo and Banerjee (2008) give the example of the Progres-Oportunidades programme in Mexico which gave cash transfers to poor families based on “good behaviour” (investment in education and preventative health). Ongoing experiments were conducted in

Mexico in the conceptualisation of this programme over several groups exposed to different conditionalities. Results of these experiments were studied and prompted further studies through an RCE process to comprehend the various factors involved in the outcome and how these factors influenced the outcome.

Critics of RCE as an approach to development, Deaton (2016) and Cartwright (2016), have argued that this approach ignores the reality that communities are different: just because a project was successful in one community does not guarantee success in the next. Deaton (2012) criticises RCE as a development approach and explains that even if the experiment itself is executed perfectly, the results are not transferable from the experimental state to the parent population and will not be a reliable guide to policy for the parent population. This is also a criticism attributed to the use of IK as a factor of the bottom-up theory of development in development projects. It illustrates the reality that although RCEs are a new approach to development they do not account for the lived realities (Escobar, 2011) of the target communities on the ground.

Isidiho and Sabran (2016) note that one of the early traditional approaches of development is the top-down theory. The top-down theory is explained as being “concerns of ruling groups to incorporate and integrate subordinate groups into the dominant ideology in order to ensure their own security and sustainability, and in this psyche they claim to rescue and reform the poor” (Isidiho & Sabran, 2016:268). This development theory assumes that the target community need not be included in the conceptualisation, planning or implementation of the development project. Khadka and Vacik (2012) explain that the top-down theory advocates international experts designing the project and then adopting it in the local or target communities, whilst Carey et al. (2015:167) describe the top-down development approach as one that contains “initiatives that are directed from an ‘authoritative core’ at strategic levels of government”. Thus, the central government, donor agencies or multilateral organisations oversee the conceptualisation, design and implementation of a project without any form of consultation with the target community.

Dinbabo (2003) adds that the Marxist theory and modernisation theory are sub-theories of the top-down development theory. The modernisation sub-theory advocates the replacing of “primitive” values, norms and ways of doing things by the target beneficiary communities and replacing these with more modern, well established and “first world” ways. The Marxist sub-

theory of development approaches development through requiring underdeveloped nations/regions to imitate the examples set by the more developed nations/regions to achieve development. Both sub-theories converge in the understanding that the targeted beneficiaries of a development project have no say in the earmarked development.

As the development agenda evolves around the world, the top-down theory has not been without its proponents or critics. Larice and Macdonald (2013) explain that the top-down approach has been favoured in furthering the development agenda as it allows for swift implementation of already prepared project proposals (prepared by the authority) and reduces the time needed for consulting with targeted beneficiaries since professional actors control the overall project process. Isidiho and Sabran (2016) further note that this theory of development has also been lauded for enabling a more effective utilisation of resources through using professional experts to determine the best development approach on behalf of the targeted beneficiaries.

Arguing against the top-down development theory, Thomas (2013) notes that this approach is nothing but symbolic as it creates a sense of achievement for the main actors without necessarily yielding the desired benefits for the target communities. Furthermore, Isidiho and Sabran (2016) explain that in a top-down development approach, planners and implementers proceed as if the intended beneficiaries have no knowledge of their own surroundings and thus create an impression that recipients are unintelligent, which results in the communities being disengaged from the overall project. They further argue that the top-down theory of development does not consider the culture and living patterns of those communities who are to benefit from the overall development. This negates the fact that any community exists in a well-established social, economic and environmental system which has enabled it to evolve over generations.

Zhang et al. (2015) give an example of a top-down development project implemented in China. To improve its agricultural sector, the Chinese government implemented the Agricultural Infrastructure Construction projects across China. The full design and implementation of the project was centralised and run by the national authorities without any consultation or engagement with community members. Zhang et al. explain that projects included the National Forest Conservation programme and the Grain for Green project. They further note that due to the lack of community participation, most community members were largely unsatisfied with



the overall project and this led to communities disengaging from the project which resulted in the project not being able to achieve its intended objectives.

Another traditional theory of development is the bottom-up theory<sup>2</sup>. Isidiho and Sabran (2016) explain the bottom-up theory as one which allows for local voices or players to partake in the overall process of the development of the local area. This is usually done with the understanding that a development project is meant to benefit the local community and is bound to alter the way of life of the local community. Isidiho and Sabran (2016) note that this approach usually alleviates the problem of the beneficiaries feeling alienated from the development project. Early proponents of the bottom-up theory of development, Cohen and Uphoff (1977), note that the approach means the involvement of the local community in the definition, design, implementation, evaluation and revision of a development project intended to benefit them. Isidiho and Sabran (2016) add that this approach enables the community to view the development project as their own and is likened to a democratic way of approaching development with the understanding that to implement sustainable development projects, local voices must take the front seat.

Isidiho and Sabran (2016) note that the bottom-up theory of development is anchored in the target beneficiary community's culture, indigenous knowledge systems and economic lifestyles which are then used as the base for a development project aimed at benefiting that community. Dinbabo (2003) explains that this approach to development is of the view that a community is capable of driving and managing its own development. Dinbabo further emphasises that an approach to development should be sensitive to the cultural diversity of the indigenous inhabitants. Coetzee (2001) notes that the lack thereof will result in unsuccessful development projects. "The answer to the problem of successful third world development is not found in the bureaucracy and its centrally mandated development projects and programs, but rather in the community itself" (Dinbabo, 2003:9). This affirms the narrative of the community overseeing its own development and not necessarily being subjects of pre-packaged solutions.

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<sup>2</sup> Sometimes referred to as the participatory theory of development, humanistic theory of development or people-centred theory of development.

The Agri-Environmental Scheme (AES) in Europe is one example of a development project which was anchored on the principles of a bottom-up theory of development. Zhang et al. (2015) note that the European Union made use of the bottom-up theory of development in the AES project to encourage environmentally friendly farming practices and conservation measures. They further explain that the AES project put farmer participation at the centre of its design and implementation. Such consultations led to design and implementation of environmental stewardship in England and the “payment-by-results” programme in Germany which were both built on extensive consultations with the intended users.

Critics of the bottom-up theory of development have noted challenges that this approach to development may encounter. Pissourios (2014) notes that although the local community is given the ability to take charge of a development project intended to benefit them, such a project may encounter legislation challenges if the desired community project is not budgeted for at the central government level or is not covered in the current legislation framework. Isidiho and Sabran (2016) highlight the difficulties that might occur with full participation and inclusion in larger communities. Furthermore, they note that such participation may result in long-winded engagements which may delay the overall implementation of the development project.

Proponents<sup>3</sup> of the bottom-up theory of development argue that the culture, indigenous knowledge (IK), ways of living, rituals, values etc of a community should form the basis of designing and implementing an earmarked development project in the intended community. Local communities develop systems and mechanisms used for communication, problem-solving and decision making (Mawere, 2014). These systems and mechanisms serve as the backbone through which a community progresses, overcome challenges and evolves over time.

IK has been cited by many<sup>4</sup> as one of the key pillars of a community’s existence and sustenance and is a critical aspect of a community’s development. The use of IK in the bottom-up theory of development in development projects is embodied in the following Lau Tse poem extract: “Go and meet your people, live and stay with them, love them, work with them. Begin with

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<sup>3</sup> Briggs, Sharp, Escobar, Silliole and Ezeanya are some of the proponents of IK as a key source of sustainable and relatable development.

<sup>4</sup> Scholars such as Onwu & Mosimege (2004), Mistry (2009), Van Rooyen & De Beer (2007) have converged around the definition and characteristics of IK.

what they have, plan, and develop from what they know, and in the end, when the work is over, they will say: ‘We did it ourselves.’”(Dinbabo, 2003:3). Thus, to develop sustainable projects in a community, a development practitioner needs to start off by understanding the community and its IK.

Many scholars<sup>5</sup> explain that IK of a community captures knowledge bodies and systems that are localised, unique to a given cultural or ethnic group. These knowledge systems are produced within the community through interactions between the community and its environment (Ogunniyi, 2013). Zinyeka (2016) augments this narrative by highlighting that IK is a cumulative and evolving knowledge based on experience. As problems arise or decisions are to be taken, a trial-and-error approach is adopted to solving or making decisions. These trial-and-error sessions, accumulated over a period of time, amount to experience or “know-how” that a community uses as a framework for decision-making in matters pertaining to the social, environmental and economic issues that affect the community. In the design and implementation of development projects for a community, it is important to take note of these knowledge systems through a consultative process to ensure an inclusive approach to development.

### **IK as a factor of the bottom-up theory of development**

Proponents of IK as a factor in the bottom-up theory of development in development projects have cited this relationship as one that would yield desired sustainable developmental results. Simply put, the concept of indigenous knowledge calls for the inclusion of local voices and priorities and promises empowerment through ownership of the development process (Briggs & Sharp, 2004). This point is further supported by Ezeanya (2014) who argues that economic development of targeted communities can only take place when the local realities are considered, and the community is given an opportunity to drive their own development.

Sillitoe and Marzano (2009) explain that IK research is concerned with how to best integrate the local voices into a community’s development projects, done either by developmental technicians or managers working on such projects, or politicians and policy makers at national and international levels. Briggs and Sharp (2004) note that the approach to development has

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<sup>5</sup> Scholars such as Onwu & Mosimege (2004), Mistry (2009), Van Rooyen & De Beer (2007) have converged around the definition and characteristics of IK.

been that experts are brought to a community to analyse the developmental needs and offer solutions based on scientific methods, an approach that Ezeanya (2014) refers to as the top-down approach, which she argues has failed the development community. Multilateral development agencies such as the World Bank have also come out in support of incorporating IK to create sustainable development, stating that sustainable development can only be attained when founded on the IK that already exists within the intended community (Ezeanya, 2014).

An example of IK incorporated into sustainable development projects is *sasi laut* IK practised in Misool, Indonesia, which has assisted in the management of natural resources. (Prasetyo, et al. 2020). *Sasi laut* is a traditional approach to the management of natural resources through the temporary closure of fields, reefs, forests and fishing grounds to give time to certain animals or plants to grow and reproduce (Boli et al. 2014). “The practice of *sasi laut* has also been incorporated by the local government in its conservation programmes” (Prasetyo, et al. 2020:53). Prasetyo et al. (2020) further found that *sasi laut* was instrumental in the development of Misool marine ecotourism and as a way of attracting tourists.

Calls for incorporation of IK into development projects have increased in recent years because of failing development projects. Many development solutions that have been proposed to address problems in rural communities have failed in the field because they do not consider the local culture, particularly a society's preferences, skills and knowledge (Cashman & Warren, n.d.). “Success in development is more likely to be achieved when local people are involved in the planning and implementation of development projects; and project officials who are familiar with indigenous knowledge are better equipped to facilitate participation by the local populations” (Cashman & Warren, n.d.:3). Briggs and Sharp (2004) note the importance of a developmental agenda stimulated by IK wherein local communities are empowered through valuing their local knowledge and thus promoting development and environmental programs at a local level. IK as a factor of the bottom-up approach to development should be adopted to create sustainable development projects.

The resistance of development interventions by farmers in northern Ghana is an example of failing development initiatives due to a mistrust and lack of consultation existing between farmers and development actors (Vercillo & Hird-Younger, 2019). Vercillo and Hird-Younger (2019) showed that farmers did not engage with the initiative because they felt ignored in the overall development and conceptualisation of the project. “Farmers perceive that agriculture

priorities and projects are determined at global and national levels, which means that they do not always reflect the vision or desires of farmers, and farmers also do not always have a choice about whether and how to adopt a technology or not” (Vercillo & Hird-Younger 2019:772).

## **Analysis of indigenous knowledge in various developmental interventions**

### **Indigenous knowledge in climate change adaptation and mitigation interventions**

Apraku et al. (2010) argue that IK is used as a tool to combat climate change in communities. It is accepted as a foundation through which climate change interventions are premised within a given community: it is the local communities whose knowledge of the environment is used to localise policy interventions. Climate change mitigation interventions use IK as a base in designing and implementing policies and interventions for communities affected by climate change. This can be directly contrasted with a top-down approach to combating climate change where policy interventions completely ignore the lived interactions of a community and its environment in favour of international experts’ knowledge and expertise of central government-driven solutions.

Chisadzi et al (2013), Mtambanengwe et al (2012) and Ajani et al (2013) discuss the existence of an extensive amount of IK which communities use to respond to issues of climate change. Chisadza et al. (2013) describe the use of IK to forecast and predict the weather and thus inform farming patterns (Mtambanengwe et al, 2012) within indigenous communities. Furthermore, Opare (2018:73) explains that the Dupong indigenous community of Ghana use their IK on climate change mitigation and adaptation to develop “key strategies such as rainwater harvesting, reliance on alternative sources of water and increased roles of males in household water collection that enabled them to minimise the adverse impacts of climate change on their water supply situation”. Speranza et al. (2007) emphasise this point describing zero-tilling practises during cultivating, making use of organic farming (instead of using chemical fertilisers), mulching, and cultivating using the fallow system (which encourages developments of forests) as techniques that the Sahel people use in order to mitigate and adapt to climate changes in their area.

In the sub-Saharan region of Africa, IK has also been used in developing resilient and sustainable climate mitigation strategies. Ajani et al. (2013) explain that the region is rich in IK, such as the fallow system, organic farming, collection of rain-fed water etc, for coping with

and adapting to the prevailing climate changes. Furthermore, they highlight how in this region IK related to climate change is informing policy and the implementation of climate mitigation and adaptation strategies. This is done through a bottom-up participatory approach which encourages local communities to participate in climate change programmes designed for those communities. The developed policies and implementation strategies are informed by the community's insight on how such communities and households interact and share ideas. This is a similar phenomenon to the Rwandan LWH project where RWH IK informed the design and implementation of the overall project through a consultative process which brought to the light the community's ways of harvesting water. Similar to this approach is the RCE development approach which allows for development solutions to be anchored on tried and tested experiments within the intended community.

### Indigenous knowledge and education interventions

Mawere (2015) outlines various roles that indigenous knowledge plays in the education system within the Sub-Saharan Africa region and highlights that it is through the incorporation of indigenous knowledge in an education system that allows for relatable knowledge solutions for a community. This is further supported by Zinyeka (2016) who argues that teaching should be cognisant of the fact that learners actively construct knowledge hand in hand with cultural and social settings. In addition, Maware (2015) advocates a learning by doing approach which includes observation, imitation and participation, which allows the acquired knowledge to be matched to a practical act. The literature suggests that IK in education bridges the gap between learnt knowledge and the daily experiences of those acquiring the knowledge (Zinyeka, 2016).

In her research, Zinyeka (2016) found that study participants concurred with the notion that IK is an effective tool to enhance the learning and understanding of learners in a classroom. She outlines incorporating IK as a part of the school curriculum as a way of using IK to enhance learners' experience within an education system. In developing learner material, IK forms the base on which such is compiled in order to ensure that the material is relatable to learners. Ezeanya (2019) emphasises this approach to learning by arguing that classroom learning should be relatable to lived realities of students and, as such, the education system should assist individuals to understand their lived realities.

Mawere (2015) further contends that the Kalanga people of Zimbabwe are well known for their mat crafting skills whilst the Chikonamombe people, also known as the Mashayamombe people, are widely known for their leather tanning skills and expertise, and an education system aimed at advancing the development of these groups should consider this critical knowledge. Ezeanya (2019:11) argues that “education, in its entirety, should not be based on some perfected system of truth, but should strongly encompass a system of knowing that is rooted in experimentation, existing and emerging reality”. Following Ezeanya’s example, the design and implementation of the schooling curriculum of the Chikonamombe people should include most of their leather tanning IK.

Furthermore, an argument based on pedagogical considerations has also been put forward in favour of incorporating IK into the mainstream educational system (Zinyeka, 2016). Learners may face difficulties in engaging mainstream education due to having pre-existing worldviews that may not necessarily be in harmony with current educational worldviews (Ezeanya, 2019). Based on the above, it is evident that IK as a factor of the bottom-up theory is an efficient tool in achieving relatable education solutions for a community. Through a bottom-up consultation process, IK is incorporated into an education curriculum of a community in order to allow for an engaging educational system.

#### Indigenous knowledge and resource management

The Philippines is known for its wide-ranging IK practices relating to the issues of natural resources and environment management. The *muyong* is a system used as a way to conserve the forest, rehabilitate watersheds and for farming. Camacho et al. (2012) found that by practising the *muyong* system, the Ifugao people of the Philippines are able to provide and maintain a stable supply of water. The quality of the cultivation derived is heavily dependent on the water supplied through the *muyong* system. Similar to this practice is the *lapat* system practised and observed by the Isneg and Tingguian people of Abra province in the Philippines. *Lapat* involves the implementation and imposition of a taboo over a particular area that prohibits and prevents exploitation of natural resources in the specific area (Camacho et al., 2012). Through the *lapat* system, the Sneg and Tingguian people are able to manage their natural resources in a sustainable manner and continue to benefit from these natural resources in the future.

In 1995, the Philippines government launched the Community Based Forest Management programme (CBFM) (Avtar et al. 2019). This programme was aimed at using the existing community-based forest management within the indigenous Philippines communities, such as muyong and lapat, to amplify and emphasise forest management. Furthermore, muyong and lapat were also used by the government and the United Nations (UN) to aid their Reducing Emissions from Deforestation and Forest Degradation (REDD+) programme (Avtar et al. 2019). Central to both the CBFM and the UN REDD+ programme was indigenous forest management IK. Aquino and Daquio (2011) note that the policy formulation of the CBFM programme allied with community members to ensure that the programme is people-orientated. Both the programmes were designed and are implemented within the context of the Philippines, premised on IK systems.

Similar to the indigenous practices of muyong and lapat, the Chinese village of Zhanli also uses a traditional environmental management technique to protect and preserve its forests. Juanwen, Quanxin, and Jinlong (2012) note that the Zhanli village forest is divided into one portion allocated to households within the community to look after and preserve and another to be managed and preserved by the village as a whole. Zhailaos (community leaders) are tasked with ensuring that rules and regulations with respect to the forest management system are adhered to (Juanwen et al., 2012). This further highlights the observation that communities develop a knowledge base that is used as a reference in dealing with various challenges faced by that specific community.

#### Indigenous knowledge and social policy

In Rwanda, one of the most recently implemented social and economic development projects is the Girinka program. The Girinka project was designed and implemented as a response to extreme malnutrition that plagued more than half of Rwanda's poorest citizens (Ezeanya, 2014). The Girinka programme, also known as the "one-cow-per-poor-family" programme, is designed and implemented on the foundations of the ancient and enduring traditional Rwandan value of placing cow ownership as the highest manifestation of wealth in Rwanda (Ezeanya, 2014). Onesme (2016) expands on the Girinka programme by explaining that it has, since its inception, lifted a number of less privileged families and significantly changed rural livelihoods. The success of the Girinka project is evidence that the use of IK in the bottom-up approach can yield successful development projects. In the same vein, this research assesses



the impact the Rwandan IK of water harvesting and irrigation has had (if any) on the LWH project's design and implementation.

A similar programme in Rwanda is the Ubudehe programme. It is a system of intra-community cooperation based on collective and individual actions (Niringiye & Ayebale, 2012) which is premised on ancient Rwandan IK and a grassroots approach of community development (Ezeanya, 2016). Ubudehe is aimed at utilising the social Rwandan IK to collectively address the various challenges faced by communities. Ubudehe has assisted the government in the decentralisation of governance in order to empower the grassroots (Ezeanya, 2016). This programme has seen improvements in sectors such as agriculture, healthcare etc. This augments the proposition that a bottom-up approach of development with IK as a factor can aid project development.

The recurring theme in the reviewed literature appears to be the acknowledgement of the existence of IK as a body of knowledge and the potential that such IK encompasses. There is consensus around IK being able to play a prominent role as a factor of the bottom-up theory of development which thus supports development projects. Drawing from Girinka, Ubudehe, CBFM etc, IK has been key in the design and implementation of those projects through a bottom-up consultative process, thus using a community's IK as a starting point of designing and implementing a project to benefit that community. This theme is emphasised by Dewalt (2017), Camacho et al. (2012), and Moyo and Briggs (2012) who describe the intricate nature of a community's IK and its development.

In answering the research question as outlined in the introduction, this research assesses the Rwandan water harvesting and irrigation IK and how some of the above identified characteristics are prevalent in the LWH project. The research looks into the design and implementation of the LWH project and ascertains whether a design and implementation consultative process took place and if so, was IK a feature of the consultations. If IK featured, the research assesses the overall impact of the IK in the overall outcomes of the project.

## **A critical analysis of the use of indigenous knowledge in developmental projects.**

Indigenous knowledge in the developmental agenda is not without criticism. Briggs (2013) notes that some view IK in development as unrealistic and romanticised, whilst some of the main proponents of indigenous knowledge in development projects point out that the success of IK in development projects has been below expectation. Briggs (2013) further notes that IK has not been able to make the expected leap from conceptual and empirical propositions to becoming a mainstream developmental practice, despite the optimism. This brings forth the necessary question of whether IK is worth pursuing as a way to bring about sustainable development.

Critics of using IK as a factor of the bottom-up approach of development have cited IK's inability to be scalable. Briggs (2013) explains that scaling up IK induced development projects is an issue which tends to challenge how such development projects are effectively deployed across communities. Briggs and Moyo (2012) add that IK's value is culturally and economically situated within the communities in which it is found, making it intricately connected to a specific community. Briggs (2013) adds that by attempting to scale up IK in development projects, IK loses its local strengths, resulting in a significantly reduced impact. Sillitoe and Marzano (2009) warn that scaling up in order to achieve far-reaching development projects may result in oversimplification of IK, leading to providing generic ideas and solutions in places where they are not appropriate. This body of literature highlights the fact that although scalability of knowledge systems is advantageous for development projects, scaling up of IK-induced development projects becomes detrimental resulting in IK losing its essence. This criticism levelled against IK in development projects is similar to that levelled against RCE as a development theory whilst the top-down approach development theory easily overcomes this due to the centralisation of overall design and implementation strategy of a project.

The inability to scale bottom-up development projects is in stark contrast to top-down development, according to Isidiho (2013) who argues that scalability can easily be achieved in top-down development. He explains that given that in a top-down approach projects are selected, designed and monitored at a central and coordinated level, replication of successfully designed and implemented projects is easy, which results in scalability. As this approach is not concerned with community-specific nuances, it allows easy adaptation of such successful

projects across communities. This is evidently in contrast to the drawback associated with the bottom-up and RCE theory of development.

Another critical disadvantage of incorporating IK in development projects is the lack of confidence that exists in IK as a body of knowledge, resulting in its proponents needing validation by science or the current development knowledge systems. Briggs (2013) explains that proponents of indigenous knowledge have lacked confidence in it, resulting in a constant need for indigenous knowledge to be vetted against science in order for it to be accepted within the development space. Briggs (2013) further explains that scientists and development practitioners carry an element of scepticism towards IK which only seems to be taken seriously if it is approved by science. This additionally derails the use of IK.

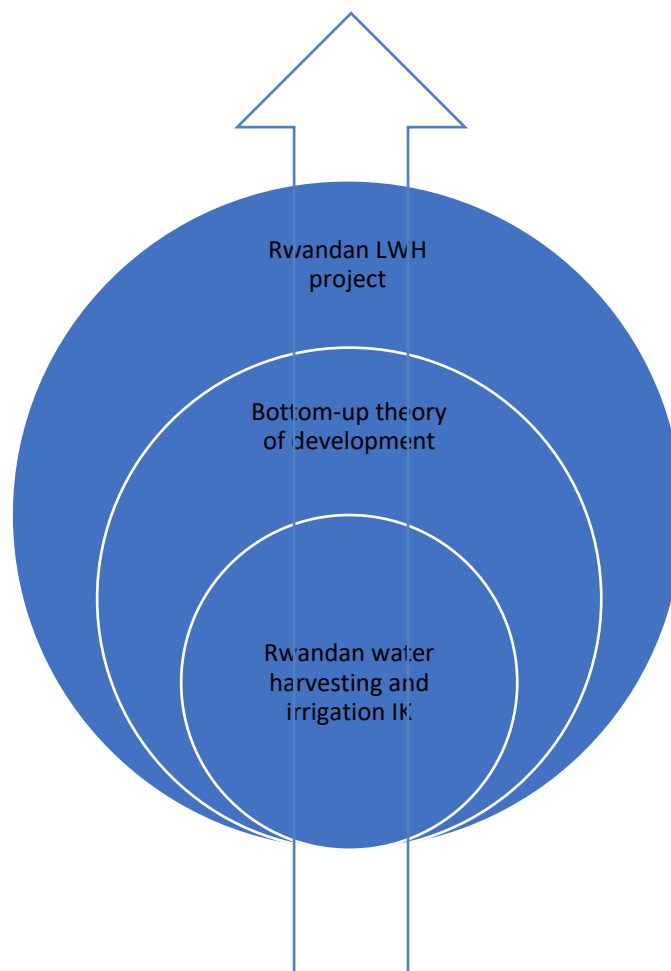
A further criticism of the incorporation of IK in development projects is associated with the manner of its transfer and dissemination within a community. Sillitoe and Marzano (2009) point out that IK cannot be documented once and for all to create a solid and static IK development framework; this is attributed to IK always changing and being subjected to continuous negotiation amongst the people of a particular community. Sillitoe and Marzano (2009) emphasise this point, arguing that IK consists of complex systems within a community, containing properties that cannot be understood or learnt if viewed in isolation of each other. Sillitoe and Marzano (2009) cite as an example the Bali irrigation system which was successfully documented from a technical point of view but lacked documentation around the beliefs and rituals that were intricately linked to this irrigation system.

### **Conceptual framework**

The research asserts that the IK of a community can aid the outcomes of a development project if incorporated in the design and implementation of such a project. The research unpacks the interaction of IK of a development target community in order to understand how these can be a source of sustainable and relatable development projects. Furthermore, the different development approaches are discussed with an emphasis placed on IK as a factor of the bottom-up theory of development. IK is further assessed in the context of the role it can play in the outcomes of a development project if incorporated in the overall design and implementation. In addition, various other development approaches are compared with IK as a factor of the bottom-up theory of development.

The LWH project is used as a case study in order to understand the variables in real life settings. Rwandan water harvesting, and irrigation IK is assessed to determine how it was incorporated in the design and implementation of the LWH project. The research findings discuss how this IK was included and how such IK through the bottom-up theory of development aided the overall predetermined outcomes of the project.

The water harvesting and irrigation IK of the Rwandan community can influence the outcomes of the LWH project if incorporated in the overall design and implementation of the project through following the principles of the bottom-up theory of development.



## Methodology

### Research approach and strategy

A qualitative research approach is deemed appropriate in further understanding of the role of IK as a factor of the bottom-up theory in development projects. This approach will assist in answering the primary research question on whether IK as a factor of the bottom-up theory of development can aid a development project. This approach enables the researcher to delve deeper and gain an in-depth understanding (Mason, 2018) of the potential relationship that may exist between the IK of a community and the success (or lack thereof) of a development project. Through this understanding, the researcher is able to conclude on the role (if any) that IK of a community can play in development projects of that community and thus contributing to the identified theoretical gap in the bottom-up theory of development. The research investigates the Rwandan water harvesting and irrigation IK and the potential role it played in the overall outcome of the LWH development project.

Furthermore, the qualitative research approach was favoured as it enabled the researcher to respond to the ancillary questions that further supports the evidence that augmented the primary research question. Through the qualitative research method, the researcher was able to ascertain if a relationship existed between the Rwandan irrigation and water harvesting IK and the LWH development project implemented in Rwanda. The collection of primary data through detailed questionnaires allowed the researcher to probe and conclude whether project participants (farmers and project coordinators) felt that their water harvesting and irrigation IK was incorporated in the project and, if so, how this assisted in the overall outcomes of the project.

The ability of the qualitative research approach to enable the researcher to probe raw data and perform thematic analysis further enabled the researcher to ascertain whether the existence of IK such as the water harvesting and irrigation IK in Rwanda could be the basis on which sustainable and relatable developments can be conceptualised. Through the qualitative research approach, the researcher was able to gather, synthesise and analyse data which then enabled the researcher to answer the second research ancillary question.

Through a qualitative research approach, underlying structures are identified from the raw data collected through detailed research questionnaires, and themes and structures are deduced from the gathered data (Lloyd, 2015). The qualitative analysis method is appreciated for being

simple, fit for purpose and straightforward for data analysis. In this research paper, primary data was gathered from the project participants involved in the LWH project to detect any casual links that may exist between the Rwandan water harvesting and irrigation IK and the success or lack thereof of the project. This led to the development of the following hypothesis: IK assists in the development and implementation of sustainable developmental projects.

## Research design

This research follows a case study research method. The case study approach is able to generate in-depth and detailed understanding of the matter being researched (Yin, 2014). Harrison et al. (2017) explain that through case study research design, complex causal links in real life interventions are able to be explained. Thus, any causal link that may exist between the water harvesting and irrigation IK in Rwanda and the success or lack thereof of the LWH project is explicable through the case study research design approach. The four districts sampled for research were each treated as an individual case, thus enabling a multiple case study method that allowed for various perspectives on the subject matter (Eisenhardt & Graebner, 2014).

The comparative case study approach followed in this research treated individual selected districts as cases and the data collected from the different districts were subjected to a similar criterion for comparison and theory building purposes. Three criteria were used in this comparative case study approach. Firstly, the respondents' understanding of the water harvesting and irrigation IK in Rwanda was used to compare across cases. Secondly, respondents' views on the overall LWH project was used; and, lastly, the respondents' views on the incorporation of the identified and understood water harvesting and irrigation IK in the LWH project and the impact of such incorporation (if any) was used for the purposes of case study comparisons and theory building. These three identified criteria enabled the researcher to answer the two research sub-questions and ultimately answer the research's primary question. In addition, the research favoured an exploratory research design which allowed the research to gather and gain some understanding of the identified problem around possible incorporation of IK in development projects. The exploratory nature of the research further allowed the researcher to lay the ground work in the field of IK and development projects which will enable future researchers in the area to further explore.

The case study research method has not been without criticism with Yin (2014) arguing that observations done over a few cases cannot form sufficient justification of generality of

findings. However, Merriam and Tisdell (2015) argue that through a case study research method, rich and detailed descriptions of the case are explored in their natural setting.

## Sampling and data collection

### Study population

The study population is the total number of districts within which the LWH project has been implemented. The LWH project was implemented in two phases across 101 sites across Rwanda, among which are the districts chosen for the research. According to a USAID report, as at March 2015 the project had more than 22 689 families (around 100 000 people) benefiting from project related activities (USAID, 2015).

### Study sample

A purposive sampling method was applied in the selection of the four districts where the LWH project was implemented. The four districts selected for the research are: Karongi, Rulindo, Nyanza and Gatsibo. Three of the selected districts (Karongi, Nyanza and Gatsibo) were purposely selected from the initial phase of the project implementation whilst Rulindo was selected from the second phase of the project. The selection of projects from both phases enabled the researcher to gain an understanding from both phases, and emphasis was placed on districts that were part of the initial phase which have been in operation longer. Five project beneficiaries were selected from each district for the purposes of completing the detailed questionnaire thus the total number of project beneficiaries selected for the research project amounted to twenty. In addition, one project coordinator was selected per district with an additional overall project coordinator at national level selected for the purposes of this research.

The purposive sampling technique was favoured in this research as it enables the establishment of general recruitment criteria but also allows for diversity in the selected sample so that different aspects of the subject matter can manifest themselves (Ritchie et al. 2013). The purposive sampling was applied using predetermined criteria in order to select districts which enabled the researcher to gather data and make insightful conclusions concerning the influence of Rwandan water harvesting and irrigation IK as a factor of the bottom-up approach of development on the LWH project, as well as answer the question on whether such IK can aid development projects.

Respondents (Appendix A and B) were selected as a mix, based on the duration of their engagement with the LWH project as well as their age. Selected respondents were distributed between farmers and coordinators who have been involved with the project for a longer period and those who have been involved for a shorter period. Furthermore, the ages of the selected respondents were distributed between the older and younger generation. The selection criteria were intended to achieve the most accurate and unbiased information regarding how the Rwandan water harvesting and irrigation IK, as a factor of the bottom-up theory of development, influenced the LWH project.

### Data collection

This research favoured questionnaires as a research instrument to collect data. Twenty questionnaires were sent out to project beneficiaries and all twenty responses were received. The project beneficiaries' questionnaires (Appendix C) were administered by experienced and trained field workers and were used to collect primary data. The questionnaires were structured in a simple and easy to complete way and were translated to Kinyarwanda for ease of completion. The field workers visited each selected farmer in all four districts to facilitate the completion of the questionnaires. Completed questionnaires were received by the LWH project national coordinators based in Kigali who assisted in translating the questionnaires to English.

Five questionnaires were sent out to project coordinators and all five responses were received. Project coordinator questionnaires (Appendix D) were distributed and administered by the LWH project national coordinator in Kigali and were also translated to Kinyarwanda for ease of completion. Questionnaires were distributed for completion to each district coordinator by email who each in turn returned the completed questionnaires to the national coordinator by email. Each questionnaire was translated back to English. An additional questionnaire was completed by the national coordinator who led a team responsible for the design, implementation, and overall monitoring and evaluation of the LWH project. All completed and translated questionnaires were sent to the researcher by email. The raw data contained in the questionnaires was manually assembled and prepared for analysis in an Excel spreadsheet.



## Data analysis

The data analysis process involved manually reviewing the raw data from each respondent and identifying prevailing themes. The themes were categorised and matched across each individual response to identify recurring themes across cases. A thematic approach to data analysis in this research allowed the researcher to summarise key features of the collected data and enabled the researcher to take a well-structured approach to handling the data (Nowell et al. 2017). Three themes were ascertained across responses: understanding IK and the types of water harvesting and irrigation IK that exist in Rwanda; respondents' views on the consultative process of the design and implementation of the LWH project as well as respondents' view on the state of the project; and respondents' views on the incorporation of the water harvesting and irrigation IK in the project as well as the role the IK played in the overall outcomes of the project.

Prevailing patterns were matched across each response to begin identifying recurring themes. Collectively, the recurring themes were used to answer the set ancillary questions and ultimately the main research question. A theme around the role of Rwandan water harvesting and irrigation IK as a factor of the bottom-up theory in the LWH development project was identified with respondents, confirming a role such IK played in the success of the project. Types of identified water harvesting and irrigation IK such as construction of anti-erosion ditches, farming on marshlands etc were compared across responses to confirm the coherence of responses. The manual analysis of the raw data from questionnaires allowed the researcher to fully comprehend the overall responses.

Central to the theme's construction was ensuring that the thematic analysis answered the primary and ancillary research questions. The first theme around respondents' understanding of the Rwandan water harvesting and irrigation IK and the role such IK can play in a development project assisted in answering the ancillary research question around whether development recipients believe that there is a relationship between their IK and a proposed development project aimed at aiding the development of their community. The second theme around understanding the overall LWH project and the consultations that occurred during the design and implementation aided the researcher to answer the question on whether the Rwandan water harvesting and irrigation IK was taken into account through the consultation

process in the overall design and implementation which would then aid the outcomes of the LWH project.

The final theme aided the researcher to respond to the overall primary question on whether IK of a community can play a role in improving the design and implementation of a development project if taken into account through the bottom-up theory of development. Furthermore, in answering the ancillary questions through the thematic analysis, the researcher was able to gain information to answer the primary research question.

The collected data was further put through ATLAS.ti, a data analysis software in order to augment the prevailing themes from the manual analysis of data. The software was used to identify prevailing themes using frequently appearing words from the responses on the questionnaires. Words such as anti-erosion ditches, marshlands, etc augmented the prevalent themes identified through manual analysis of the data.

### Research validity

This research considered triangulation as a critical element of research and construct validity. Triangulation is a process wherein the confidence in research findings is strengthened and credibility is added to whatever conclusion is reached by the findings (Mason, 2018). To strengthen the case data and attain triangulation, different role players within a district (case) were requested to complete the questionnaire. The questionnaires for all participants revolved around three themes, being: understanding of water harvesting and irrigation IK by participants; participants' view of the LWH project; and participants' views around the incorporation of IK as a factor of the bottom-up theory of development in the LWH project and the impact that has had (if any). As responses were analysed, each prevalent pattern was compared across responses within a theme to attain internal validation through triangulation.

The questionnaire participants were encouraged to complete the questionnaires in Kinyarwanda. Translators were used to translate the questionnaires to the participants' preferred language of communication. The translators were also used to translate participants' responses into English once the questionnaires were completed. The official translations and participation in preferred languages embodied the principles of trustworthiness and validity for

naturalistic inquiry (Cresswell, 2014). The credibility of the collected data was further strengthened through participants' confirmation of the information and narratives.

In addition, the findings were further validated against existing secondary data on the LWH project. The findings of the questionnaires administered were validated against the project implementation and progress report. The secondary data from this report was further used to validate and bolster the research findings from the primary data from questionnaires administered with the project participants.

## Findings

### Understanding of the Rwandan harvesting and irrigation IKS

Responses from the questionnaires highlighted that most project beneficiaries and coordinators in the LWH project understand irrigation and harvesting IKS in Rwanda, the types/examples of irrigation and water harvesting IKS that exist within Rwanda, but some did not see the relevance of these irrigation and water harvesting IKS in the current farming system. Analysis of the gathered data revealed that although participants did not have a universal description of IKS within the irrigation and harvesting space, they had some converging understanding of water harvesting and irrigation IKS. Further probes revealed that farmers are divided with regards to the relevance of the water harvesting and irrigation IKS in the current farming systems within Rwanda.

Most farmers described IKS as knowledge that is passed on from their ancestors which focused mainly on subsistence farming and involved farming of mixed crops on the same land. Farmers further explained harvesting and irrigation IKS as farming knowledge that existed prior to the introduction of improved technologies. To further illustrate this, one respondent from the Nyanza district, noted that:

“To me, IK is traditional knowledge from our ancestors. It was a farming system for subsistence that did not target markets.” (LWH9)

This response is further corroborated by a respondent from the Karongi district who notes that: “To me, IK knowledge is the knowledge that a farmer had before the improved technologies were introduced. This knowledge is very important as someone who does not know where he is coming from cannot know where he is going.” (LWH12)

A project coordinator from the national office explained that “[i]t is the knowledge that farmers had and being used before new technologies are introduced to them from outside the country” (LWHPC4). This response is corroborated by a project coordinator respondent from the Gatsibo district who described IK as “knowledge that farmers had and being used before new technologies are introduced to them” (LWHPC2). Another respondent from the Nyanza district further described IK as “knowledge that farmers are equipped with from the experiences of their elders” (LWHPC1).

These responses indicate that the project coordinators have a form of universal understanding of IK which converges to the understanding of IK by the project beneficiaries. Most of the coordinators' responses note that IK is knowledge accumulated over time and passed through from one generation to another. Their understanding of IK resembles Ogunniyi's (2013) explanation of IKS as knowledge that accrues within a community and is maintained within that community through it being passed from one generation to another.

Analysis of the responses from participants reveal that most project beneficiaries and coordinators of the LWH project understood what IK was. Probing further, participants gave examples of Rwandan IK within the irrigation and water harvesting space. Participants noted anti-erosion ditches, dam sheets, pits, canals, and the process of cultivating marshlands during dry seasons as some of the irrigation and water harvesting IKS that exist in Rwanda.

One respondent from the Gatsibo district explained some of the water harvesting and irrigation IKS in Rwanda as: "Capturing water from the stream; rivers to be used during dry seasons." (LWH19)

One of the respondents from the Karongi district explained an example of IKS as: "anti-erosion ditches with grasses planted on one side of the ditch as well as planting trees" (LWH12). Respondents to the study appeared to have in-depth knowledge and understanding of the types of IKS that exist within the water harvesting and irrigation space in Rwanda.

A project coordinator from the Gatsibo district gave examples of IK of "[c]apturing water, canaling water in their farms, watering using water cans and saucepans, buckets and digging anti-erosion ditches" (LWHPC2) whilst a respondent from the Karongi district noted "[c]onstruction of water canals and digging pits to store water for irrigation during dry season" (LWHPC3). The research analysis shows that the types of IK identified by the project coordinators are like those outlined by the project beneficiaries. This further confirms Mistry (2009)'s assertion of IKS being localised and is shared amongst the participants in the specific society in which the IKS exists.

In this segment, the research probed the participants' perspectives on the relevance of the water harvesting and irrigation IK in the current Rwandan farming sector. From the responses, it can be noted that respondents were divided with respect to the relevance of such knowledge in contemporary farming. Some respondents did not see the relevance of such knowledge whilst

others maintained that such knowledge was the genesis of the current improved farming technologies.

Some respondents felt that the IK was no longer relevant as it related to practices that were not practical in the current farming system. A respondent from the Nyanza district noted that: “the knowledge was relevant at the time when farming was for subsistence only. But now it is not relevant” (LWH9). Another respondent from Nyanza corroborated this by saying, “No, it is not relevant. The current farming sector is being done on a large scale and that cannot be enough” (LWH6). A respondent from the Rulindo district noted: “It is not relevant. After the project was introduced, we realised that there is something that was missing to improve how watering was done” (LWH2). This shows that some respondents did not view IK as relevant in the current farming system.

Further analysis of the responses received from the project coordinators showed that some didn't see any relevance of the water harvesting and irrigation IK within the current Rwandan farming system. Some participants cited the fact that the new and improved farming technologies that have been introduced within the farming sector yield better results. A respondent from the Gatsibo district noted that “[t]he knowledge is not relevant nowadays. There is a need to train farmers in improved technologies for water harvesting and hillside irrigation in order to increase production” (LWHPC2). This shows that although the IK relating to water harvesting and irrigation still exists in communities in Rwanda, some participants did not see its relevance in propelling current farming production.

Analysis of the questionnaire data collected also highlighted that some participants are of the view that the water harvesting and irrigation IK is still relevant and still plays a role in the Rwandan farming system. These respondents emphasised that the current improved farming systems are mainly based on the existing IK that farmers already possessed. They further add that the success of an improved technological farming method is easily adaptable and implementable because it is rooted in IK that already existed in the Rwandan farming sector.

In response to questions around initial consultations and engagement prior to the design implementation of the project, an overwhelming majority of respondents stated that they were fully consulted about the project and how it would be designed and implemented. Participants noted that the project coordinators convened training, consultative meetings and self-help

groups aimed at ensuring that the objectives of the project were communicated and understood by the participants.

In response to a question on consultation in relation to the design and implementation of the project, a respondent from the Karongi district said: “Yes, the project consulted us and also advised on what to do through meetings, study visits and if our vegetables are attacked by diseases; the project advised on which product to be used to control the diseases”(LWH14). Furthermore, a respondent from the Gatsibo district stated that there were consultation meetings which enabled them to give feedback and their opinions (LWH17). These sentiments were further shared by a respondent from the Rulindo district who said, “Yes, before the implementation of activities, we had sensitisation meetings” (LWH5). These responses show that participants were consulted and were part of the implementation of the LWH project.

Project coordinators’ responses outlined that the project beneficiaries were consulted and were an integral part of the design and implementation of the LWH project. Coordinators explained that various projects such as training programmes, sensitisation meetings etc were conducted. A respondent from the national level noted that “before the design and implementation of the project activities, community meetings were organised in collaboration with local authorities in order to sensitise farmers and create ownership. This was done in every district or site of interventions” (LWHPC4). This is echoed by a respondent from the Gatsibo who stated that it was “[t]hrough sensitisation meetings and via self-help groups of 15 to 20 farmers formed based on their land's proximity. Afterwards, the groups formed zones and zones formed cooperatives. Especially in Gatsibo, there is a cooperative named Koaiga Imitoma which is a maize and beans cooperative for farmers in Gatsibo” (LWHPC 2). These responses affirm that the project consulted participants during the design, implementation, and post-implementation phases.

Almost all participants had a positive response with respect to their comprehension and perspective of the project. Participants expressed their gratitude towards the project and explained how the project has assisted them in farming methods and processes. Participants explained that the project assisted them with improved farming techniques, ensuring that their ways of farming are market orientated and also assisted them in development and planting calendars.

A farmer from the Nyanza district explained: “With the project, we learn how to cultivate using improved farming techniques, contract farming and market-orientated farming” (LWH9). A recurring theme in the participants’ responses concerned land consolidation and how such consolidation assisted with increased farming productions. A respondent from Rulindo noted that they have a positive understanding of the project and that the project had achieved a lot of soil consolidation and terrace construction (LWH1).

Many of the respondents cited that the LWH project was well implemented and was achieving its predetermined objectives. Most of these respondents added that, through the LWH project, their farming yields and outputs had increased. A respondent from the Rulindo district affirmed the success of the project by stating that one of the indicators of the success was the increase in production (LWH3). Another respondent from the Karongi district further noted that, through the LWH project, their land had been terraced and they had now valorised the treated land and were getting enough agricultural production (LWH13). This further affirms the observation that most of the farmers participating in the LWH project have benefited significantly from the project. These responses affirm the participants’ understanding of the project and highlight some of the positive impacts that the project has had on their farming practices.

All the project coordinators who responded to the questionnaire noted that the LWH project was achieving its set objectives and the farming community had seen an increase in farming output as a result of the project. When asked about their perspective of the LWH project, a respondent from Gatsibo district explained that “[t]his is a very important project, especially for the community, to help them to increase their agriculture production. The farmers are trained on how to sustainably manage their farms and, in the treated/irrigation schemes, farmers are able to cultivate three seasons throughout the year (Season A, Season B and Season C). As a result, agriculture production has increased both in quantity and in quality. Farmers are able to feed their family and take excess to the markets” (LWHPC2). These responses further affirm those received from the project beneficiaries who noted that the project is indeed achieving its set objectives and farmers have benefited from the implementation of the LWH project.



## Respondent's views around incorporation of IK in the LWH project and the impact

In responding to questions around the incorporation of water harvesting and irrigation IK in the LWH project and the impact thereof, if any, most participants felt that their water harvesting and irrigation IK was included in the design and implementation of the project and that the incorporation of such knowledge had had a positive impact on the overall success of the project as well as their ability to participate in the project as intended. Most participants felt that the design of the project was cognisant of their traditional ways of harvesting water and irrigating and, as a result, it enabled a quick adoption and positive acceptance of the overall project.

A respondent from the Rulindo district noted: “The knowledge was included. Previously we used to capture water to fight against soil erosion. With the support from the project, rainwater is harvested and being used for irrigation” (LWH2). Another respondent from the Rulindo district mentioned that “[t]he project did not start at nothing, we had anti-erosion ditches and used it to capture rainwater; the knowledge was considered” (LWH3). This was further echoed by a respondent from Nyanza who said, “Yes, land husbandry technologies were based on the existing soil erosion control measures” (LWH7). Another respondent from Nyanza further noted that “from our traditional ways of irrigation, the project improved that by way of using irrigation pipes that cause the increase of production” (LWH10). These responses from participants show that their IK around water harvesting and irrigation was incorporated in the project.

Participants also highlighted that the incorporation of their existing water harvesting and irrigation IK in the LWH helped in ensuring that the project achieved its objectives and at a quicker rate. Responding to a question of the impact of the incorporated IK on the LWH project, respondents said:

“Yes, it helps the project achieve its objectives very quickly and increased farmers ownership” (LWH4);

“Yes, production was increased, and project achieved its objectives very quickly” (LWH8);

“Yes, we used to irrigate using watering cans and buckets, but now we use pipes. Our knowledge helped us to adopt the new technologies very quickly” (LWH12); and

“Yes, the project achieved its objectives very quickly and we benefited” (LWH19).

With responses such as the above, participants cited positive impacts that are a result of the incorporation of their IK in the LWH project.

Analysis of the responses received from the project coordinators of the LWH within the selected districts reflect that project coordinators have a sound understanding of IKS. The coordinators further reflected on the types and examples of water harvesting and irrigation IKS that exist in Rwanda. The analysis reflected similarities between the types of water harvesting and irrigation IKS that exist in Rwanda. IKS such as capturing water in marshlands, construction of water canals, digging of pits and construction of anti-erosion ditches are some of the types of IKS identified by the project coordinators in answers to the questionnaires. Most of the responses from the project coordinators noted that although IKS still exist within the water harvesting and irrigation sectors within Rwanda, most of these IKS are no longer relevant in the current farming sector within Rwanda.

In analysing the responses received from the project coordinators concerning the incorporation of the Rwandan IK within the LWH project, it was noted that most project coordinators confirmed that IK was incorporated in the project and that the incorporation of such IK was instrumental in the overall success of the project. Project coordinators explained that the quick and successful adoption of the LWH project projects were propelled by the IK that already existed within the communities.

Coordinators affirmed the incorporation of IK within the LWH project and explained that such incorporation was essential in the overall success of the project. A respondent from the national level explained that “like anti-erosion ditches, projects train farmers on how to improve this technique by just planting grasses on upside of the ditches. This has the two advantages of reducing the silting of soil in the ditches and, later, grasses serve as fodder for livestock (cows)” (LWHPC4). This assertion was further affirmed by a response to a question on whether IK was incorporated in the project wherein a respondent from the Gatsibo district explained that “[t]he project interventions were based on the existing traditional knowledge and that was really an entry point for farmers to adopt the new technologies” (LWHPC2). The national level respondent also explained that in order to implement a successful project, one cannot reject the traditional knowledge that already exists in the community but should simply build on that existing knowledge (LWHPC4). This highlights the important role that the existing IKS within the Rwandan communities played in ensuring the success of the LWH project.

Data analysis showed that one of the main benefits of the incorporation of IK into the implementation of the LWH was ensuring good reception by the intended beneficiaries. A project coordinator from the Rulindo district explained that an important benefit of the incorporation of IK was that the intended beneficiaries were more receptive to the project and such incorporation increased the project adoption rate by the intended beneficiaries (LWHPC5). This benefit is highlighted by Escobar (2011) who explains that a key element to the development theory is the inclusion of local voices and not simply assuming and relying on the universal applicability and superiority of scientific imported knowledge. Ezeanya (2017) elaborates, explaining that an approach that takes the IK of the intended beneficiary communities into account enables such communities to take greater responsibility and accountability of the development process. This highlights the importance of ensuring that the development process takes into account the existing local knowledge systems in order to attain greater success and allow project ownership by the intended beneficiaries.

Analysis of the questionnaire received from the project coordinators also highlighted the fact that the IK within the water harvesting and irrigation sector in Rwanda in the LWH project enabled the project to design clear and concise project goals. A respondent from national level explained that IK allowed greater and quicker project facilitation and also enabled the project goals to be clearly set out (LWHPC4). This benefit is supported by Escobar (2011) who argues that imported development solutions without consulting the local beneficiaries are often inappropriate and irrelevant. This shows that IK is an important part of the development process and has many benefits.

The findings from the primary data collected through questionnaires is further bolstered by published secondary data. In their impact evaluation report, Kondylis et al., (2020), the LWH project was found to have achieved most of its predetermined objectives. The report outlines the successful attainment of objectives such as increasing agricultural output yields, improving food security, increased soil management etc. The report attributes the successes to the design and implementation of the LWH project which were the project's overall foundation. The report further attributes the quick adoption, the greater sense of accountability and level of project relatability to its overall design and implementation.

## Study limitation

The researcher acknowledges that other factors may exist that may influence and impact the bottom-up approach either positively or negatively, but these were not alluded to in the research.

An additional limitation of the study arises in that the research did not study the impact that other factors of the bottom-up theory might have on each other. Thus, the research did not look into how other factors may impact IK's influence in the theory. In conducting the research, the researcher focused on IK's influence on the theory and, by extension, development projects. The researcher acknowledges that the theory is influenced by a variety of factors (including IK) and such factors can in turn have an impact on each other, either negatively or positively in contributing to the bottom-up theory to development projects.

In addition to the above noted limitations, the research data was collected from two sets of project participants, namely, project beneficiaries and project coordinators. The research findings are based on the analysis of responses and data as received from these two sets of project participants. No data was collected from other stakeholders such as funders (World Bank), the government of Rwanda etc which is noted as a limitation in this study.

Furthermore, the exploratory nature of the research posed some limitation on the research. The narrow set of respondents used for the purposes of this research limited the diversity of responses and insights. Therefore, for the purposes of future research, a wider scope of respondents such as funders, the World Bank and the Rwandan Ministry of Agriculture etc can be co-opted in future research to get a wider and more diverse views of the influence of IK on the LWH project. An additional limitation is the scope of questions that were focused more on perceptions, future research should focus and measure causality. Additionally, future research should incorporate the use of secondary data in relation to the project to further understand the impact IK on the overall outcome of LWH project.

## Research conclusion

### Relating findings to existing research

Some findings from previous research conducted have indicated that IK as a factor of the bottom-up theory has a role to play in ensuring successful developmental projects whilst some findings indicated that IK has no role to play in current and future developmental projects. Findings from my research project affirms the existing body of knowledge that speaks to the importance of the role played by IK in development projects.

Cashman & Warren (n.d.) argued that a community's IK is central to the success of a development project and essential in project acceptance by the community which in turn leads to quick adoption by the intended beneficiary community. Farmers and project coordinators within the LWH project have affirmed the assertion made by Cashman & Warren around quick adoption and high project acceptance of the LWH project. The project beneficiaries found the project to be relatable and in turn made it easier to participate and reap intended project benefits.

In addition, Cashman & Warren (n.d.) argued that incorporating a community's IK in the design of a development project clearly sets out the goals and objectives of the project in a congruent manner and in a way that speaks to the intended community's lived realities. Participants of the LWH project explained that the participatory approach to the design of the project allowed for their voices to be heard and their IK incorporated into its design. Participants concurred with the views of Cashman & Warren (n.d.) that project goals and objectives are defined in a better and clearer manner when a community's lived realities are reflected in a development project intended for their benefit as was done in the LWH project.

Escobar (2011) additionally found that incorporation of IK in a development project further increases a community's sense of ownership and accountability over the project. This view is further supported by Ezeanya (2014) who also found that project beneficiary communities relate better to development projects that reflect their daily lives. This research affirms this body of knowledge with project participants agreeing that the relatability attribute of the project, which is a result of the incorporation of IK into the LWH project, gave them a greater sense of ownership and accountability.

The research findings further affirm the findings of Ezeanya (2017) and Escobar (2014) on quicker attainment of project goals and objectives through the incorporation of IK in a development project. LWH project coordinators and administrators agreed that the incorporation of Rwandan IK in the design and implementation of the LWH project was essential in realising set project goals. World Report (2014) report on the impact of the LWH project further confirms that the project achieved its predetermined objectives and goals.

The study contributes to the existing body of literature by expanding on the role of IK as a factor of the bottom-up theory of development in development projects. In answering the question on whether IK can aid development projects, the research contributes to the identified theoretical gap around that role IK can play in aiding development projects through the bottom-up theory of development. This research further informs development practitioners on how to better design and implement future development projects taking cognisance of the intended community's IK in the consultative process.

The research finds that IK as a factor of the bottom-up theory of development yields increased project relatability to project beneficiaries. Beneficiaries can partake and interact with the project better when it contains characteristics (water harvesting and irrigation IK characteristics) that are familiar to them. In the LWH project, project coordinators used existing irrigation and water harvesting IK in the design and implementation of the project to ensure that the project became relatable to the project beneficiaries. On the other hand, the farmers used the same IK to easily engage and participate in the project. The IK informed project coordinators how to create a fit for purpose project and the farmers were receptive as it was speaking to what they already knew. This research finding contributes to the theoretical gap by enhancing the role of IK in the bottom-up development theory.

Furthermore, the research informs practitioners of increased project accountability as a benefit of incorporating IK in the design and implementation of a development project. The research findings show that IK enables better project accountability and ownership. This contribution arises as a result of increased relatability in a development project. Research participants noted that they felt that the LWH project was quite relatable and as result prompted them to have greater ownership over the project. Ownership and accountability meant participants felt so familiar with the project that they ensured its overall success.

## Conclusions

The research objective of the study was to understand whether IK as a factor of the bottom-up development theory has any influence on development projects. The study used the Rwandan water harvesting and irrigation IK to determine if such IK has had any influence on the overall outcomes of the LWH development project. In answering the primary research question, the researcher understood LWH participants' understanding of IK as a body of knowledge and a factor in the bottom-up theory, their views on the relevance of such IK in the current Rwandan farming system, the overall perceptions of the LWH design and implementation consultation processes and their perspective on the role that IK as a factor of the bottom-up theory played in the overall outcomes of the LWH development project.

The research found that the majority of the participants of the LWH project concurred about the existence of water harvesting and irrigation IK and there was convergence around the types of IK that existed in water harvesting and irrigation in Rwanda. Secondly, the research found that a thorough participatory process took place during the project design and implementation phase of the project and participants affirmed that their voices were incorporated in the overall project design and implementation. Lastly, the majority of the research participants agreed that IK played a notable role in the success of the project, and they felt its incorporation in the project.

One of the main benefits that arose as a result of using IK as a factor of the bottom-up approach in the LWH project was that project beneficiaries found the project to be relatable. In line with Escobar (2011)'s view, the research found that project beneficiaries were able to interact, engage and relate better with the project given that it was founded on their indigenous ways of doing things. The research further found that the thorough consultative process led to beneficiaries being included in the design and implementation of the project and thus creating a greater sense of relatability to the project. The research also found that the incorporation of IK in the project allowed the design and implementation to have clearer goals and objectives.

In addition to the relatability benefit, the research found that the LWH project enabled participants to express a greater sense of accountability and ownership over the LWH project which was induced by the influence of IK as a factor of the bottom-up theory of development. Ezeanya (2017) explains that using grassroots approaches to development projects yields a

greater sense of accountability over the project. Participants of the LWH project felt a need to protect and engage the project in a more meaningful manner due to its greater levels of reliability.

Furthermore, participants of the LWH project agreed that the incorporation of their IK into the design and implementation of the project allowed for a quicker adoption of the project. As it was based on their IK, project beneficiaries easily adopted and engaged better with the project. This is supported in literature by Dewalt (2017), Chamacho et al. (2012) and Briggs & Moyo (2012) who agreed on the need for a development project to be founded on the IK of the community which it is intended to benefit.

The research findings answer the initial primary question on whether IK as a factor of the bottom-up theory of development can play a role in improving the design and implementation of development projects as well as the research ancillary questions which are whether there exists a relationship between IK and development projects and whether IK can be a source of reliable development projects. The findings in relation to the questions are summarised below:

The research found that through a thorough consultative process, IK as a factor of the bottom-up theory of development can aid the design and implementation of a development project. Furthermore, the research concludes that such incorporation, leads to quicker project adoption which in turn allows for the overall project objectives to be attained. Another key research conclusion is around the greater sense of project ownership and accountability that can be exhibited within the LWH project because of the incorporation of IK as a factor in the design and implementation of the project.

In examining the relationship in the Rwandan LWH project, the research also found that there was a relationship between a development project and the IK of the intended benefiting community. The research found that the outcomes of the LWH project were greatly enhanced by the incorporation of IK in the design and implementation phases of the project.

In line with Escobar's views (2011), the research also found that the use of a community's IK as a foundation for development projects can result in reliable project outcomes and thus allowing intended beneficiaries to engage better and derive better results from the development project. Respondents in the research confirmed that the fact that the LWH project was founded



on their water harvesting IK such as anti-erosion ditches etc, led to a quicker adoption of the project and enabled ease of association with the project goals and objectives.

### **Future research direction**

Future research is required to study the impact of other factors of the bottom-up theory of development on development projects. This may also involve ascertaining the role of IK in a development project with other factors factored in. Thus, a study to understand if IK as a factor will still have a similar influence when other factors of the bottom-up theory are studied holistically. Further research is required to understand the relationship that IK has with other factors of the consultative theory to development in aiding a development project's goals and objectives.

In addition, future studies are required to understand the impact that other factors of the bottom-up theory may have on IK as a factor. Would other factors hamper or enhance IK as a role player in a bottom-up theory induced development project? Would the other factors of the bottom-up theory of development, such as technological advancements in the agricultural sector, render IK as a factor less or more effective.

This research was set up as an exploratory research and as a result enables future research to be conducted around area of IK as a factor of the bottom up theory of development and how this impacts on development projects. The findings of this research can be used as a basis for future research to build on and gain further understanding of potential benefits of incorporating IK as a factor of the bottom up approach of development in development projects.

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### Appendix A Sampled project beneficiaries (farmers)

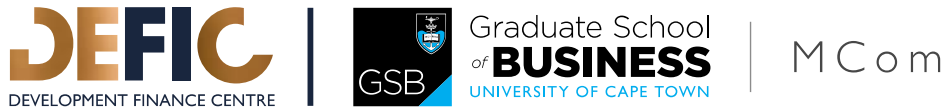
Code	Gender	Age	Farming area	Number of years in farming	Farming products	Numbers of years in LWH
LWH1	Female	52	Rulindo- Buyoga sector	38	Farming and livestock keeping	1
LWH2	Male	62	Rulindo- Cyinzuzi	30	Farming and livestock keeping	2
LWH3	Male	64	Rulindo Burega sector	34	Farming and livestock keeping	7
LWH4	Male	37	Rulindo- Buyoga- Gahororo	14	Farming and livestock keeping	3
LWH5	Male	57	Rulindo-Cyinzuzi	26	Farming and livestock keeping	3
LWH6	Female	48	Nyaza- Cybakamyi Nyabinyenga	28	Maize and beans	6
LWH7	Male	87	Nyanza Cybakamyi, Nyarurama	67	Maize, beans, cassava and livestock keeping	6
LWH8	Female	38	Nyanza, Cybakamyi, Nyarurama	22	Maize, beans and cassava	6
LWH9	Male	67	Nyanza Nyagisozi Kibirizi	44	Farming and livestock keeping	6
LWH10	Male	35	Nyanza Cyabakammyi- Nyabinyenga	19	Beans, maize, fruits and vegetables, livestock (goats and poultry)	6
LWH11	Female	42	Rugabano, Mucyamba, Kamonyi	20	Farming and livestock keeping	8
LWH12	Male	31	Rubengera	9	Snow pears, carrots, onions, beans, livestock	9
LWH13	Male	64	Nyarubuye	40	Farming and livestock keeping	5
LWH14	Female	58	Nkomagurwa, Gacaca, Remera	40	Farming and livestock keeping	9
LWH15	Male	59	Rugabano and Rubengera	35	Vegetables and livestock keeping	2
LWH16	Male	68	Mugera cell, Gatsibo sector, Gatsibo district	40	Vegetables, maize and beans	6
LWH17	Male	72	Mugera, Gatsibo	45	Farming and livestock	6
LWH18	Female	32	Kageyo Sector, Busetsa cell, Gatsibo district	19	Fruits, vegetables and livestock keeping	11
LWH19	Male	41	Gatsibo	26	Farming and livestock keeping	6
LWH20	Female	55	Gatsibo	36	Maize and beans	6

## Appendix B Sampled project coordinators

<b>CODE</b>	<b>Gender</b>	<b>AGE</b>	<b>AREA/DISTRICT OF RESPONSIBILITY</b>	<b>CROPS IN DISTRICT</b>	<b>NUMBERS OF YEARS IN LWH</b>
<b>LWHPC1</b>	Female	41	Nyanza	Maize, beans, cassava, banana and vegetables	6
<b>LWHPC2</b>	Male	41	Gatsibo	Maize and beans	6
<b>LWHPC3</b>	Male	40	Karongi	Maize, beans, Irish potatoes, fruit and vegetables.	7
<b>LWHPC4</b>	Male	40	National level	Maize, beans, Irish potatoes, wheat, vegetables and fruit	9
<b>LWHPC5</b>	Female	36	Rulindo	Maize, beans, various vegetables and fruit	8



## Appendix C Questionnaire project beneficiaries



### **Questionnaire information sheet**

**Researcher:** Itani Phaduli

**Contact details:**

**Cell number:** +27 76 320 1456

**Email address:** Iphaduli@gmail.com

**Qualification enrolled:** Master of Commerce specialising in Development Finance.

**Institution:** University of Cape Town Graduate School of Business.

**Project title:** Incorporating indigenous knowledge in development projects: A case of Rwanda's land, husbandry water harvesting and hillside irrigation project.

### **Brief project summary**

The aim of the research project is to understand perceptions and views around the incorporation of indigenous knowledge systems in development projects using Rwanda's land, husbandry water harvesting and hillside irrigation project as a case study.

Below is a short and quick questionnaire for your completion.

**Murakoze!**

**Question 1**

As a way of introduction, could you please tell me more about yourself and farming experience:

- a. How old are you?

-----

- b. Your gender?

-----

- c. How long have you been a farmer?

-----

- d. Where do you farm?

-----

- a. What do you farm?

-----

- b. How long have you been part of the land, husbandry water harvesting and hillside irrigation project?

-----

**Question 2**

- a. What is your understanding of indigenous knowledge?

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- b. What indigenous knowledge exists in water harvesting and irrigation within Rwanda?

-----

-----

- c. Do you think this water harvesting and irrigation knowledge is relevant in the current farming sector?

-----

-----

**Question 3**

- a. What is your view on the land, husbandry water harvesting and hillside irrigation project?

-----

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b. Were you consulted in the development of the land, husbandry water harvesting and irrigation project?

-----  
-----

c. Were the project objectives communicated to you?

-----  
-----

d. Do you think the project is achieving its objectives?

-----  
-----

e. Did the project increase your farming output?

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**Question 4**

a. Do you think the Rwandan indigenous knowledge on water harvesting and irrigation was included in the project?

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b. If yes, how do you think this knowledge was included into the project?

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-----

c. If yes, do you think such knowledge was helpful in the overall project?

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d. If no, what impact (negative/positive) do you think the lack of incorporation of this knowledge might have on the project?

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## Appendix D Questionnaire Project coordinators



Graduate School  
of **BUSINESS**  
UNIVERSITY OF CAPE TOWN

M C o m

### Questionnaire information sheet

**Researcher:** Itani Phaduli

**Contact details:**

**Cell number:** +27 76 320 1456

**Email address:** Iphaduli@gmail.com

**Qualification enrolled:** Master of Commerce specialising in Development Finance.

**Institution:** University of Cape Town Graduate School of Business.

**Project title:** Incorporating indigenous knowledge in development projects: A case of Rwanda's land, husbandry water harvesting and hillside irrigation project.

#### **Brief project summary**

The aim of the research project is to understand perceptions and views around the incorporation of indigenous knowledge systems in development projects using Rwanda's land, husbandry water harvesting and hillside irrigation project as a case study.

Below is a short and quick questionnaire for your completion.

**Murakoze!**

#### **Question 1**

As a way of introduction, could you please tell me more about yourself and RAB experience:

a. How old are you?

-----

b. Your gender?

-----

c. How long have you been a project coordinator/manager for RAB?

-----

d. Which district/province do you focus on?

-----

a. What are the main crops in those districts?

-----

b. How long have you been part of the land, husbandry water harvesting and hillside irrigation project?

-----

**Question 2**

a. What is your understanding of indigenous knowledge?

-----

-----

b. What indigenous knowledge exists in water harvesting and irrigation within Rwanda?

-----

-----

c. Do you think this water harvesting and irrigation knowledge is relevant in the current farming sector?

-----

-----

**Question 3**

a. What is your view on the land, husbandry water harvesting and hillside irrigation project?

-----

-----

b. Did you consult farmers in the planning and development of this project?

-----

-----

c. Were the project objectives communicated to the farmers?

-----  
-----  
d. Do you think the project is achieving its objectives?  
-----  
-----

e. Do you think the project increased the farmers' outputs?  
-----  
-----

f. Are you satisfied with the level of engagement and interactions you receive from farmers on this project?  
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**Question 4**

a. Do you think the Rwandan indigenous knowledge on water harvesting and irrigation was included in the project?  
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b. If yes, how do you think this knowledge was included into the project?  
-----  
-----

c. If yes, do you think such knowledge was helpful in the overall project?  
-----  
-----

d. If no, what impact (negative/positive) do you think the lack of incorporation of this knowledge might have on the project?  
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**Murakoze!**