WATER USE AND FOOD SECURITY: KNOWLEDGE DISSEMINATION AND USE IN AGRICULTURAL COLLEGES AND LOCAL LEARNING NETWORKS FOR HOMESTEAD FOOD GARDENING AND SMALLHOLDER FARMING

VOLUME 1: RESEARCH AND DEVELOPMENT REPORT

Report to the
WATER RESEARCH COMMISSION

by

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This report forms part of a series of two reports. The other report is *Water Use and Food Security: Knowledge Dissemination and Use in Agricultural Colleges and Local Learning Networks for Homestead Food Gardening and Smallholder Farming. Volume 2: Action Oriented Strategy* (WRC Report No. TT 694/16).

Supplementary information appears on the CD enclosed at the back of this report.

EXECUTIVE SUMMARY

This final report has detailed the work that went into pilot testing an Action Oriented Strategy (AOS) to support Agricultural Colleges to make use of the two sets of WRC materials that were the focus of the project. The general objective of this project entitled *"Action oriented strategy for knowledge dissemination and training for skills development of water use in homestead food gardening and rain water harvesting for cropland food production"* was:

> To develop a strategy for achieving effective knowledge dissemination and practical training to encourage productive water use for food crop production [amongst smallholder farmers and food growers in South Africa].

The AOS has been developed out of the experience of working with two sets of WRC Rainwater Harvesting and Conservation (RWH&C) materials with a wide range of stakeholders in the agricultural sector, and using a variety of media through which to share the materials and the information contained in them. The materials that were used to develop the AOS were:

- '*A comprehensive learning package for education and the application of water harvesting'* (WRC Report No's: TT 492/11; TT 493/11; TT 494/11; TT 495/11; TT 496/11) [referred to as **WH&C materials** (Denison, Smulders, Kruger, Ndingi & Botha, 2011)]; and
- *'Agricultural Water Use for Homestead Gardening Systems – Resource Material for Facilitators and Food Gardeners'* (WRC Report No. TT 431/09) [referred to as **AWUHGS materials** (Stimie, Kruger, de Lange & Crosby, 2010)]

The full detail of this process is captured in this, Volume 1, of the research report entitled: ***Water Use and Food Security: Knowledge Dissemination and Use in Agricultural Colleges and Local Learning Networks for Homestead Food Gardening and Smallholder Farming, Volume 1: Research and Development Report.*** It is accompanied by a shorter, more popularly accessible Action Oriented Strategy, constituted as Volume 2 of this research report, which is entitled ***Water Use and Food Security: Knowledge Dissemination and Use in Agricultural Colleges and Local Learning Networks for Homestead Food Gardening and Smallholder Farming, Volume 2: Action Oriented Strategy.***

Chapter 1 of the report explains the theoretical framework of the project which sought to establish a knowledge dissemination approach that was oriented towards a systemic, innovation oriented and relational approach to knowledge dissemination so as to further the objectives of knowledge co-construction and social innovation in the area of rainwater harvesting and conservation (RWH&C) for food production at household and smallholder farmer level. The report adopts 'Strategy-as-Practice' approach which focusses in on people and the interrelations between people and practice in the emergence of strategy. Chapter 1 also includes a detailed policy analysis which highlights the relevance of the AOS work at national level, and across a number of sectors, highlighting also Agricultural Education and Training policy systems. Additionally, a detailed analysis of the materials that were the core focus of the AOS is provided in this section.

Chapter 2 of the report provides a detailed contextual analysis for part of the South African Agricultural Sector, highlighting the level of farming and food production targeted by the AOS, namely the smallholder farmer and homestead food producer. The contextual analysis includes a focus on the SA government extension services as it is these extension officers that directly support smallholder farmers with new knowledge such as that contained in the WRC materials. It also

considers smallholder farmers themselves and how they obtain information on RWH&C practices, and then goes on to review various communication and media approaches that are most appropriate for this level of farming practice in South Africa. The contextual analysis also includes a focus on the agricultural education and training provisioning system in South Africa, highlighting the flux that currently characterises the sector as well as new interventions, such as the re-orientation of agricultural colleges into Agricultural Training Institutes, and the move towards adopting competence-based approaches. This section provides the rationale for some of the key approaches adopted to the AOS development process, which were grounded in consultations in the field, stakeholder analysis, policy analysis, and carefully targeted contextual analysis work.

Chapter 3 of the report provides insight into the actual knowledge mediation and dissemination processes that were pilot tested in the programme. Key amongst these was the establishment of a learning network structure that was inclusive of all stakeholders in the agricultural learning system. Within this, a Training of Trainers (ToT) programme was established to mediate the WRC knowledge and to support the stakeholders in the agricultural learning system to take up and use the WRC knowledge. In the Agricultural Colleges, lecturers were supported to develop curriculum innovation projects which included share demonstration site development. Other stakeholders (extension officers, Local Economic Development (LED) officers, researchers, farmers and farmers association members) were also included in the ToT, where they too were supported to develop learning support innovation projects and to participate in the shared demonstration site development process. This brought the value of working in learning networks to the fore, as different stakeholders were able to mobilise their prior knowledge, experience and expertise in a local context, where the end result was contributions to improved farming practice amongst farmers, knowledge exchange between farmers, improved curriculum options for college students, and better support to smallholder farmers to use RWH&C knowledge in local context. However, it was only possible to implement one such learning network in some depth over a period of 18 months, but shorter ToT programme were run, and other learning networks were emerging at the time of the projects' end. A key extension to the above, was development of a media component for facilitating the expansion of access to, and use of the WRC materials. This involved development of a project branding, which re-named the initiative 'Amanzi for Food' allowing quick access and association with the key message of the programme, an associated and dedicated website (www.amanziforfood.co.za) which allowed multi-levelled access to the materials via various access tools, including a 'navigation tool' which served to be critical to the whole knowledge access and dissemination process, links to other social media, including a Facebook page, blogs and news items and links to other websites where the WRC knowledge is being shared. Posters and YouTube videos were also developed and pilot tested to assist with visualisation of the RWH&C practices. Additionally, a community radio programme was established with a radio handbook produced out of the experience of designing and hosting the radio programmes. A significant finding out of the media component is that the various forms of media operate *in relationship, requiring an integrated approach* to media development for enhancing knowledge dissemination.

Based on the lessons learned as communicated in Chapter 3, Chapter 4 of the report ends with recommendations for implementing the Action Oriented Strategy further, and with recommendations for further research. The recommendations include recommendations for expanding the Training of Trainers programme, further knowledge dissemination, and further research and materials development. These recommendations are also further communicated in Volume 2, which is the Action Oriented Strategy, which makes recommendations for various stakeholders in the agricultural learning system who have an interest in RWH&C knowledge dissemination and uptake

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ADRI	Agricultural Development Research Institute
AET	Agricultural Education and Training
AgriSETA	Agricultural Sector Education and Training Authority
AIP	Association of Independent Publishers
AOS	Action Oriented Strategy
APAC	Agricultural Principals Association for Colleges
ARC	Agricultural Research Council
ASSAF	Academy of Science South Africa
ATIs	Agricultural Training Institutes
AWUHGS	Agricultural Water Use in Homestead Farming Systems for Improved Livelihoods
CBE	Competence Based Education
CBL	Competence Based Learning
CBO	Community Based Organisation
CEP	Community of Expert Practice
CHE	Council of Higher Education
COLA	Community of Learning for Agriculture
CRP	Colleges Revitalization Plan
CSA	Climate Smart Agriculture
CSI	Corporate Social Investment
DAFF	Department of Agriculture, Forestry and Fisheries
DBE	Department of Basic Education
DBSA	Development Bank of Southern Africa
DFID	Department for International Development (UK)
DHET	Department of Higher Education and Training
DoA	Department of Agriculture
DRDLR	Department of Rural Development and Land Reform
DVD	Digital Video Disk
DWA	Department of Water Affairs
DWAF	Department of Water and Forestry
ELRC	Environmental Learning Research Centre
EO	Extension Officer
ERP	Extension Recovery Plan
FAO	Food and Agricultural Organisation
FET	Further Education and Training
HEI	Higher Education Institutions
HET	Higher Education and Training
IB (LN)	Imvothu Bubomi (Learning Network)
IBA	Independent Broadcasting Association
ICT	Information Communication Technology
IE	Irrigation Extensionist
IRWH	In-field Rainwater Harvesting

ISCW	Institute for Soil Climate and Water
K*	Knowledge dissemination and use approaches and processes
LDA	Limpopo Department of Agriculture
LED	Local Economic Development
MB	Megabyte
NCCRWP	National Climate Change Response White Paper
NCRF	National Community Radio Forum
NCV	National Certificate – Vocational
NDP	National Development Plan
NEDA	Nkonkobe Economic Development Agency
NFSD	National Framework for Sustainable Development
NGO	Non-Governmental Organisation
NPC	National Planning Commission
NPO	Not for Profit Organisation
NQF	National Qualifications Framework
NSSD 1	National Sustainable Development Strategy 1
NWRS-2	National Water Resources Strategy 2
PTID	Participatory Technology and Innovation Development
QCTO	Quality Council for Trades and Occupations
RAMS	Radio Audience Measurement Survey
RDC	Rural Development Centre
RDDA	Research Develop Disseminate Adopt
RESIS	Revitalisation of Smallholder Irrigation Schemes
RIAs	Registered Implementing Agents
RPF	Resource Poor Farmers
RSA	Republic of South Africa
RU	Rhodes University
RWC	Rural Wealth Creation
RWH	Rainwater Harvesting
RWH&C	Rainwater Harvesting and Conservation
RWSN	Rural Water Supply Network
s-as-p	Strategy-as-Practice
SABI	Suid Afrikaanse Besproeiingsinstituut
SACRIN	South African Community Radio Information Network
SANBI	South African National Biodiversity Institute
SAQA	South African Qualifications Authority
SDGs	Sustainable Development Goals
SETAs	Sector Education and Training Authorities
SMS	Short Messaging System
StatsSA	Statistics South Africa
TA	Technical Assistants
TACATI	Transformation of Colleges of Agriculture into Agricultural Training Institutes
ToT	Training of Trainers
TVET	Technical & Vocational Education and Training
UFH	University of Fort Hare
UK	United Kingdom

UKZN	University of KwaZulu-Natal
UNICEF	United Nations Children Fund
UNISA	University of South Africa
VLSA	Virtual Livelihoods School Africa
WAR	Water Access Rights
WHC	Water Harvesting and Conservation
WRC	Water Research Commission
WUA	Water Users Association

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1 INTRODUCTION

1.1 Objectives

The general objective of this project, entitled *"Action oriented strategy for knowledge dissemination and training for skills development of water use in homestead food gardening and rain water harvesting for cropland food production"* , was:

> To develop a strategy for achieving effective knowledge dissemination and practical training to encourage productive water use for food crop production [amongst smallholder farmers and food growers in South Africa].

There are four specific aims that were used to guide the project:

No.	Aim
1.	To review available knowledge products, with emphasis on agriculture water and food production learning materials developed with WRC funding, leading to the design of a possible training DVD and the design of related knowledge products.
2.	To pilot and design knowledge mediation processes through intensive engagement with selected Agricultural Colleges to inform a national strategy that will target a wider group of learning and training organisations.
3.	To pilot and design a mass media strategy leading to a listing of contents of a radio / low cost media content manual for the effective inclusion of available agriculture water knowledge into existing low cost media channels.
4.	To develop a national strategy for agricultural water knowledge dissemination for smallholder farmers and food-growers using the tools and processes developed in the project. This will enable a large scale roll out of the knowledge dissemination processes of targeting food-growers, particularly women, directly and learning organisations who are involved in the training of extension officers and rural-development workers in the field of food-security and smallholder agricultural production.

1.2 Context and Purpose of Action Oriented Strategy (AOS) Development Process

1.2.1 Broader context and rationale

This research project sought to address the challenge of getting greater uptake of available research and training information to homestead food-growers and smallholder farmers who are keen and able to use it. Household food security in South Africa remains a national challenge with an estimated 59% of 13.7 million households being food insecure, with hunger and chronic malnutrition being widespread within this group (Hart, 2009; Wenhold and Faber, 2008 in Backeberg and Sanewe, 2010). Agriculture contributes significantly to the livelihoods of an estimated 4.5 million people who have access to small portions of agricultural land (Vink and Van Rooyen, 2009), estimated at 6-12% of household income in a rainfed context and 21-60% in an irrigated context. Yet, utilisation of available land water resources for smallholders (0.5-10 ha), both in home-gardens and fields remain

low (Backeberg and Sanewe, 2010). As it is women who are responsible in the majority of cases for farming decisions, they are a key group to target in initiatives aiming for increased crop-production and food-security. There is a substantial body of training information in the public domain which responds to the multi-faceted crop-production challenges faced by small growers, which formed the focus of this research and development initiative. Two recent WRC research products were prioritised; one targeting home-food production (Stimie et al., 2010) and the other water-harvesting and conservation techniques (Denison et al., 2011).

Issues associated with inadequate knowledge transfer are reflected in relevant WRC publications. The report on the Comprehensive Learning Package for Water Harvesting and Conservation (Denison et al., 2011) noted that 7 of the 11 agricultural colleges expressed substantial interest in using the course materials developed with funding from WRC, but they had limited or no capacity to embed these into their existing curricula. Furthermore, the content of water-harvesting and low-external input sustainable agriculture was largely unfamiliar to their lecturers who would have to be sensitised and trained in order to effectively lecture/facilitate such content. Similarly, the Agricultural Water Use in Homestead Gardening Systems publication (Stimie et al., 2010) was produced as a highly informative resource pack for facilitators, with detailed illustrations for food-growers in English, isiZulu and seSotho, where parts can be selected and used in different learning situations. While the latter publication was successfully being used in a UNISA food security and UKZN Department of Agriculture courses at the time of this project's initiation, there was opportunity for more effective and wider uptake.

In order to reach the target audience of primarily women farmers, in many cases elderly women, a wide concept of 'training organisation' needed to be adopted in this strategy development programme; and included those agricultural education organisations that train extension staff that work with this constituency; as well as those community-based organisations that have an education and communication role at grassroots level (e.g. NGOs, community radio producers; churches, local schools and CBOs). This more accurately reflects an **agricultural learning system.** Thus, at the start of the project, it was proposed that an effective dissemination strategy is likely to be one that targets: a) organisations where trainers are trained; and b) radio, communication and practice organisations that also directly target or engage with the end-users (farmers, home-food growers). The project therefore set out to test out knowledge dissemination strategies that cover this range.

The research project sought to contribute to human capital development and the development of more co-ordinated and effective knowledge dissemination approaches to inform and support water utilisation for poverty reduction and wealth creation in agriculture. Through more effective dissemination and use of knowledge, the project sought to contribute to sustainable water-based agricultural activities in rural communities. It made use of existing learning products produced with support by the WRC, and strengthened their application in a range of knowledge dissemination contexts, especially in agricultural colleges, amongst extension and fieldworker change agents, and media programming agents. Through action research approaches, it sought to contribute to, and monitor expanded knowledge dissemination practices in these contexts, focussing on two water use practices – homestead food gardening, and water harvesting for crop growth on small plots. All of this fed into the development of an evidence based, Action Oriented Strategy (Volume 2) for knowledge dissemination and training for skills development of water use in homestead gardening and rain water harvesting for cropland food production.

The eventual beneficiaries of the project are people who have underutilised natural and other resources for agricultural production at their disposal and have an interest in crop production; in

gardens and on small farms. Improved water management and food production practices are key contributors to more productive, lower risk and profitable farming. The Action Oriented Strategy (Volume 2) sets out how to target different groups of growers, introduce information in relation to practices, and promote local knowledge networks; all informed by existing WRC information sets and learning products related to two key water use practices: homestead food production and water harvesting techniques for crop irrigation.

1.2.2 Project implementation context and focus

The Rhodes University (RU) Environmental Learning Research Centre (ELRC) was contracted in April 2013 by the Water Research Commission (WRC) to undertake development work focussing on an action oriented strategy for knowledge dissemination and training for skills development of water use in homestead gardening and rain water harvesting for cropland food production for smallholder farmers and food growers in South Africa, focussing on two sets of WRC materials. The purpose was to test elements of such a strategy using action research approaches, to inform the design of a final strategy for national roll out.

The project extended over three and a half years, and took place in three main knowledge dissemination contexts (agricultural colleges, extension / NGO training contexts and public media contexts). The project was situated in one main pilot site where in-depth AOS development work took place, with initial extensions to other sites, but due to the complex nature of developing a strategy from action processes (i.e. via an implement, test and reflect approach) it was not possible to develop the same level of in-depth engagement in more than one site, especially since supporting materials to facilitate access and use of the materials also had to be produced. The project commenced in April 2013 and was completed in July 2016.

This report shares the insights gained from pilot testing approaches that facilitated the use and uptake of knowledge found in two sets of WRC materials (previously developed in other research projects). These two sets of materials provide the 'core focus and content' around which the knowledge dissemination strategy was developed. These materials were:

- *'Development of a comprehensive learning package for education on the application of water harvesting and conservation'* (WRC report no's TT 492/11; TT 493/11; TT 494/11; TT 495/11; TT 496/11)[1] [referred to as **WH&C materials** (Denison et al., 2011)]; and
- *'Agricultural Water Use for Homestead Gardening Systems – Resource Material for Facilitators and Food Gardeners'* (WRC Report No. TT 431/09)[2] [referred to as **AWUHGS materials** (Stimie et al., 2010)]

[1] Materials available in a Comprehensive Learning Package (Denison et al., 2011)

- Water Harvesting and Conservation Volume 1: Development of a comprehensive learning package for education and the application of water harvesting (Report No. TT 492/11)
- Water harvesting and Conservation Volume 2, Part 1: Technical manual and farmer handouts (Report No.TT 493/11). *This is the volume that was most widely used in the Amanzi for Food programme.*
- Water Harvesting and Conservation Volume 2, Part 2: Facilitation and assessment guide for the technical manual (Report No. TT 494/11)
- Water Harvesting and Conservation Volume 2, Part 3: Facilitation manual (Report No.TT 495/11)
- Water Harvesting and Conservation Volume 2, Part 4: Facilitation and assessment guide for the facilitation manual (Report No. TT 496/11)

Figure 1: Covers of the two sets of materials that formed the focus of the knowledge dissemination strategy development process

In seeking to develop an ***action oriented strategy*** focussing on knowledge dissemination and training for skills development of water use in homestead gardening and rainwater harvesting for cropland food production, as supported by these two sets of materials, the project adopts a 'Strategy-as-Practice' approach to strategy research and development. 'Strategy-as-Practice' research is a recognised research field, and has been influenced by wider concerns to humanize management and organization research by bringing people back into the centre of strategy processes (Weick, 1979; Whittington et al., 2003). As noted by Jarzabkowski and Spee (2009) in a comprehensive review of strategy-as-practice research "… the developing field of research has taken this concern seriously, bringing *human actors and their actions and interactions* to the centre stage of strategy research" (pg. 1, our emphasis). He goes on to argue that "Above all, strategy-as-practice provides insights beyond

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[2] This is accompanied by a research report entitled 'Agricultural Water Use in Homestead Food Gardening Systems' (Report No. TT 430/09) (Stimie et al., 2010)

studying organisational processes and *embeds strategizing activities in the wider practices of societies* (Whittington, 2006; 2007, emphasis added) In defining strategy-as-practice research, he notes that strategy has been defined as "… *a situated, socially accomplished activity*, while *strategizing comprises those actions, interactions and negotiations of multiple actors and the situated practices that they draw upon in accomplishing that activity*" (Jarzabkowski et al., 2007, 7-8, emphasis added). The emphasis in the development of the action oriented strategy has therefore been on the factors outlined by strategy-as-practice researchers, emphasised above.

1.3 Policy Relevance of the AOS Development Process

1.3.1 General macro-level policy relevance of the AOS development process

There is a vast array of policy that emphasises knowledge dissemination for improvement of smallholder farming practices, which would appear to require a focus on agricultural water use and conservation practices. This policy is spread across different government departments, making up the major national stakeholders who may have an interest in the WRC materials and their use and the AOS. The policy is also spread across national, provincial and local government level policy making for a complex policy set-up. In the analysis below, the relevance of the AOS development process to key policies and policy processes is outlined in brief, with a more detailed analysis in this project.

When the project was initiated, the international Millennium Development Goals were still in force, nearing the end of their implementation cycle. In September 2015, the South African government, along with governments around the world, agreed to a new global development agenda which sets out a plan of action for people, planet and prosperity with 1 January 2016 the starting date for implementation of this agenda. This document entitled *'Transforming our World: The 2030 Agenda for Sustainable Development'* (United Nations, 2015) stresses that eradicating poverty, in all its forms and dimensions, including extreme poverty, is the greatest global challenge, and is an indispensable requirement for sustainable development. This document sets out a number of Sustainable Development Goals (SDGs) with targets and means of implementation. Importantly for the AOS, the 2030 Agenda for Sustainable Development notes in paragraph 17 that "there are deep inter-connections between and many cross cutting elements across the new Goals and targets". Within this integrated framing, the AOS addresses especially the following SDGs:

- Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
- Goal 5: Ensure availability and sustainable management of water and sanitation for all

Additionally, the AOS contributes to a number of the other SDGs such as reducing poverty (Goal 1), empowering women (Goal 5), promoting well-being (Goal 3), and addressing climate change impacts (Goal 13). The intentions of the SDGs are aligned with the intentions of the South African Constitution, which, in Section 24 and Section 27 respectively, reflects South Africa's commitment to "secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development", and ensure that "everyone has the right to have access to...sufficient food and water..." (RSA, 1996). These provisions make it very clear both that food and water security are paramount rights, and that these must be achieved in balance with sustainable use of the natural resources and that efforts related to these provisions should also be oriented towards addressing poverty.

Also relevant to the AOS, is the focus in the National Development Plan (NPC, 2012) which seeks to promote ways of enabling rural communities to participate more actively in the economic, social and political life in the country. Key to this is an envisaged expansion of smallholder agricultural development, involving increased support and conversion of opportunities for smallholder farmers, coupled with successful land reform. The NDP emphasises skills development in the agricultural sector, including entrepreneurship training. These would include the training of a new cadre of extension officers to respond to the needs of smallholding farmers and contribute to their integration into the food value chain. Key amongst the skills needed by the agricultural extension officers would be knowledge mediation and sharing of knowledge on agricultural water use and conservation. The NDP suggests that farmer-to-farmer skills transfer and knowledge networks need to be considered to help develop a new generation of farmers, and with other initiatives move towards a deracialised agricultural sector. Another issue noted in relation to the development of smallholder farming is the *empowerment of women*, and black and gender economic empowerment have been identified as a priority in the formation and expansion of new businesses, including agri-business with emphasis on value adding (Denison et al., 2015). In setting out the basis for a strategy, the Commission highlights the risks of industrialised agriculture to the country's unique ecosystems and calls for attention to be paid to ecological approaches to sustainable agriculture. These would include greater attention to alternative energy, soil quality, minimum tillage and other forms of conservation farming. The emphasis on ecological sustainability does however omit water harvesting and conservation technologies, which are shown to support resilience and increased food security in the rainfed context (Denison et al., 2015).

From a skills development perspective, and of particular relevance to the proposed AOS, is the emphasis placed in the NDP on the need for extension with a 'new cadre of extension officers'. It calls for innovative means for agricultural extension and training by the state. The NPD does not, however, suggest how this should be done in practice. The AOS put forward by this project contributes directly to the development of model approaches that can feed into contemporary discourses and practices of building a 'new cadre' of extension services using new models, methods and approaches of training and extension and as such, the AOS seeks to be innovative in its knowledge dissemination approaches.

1.3.2 Sectoral and cross-sectoral policy relevance of the AOS development process

The overlapping mandate between the national Department of Rural Development and Land Reform (DRDLR) and the Department of Agriculture, Forestry and Fisheries (DAFF) is premised on effective cooperative governance, in particular alignment of regional and local efforts around agreed programmes and projects. Agriculture when extended to irrigation and water-harvesting requires in addition, the involvement of the Department of Water and Sanitation. Alignment of policy, financial and practical efforts of this trio of Departments remains a primary challenge. Practical institutional solutions that give effect locally are needed, hence the focus on design and promotion of multi-stakeholder learning networks in the AOS.

The AOS is also related to the wider context of policy on land reform, as land reform influences *the contexts of practice of smallholder farming, the security of their enterprises, and longer term sustainability of smallholder farming enterprises.* The AOS can therefore be of use to the Department of Rural Development and Land Reform and their initiatives to support land reform and rural development which include initiatives to address food security and to expand access to food production in rural and peri-urban areas, such as the Comprehensive Rural Development Programme which was introduced in 2009.

Efforts by the Department of Agriculture, Forestry and Fisheries to bolster extension services in support of rural development, boosting of various agricultural sectors and practices, and improving smallholder farming could also draw benefit from the knowledge and approaches promoted via the AOS. Throughout, since 1994, DoA policies show an awareness of the pressing and complex challenges of scarcities of water, and that bringing agricultural development into more remote and rural areas to stimulate equitable livelihood practices, including those providing services to these areas, is an act of good governance. They also show awareness of the need to strengthen the capacity of extension services.

Significant to the model developed for knowledge dissemination via this project and the AOS is the critical review of extension services produced in the '*Presidency Fifteen Year Review Project Review of agricultural policies and support instruments 1994-2007'* produced by the Department of Agricultural Economics University of Stellenbosch (Tregurtha, Vink, & Kirsten, 2010). This review identifies some less helpful policies including the decentralisation of extension offices. Over time these have become less effective as those employed are not provided with proper training, or prepared adequately to take on broader roles as the sector grew. It is said that here needs to be more accountability and the institution of a feedback system in order to improve on extension support if it is to remain. Farmers it was said in the document, are critical of extension practices, and often feel that they are more skilled than those that are supposed to help them. In discussions with the agricultural colleges in this project, it was generally agreed that the commercial farmers make little if any use of government extension services, relying instead on advice from their agricultural equipment and material manufacturers and suppliers. The government extension services are therefore generally restricted to advising smallholder subsistence and emerging farmers.

The current Strategic Plan of 2015/16-2019/20 if the *Department of Agricultural, Forestry and Fisheries (DAFF) Republic of South Africa (*DAFF, 2015) is a more refined and structured document aligning current and past ideology to create a more just and sustainable South Africa. The document outlines the way forward across the three sectors: agricultural, forestry and fisheries. A new, more pressing concern running as a theme throughout the document is the issue of climate change, which could derail the current food security strategy. There is also acknowledgment of rising population pressures (the current estimate is that there will be 9 billion people globally in 2050), which will place considerable strain on current food growing practice and supplies if there is not a serious push forward to increase smallholder/small-scale production. The Strategic Plan also includes a full programme on Food Security and Agrarian Reform (Programme 3) which has the following purpose:

It aims to develop and institutionalise the National Policy on Food and Nutrition Security initiative by 2019/20, through:

- Coordination of the implementation of the National Policy on Food and Nutrition Security
- Increasing the number of households benefiting from food and nutrition security initiatives by 200 000
- Establishing and supporting 80 000 smallholder producers
- Cultivating 600 000 ha of underutilised land in communal areas for production

In terms of production by subsistence and smallholder producers, DAFF (2015) states that specific commodities will be targeted in line with the food and market demand within a given geographical area. Over the medium term, the focus will be on household food production and food security through targeted support to subsistence and smallholder producers and/or processors. Optimum production by smallholder farmers/producers will ensure that a third of what they produce is for own consumption, a third for storage, while the last third will be for national and international markets. The

same Strategic Plan also indicates that the DAFF will support agricultural training colleges to become centres of excellence. This AOS and the approach developed could be used directly to support these most recent policy intensions.

The AOS is also relevant to water sector policy, especially those policy aspects relevant to smallholder farmers. Where smallholder farmers do need to access recognised and regulated sources of water (therefore beyond simple rainwater harvesting) the National Water Act (RSA, 1998) requires, in relation to Water Access Rights (WAR), that Government:

- Take pro-active steps to meet the water needs of historically disadvantaged individuals (i.e. 'blacks and women'),
- Ensure participation of the poor and historically disadvantaged individuals,
- Work with other agencies to help build capacity to use water productively,
- Promote the sustainable use of water resources, and
- Promote beneficial and efficient use of water in the public interest.

In the focus on WAR there is also a commitment to provide support to resource poor farmers, mainly through the provision of a range of subsidies for bulk water infrastructure, operational subsidies and rainwater harvesting storage systems. The AOS can be particularly helpful in supporting learning networks that facilitate the development and use of these rainwater harvesting storage systems at local levels. While the promotion of rainwater harvesting for resource-poor farmers and households in the recent National Water Resources Strategy (2): Managing Water for an Equitable and Sustainable Future (DWA, 2013) includes smallholder and resource poor farmers, the very low usage of water entailed by them may end up effectively puts them on the margins of the main thrust of the NWRS-2, which has a macro focus in setting a framework for the management of both the supply and demand sides of water usage and allocation in this country. The AOS can potentially assist with implementation of the NWRS-2 via establishment of learning networks to mediate the water knowledge needed for implementation of water policy.

In 2008, Cabinet approved the National Framework for Sustainable Development (NFSD) (2011-2014) signalled a new wave of thinking aimed at promoting the effective stewardship of South Africa's natural, social and economic resources. It is linked to the 2012 Rio+20 process and the newly proclaimed SDGs mentioned above all of which promote the emergence of green economies for poverty reduction and sustainable development. Under its objective on 'building sustainable communities' the NSSD 1 suggested the need to strengthen community awareness and participation in working together to change behaviour for using resources more sustainably, and also for supporting building self-sufficient farming strategies through using indigenous knowledge and sustainable production approaches. It considered strategies for creating new jobs within a 'green economy' framework and effectively adapt to climate change, as is also proposed in the National Climate Change Response White Paper (RSA, 2011).

The NSSD1 is currently being developed into a revised National Sustainable Development policy that is aligned with the Sustainable Development Goals. NSSD 1 and the emerging revised policies are aligned with the New Growth Path, which adopts a labour-absorbing growth path, as also mentioned in the analysis of the National Planning Commission's National Development Plan (NPC, 2012) and in the agriculture sector policy above. Key to this is the smallholder farmer, and their support within a sustainable development, green economy growth path. For this to be achieved, the NSSD 1 states that, "*The need to ensure that there is capacity to implement sustainable development remains critical across all sectors in South African society, especially in the public sector*" (which would include the agriculture and water public sectors). It specifically suggests that there is a need to "*build capacity to*

enhance the effectiveness of government agencies to empower communities" (under Priority 1 of the NSSD 1).

A new national policy that also has significant implications for sustainable agricultural water use knowledge dissemination and the roll out of the AOS is the *National Climate Change Response White Paper (NCCRWP)* (RSA, 2011). It identifies increases in overall temperature and changes in rainfall patterns, increased frequency of heavy rainfall and extreme weather events, and more intense and longer droughts as key issues that also pertain to South African vulnerability to climate change. All of these have impacts on agriculture and food security, especially amongst smallholder and more vulnerable farming communities. The NCCRWP consequently outlines a number of commitments to mitigation and adaptation, with a stated commitment that adaptation plans will be integrated into major national plans such as the Strategic Plan for South African Agriculture, and the National Water Resources Strategy (amongst others). From the perspective of water, the NCCRWP states that South Africa is a water scarce country with a highly variable climate and it has one of the lowest run-offs in the world – a situation that is likely to be significantly exacerbated by the effects of climate change. Important to the type of knowledge being disseminated via the AOS (namely rainwater harvesting and conservation), based on current estimates, South Africa will exceed the limits of economically viable land-based water resources by 2050. Water availability in South Africa is a key climate-change related vulnerability and negative impacts on the availability of water will be felt by people, ecosystems and the economy, including smallholder farmers. Agriculture is identified as a key adaptation priority in the NCCRWP, and it is said that 'Climate change significantly impacts agriculture and commercial forestry, and they have significant potential for adaptation' (pg. 17) and that 'Climate resilient sectoral plans have the potential to directly address the plight of those most impacted by climate change – the rural poor' … and … "in these sectors climate resilience addresses issues of strategic national importance: food security, water, health and land reform" (pg. 17). It is said further that "Under-resourced, small-scale and subsistence farmers are particularly vulnerable to the impacts of climate change". Significant to the relevance and roll out of the AOS, is that the adaptation priorities defined for agriculture in the NCCRWP include a need to invest in and improve research into water, nutrient and soil conservation technologies and techniques, climate resistant crops and livestock, as well as agricultural production, ownership, and financing models to promote the development of 'climate-smart agriculture' …[3]

As put forward in the AOS (see Volume 2), this points to the need to invest in education and awareness programmes in rural areas and link these to agricultural extension activities to enable both subsistence and commercial producers to understand, respond and adapt to the challenges of climate change. In the light of this, the AOS can be integrated into wider imperatives for 'climate-smart' agriculture, and the activities and knowledge promoted via the AOS can help with addressing climate resilient development. The Long Term Adaptation Scenario (DEA, 2013) recommends integration of climate smart approaches to agriculture in agricultural curricula, and it identifies research on improved education and awareness programmes in rural areas. It notes that links between these and agricultural extension activities is an important focus for future research into climate change

[3] Climate smart agriculture is defined by FAO (2010) as agriculture that contributes to the development of sustainable development goals. It integrates the three dimensions of sustainable development (economic, social and environmental) by jointly addressing food security and climate challenges. It is composed of three main pillars 1) sustainably increasing agricultural productivity and incomes; 2) adapting and building resilience to climate change; 3) reducing and/or removing greenhouse gases emissions, where possible. The CSA approach is designed to identify and operationalize agricultural development within the explicit parameters of climate change (FAO, 2013).

adaptation in the Agriculture sector in South Africa. *The work of developing the AOS as conducted via this WRC project, would appear to address this need directly.*

While these commitments to smallholder farming and improved access to, and more effective water use approaches are evident at policy level across a number of sectoral policies, programme design at farm level and in agricultural education and training systems still persist with centralised, state-driven farming initiatives failing to promote an environment where individual smallholder enterprise is nurtured through strategic interventions that build knowledge-based organisations, reduce farmer risk and increase profitability through better access to value-chains. The work of this project, the WRC materials it is mediating, and the model it provides in the AOS therefore has potential to be part of the proposed re-orientation process in national sustainable development and related sector-based policies.

1.3.3 Agricultural Education and Training (AET) system policy relevance of the AOS

The National Education and Training Strategy for Agricultural and Rural Development in South Africa: (AET Strategy) produced by the Directorate Education and Training, Department of Agriculture (DoA, 2005), is instructive in relation to some of the complexities of agricultural education, training and social learning in the agricultural learning system, which the model promoted via the AOS in this project seeks to address. This strategy, intended to guide both formal and informal education and training in the agricultural sector, identifies a number of pressing challenges[4] faced by the sector:

- ***Fragmentation and lack of co-ordination*** – citing lack of coherence not only between the formal and informal education and training sub-sectors, but also in vertically between the levels in the formal sub-sector. It indicates that the AET system lacks strategic direction to focus development or determine priorities. It also identifies continuing imbalances in funding between the former 'white' organisations and their 'black' counterparts, and the wide variance in quality, standards, outcomes and curricula in the organisations.
- ***Poor and inconsistent quality control*** – in particular in relation to the informal sub-sector.
- ***Ineffective and non-responsive education and training system*** – including inappropriate curricula; Inadequately trained teaching staff; poor linkages between AET and industry; and lack of sufficient post-graduate students, leading to a paucity of research.
- ***Poor access to AET by emerging farmers*** and new entrants into the agriculture sector, which is exacerbated by agriculture's negative career image.
- ***Shortage of critical skills*** – including agricultural production, engineering, economics, development, and of veterinarians.

In terms of the lack of skills for agricultural development the policy states that: *There is an increasing number of new entrants into agriculture. This is however not addressing the needs of the rapidly changing landscape. The skills required cover areas such as agricultural extension, sustainable livelihoods, food security, resource management, agricultural law and policy, land care, and environmental management.* Agricultural extension presents a special case in that it is particularly urgent that all agriculturalists, economists, engineers, and scientists – at all levels – be skilled in taking their speciality into the field, to the farmer. The skill of engaging farmers, producers and small-scale value-adders in technology development is also a singular challenge to the AET system. In this project, the AOS model creates a learning network environment in which knowledge and skills can be

[4] It is interesting to note that while this study was done in 2005, many similar challenges are still being reported in the AET system, as highlighted during the course of this project.

shared across stakeholders in the learning network (including agricultural extension officers) with potential to also support them. It also produces a stronger 'demonstration practice' focus for agricultural education and training that is community engaged, at smallholder farming level, thus providing opportunities for extension trainees to gain experience in this type of extension work.

There has also been a process to develop *National Policy on Extension and Advisory Services to Agriculture, Forestry and Fisheries (the* DRAFT Version 5-29 March 2013, was reviewed, with comments on its presentation to Parliament in March 2015). This draft policy (in draft and as yet unadopted at the time of writing) was developed in recognition of the absolute centrality of a fully functional extension service to the imperative of transforming the agriculture, forestry and fishery sectors. It has been developed for DAFF by the Chief Directorate of National Extension Support in response to a commitment in the department's strategic plan (2012/2013-2016/2017) to prepare and integrated extension policy to support the three sectors.

Box 1: Extension and advisory services as framed in the draft policy

1. **For the purpose of this policy**, extension and advisory services refer to the active collaborative engagement of all stakeholders, actors and role-players involved in the agricultural, forestry and fishery value chains to support wise decision-making about the socially, economically and environmentally sustainable use of resources in the pursuit and advancement of their livelihoods to ensure the optimal contribution of each sector to the economy and the welfare of society.
2. **Active collaborative engagement** includes, among other things, facilitating access to knowledge, information and technologies, fostering learning and practical partnerships, and assisting all parties to develop their technical, organisational and management skills and practices. Participants include primary producers, agri-businesses, processors and research, education, and other relevant organisations.
3. Unlike traditional top-down approaches, the extension and advisory services proposed for agriculture, forestry and fisheries in this policy focus on **the provision of services that respond to users' expressed needs, ambitions and circumstances,** which are linked to **participatory, shared research and learning** through combined efforts of extension and advisory personnel, producers and processors. Those involved in providing extension and advice **play facilitation roles**, helping individuals, groups and organisations to access a wide range of information, advice and services within, and sometimes beyond, these sectors with the express aim of aiding the farmer, fisher or forester and others in the respective sectors to make wise decisions about the resources at their disposal. Rather than promoting simple adoption, a key outcome of any engagement with extension and advisory services is to share knowledge and strengthen individual and collective capacity to work with greater self-reliance and confidence. This enables producers and processors to contribute to, and benefit from the prosperity of South Africa while pursuing their chosen livelihoods.
4. Modern strategy for extension and advisory services is **pluralistic**, recognising that there are roles for the state, the private sector, non-profit organisations and for producers themselves in delivering services. The new approaches thus reflect a **reduced operational role for the state**, which, in addition to providing policy direction appropriately fills certain extension and advisory niches, but leaves other functions which can be better performed by the private sector, by NPOs, through public-private partnerships and, indeed, by producers and producer organisations themselves.
5. In South Africa, there are serious questions about the effectiveness of extension and

advisory services delivered by government and about the coherence of services delivered by the private sector and NPOs. **A new strategy is needed** that reflects current economic, environmental and social realities and aspirations, and assigns appropriate roles to all elements of society engaged in agriculture, forestry and fishing. Global trends in extension and advisory services emphasise the need for new thinking about how best to deliver extension and advisory services. In South Africa this policy represents the first step in that direction.

6. The policy commits South Africa to developing, delivering and maintaining a **pluralistic, harmonised, co-ordinated extension service** for agriculture, forestry and fisheries sectors that operates on a common set of principles and values and which responds to the needs, aspirations, opportunities and other circumstances of the many actors in the respective value chains.

Making the AOS particularly relevant in this context, and in discussing the current approaches to extension (in contrast to traditional 'top-down' approaches), the policy states:

Current approaches

1. *In recent decades,* ***the concept of extension has broadened****. Rather than simple technology transfer from the informed to the 'ignorant', current approaches emphasise the concepts of advice, facilitation, empowerment and learning within a revised understanding of the roles of the state.*
2. ***Facilitation and learning-based extension*** *places the extension worker in a more responsive role as 'knowledge broker' or guide through unfamiliar organisational or technical landscapes to the advice or information that the user needs. She or he may help build systems of mutual learning among groups of interested people, or help identify sources of expertise from the state or private sectors. Building capacity among farmers to learn and to develop and share their own solutions also comes into the mix.*

This policy provides the principles and the framework within which the AOS for WRC materials must ultimately operate. It is interesting to note that the social learning role of extension is more strongly emphasised in this policy, and also the notion of 'knowledge brokering'. It is also encouraging to note that there are no inconsistencies between the approach articulated here and the approaches proposed by the AOS as developed via the piloting processes and activation of the knowledge in the WRC materials via the learning network approach. This is also significant as Agricultural Colleges now also have new mandates for training of agricultural extension services as also indicated below by a debate on the draft Policy in March 2015 in Parliament, outlined below.

Significant to the work done in developing this AOS, in his address to Parliament on the above mentioned policy in March 2015, the Minister of DAFF, Mr Senzeni Zokwana re-iterated the perspective above that the concept of extension has broadened to emphasise a more responsive, engaged social learning role for the extension worker. Additionally, and important for the focus on multi-media platforms in the AOS, Mr Mokutule Kgobokoe, Deputy Director-General, Department of Agriculture, Forestry and Fisheries, in the parliamentary debate on the policy stated that "the policy sought to design user-friendly Information and Communication Technology (ICT) knowledge sharing platforms, such as social networks, to effect mass communication which would ensure free accessibility to research outcomes", and that there was need for giving attention to "how the transformation of the core competencies of extension practitioners" would emerge. He noted that

"…the officers must be the 'reservoir of information' that was needed by producers". He also communicated the Departments' plans to institute a four-year qualification in agriculture before an extension officer could be appointed, and that the Department was supporting agricultural curriculum transformation that would embrace a competence-based model, and a concept of a multi-disciplinary curriculum. He noted too that processes were underway to revitalize agricultural colleges, with colleges in the Eastern Cape, Limpopo and North West provinces receiving attention (https://pmg.org.za/committee-meeting/20459/, 10 March 2015).

Critical comments on the draft agricultural extension policy document indicate that inadequate attention has been paid to *how* the policy suggestions will be implemented to give effect to international trends in favour of farmer focused, demand-led, experiential approaches (Aliber, 2012). The AOS development work, reported here, therefore potentially offers a 'demonstration' of how aspects of the policy could be implemented in a way that builds responsive, social learning capacity amongst agricultural extension and education systems, via engaging across the agricultural learning system in order to be more responsive to farmer needs and interests via experiential approaches. To more fully understand this recommended approach, there is also need for a critical, theoretical understanding of knowledge dissemination and flow within this paradigm, which is discussed next.

1.4 Knowledge dissemination and flow

As the focus of the knowledge dissemination strategy was to establish stronger knowledge flows and research into use for WRC products in ways that are also aligned with policy imperatives (outlined above) there was need to frame the project theoretically within literature on knowledge dissemination and flow.

It is widely appreciated that information on its own does not lead to capability development, and education, training, knowledge dissemination and communication involving a range of knowledge dissemination and mediation processes (Blackmore et al., 2011; Shaxson et al., 2012) are required for information to translate into action. Research outputs and information resources are usefully disseminated through academic papers, popular articles and in some cases targeted workshops, but there is potential for much greater uptake and impact. The challenge of achieving traction from research outputs is a global one; and is related to what is now recognised as inadequate Research-Develop-Disseminate-Adopt (RDDA) assumptions of how knowledge is / ought to be mediated in society (Robottom, 1987).

Contemporary theories of learning and change indicate that for knowledge or information to become meaningful, there is 1) a need for the information to be related to the situation and experience of the user; and that this needs to 2) be mediated in context; in addition to 3) providing new knowledge or information that can expand existing knowledge and/or practice. These are increasingly referred to as knowledge co-production processes, and can be described through use of social learning theory (Blackmore et al., 2011; Shaxson et al., 2012). Social learning theory and knowledge co-production processes are being rapidly developed in adaptive natural resource management contexts; and in participatory agricultural development (Lotz-Sisitka, 2011; Mukute, 2010; Masara, 2010). Social learning is interested not only in the cognitive gains that accrue from learning, but the actual social and practical changes that result from the learning; and also how such change can be facilitated through experiential and change oriented learning interactions, and knowledge exchange.

Aligned to these understandings of learning and change, is a growing body of knowledge on the issue of knowledge dissemination, as scientific organisations around the world begin to confront problems of dissemination and uptake. The UK DFID for example, launched a 'Knowledge-in-use' programme

(2006-12), and there is also a burgeoning practitioner literature on information intermediation, knowledge translation and knowledge brokerage (Blackmore et al., 2011; Shaxson et al., 2012) as well as a burgeoning academic literature on transdisciplinary practice (Regeer & Bunders, 2009; Colvin et al., 2011) which seeks to mediate knowledge in practice through knowledge co-production processes involving researchers and practitioners working together on knowledge and practice problems or innovations. Shaxson et al. (2012), define these in a continuum which has been adapted here to provide a foundation for testing out diverse strategies for knowledge dissemination in this research programme (see also Figure 1 below):

1. *Information intermediary* – helps people to access information from one or more sources (e.g. community radio; local resource centres)
2. *Knowledge translator* – helps people make sense of and apply information (e.g. agricultural colleges)
3. *Knowledge mediator* – works with others to use knowledge in decision making processes and in knowledge co-production processes (i.e. in participatory practices) (e.g. extension officers, NGO fieldworkers)
4. *Knowledge innovator* – works with existing knowledge in contexts of practice to facilitate new knowledge production and social innovation (e.g. action researchers / communities of practice)

The continuum outlined above (1-4) shows a shift in focus from linear dissemination from knowledge producer to knowledge user at 1; to co-production of knowledge, social learning and social innovation at 4. At 1, the primary function is informational, while at 2/3 the function shifts to become more relational, and at 4 the function shifts to become more systemic (Shaxson et al., 2012). This framework, complemented by recontextualisation theory that explains *how* the knowledge dissemination actually takes place (Bernstein, 1990) provided a potentially useful way of examining knowledge dissemination strategies using the WRC materials in different contexts of practice and use. The examples of recontextualising agents (e.g. agricultural colleges, media, extension services, action researchers) linked to the four types of knowledge dissemination listed above, shows that there are different mediation agents involved in knowledge dissemination along this continuum, and if a comprehensive knowledge dissemination strategy was to be developed, use of the WRC materials should be tested and extended in these different contexts with the agents concerned.

The project design was initially therefore based on a conceptual framework for knowledge dissemination adapted from Shaxson et al. (2012) model, which proposes a ‘continuum’ of knowledge dissemination approaches, contexts and relations (see Figure 2) within a systems approach to knowledge dissemination. This framework was used to define research contexts, and the same framework is used to provide critical comment on the knowledge dissemination approaches and processes that were tested out for the AOS using the WRC materials.

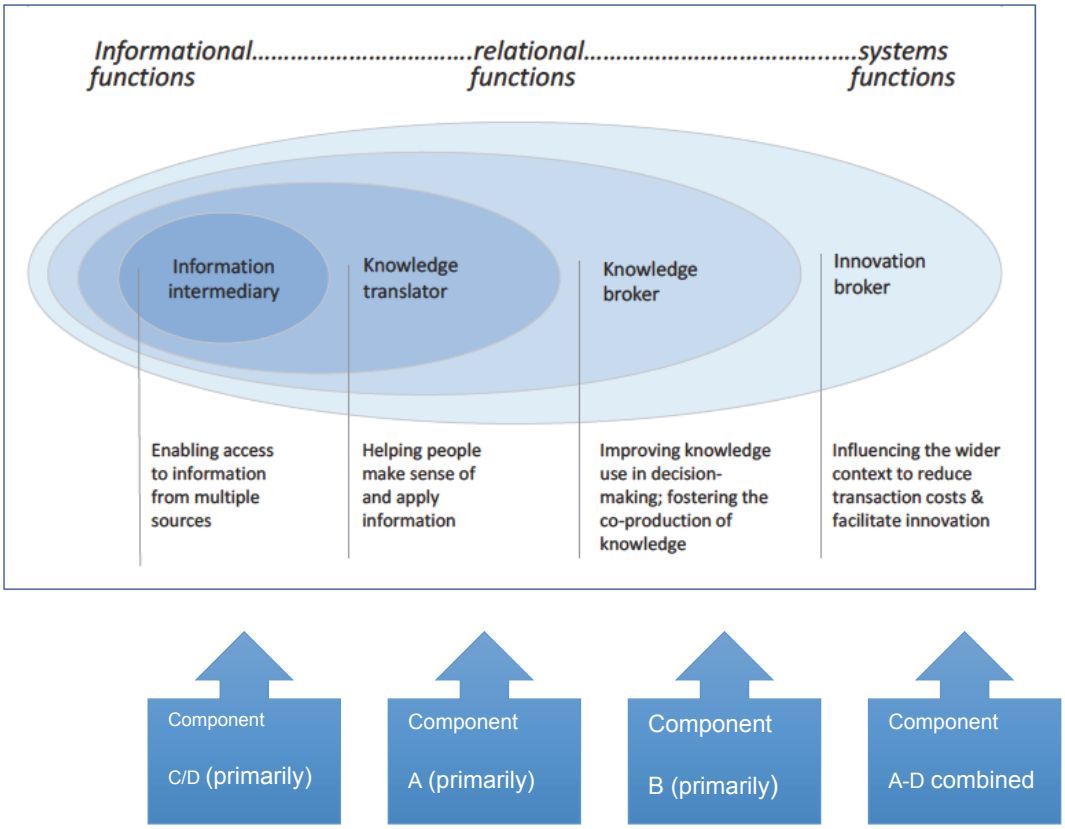


Figure 2: Knowledge dissemination continuum (with associated project component foci, from Shaxson et al., 2012)

- **Component A:** Identification of, and individual engagement with learning organisations where the primary form of knowledge dissemination can be typically identified as 'knowledge translator' (Shaxson et al., 2012). In the context of this knowledge dissemination strategy the primary focus here was on Agricultural Colleges with possible inclusion of other formal agriculture training providers (universities and/or private training providers).
- **Component B:** Identification of and engagement with government departments, extension services and field-based change agents / fieldwork staff in key organisations (NGOs) identified as being critical to knowledge dissemination in relation to the agricultural water use practices promoted in the WRC materials, and the primary target group. In the Shaxson et al. (2012) framework, the typical form of knowledge dissemination in this context would be knowledge mediators and/or social innovators (however, other forms of knowledge mediation may also predominate).
- **Component C:** Design and testing of media enhanced approaches that can strengthen use and application of WRC materials relevant to the agricultural water use practices promoted in the WRC materials, and to understand how these extend the knowledge dissemination possibilities in Component A and B. Initially the proposal was to produce an expanded knowledge resource in the form of a DVD, but further analysis is of materials-in-use and contemporary trends associated with media expansion led to use of a website (www.amanziforfood.co.za) combined with posters, a short messaging system (SMS) application named WhatsApp, with you tube video materials to maximise the potential of Web2.0 for knowledge dissemination.

- **Component D:** Design and piloting of a methodology and approach to develop mass media programmes – primarily use of community radio – that directly targets farmers and food growers using the knowledge content in the WRC materials that also complemented other knowledge dissemination strategies.

While the project focussed in on these four components, the model provides for a systems-based analysis of knowledge dissemination and use that transcends earlier technology transfer views of knowledge dissemination (see figure 3). Such views assumed a linear approach of knowledge transfer – from research production, to research 'adoption'. This Research, Develop, Disseminate and Adopt (RDDA) model has long since been critiqued for not taking full account of the complexity of societal relations and the structural, cultural and historical conditions that shape and influence knowledge production and dissemination (Robottom, 1991; Lotz, 1995).

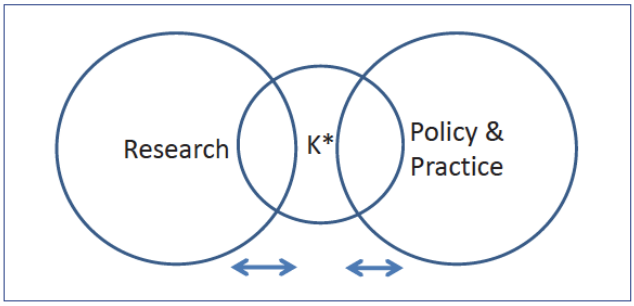


Figure 3: Earlier technology transfer views of knowledge dissemination and use (Shaxson et al., 2012)

A systems view, differently to the RDDA model, sees knowledge 'flow' as being at the intersection or 'nexus' of different lifeworlds. It sees these in 'constant flow' and interaction, and recognises that knowledge flows are influenced by structural, organisational, individual and system challenges in a range of different contexts. For example, for WRC research knowledge to be used in Agricultural Colleges, there is a need to analyse and understand the structural, individual, organisational and system challenges faced by Agricultural College managers, lecturers and curriculum developers in order to develop strategies that will enhance knowledge flow or uptake and use of new knowledge in this context. There is also need to consider how the Agricultural Colleges are linked to other stakeholders in the agricultural learning system for the knowledge dissemination to not be narrowly conceptualised.

Shaxson et al. (2012) refer to K* where the * indicates the variety of knowledge dissemination processes that may take place in any given context (see Figure 2). Such knowledge dissemination processes take place at the nexus of policy, practice, and science and in the case of the WRC project, agricultural training organisations, farmers, farmers associations, local government support services and media practitioners (which make up the full agricultural learning system). Understanding K*; or diverse forms of knowledge dissemination and flow from this perspective, gives a more holistic view of knowledge dissemination than the traditional model as outlined in Figure 3. Figure 4 provides such a systems view of knowledge dissemination and use.

Figure 4: A systems view of knowledge dissemination (adapted from Shaxson et al., 2012)

From the above, **K* [knowledge dissemination and use approaches]** in the context of this research project *refers to a collective term for the set of functions and processes at the various interfaces between science, policy, practice and training organisations that improve the sharing of knowledge and its application, uptake and value in the pursuit of progress towards productive water use for food crop production amongst smallholder farmers and food growers in South Africa (definition adapted from Shaxson et al., 2012).*

This systems approach to knowledge dissemination was further extended by learning network theory. Cousin and Deepwell (2005) indicate that a *learning network* is a group of people who have come together to learn about certain topics that are of interest to all members; and that these networked groups are potential platforms for learning to occur (Weaver, 2016). Members of these learning networks bring their own experiences and competences from their diverse backgrounds, creating opportunities for collaborative learning and engaged practice (Wenger et al., 2011). According to Lieberman (2000), educational networks are often constituted as flexible partnerships that develop around common interests, much like in communities of practice (CoP). However, Brown and Duguid (2002, in Weaver, 2016: 31) suggested that "the term network is used when the relations among network members are significantly looser than the relations among those in a CoP". Wenger et al. (2011) have also noted "… that people in social networks use connections and relationships as a resource to solve problems, share knowledge and to meet more people" (Weaver, 2016: 31).

Weaver (2016) discusses a case study in the Eastern Cape (Hobeni) which showed that through facilitating and building effective networks, agricultural resources and information can be disseminated effectively (Fay, 2010). It was stated that partners in these networks share a great deal of knowledge even though they may not interact much. Weaver (2016: 31) suggests that "for a learning network to be successful, the participants need to be flexible, responsive and continually learning from one another. Furthermore, it is important for the partners to strike a balance between inside (experiential and internal knowledge) and outside (external research knowledge) knowledge to form successful collaborations (Lieberman, 2000)".

Weaver (2016: 32) argues further that "A network can be a very effective learning resource when the network is designed in a way that learner differences, such as their diverse competencies, are accepted and utilised (Cousin & Deepwell, 2005) and individuals act as nodes and encourage information flows in the broader network (Wenger et al., 2011)". Knowledge dissemination cannot,

however, take place without attention being given to the type of knowledge that is to be dissemination, intended users of the knowledge, and mediation or facilitation approaches that might be used.

1.5 WRC Materials and their Use

1.5.1 A focus in on the two sets of WRC materials

As indicated above, to develop the AOS, the project worked with two sets of WRC materials (see Figure 1), namely:

- *'Development of a comprehensive learning package for education on the application of water harvesting and conservation'* (WRC report no's TT 492/11; TT 493/11; TT 494/11; TT 495/11; TT 496/11) [referred to as **WH&C materials** (Denison et al., 2011)]; and
- *'Agricultural Water Use for Homestead Gardening Systems – Resource Material for Facilitators and Food Gardeners'* (WRC Report No. TT 431/09) [referred to as **AWUHGS materials** (Stimie et al., 2010)]

These materials are extensive in content and scope, and to focus the AOS development work, there was a need to conduct and in-depth review of the materials in order to identify the knowledge that was at the core of materials, thus addressing the issue of *what* the knowledge dissemination process would focus on. Three dimensions of these materials were reviewed:

1. How the materials were developed, with emphasis on **intended audiences and uses** for the materials and the different dissemination pathways that were chosen, and their appropriateness for future use within an AOS aimed at further activating their use.
2. The **facilitation approaches** being promoted by the materials and their appropriateness for the contexts in which they are intended to be used and the relevance of these approaches within the policy context outlined above in section 1.2.
3. The content of the materials, with specific reference to the technical **agricultural water use practices** they promote and the underpinning knowledge required for these, and whether or not this is provided by the materials.

The practices analysis (focussing in on the core content of the materials) was then linked back to appropriate education and facilitation approaches, and to kinds of work (or field)-based experiences required to complete the learning. This analysis was undertaken to provide 'key lessons' from the history of the materials which could inform the further activation of the materials via the AOS process.

1.5.2 Intended target audiences and initial experiences of development and use of the materials

These two sets of comprehensive materials essentially cover much the same ground; the harvesting and use of rainwater resources for food production. However the audiences and beneficiaries for whom they are intended are different in that the first project, henceforth identified as 'Water Harvesting and Conservation' (WHC)[5], is intended to benefit small-scale and emerging commercial cropland (mostly vegetable) farmers, while the second, identified as 'Agricultural Water Use in Homestead Gardening Systems' (AWUHGS) is very much focussed on homestead, subsistence level vegetable production. It also covers all other aspects of homestead food gardening, so the rainwater harvesting component is only one of a number of different components, whereas the WHC materials

[5] These identifications are based on the titles of the respective materials, to ensure consistency

are focussed almost exclusively on rainwater harvesting, but also looks at soils and water and provides background into the value of water, and water harvesting and conservation.

The WHC materials were developed for use principally within the formal education and training system, in particular by Agricultural Colleges (in the FET band) in their training of agricultural extension officers and others with professional involvement in the agricultural sector, and by training providers accredited by the AgriSETA. The colleges were consulted on drafts of the materials and have some familiarity with them. There is also some potential with these materials for them to be taken up at a higher level by Higher Education Institutions (essentially the universities with agricultural faculties and programmes) and integrated into diploma and degree courses. These materials were developed in such a way that they can be formally registered, with the Technical Manual developed in the form of an occupationally directed short-course, and the accompanying Facilitation Manual is linked to two existing Level 5 Unit Standards. Both manuals have the potential to carry 15 credits on the National Qualifications Framework.

The AWUHGS materials on the other hand have been developed principally for use in the informal training sector by non-governmental organisations (NGOs) and community-based organisations (CBOs) in their work in supporting subsistence farmers. However, the agricultural colleges, through their representatives at the Association of Principals of Agricultural Colleges (APAC), have apparently expressed interest in the materials, as have the Departments of Agriculture and of Water Affairs. UNISA and the University of KwaZulu-Natal were closely involved in the development process, and a professor from Tshwane University of Technology was part of the research team. The materials themselves are neither aligned to any Unit Standards, nor developed as an occupationally directed programme. They therefore cannot, without considerable revision, seek to be used as is for courseware aligned to unit standards accredited by the AgriSETA, and they do not require accredited training providers for their facilitation. They do not carry any credits within the National Qualifications Framework (NQF).

The two sets of materials were developed under quite different paradigms. A high-level technical and facilitation team, drawing on existing information from a list of primary references, developed the WHC materials. This could be characterised as ‘Consultative Development’. The consultations at this stage were concerned mostly with the accreditation process, although there were some discussions regarding the necessary content. The principal issues concerning accreditation revolved around the existence or absence of appropriate Unit Standards as required by South African Qualifications Authority (SAQA) under the then existing course registration requirements, and the shift towards occupationally-directed short courses within the organising framework of the Quality Council for Trades and Occupations (QCTO). The materials developers found considerable uncertainty in the ‘accreditation’ (actually registration) process, which was then and is still in a state of flux. The AgriSETA advised that there was no point in trying to establish new Unit Standards, as they were being discontinued in favour of the OCSC approach. However, the latter approach could itself not be followed without registration by the QCTO of a clearly defined ‘occupation’ developed by a Community of Expert Practice (CEP). At one stage this process seemed to have been underway, but it is yet to be realised. On completion, the draft materials were sent around the agricultural colleges for comment on usefulness and potential uptake. According to the project report, the purpose of the consultations was *‘...to provide additional guidance on* accreditation of the learning package and publishing and marketing of the final learning package. The aim of the interaction was to ensure maximum relevance and uptake of the WHC content by existing learning organisations.’ At the time, the content was perceived to be relevant to teaching needs in the colleges, with five colleges showing substantive interest in the materials: Elsenburg, Cedara, Fort Cox, Grootfontein and Lowveld. There

did not appear to be concerns about accreditation at the colleges, as colleges as have the freedom to effect a 30% alteration to their curricula without recourse to any formal re-registration process. However, and significant to the way in which this AOS was developed, was the finding at the time a critical weakness related to *curriculum development competence in colleges* was identified. The report states that: *'The interviews with colleges showed that none have the capacity to address curriculum formulation issues with any rigour.'* It goes on to illustrate the colleges' lack of capacity in this respect. This process also identified that *WHC was a very new concept to almost all the college lecturers and a 'Training of Trainers (TOT) course* would be required. The materials were then piloted over 6 months at the UKZN Centre for Adult Education, with 13 out of 14 initial participants graduating with Certificates in Development Education.

A broad-based high-level technical and facilitation team, through what they describe as a 'Participatory Development' process, developed the AWUHGS materials. This drew widely on existing materials, and also the knowledge and expertise of practitioners, through quite wide consultation and in-field observations. The materials were then subjected to extensive field-testing and refinement. They were piloted through two full courses at Bergville and Phuthaditjaba, and refined considerably as a result of these experiences.

There are several different ways the materials developers suggest that their materials can be used. The WHC materials can either be used in their entirety as a 30 credit occupationally-directed short-course / skills development programme (under the new QCTO framework), administered either by an agricultural college or other accredited service provider. (However, in order for this to be registered it must be linked to a recognised 'specialisation', which has to date not been identified.) The colleges can also select from the materials to include different elements within their existing courses, or use the materials as supporting resources for their courses. No specific registration is required for this provided the inclusion of the materials does not constitute a more than 30% change in the curricula within the Higher Education and Training band (level 5 / 6). Using the materials at levels 1-4 would require more careful integration into structured curricula. The associated 3-day facilitators training course does not include any needs analysis element, but does include sessions where 'animators' select particular activities (linked to specific practices), and 'academics *… study relevant parts of the manuals for input during coaching and mentorship sessions'* (to select relevant underpinning knowledge).

The AWUGHS materials are less structurally defined by the accreditation framework. The materials developers suggest that the AWUHGS materials should be considered a '...standardised process within which particular bits of content can be fed, rather than a course consisting of designed content per se.' However, there is a considerable amount of content, suggesting that the idea is that there should be selection of appropriate content for any given situation. These materials can therefore also be used either in their entirety (for a very long engagement of up to 9 months), or selected elements can be used according to the needs in any context. Although there is reference in the materials to conducting a training needs analysis, the associated 3-day community facilitator training course does not include such a component, and neither does it include any component dealing with selection of appropriate elements for any given context and needs. In particular, the need to select both appropriate practices for dissemination, and the relevant underpinning knowledge required to support these practices.

Selection of appropriate materials is a particular skill, and in particular the selection of the underpinning knowledge needed to understand the reasons for and value of any practice. Each set of materials includes a considerable amount of background information and underpinning knowledge (in

particular the very extensive AWUHGS materials contain a wealth of quite disparate kinds of information), and it is the selection of this that could perhaps be challenging to users.

From the above, it is possible to see that the two sets of WRC materials being examined here each therefore currently represent quite distinct knowledge flows and knowledge dissemination pathways, with their concomitant differences in pedagogic, facilitation and mediation approaches. These distinctions are not absolute and there is considerable overlap between the materials and the associated pedagogies. Although the materials cover very much the same ground and have quite similar orientations to the practices of rainwater harvesting and use in agriculture, there are considerable differences in the way the ideas are presented, the language used, and the nuances of and between different practices and regarding the underpinning knowledge. Working with both sets of materials along the same pathway, with the same organisations, could therefore have the potential to create considerable confusion, and a strong *navigation tool* to assist with making sense of the contents of the two sets of materials would seem to be needed.

Given these differences, one of the critical decisions that needed to be made early on in the AOS development process was whether to:

- Activate and support use of the materials via two separate pathways with the WHC materials being used for the formal sector and the AWUHGS materials being used in the informal sector, **OR**, to
- Activate and support use of the materials via an integrated pathway (where both sets of materials could be used by different audiences) using a strong navigation tool or framework to access the content of the materials across the two sets of materials, based on their interest and need.

1.5.3 Facilitation and mediation approaches supported by the two sets of materials

Another key distinction between the ways in which the two sets of materials were developed lies in the manner in which guidance for the facilitation of the information has been dealt with.

The WHC materials comprise two distinct elements or Manuals; Technical and Facilitation, each carrying 15 NQF credits. This suggests that the material developers felt that it was perhaps necessary to support facilitators of the technical information, principally college lecturers and training providers, to develop understandings of and skills in appropriate pedagogies, perhaps different to the educational approaches they usually employed. A 2009 review of Agricultural Colleges' curricula and teaching methods indicated that the preferred approach was very much 'chalk and talk', corresponding strongly with the 'knowledge translation' type of knowledge dissemination as identified by Shaxson et al. (2012) – *see Figure 2, and section 1.3 above*. The 'Facilitation and Assessment Guide' for the WHC Technical Manual appears to favour a more 'knowledge translation and mediation' (Shaxson et al., 2012) approach, while the focus on a 'Participatory Technology and Innovation Development '(PTID) approach in the Facilitation Manual, suggests a strong 'Knowledge innovation' (Shaxson et al., 2012) approach. This suggests recognition of the different learning contexts, with the trainees being trained in taking a more participatory and innovatory approach with the farmers they train than is appropriate for the main course through which they are being trained.

Chapter 2 of the AWUHGS materials similarly provides guidance on the facilitation and mediation processes. These, together with the farmer experimentation and innovation approach adopted throughout also indicate a preference for a more 'knowledge innovation' (Shaxson *et al.,* 2012) approach as outlined in the Shaxson et al. (2012) framework.

Each set of materials includes a 3-day training programme for facilitators. The WHC materials provide details of their 'Introductory Course for Facilitators', but with no indication of whether it has been piloted. The course has a strong facilitation focus, and combines developing trainees understanding of the technical content, with the ways in which this can be facilitated.

The AWUHGS materials also provide details of an associated 'Community Facilitators' Course'. This has more focus on the technical content, with only three short sessions dedicated to aspects of facilitation. This training was piloted once. While the trainee facilitators apparently enjoyed the course and engaged well, follow-up visits indicated little apparent follow-through in their work with communities. The research team concluded that more 'hand-holding' was needed for some considerable time after training. This suggests strongly that you cannot create a facilitator in three days, especially in three short sessions. As these training courses are presented by the materials developers as vital elements in any dissemination strategy, there was also need to analyse their potential.

Different approaches to facilitation may be appropriate in different contexts. In formal contexts, such as the agricultural colleges, the tendency is generally towards a 'knowledge translation' (Shaxson et al., 2012) approach, which is mitigated to some extent through the practical elements of much of the training. Requiring college lecturers to adopt a 'knowledge innovation' (Shaxson et al., 2012) approach such as PTID for facilitation of the WHC materials is clearly well intentioned, but may not be entirely appropriate in such contexts. It will certainly push many lecturers out of their comfort zones; which is not entirely a bad thing, but does carry some risk. A more pragmatic approach, requiring a rather less radical shift in orientation may be more appropriate, at least to start with, as lecturers become more accustomed to changes in pedagogical approaches and practices. The WHC materials do suggest, as discussed above, that this may well be the approach adopted.

The knowledge innovation approach promoted by the AWUHGS materials is perhaps more appropriate to the NGO/CBO context, and the desire to encourage farmers to become experimenters in their own right is again well-intentioned. However, it can be inappropriate in some situations, where the farmers are really looking for someone to give them answers to their problems. In other words, it is not possible to assume that they will respond better to this approach than to a more 'mediation' approach or even 'translation' approach.

While it is neither possible nor advisable to be entirely prescriptive in suggesting which dissemination approaches are appropriate in different contexts and/or with different kinds of information the following outline in Table 1 below may provide some indication in relation to the three main approaches discussed in this document, used to inform the development of the AOS processes.

Table 1: Dissemination approaches related to context

Approach	Context/Audience	Kinds of information
Knowledge translation – backed by practical demonstration and activity	Formal context (colleges) with Agricultural professionals Informal context with small-scale farmers and with homestead food-growers	Underpinning science-based knowledge
Knowledge mediation – backed by practical demonstration and activity	Formal context (colleges) with Agricultural professionals Informal context with small-scale farmers (experienced and inexperienced) and with homestead	Underpinning science-based and indigenous knowledge

Approach	Context/Audience	Kinds of information
Knowledge mediation – backed by practical demonstration, site visits and activity	food-growers (experienced and inexperienced) Formal context (colleges) with Agricultural professionals Informal context with small-scale farmers (experienced and inexperienced) and with homestead food-growers (experienced and inexperienced)	Technical practices
Knowledge innovation – backed by practical demonstration site visits and experimentation activity	Informal context with experienced (*functioning) small-scale farmers and homestead food-growers	Technical practices

The suggestion here is that it is more realistic to expect experimentation and innovation by those farmers and gardeners who have real experience and are already producing crops, than by those with little experience who are struggling to set themselves up and produce crops. The latter group is likely to be more in need of quite directed guidance and advice. *This insight was important for decision making around use of practical demonstrations for learning in the AOS process.*

In all situations it should be recognised that a knowledge innovation approach requires very specific high-level skills on the part of facilitators; the kinds of skills that are not easily developed through a facilitators training course, and which require considerable experience. It should also be recognised that a mix of different approaches, from translation, to mediation and innovation may be more appropriate; the balance of the mix depending on the context, the audience, the skills of the facilitators, and the nature of the information and practices that are being shared.

It should be noted that training facilitators in both formal and informal contexts perhaps rarely if ever analyse their pedagogic approach in this way, and tend to teach or train in the way in which they feel most comfortable, irrespective of the audience. Some intervention is therefore almost certainly required to enable them to broaden both their understanding and their practice, which indicates the need to include a focus on learning and mediation processes in the AOS process.

There is no 'one-size-fits-all' approach, and while the tendency with both sets of materials towards a knowledge innovation approach is generally welcome, it should not be assumed to be the panacea in all situations. In particular, each approach, each pedagogy requires a different range of skills, with mediation and innovation approaches requiring quite sophisticated facilitation capabilities. Attempting any facilitation approach without the possession of the appropriate skills and orientations is problematic. For example, a poorly facilitated innovation approach is likely to be far less effective than a well-facilitated translation approach. Given the pending Agricultural Extension Policy emphasis on a wider range of learning approaches in extension, this insight from the materials analysis was particularly important for the AOS development.

Given the above, it was important in the AOS development process to establish the knowledge flow trajectory that was proposed by the writers of the materials, and how this differs or is the same to that used in contexts of practice (in colleges and NGO training settings). This appeared to be a key potential 'transformative site' for the knowledge flow process. This analysis also allowed the AOS development team to recognise that if the process is different from the current standard approach (or

dominant approach used in a particular institutional or social context) the transition will take more time. In relation to the policy analysis outlined in section 1.2 above, it was clear that it would be important to engage users of the materials in a wider range of knowledge dissemination and mediation approaches, as also argued from a theoretical perspective in section 1.3 above via the Shaxson et al. (2012) model.

1.5.3 Deciding on 'critical starting points' for the AOS development: selecting a content focus from the materials

Both sets of materials include information about considerably more than rain water harvesting and use for vegetable production. The WHC materials include four 'introductory' chapters, including on 'Water in the World', 'Systems', and 'Water in the Landscape'. There is also a chapter on 'Soils'. The final two chapters, 5 (WHC Planning) and 6 (WHC Methods), deal specifically with water harvesting and conservation. The AWUHGS materials cover every aspect of homestead vegetable production with one chapter (5) focussing on 'Garden and Homestead Water Management for Food Gardens', with chapter six looking at 'Soil Fertility Management: Optimising the Productivity of Soil and Water'. Due to this broad scope, to start the AOS process, there was need to focus on a starting point for more in-depth engagement with the knowledge dissemination process.

Given that the strongest area of overlap in the two materials was on rainwater harvesting and use (see Table 2 below), for the AOS process this project chose to focus in on rainwater harvesting and use. This is not to ignore the rest of the content of the materials, or to deny a social-ecological systems framework or the need to focus on the entire food production pathway, it was rather to focus in on the AOS *process within a 'critical starting point' perspective*, which could then be broadened to include all of the content in the materials over time. This choice was both for pragmatic reasons, namely that exploring the knowledge dissemination implications of all aspects of both materials would be almost impossible. The selection of some of the material for the knowledge dissemination process was also to respond more directly to the focus of this project which was to develop an AOS in connection with knowledge dissemination and training for: '...*water use in homestead gardening and rainwater harvesting for cropland food production.'* The intention is that appropriate dissemination processes developed and piloted for the rainwater harvesting and use aspects of either set of materials can then be applied to all other aspects of that material, and to other material produced by the WRC and other stakeholders.

Table 2: Summary comparison of WHC and AWUHGS materials

Aspect	**Water Harvesting and Conservation**	**Agricultural Water Use in Homestead Garden Systems**
Ultimate beneficiaries	Small-scale and emerging commercial farmers engaged in cropland (vegetable) production	Homestead level subsistence farmers/gardeners
Principal users (facilitators of the materials)	Agricultural College lecturers, accredited training providers	Non-governmental organisations (NGOs) and community-based organisations (CBOs)
Uses of the materials	Either in their entirety or selection of different components	Either in their entirety or selection of different components according to context and need

Aspect	Water Harvesting and Conservation	Agricultural Water Use in Homestead Garden Systems
Educational sector	Formal – FET, particularly agricultural colleges, possibly HET	Informal currently. Potential for integration into agricultural college curricula, and adoption by DoA (AET Strategy) and DWA (for IWRM training), also Tshwane University of Technology (TUT) short courses
Educational Level	New NQF Level 5/6	No level specified
Development and piloting	High-level technical and facilitation team, Consultative Development, drawing on existing sources. One pilot, no indication of refinements as a result of this	Broad-based high level technical and facilitation team, Participatory Process, drawing on existing sources, practitioner expertise, consultations and observations. Two pilot, extensive refinements as a result
Content	Very water focussed, with one chapter on soils, and two on WHC (Planning and Methods)	Very broad – all aspects of small-scale vegetable production. One chapter on Garden and Homestead Water Management, a second on Soil and Water
Facilitation guidance	Complete Manual (half the entire materials) – linked to 2 Unit Standards, 15 credits	One chapter (2)
Facilitation training	3-day Facilitators Course. Not piloted? Balance between technical content and facilitation skills Lacking materials and knowledge selection component	3-day Community Facilitators Course. Emphasis on technical content, far less on facilitation. Piloted with short-term positive outcomes – less so in the long term Lacking materials and knowledge selection component
Facilitation orientation	Knowledge mediation to knowledge innovation	Knowledge mediation to knowledge innovation

1.5.4 Analysis of content and practice knowledge

As discussed above, a decision was taken to identify and select specific aspects of the materials as 'critical starting points' for the development of the AOS. The primary initial content selection for the AOS process was therefore **rainwater harvesting practices**, as described in the two resources, with the secondary selection being of **knowledge content relevant to these practices**, as provided by the resources. While it could be argued with considerable justification (probably more so with the WHC materials) that everything in both resources has relevance for or is connected to rainwater harvesting and use and food production (in the *AWUHGS* materials), only elements with clear and direct connections were selected. For example, the underpinning knowledge required to support the construction of swales, does include understanding of water flow, and contours or levels, but does not

necessarily include knowing about the United Nations Summit of 2000, although this has interest and value as background knowledge. The distinction made, therefore, is between underpinning 'essential' knowledge, and useful background knowledge. **The aim was to create coherent clusters of information and associated facilitation activities that can be tracked and evaluated through the different dissemination pathways**. In addition, the selection process, in particular the linking of relevant underpinning knowledge to the selected practices was intended to contribute to the development of a navigation tool / framework to guide similar selection processes undertaken by users of both sets of materials.

The two sets of materials were then analysed under the following four criteria:

- The key technical **practices** required for rainwater harvesting and use as described in the materials (both the WHC technical materials and AWUHGS materials);
- The underpinning **knowledge** required for these practices, as identified in the materials
- The **educational (facilitation) methods** for dissemination or sharing the knowledge of these practices, as described in the materials; and
- The kinds of relevant **field-based or work-based experience** required for embedding of these practices and the underpinning knowledge, identified both in the materials, and proposed.

These can be analysed in relation to actual curriculum contexts and qualifications in use in various Colleges, but this would require further qualifications analysis work, which was found to be outside of the boundaries of this project (see recommendations for further research in Section 4).

Table 3 below provides an analysis of the selected aspects of the WHC materials and Table 4 below provides an analysis of the selected aspects of the AWUHGS materials.

Table 3: Analysis of Water Harvesting and Conservation Materials (Technical Manual, Chapters 6 and 7)

Technical Practice Handout (H), Text (T)	**Underpinning Knowledge Required (R) and Provided (P)**	**Educational/Facilitation Method and Approach**	**Field or Work-based Experience Required**
Planning the site (T)	Understanding concepts of topography (aspect and slope), effects of wind, soil types, water availability, security, access (P)	Translation and mediation of underpinning knowledge	Site assessment and report Assessment of potential for water harvesting, and by which methods, reporting on this
Constructing a 'Line level'[6] (T + H)	Understanding the concepts of 'level' or 'horizontal' (R), topography and slope (P) Understanding of the way in which water moves (always downwards) (R), basic measurements (P)	Practical demonstration and construction activity Farmers Hand-out (H) linked directly to text	Constructing a line-level
Constructing and calibrating an 'A-frame' (T + H)	Understanding the concepts of 'level' (R) or 'horizontal', topography and slope (P) Understanding of the way in which water moves (always downwards) (R), basic measurements (P)	Practical demonstration and construction activity Farmers Hand-out (H) linked directly to text	Constructing an A-frame
Using an A-frame or a line-level to measure slope (T + H)	Understanding of slope, degrees, percentages, basic measurements and calculations (P)	Translation and mediation of underpinning knowledge; practical demonstration and activity Farmers Hand-outs (H) linked directly to text	Using an A-frame or line-level to measure a slope, recording the measurements and calculations
Using an A-frame or a line-level to mark contours (H)	Understanding of elevation and contours (P)	Translation and mediation of underpinning knowledge, practical demonstration and activity Farmers Hand-outs linked directly to text	Using an A-frame or line-level to mark contours
Thirteen Water Harvesting and Conservation Methods: 1. Diversion Furrows (H) 2. Trench Beds (H)	Wide range of different knowledge and understanding depending on the method: Water scarcity, need for conservation (P); water requirements (household , gardens	Translation and mediation of underpinning knowledge; practical demonstrations and activities; field visits and visits to existing WHC systems	Application of methods appropriate to context, including construction of associated structures

[6] Interesting to note that in the Technical Manual the construction of the A-frame and the Line level come after their use.

3. Mulching(H) 4. Stone Bunds (H) 5. Tied Ridges (H) 6. Swales (H) 7. Terraces (H) 8. Fertility Pits (H) 9. Greywater Harvesting (H) 10. Roofwater Harvesting 11. Ploegvore 12. Dome Water Harvesting 13. Saaidamme [Alternative names are provided for most of these, also information on whether they are suitable for gardens, fields or croplands]	and crops) (P); soil types (H); soil erosion, structures, soil and water (P); water flow (R); appropriateness of methods for different soils, slopes, rainfall amounts, scales (P), resource and skills availability (R); basic and more complex construction (P); fertility, organic matter (H), compost; water movement, evaporation, transpiration; run-off, run-in (infiltration), overflow (P); basic and more complex calculations (P)	Farmers Hand-outs (H) for most practices. Seemingly selected for the practices most likely to be useful? Linked directly to text Underpinning knowledge mostly in earlier chapters, not linked directly to practices, but fairly accessible. Some calculations (water requirements, roofwater harvesting) unnecessarily complex (principle to catch and store as much water as possible in every situation?)	

Table 4: Analysis of Agricultural Water Use in Homestead Gardening Systems Materials (Chapter 5)			
Technical Practice Handout (H), Text (T), Case Study in text (CS)	**Underpinning Knowledge Required (R) and Provided (P)**	**Educational/Facilitation Method and Approach Case Study (CS)**	**Field or Work-based Experience Required**
Making and using an A-frame to mark out contours (H)	Understanding the concepts of 'level' (R) or 'horizontal', topography and contour (P) Understanding of the way in which water moves (always downwards) (R), basic measurements (R)	Translation and mediation of underpinning knowledge? Only in Hand-out? No link to text No indication of how this is facilitated	Constructing and using an A-frame
Making and using a line-level to mark out contours (T)	Understanding the concepts of 'level' (R) or 'horizontal', topography and contour (P) Understanding of the way in which water moves (always downwards) (R), basic	Translation and mediation of underpinning knowledge? Only in text, to be copied (no hand-out) Some facilitation notes, but for general run-on learning	Constructing and using a line-level

	measurements (R)		
Capturing water, a variety of means identified, mostly in relation to a Case Study (CS): • Check Dams (no detail) – CS • Vegetation – planted on contours (no detail) – CS • Terraces (no detail) – CS • Berm-n-basins (no detail) – CS These are in effect the same as 'Bunds' and 'Swales', below. • Infiltration basins (limited information) – CS . • Fruition pits (limited information) – CS • Hand-dug Wells (CS) • Catching and slowing water – garden layout (T + H) • Bunds/Earthbanks (detail in CS and H) • Swales (detail in CS and H) • Tied Ridges (H) • Roofwater	Wide range of different knowledge and understanding depending on the method: Water scarcity, need for conservation (P); water requirements (household , gardens and crops) (P); soil types (H); soil erosion, structures, soil and water (P); water flow (R); appropriateness of methods for different soils, slopes, rainfall amounts, scales (R), resource and skills availability (R – but addressed to some extent in Hand-out); basic and more complex construction (P); fertility, organic matter (H), compost (P); water movement, evaporation, transpiration; run-off, run-in (infiltration), overflow (P); basic and more complex calculations (P)	Translation and mediation of underpinning knowledge? Some in text (CS), some in Hand-out (H) No indication of how this is facilitated, although visits to demonstration areas and some practical activities. The Hand-outs contain the clearest guidance for most practices, but there is not a strong, obvious link to the text in the chapter Much of the underpinning knowledge is scattered throughout the materials, not necessarily easy to link with the practices. There is also a considerable amount of useful underpinning knowledge that does not lead to any clear practices (i.e. planting vegetation on contours).	Constructing water capturing systems appropriate to the context
Channelling Water to where it is needed: • Runoff Furrows (mention in H) • Trenches (and trench beds) (CS) (H) • Run-on ditches (CS) •	As above	Translation and mediation of underpinning knowledge? Some in text (CS), some in Hand-out (H) Facilitation notes for run-off learning Links between hand-out and text not always clear	Constructing water channelling systems appropriate to the context
Storing Water: • Roof tanks (T + H) • Dams (T + H)	As above Estimation of water requirement Simple and complex construction (R	Translation and mediation of underpinning knowledge? Some in text (CS and elsewhere), some in Handout (H) Activities (estimating needs)	Constructing and/or installing appropriate water storage systems

• Underground tanks (H)	some P) Maintenance (P)	Some calculations (water requirements) unnecessarily complex (principle to catch and store as much water as possible in every situation?) The Handouts contain the clearest guidance for most practices, but there is not a strong, obvious link to the text in the chapter Much of the underpinning knowledge is scattered throughout the materials, not necessarily easy to link with the practices. There is also a considerable amount of useful underpinning knowledge that does not lead in any obvious way to any clear practices	
Homestead Irrigation: • Mechanical pumps (H) • Drip Irrigation and Kits (H) • Buried pipes (H) • Spaghetti lines (H) • Sponge lines and string lines (H)	As above Resource availability (R some P) Simple construction (some P) Water distribution (P)	Translation and mediation of underpinning knowledge? Some in text in different places, some in Handouts (H) Activities (estimating needs) Some calculations (water requirements) unnecessarily complex (principle to catch and store as much water as possible in every situation?) The Handouts contain the clearest guidance for most practices, but there is not a strong, obvious link to the text in the chapter Much of the underpinning knowledge is scattered throughout the materials, not necessarily easy to link with the practices. There is also a considerable amount of useful underpinning knowledge that does not lead in any obvious way to any clear practices	Constructing and/or installing appropriate irrigation systems
Bed Design: • Keyhole bed (H) • Trench beds (details in Chapter 6 + H)	As above Simple construction (R some P)	Translation and mediation of underpinning knowledge? Some in text in different places, in different chapters (2 and 6) some in Handouts (H) for both chapter 5 (keyhole) and chapter 6 (trench) The Handouts contain the clearest guidance for most practices, but there is not a strong, obvious link to the text in the chapter Much of the underpinning knowledge is scattered	Constructing appropriate vegetable beds

		throughout the materials, not necessarily easy to link with the practices. There is also a considerable amount of useful underpinning knowledge that does not lead in any obvious way to any clear practices	

1.5.5 Summary of the main features of the two WRC materials

WHC Materials: These are generally very clear and coherent, arranged logically and with the information, both the practices and underpinning knowledge, easily accessible. The focus of the materials is very obvious and consistent throughout. The links between these (practices and knowledge) could be more explicit, but this should be possible through sensitive and effective facilitation. However, it requires facilitators to have a deep knowledge of these practices.

The Farmer Handouts are essentially taken from the main text and are entirely consistent with this, thus adding to the sense of coherence of the whole.

The Facilitation Manual, not analysed in detail here, is focussed strongly on techniques and approaches for facilitation of participatory learning processes, in particular PTID. After three chapters devoted to facilitation skills of various kinds the Manual makes the links to engaging people in activities related to WHC in the following three chapters. This establishes a good connection between the two strands of the training. Details of a number of PTID tools are only introduced in the final chapter (7), although they are identified as being important to use in the previous three chapters.

These materials (both Manuals) appeared to be relatively easy to access and facilitate, and provided a strong foundation for WHC training in the formal, and potentially the informal context.

AWUHGS Materials: These are clearly designed to cover all aspects of sustainable homestead food gardening, and are therefore far broader in scope than the WHC materials. Chapter 5 covers most of the aspects relevant to rainwater harvesting and use, although some aspects are found in Chapter 6, on soils, and in the facilitation chapter (2).

There is an absolute wealth of information gleaned from a wide variety of sources, with some in the main text, some in case studies, and some in the handouts. While there appears to be a broad logic in the arrangements of the chapters, and in the overarching concepts and approaches, there seems considerably less in the arrangement of the information within the chapters, both on practices and the underpinning knowledge. It is not so easy to make clear connections between the different kinds of information, perhaps because there is simply too much to sift through. There are many practices referred to in case studies, but then not taken further. Selection of appropriate practices and relevant underpinning knowledge in these materials may prove a challenge for facilitators in the field, and strong support for learning how to select appropriate content in relation to context and need would seem to be required.

The Handouts sometimes contain the same information as in the text, but often provide additional and different information. Thus, for the AOS process, those key practices described in these Handouts were selected, as it is this information with which the homestead food-growers will be left.

As can be seen from the above, the in-depth analysis of the two sets of materials offered useful insight for developing an AOS process. Additional insights were also gained from related WRC materials and projects, which formed part of the scoping of WRC materials to inform the AOS development process, reported on below.

1.5.6 Analysis of additional, related materials to inform the AOS

The following materials were reviewed as ‘additional’ materials with potential to complement the AWHGS and WH&C materials that form the main focus of this project. Full detail of this analysis is contained in this project. Only key insights relevant to the AOS are summarised here.

Printed Materials: On-farm Application of Infield Rainwater Harvesting on Small Plots in the Central Region of South Africa' (IRWH) (Botha et al., 2007)

This project (WRC report by Botha et al., 2007), was essentially the culmination of a long-term research programme, conducted by the ARC-ICSW in collaboration with Glen College of Agriculture in the Free State, between 2001 and 2007. The project involved implementation of ***one specific rainwater harvesting practice*** by a large number of farmers in the Thaba Nchu and Botshabelo areas. At its peak, 1033 households, in 42 communities were implementing the practice, making it one of the most extensive projects of its kind ever in South Africa. It had initially been intended to work with only 6 communities in these areas, but after an initial 2 years the demand was so great that the project duration and coverage was extended. The implementation phase followed several years of field research which revealed that the practice concerned could increase crop (particularly maize) yields by up to 50% in the conditions provided in the study areas. During the initial implementation phase (2005-2006) a wide range of pamphlets, posters and other materials were developed and used, but the *Extension Manual*, assessed below, was only developed during the extension of the project. Perhaps the most important feature of the Manual, and indeed of the project, is that it focussed on one specific practice. This is known as 'In-field Rainwater Harvesting' (IRWH), and is graphically represented in both the Manual and the Report as:

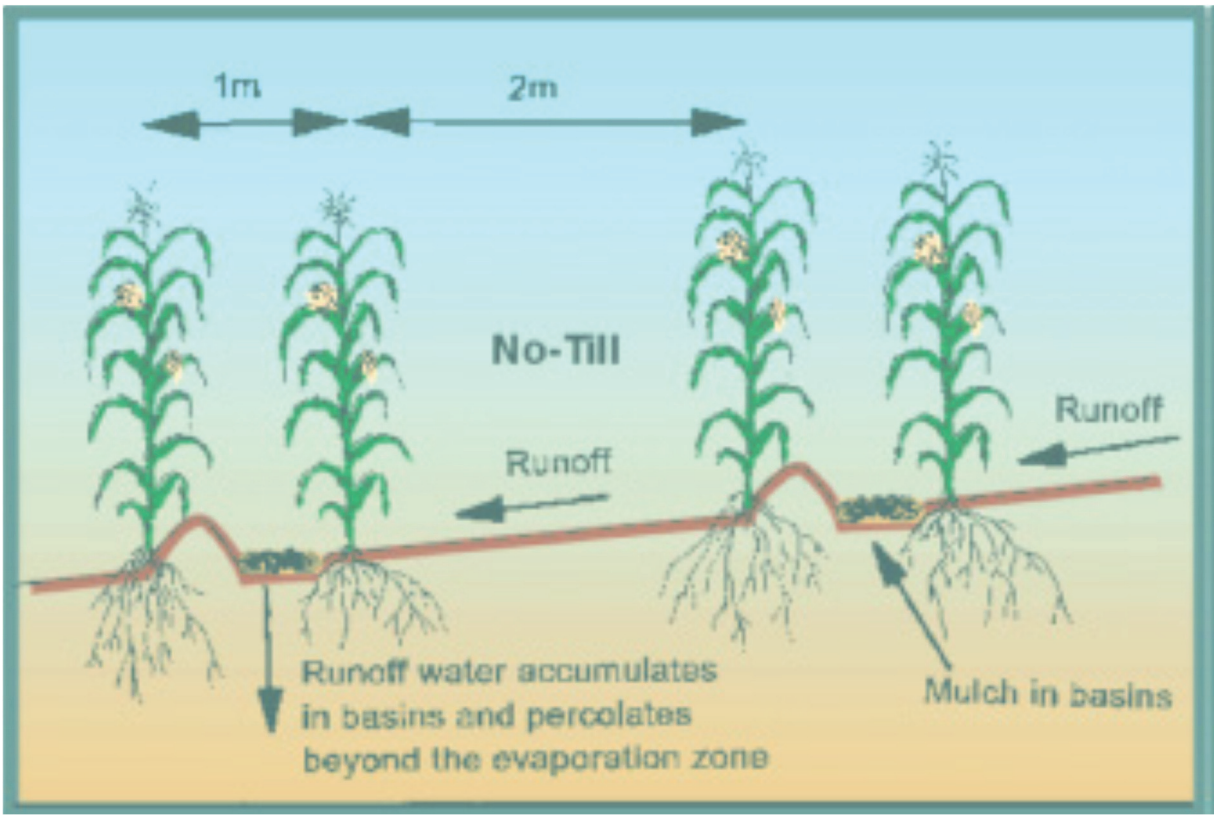


Figure 5: Graphic Representation of IRWH (Source: Botha et al., 2007)

This is essentially a fairly simple, and easily replicable technique requiring no specialist equipment or materials. It can be applied at a range of scales of food production practice, but perhaps not at the largest scale represented in the RWH&C materials. The critical factors for success are the soil type and the degree of

slope. Focussing on one technique has the advantage of removing any challenges associated with making choices from a number of different techniques, according to context and need. However, it is not applicable in all contexts, in fact in probably only a minority of geographical/ecotope contexts. In terms of the Extension Manual, it certainly reduces the amount and complexity of the information that needs to be shared.

Significant to informing the AOS process was the insight gained into the range of communication methods used to disseminate IRWH technology were a combination of individual, group and mass approaches'.

- **Mass approaches** used to disseminate IRWH information were local radio stations, television stations, video, brochures, pamphlets, leaflets, training manuals, newsletters, scientific publications, songs and posters.
- **Group approaches** used consisted of on-station and on-farm demonstration plots, on-farm trials, focus group discussions, seminars and conferences, workshops, short courses, farmers' and information days, training sessions, computer programs, 3D models, focus group discussions, support by ARC-ISCW technical assistants (TAs) and festivals.
- **The individual methods** included activities like visits (office or farm), letters, telephone calls and informal contacts. These various communication channels were used at different stages of the technology exchange process. By using various communication channels in most cases at least one of them conveyed the correct messages to an individual or group. It was observed during the project that at certain stages in the technology exchange process certain communication channels played a specific role. During the initiation phase, video, pictures and posters played an important role to introduce the IRWH technique for the first time. These visual pictures or evidence made the farmers curious and presented hope to them. Thereafter the 3D model was a very good communication channel to explain and demonstrate the differences between conventional tillage (CON) and IRWH. This communication channel explained the principles of the IRWH technique.
- **Demonstration plots**, when used correctly, presented the opportunity to involve the farmers from the beginning (application and implementation) all the way through to the end of the growing season (harvesting) and the fallow period. At the demonstration plots, activities like the application of the IRWH technique, planting of various crops, fertilization, weeding, insect and pest control, harvesting and maintenance were demonstrated. The farmers were encouraged to participate in these actions in order to master the various arts. This presented the opportunity for the farmers to be involved as if they were demonstrating the technique. It helped with ownership of the technique.
- **Focus group discussions** and support from the ARC-Institute of Soil, Climate and Water (ISCW) Technical Assistants played a very important role to mobilize the individual farmers and communities, address problems as they appear, motivate and encourage the farmers.
- **Festivals** were the tools that created excitement; they motivated and encouraged the farmers. Festivals contributed towards the explosion of the use of the IRWH technique in the target area. This is one of the best communication channels to motivate and encourage people and contributed towards keeping the momentum. It also presented a fantastic platform to communicate with each other and to convey the intended messages. Festivals also presented the perfect opportunity for the farmers to be recognized for their efforts, hard work and dedication.

The report of Botha et al. (2007) goes into considerable depth in terms of the authors' analysis of the effectiveness of the various communication methods used. The most successful method was undoubtedly the festivals at which farmers learned from others how to correct their mistakes in implementation of the practice and gain new knowledge on the practice and on food production and improving their economic situation. The second most effective method was visits to demonstration plots, together with support from the technicians, followed by viewing the IRWH video in third place. The 3D model was also a powerful communication tool,

especially in helping to explain the way in which the practice worked. It was clear that different communication methods were most effective at different stages in the process.

While the IRWH project was focussed on one practice, appropriate in only certain areas, it provided some very useful pointers in terms of the development of an AOS for the wider dissemination of rainwater harvesting and conservation techniques:

- The use of a wide variety of communication methods and channels is necessary in any context,
- Different methods and approaches are appropriate for different audiences (although this did not come out strongly in the report), and for different stages in the dissemination (learning) process,
- The department of agriculture, at all levels, is crucial to any strategy, especially in relation to the sustainability of implementation of RWH&C practices,
- It is vital to avoid reliance on committed individuals in any context, and practices need to be institutionalised; whether within colleges, extension services, or communities, and
- There are a large number of social and other factors outside the control of any project or strategy that can undermine its sustainability.

- **Printed Materials:** Revitalisation of Smallholder Rainfed and Irrigated Agriculture(Botha & De Lange, 2005; Botha, 2009)

Three reports: *A Guide for Farmer Trainers and Facilitators* (WRC Report No. TT 254/1/05; TT 254/2/05 by Botha & De Lange, 2005), and *Application of the Guide for Farmer Trainers and Facilitators* (WRC Report No. KV 221/09 by Botha, 2009), were examined in relation to the original project from which they emanated, namely, *Implementing and Testing the WRC Guidelines on Developing Sustainable Smallscale Farmer Irrigation in Poor Rural Communities.* The first document is concerned with the development of a training package to support the training of smallholder farmers in appropriate irrigation techniques, including rainwater harvesting, particularly by the colleges, and the second document is a report on how this training package was introduced to all agricultural colleges across South Africa. The two documents therefore provide considerable insight into the opportunities and challenges associated with the introduction of new material and information into college curricula. It is important to note here that the initiative for this project came from the Limpopo Department of Agriculture (LDA) who in 2005 launched a major programme for the Revitalisation of Smallholder Irrigation Schemes (RESIS). The project was therefore located within the policy and strategies of the department, and in fact driven by the department to some extent. The report claims that this approach, originally applied in the training of some 7000 resource-poor farmers in Limpopo province over 5 years lead to an improvement in production from an average of 3.5 bags of maize per 1.2 hectare holding, to an average of 40 bags per holding. The main outcomes were the Facilitators Guide and the capacity building of the trainers. The training courses and modules were also being institutionalised in the two colleges. A considerable amount of effort and resources, building on both the WRC's own training materials and the Johann Adendorff approach (Botha & De Lange, 2005), was put into the development of capacity within both agricultural colleges. In terms of the materials themselves, the trainers were especially keen on the fact that they were pitched at the Adult Basic Education and Training (ABET) training levels which were most appropriate for the farmers, and commented that there was little material available at this level, and also that they themselves had little experience in developing materials at this level. In addition to the presentations made at each and every agricultural college, the project made a special presentation at a meeting of the Association of Principals of Agricultural Colleges (APAC), which again was warmly received. In summarising the 'Insights gained and lessons learnt' the report includes:

- All finalised learning material packages should be “marketed” and disseminated among the Colleges/end users in a similar hands-on, interactive manner as was done during the course of this consultancy;
- All learning material must also be made available electronically in PDF-format; (for this purpose, it might be a consideration to introduce a “Learning Material Library” on the WRC website from where all learning material developed by the WRC can be accessed and downloaded);
- As far as possible, all learning material development project teams must also include as many as possible representatives (ideally farmer trainers) from the Colleges as project team members.
- The College Principals requested that some kind of information sharing system (e-forum) be formed by which the Colleges can be informed on the progress of these and possible future projects of the WRC;
- It was suggested by the APAC-meeting that the status quo should be maintained with regards to the new learning material developed within the WRC projects – that is in terms of Unit Standard alignment of such learning material.

The long-running series of projects represented in these reports represents a tremendous amount of work and resources applied to the issue of developing suitable training materials and processes for developing the capacity of both farmer trainers and farmers to understand and implement rainfed irrigation practices. The central involvement of the Limpopo Department of Agriculture in initiating the second phase of the process would seem to imply that this was considered of paramount importance, and indeed the final phase of the process was to take the concept nationwide. During this third phase the colleges appeared to have been brought completely on board, to the extent that they were calling for copies of the forthcoming WH&C and AWHGS materials before they were completed even in draft form. However, in the period between 2009 (the end of this process), and 2013 (the commencement of this project), it is hard to see any movement towards either integration of any of the materials into college curricula, or any widespread farmer training in RWH&C practices. The big question that confronted us for the AOS, based on this review was*: If almost everything seems to have been tried, what is there left to do, that might have a different outcome?* The challenge for the AOS process therefore appeared to be development of an approach that combines the best aspects of all previous projects in the area of RWH&C with an approach that supports all stakeholder colleges, extension services (through the departments of agriculture), and ultimately the farmers themselves to take full ownership of the learning and implementation processes.

- **Research Project on RWH materials and facilitation of water knowledge use:** ‘Investigating Water Knowledge Flow to Communities’ (Burt & Berold, 2012; Burt et al., 2014)

This review was of a research programme which tried to address the problem of knowledge flows surrounding water knowledge to communities entitled ‘Investigating Water Knowledge Flow to Communities’ (WRC Report No. KV 288/11, Burt & Berold, 2012). The project was initiated by the WRC initially as a consultancy, to improve understanding of how knowledge, in this case about water, is best shared with communities, and why, despite the plethora of information and materials available, this has not translated into better understanding or practice, at least not on a large scale. The first consultancy report was then followed by a more in-depth research project entitled ‘*The role of knowledge in a democratic society: Investigations into mediation and change-oriented learning in water management practices*’ (WRC Report No. 2074/1/13) implemented by the Rhodes University Environmental Learning Research Centre (Burt et al., 2014)

The consultancy research project report summarises the outcomes of research conducted in the project under three main ‘learning points’:

- ***Learning point 1 – basing resources on practice*:** Almost everyone interviewed felt that the way knowledge was currently being disseminated, particularly by government, was not done in a way that encouraged individuals to question their practice or consider how to adapt it. All agreed that presenting 'factual' packaged information was not enough. Learning resources work more effectively when they engaged learners with water issues as they experienced them, in their local context (Burt & Berold, 2012).
- ***Learning point 2 – disseminating resources and making them accessible:*** A common complaint from those interviewed was there was no shortage of water research knowledge in South Africa, but that this knowledge is not presented in a way that is understandable to non-specialists (Burt & Berold, 2012).
- ***Learning point 3*** – ***the mediation of knowledge****:* The water communicators agreed that even when a target audience was literate, a learning resource was not very useful unless mediated by a local organisation or individual. A skilled mediator will re-interpret knowledge in a way that is relevant to a particular water practice and to those involved. Even a 'bad' resource can be used successfully if facilitated by a good mediator (Gauteng focus group, Burt & Berold, 2012).

The issue of ***mediation*** was one of the main themes emerging from the consultancy. In addition to these three learning points, the report discusses in some detail the development of both knowledge itself, and of materials/media through which to share knowledge. In both cases, *the over-riding lesson is that of co-creation*, where *both knowledge and the media are developed collaboratively with researchers, 'mediators' (trainers and facilitators), and users working together*. In particular, it is important that *both knowledge and the media are congruent with and have relevance to existing practice* (Burt & Berold, 2012; Burt et al., 2014). This represents something of a shift from the conventional approach of development of knowledge and production of material by experts for dissemination amongst users, often through the medium of facilitators. In the conclusion to the report the authors state that:

> *We have to go beyond the notion of 'knowledge transfer'* ***to a deeper understanding of the way people learn****.* ***All knowledge is linked to practice,*** *and the challenge for water communicators is how to mediate knowledge in a way that allows for dialogue and questioning, linked to people's understanding and practice. At the same time, in order to have influence, people also need to learn the language of 'authoritative' knowledge so that they can negotiate with people and organisations that directly influence their lives. The research also highlights the importance of the role of a mediator and the skills that mediators need to be able to both provide relevant information and, more importantly to mediate learning and action within a broader social movement* (Burt et al., 2014).

For the AOS, this pointed to taking account of how people learn, mediation and co-construction of meaning. This focus was then taken into the extended research programme on mediation of water knowledge, which focused in some depth on the process of developing a RWH water tank 'question driven resource' and the issues raised about water knowledge mediation (i.e. the focus was on mediating one RWH practice) following a three phased process:

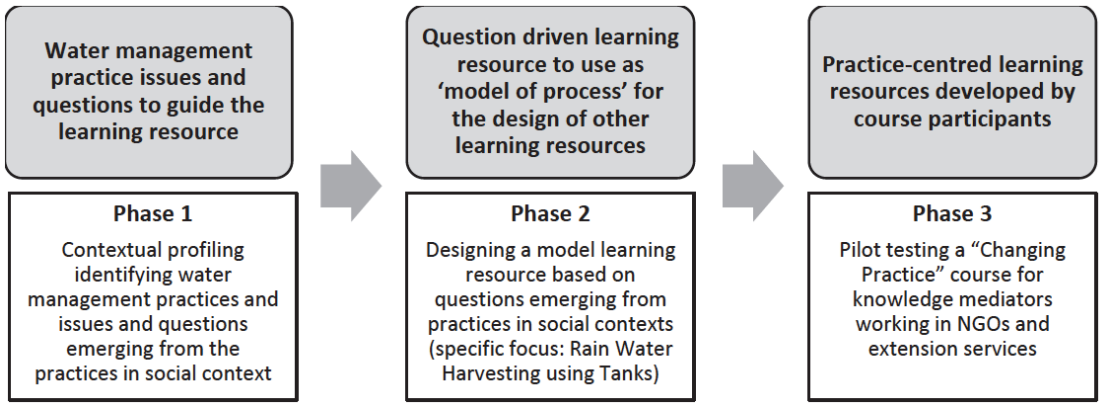


Figure 6: Three phase knowledge mediation process around RWH tanks in rural communities (Burt et al., 2014)

This project offered the following insights for the AOS development process:

1) The project adopted an approach to knowledge dissemination that emerges from people's existing experiences in practice and the issues that they are experiencing (i.e. it does not take the knowledge available to disseminate as its starting point; but rather practices and experiences of practice as starting point).
2) The project was based on a practice-centred approach to learning, and draws on 'best available' learning theory that recognises that for meaning making, there is a need to link existing experience, culture and knowledge to new knowledge via a mediation process. Knowledge is not only contained in learning resources, but also in local knowledge networks, and these need to be 'brought together' in processes of changing practice. Knowledge can also not be separated from the *processes of empowerment*, from language and cultures of practice.
3) Mediation of knowledge is a skilled process that needs to be supported (in this case via a course that built the capacity of the facilitators and mediators to link people's experiential knowledge and practice with new knowledge available in both knowledge resources and knowledge networks) and to develop the skills to select and adapt and develop associated materials to help with the mediation process.

The researchers summarised the value of the research as follows:

> *A key outcome of all three phases of the research is* ***a transformational model of learning that adopts a situated, practice-centred approach to the mediation of knowledge.*** *This model overcomes some of the weaknesses and assumptions of transfer model approaches to learning and extension where new knowledge is simply 'transferred' with little regard for contextual meaning making and uptake / use of knowledge. … The research shows that knowledge mediation requires that careful attention be given to a range of contextual factors that are social-ecological or socio-material, historical-educational, linguistic and cultural. The research also shows that it is possible to strengthen support for NGOs and extension service agents that have a responsibility for the mediation of water knowledge at community level in ways that ensure that the learning processes contribute to meaning making in social contexts of practice; thus contributing to changes in practice.* (Burt et al., 2014).

- **Websites and other media**

Websites: An initial search for relevant websites proved quite frustrating as simply using 'rainwater harvesting' as the search phrase yielded almost nothing. However, the team was kindly helped by Marna de Lange who provided a number of website links. The first lesson is clearly that for any 'outsider' to the field, accessing

relevant sites is not straightforward, and should websites be used, there must be other means of accessing them, or strategies to direct people to the websites.

Box 2: Websites analysed

- http://us6.campaign-archive2.com/?u=76443dd8c4881218d77e1bda5&id=a70a74a33f&e=0c4920d3de – This leads to a site called Rainwater for Food Security, hosted by the RAIN Foundation. It partners with another site, the Water Channel: http://www.thewaterchannel.tv/media-gallery which includes the three videos developed by Erna Kruger and Rural Integrated Engineering on their rainwater harvesting projects in Potshini and Phuthaditjhaba (see, videos, below). The fact that these are South African cases is very important in terms of their training and motivational potential as it is often difficult for many people to take lessons from contexts very, or even slightly different from their own. This links to the point above about 'making connections' to people's existing experiences and practice in the learning process.
- http://drwh.enterpriseworks.org/Library – This link leads to the EnterpriseWorks/VITA rainwater harvesting community, which contains a number of international case studies on rainwater harvesting in downloadable pdf format. Unfortunately, there are no South African case studies on this site, which possibly (but not necessarily) limits its usefulness in terms of training and motivation in this country (see above); depending how these are mediated.
- http://www.harvestingrainwater.com – This is a site establishes by a rainwater harvesting expert, Brad Lancaster, in Tucson, Arizona, USA. It offers a number of videos on rainwater harvesting and other free materials (including songs), while promoting the sale of Mr Lancaster's books on the subject. Unfortunately, although the principles underlying the materials are entirely relevant to the South African context, the US setting may reduce their value in this country (again, depending on how they are used and supported in the learning process).
- http://www.rural-water-supply.net – This Rural Water Supply Network (RWSN) site is slightly confusing, but does indicate that this network operates, among other places, in Sub-Saharan Africa (although not South Africa), and has a focus on supporting rural communities in accessing water, although the emphasis is clearly on groundwater, with the digging/drilling of wells a key activity. The RSWN is supported and partnered by a number of international NGOs and United Nations Agencies, and is hosted by the SKAT Foundation from Switzerland. While visitors to the site are invited to join the network, it is perhaps not appropriate for those interested in rainwater harvesting.

Other websites visited in the search for information and materials on rainwater harvesting included:

- www.mvula.co.za – This is the website for the Mvula Trust, a developmental NGO with a focus on the provision of water and sanitation in rural areas, with a strong emphasis on empowerment of rural communities. One of its main focus areas is rainwater harvesting and livelihoods, an area in which it runs several projects. The site provides access to several resources related to rainwater harvesting, in particular: Water for Food: The War on Hunger (although this document would not download); Resilience and Vulnerability: Rainwater Harvesting as an Adaptation Strategy; Civil Society form a Rainwater Harvesting Network; Supporting Household Food Production through Rainwater Harvesting. There is also a considerable number of policy documents. Mvula have apparently also developed some 'dissemination' materials, although these were not available on the website. This site at present appears to be perhaps the most immediately relevant and accessible site in terms of information on rainwater harvesting, although the information is fairly limited. ***The Rainwater Harvesting Network offers some potential for dissemination of WRC***

materials.

- http://www.wrc.org.za – The WRC website, where all the reports from the various projects associated with rainwater harvesting research are housed. Clearly there is a wide range of materials available, however it does require some experience of the site to be able to navigate the site in order to access the required documents, and there is no option for accessing the videos produced by many of the projects, except by asking for CD-ROMs to be sent by mail. Indeed, there is often no reference at all to any videos associated with the project reports and written materials.
- www.arc.agric.za – The Agricultural Research Council (ARC) website. The institute of most relevance to this project is the Institute for Soil Climate and Water (ISCW), which conducted the IRWH project. It could be expected that the website, which includes a large number of research publications, fact sheets and advice leaflets on a wide range of farming issues, would include some publications on rainwater harvesting. However, this is not the case and there is currently no information available on the ARC website on RWH&C.
- www.sabi.co.za – this is the website of the South African Irrigation Institute (Suid Afrikaanse Besproeiingsinstituut – SABI). It has a magazine, produced 6 times a year, for which a subscription is required, and a free online 'NewsJet', produced every 4 months. Both publications are aimed very much at SABI members, rather than the general public. Examination of the NewsJets for 2013 and March 2014 revealed no reference to rainwater harvesting as an irrigation technique, with the focus very much on high technology irrigation systems.

Video materials: Although almost every WRC project which developed training materials included DVDs or CD-ROMS in these materials, the only two that were accessed were those associated most closely with the WH&C materials and the AWHGS materials:

- ***Indigenous Water Harvesting and Conservation Practices: Historical Context, Cases and Implications (Jonathan Denison and Luvuyo Wotshela)*** – This DVD covers a number of different rainwater harvesting practices, which are appropriate at different scales. From this perspective it is extremely useful as it shows that rainwater harvesting is not only for resource-poor farmers operating at a small or subsistence scale, but also relevant to larger scale, commercial operations. It also, as does the report on which the DVD is based, place RWH&C in a historical context, showing that such practices have been part of farming forever. The local appropriateness of specific techniques in different geographical (or, more accurately, 'ecotope') contexts (such as Saaidamme in the Northern Cape and Gelesha in the Eastern Cape) is also described.
- ***Rainwater Harvesting and Food Security*** – This series of three videos was developed out of the AWHGS project by Erna Kruger and Rural Integrated Engineering. Part 1 provides some background to the importance of rainwater harvesting, and the approach taken by the project in terms of provision of rainwater tanks (contributed by Jojo Tanks), for collection of water both from roofs and from surface run-off for eventual use on food gardens. Other practices such as the use of trench beds to capture and hold surface water are also examined. So the focus is on a few relatively simple practices in a particular rural context. Parts 2 and 3 show the experiences of farmers in two rural communities in implementing this practice. The videos are clearly relevant for training and motivation in many similar situations around the country.

➢ **Posters:** Umthathi Training Programme Posters

While these posters are not focussed specifically on rainwater harvesting (but rather on food gardening, nutrition, home-based care and financial management) they do provide a model for a simple, graphic resource

that can capture the key elements of any training process in a direct and accessible manner. They have the additional advantage of being of great value to both trainers and facilitators and the trainees in providing a constant reminder of what is being learned and the sequence of the learning. This ensures that every aspect of the learning is covered, and provides opportunities to revisit any aspects that are not immediately grasped, or require further discussion.

The posters are designed to reflect the learning process through a series of photographic images representing each stage, with a central image capturing the key message of and focus for the learning. They use simple and accessible text to highlight the main points at each stage of the learning, and this text can be translated easily into whatever language is required in the context. The Umthathi posters are produced in English on one side and isiXhosa on the other (see Figure 8 below).

When used by the Umthathi facilitators, large format (A1) durable, encapsulated versions of the posters are displayed prominently throughout the training, with smaller (A4) versions given to the trainee groups as a long-term resource. Feedback from both facilitators and trainees indicates that the posters are considered the most accessible and useful of all the materials employed in the training. Trainees often use their versions to train others in their communities. Of significance for the AOS development process, is that the posters were carefully designed and developed through a *consultative process* with the trainers / mediators which helped to facilitate ownership and use of the posters in the field. Another important feature of the posters is their 'portability' and non-reliance on high-tech media for use in the field. They provide a useful format for community engagement 'in the field' and may be helpful to extension officers, NGOs and others who are to share water-use knowledge in the field.

Figure 7: Umthathi Posters (English and isiXhosa)

From these analyses further useful insights were gained for the AOS development process:

- Access to appropriate information on the Web, in particular information set in the South African context is currently very limited. Even sites such as the Mvula Trust site with a strong rainwater harvesting focus, offer relatively little information that may have direct use value in the field, or by trainers and facilitators. There is also the question of who might wish to or be able to access the web for information. The main issue in terms of the AOS is that currently accessing information on the internet relating to rainwater harvesting in South Africa is a fairly difficult process, and *the AOS should therefore include an approach to improve access*.
- In almost all the project reports it has been claimed that videos are powerful learning tools, and almost every project has developed their own videos. Once again, however, access to these is quite limited. This suggests that there are very useful materials sitting on shelves, and not reaching those who would benefit most from viewing them. The AOS must include guidance on how such materials should be made more accessible – perhaps t*hrough a dedicated video library on the WRC or other website, or through a series of 'You Tube' Video's specifically targeted at this purpose*, and also through a mechanism by which CD-ROMs can be distributed at little or no cost to the farmer trainers and facilitators and the farmers who need them (e.g. the You Tube route).
- Posters, if carefully designed to include accessibility features such as local vernacular language and process maps, can be developed through a *consultative process* with the trainers / mediators, and that this can helped to facilitate ownership and use of the posters in the field. Another important feature of the posters reviewed, is their 'portability' and non-reliance on high-tech media for use in the field. They potentially therefore provide a useful format for community engagement 'in the field' and may be helpful to extension officers, NGOs and others who are to share water-use knowledge in the field.

1.5.7 Conclusion

As can be seen from the above, a detailed assessment of the two sets of WRC materials and a range of other materials and research insights into the materials and their use was undertaken, providing useful insights for the AOS development process. The way in which these were actualised in further development of AOS development process is reported on in Chapter 3.

In the process of analysing different the WRC materials and associated materials, it became clear that irrespective of the quality of the materials and the relevance of the information, and the mediation processes which were highlighted in the discussion above, a further critical factor in terms of their dissemination is the 'profile' and formal credibility of the practices themselves in the different agricultural sectors, including the agricultural training sector; i.e. the contexts of uptake also need to be well understood. This is taken up in the next section, where the contexts of use are reviewed.

2 ANALYSIS OF KEY CONTEXTS WHERE THE WRC MATERIALS CAN BE USED

2.1 South African Smallholder Agricultural Sector

2.1.1 Smallholder farmers and homestead producers in the SA agricultural sector

The South African agricultural sector, like other sectors in South Africa, is in a process of transformation. It is highly complex, encompassing farming activities ranging from very small-scale 'subsistence' level production to highly sophisticated and capitalised commercial enterprises serving the export market. Agricultural policies developed since 1994 have striven to create frameworks within which these vastly diverse activities can be supported, with an increasing emphasis on the need to support small-scale farmers, particularly women, to increase their productive capacities and move towards more income-generation, as reported on in the policy relevance section above (section 1.2). This emphasis reflects the focus of this project in which homestead level and small-scale commercial farmers, especially women, are foregrounded.

The most recent DAFF Strategic Plan (2015-2020) (DAFF, 2015) states that "The challenge of growing the smallholder sector (small-scale farmers who produce for the purpose of deriving an income) is closely linked to the challenge of making smallholder faming more remunerative. Currently, more than half of all smallholder households live below the poverty line". It states further that,

> *Presently, about three-quarters of smallholders farm within the former homelands, and the rest of them are split between urban areas and commercial farming areas. There is scope to increase the size of the smallholder sector in each of these areas. In the former homelands, there are thousands of hectares of underutilised arable land that can be put back into production, especially with a concerted support for input access, mechanisation services, technical support and linkages to markets. Smallholders in urban areas are poorly supported at present, but could contribute to local vegetable production in particular (DAFF 2015, pg. 12).*

DAFF (2015) goes on to say that "While the 2013 General House hold Survey report indicated that between 2002 and 2013 the percentage of households that experienced hunger decreased from 29,3% to 13,4% and while households with inadequate to severely inadequate access to food decreased from 23,9% in 2010 to 23,1% in 2013, the need to ensure increased availability and affordability of food for all South Africans remains critical" (pg 12). AgriSETA in 2014 reported that FoodBank SA suggests that 11 million people in South Africa are food insecure whilst a further 14 million are vulnerable to food insecurity.

High levels of poverty and deep inequality remain major challenges in post-apartheid South Africa. Rural areas in the former homelands are most affected by these persistent challenges. Since the 1960s external sources of income are the main sources of income for rural households in these areas (Hebinck et al., 2007). Agriculture only makes a modest contribution to household income, and on average `own production' of food contributes little to food security at household level (Vink & Van Rooyen, 2009). This situation *under-represents* the potential for increased household food security and enterprise development through smallholder farming and household food production processes. This is more especially so when one considers the context of such farming practices from a social justice and redress perspective. According to Aliber and Hall (2010), there are approximately 4 million black people involved in agriculture at some level. About 92% of these people are subsistence oriented smallholders while 8% are commercially oriented smallholders (see also more recent statistics from StatsSA, 2016). Women make up 61% of all those involved

in farming and contribute to food production (Denison et al., 2015). Women are most disenfranchised when it comes to landholding, which in turn affects their capacity for participation in more sustainable and expansive forms of agricultural production. It is this context of agriculture and this segment of agricultural practice in South Africa that this AOS targets.

As indicated in section 1.2, the National Development Plan (NPC, 2012) includes an envisaged expansion of smallholder agricultural development, involving increased support and conversion of opportunities for smallholder farmers, coupled with successful land reform. These approaches are expected to increase food security and empowerment of these communities. It proposes:

> *To achieve this (job creation and poverty reduction impact), irrigated agriculture and dry-land production should be expanded, with emphasis on smallholder farmers where possible. The 1.5 million hectares under irrigation (which produce virtually all South Africa's horticultural harvest and some field crops) can be expanded by at least 500 000 hectares through the better use of existing water resources and developing new water schemes.*

This vision suggests 500,000 ha of new smallholder irrigation and suggests that smallholder irrigated agriculture will be the 'driving force' of growth and change in the country's rural areas to achieve job creation and poverty alleviation. The NPC states explicitly that the expansion of irrigated agriculture, supplemented by dry-land production where feasible is the main strategy for addressing underdevelopment, including in the former homelands (NPC, 2012:218). Denison et al. (2015) however suggest that,

> *The only way the target of 500,000 ha could be attempted seems to be to adopt a more expansive definition and extend 'irrigation' to 'agricultural water', thereby including smallholder irrigation plus all water-harvesting interventions in the programme. The reach of these combined technologies is much greater than formal irrigation, which requires a massive budget, and a target of 500,000 ha is also within the practical soil and water resource limitations of the country.*

This builds on earlier policy discussion in the Department of Agriculture, where it was noted that,

> *One of the encouraging developments in recent years has been the growth in support for home gardens, especially in peri-urban and urban areas, where small plots, of vegetables in particular, can contribute significantly to both livelihoods and nutritional standards.* (Ministry for Agriculture and Land Affairs, 1998:12)

2.1.2 Considering the WRC materials in relation to differentiated contexts of smallholder farming practice

This context and level of agricultural practice in South Africa is also differentiated, and differentiation tends to occur as shaped by farmer aspirations and levels of resources including land holding size. For the AOS the project developed the following framework to describe this segment of the agricultural sector further, in order to provide access to the WRC materials and their use in these contexts:

- **Scale 1: Umzi / garden / homestead, where focus is on subsistence level production**

This is the smallest scale band and includes homestead gardens and shared community gardens, with the focus very much on production for own use, although with potential for sharing, barter, and limited sales. This scale of agricultural practice can include keeping small numbers of small livestock. The production sites are either attached to or quite close to the farmers' (or gardeners') homes. This context of food production is unlikely to involve employment of farm workers from outside the family. It is characterised by low input costs, with little or no financial income. Areas involved are usually less than 1 ha, and can be a backyard garden. This scale of farming also generally uses low cost water harvesting technologies:

- Technologies – basic gardening equipment
- Skills and understanding – as required for basic gardening
- Cost R0-R1000
- Maintenance – none, one or two days a year, simple repairs

➢ **Scale 2: Small arable (field), where the focus is smallholder commercial production**

This mid-scale band includes larger shared community/co-operative gardens, and dedicated arable plots, with the focus on production for income generation, with some for own use, sharing and bartering. The focus is generally on producing fresh produce, although with potential for processing and value-adding. The produce market tends to be focused on supplying local and nearby, and potentially some national markets. These enterprises can also include small livestock production. Production areas may be some distance from the farmers' homes and may involve employment of workers from outside the family. This scale of farming generally involves increased input costs with generation of some income. Farming area sizes are generally areas of 1-2 ha. This level of agricultural practice generally uses medium range water harvesting technologies:

- Technologies – simple testing or measuring kits, tanks, pipes
- Skills and understanding – as required for small-scale business
- Cost R1000-R10 000
- Maintenance – regular but infrequent checking/repair, 7-10 days/year, technical repairs

➢ **Scale 3: Large arable and livestock (farm), focussing on full commercial arable production, and differing levels of (small and large) livestock production**

This level of agricultural practice is focussed on production for income generation with little, if any, for own consumption. The products include some fresh produce, but also produce grown for mass processing. This can include production of crops not consumed locally, for national or international markets. Production areas may be some distance from the farmers' homes. Almost invariably this scale of production involves employment of workers from outside the family. There is a relatively high input cost, producing a reasonable income. Farm sizes are generally areas of more than 2 ha (2-20 ha). This scale of farming can make use of more extensive or a higher level of water harvesting practices and technology:

- Technologies – specialised equipment (tractors, mechanical pumps, laboratories, etc.)
- Skills and understanding – as required for professional specialists
- Cost >R10, 000
- Maintenance – essential regular and frequent checking and repair, up to 50 days/year, complex technical repairs

For each of these levels there are relevant RWH practices outlined in the WRC materials. The review of the two sets of RWH materials reported on in section 1.4 pointed to the following in terms of context of use, and relevance of the RWH practices being promoted in the WRC materials. There are also different *types* of RWH practices and skills related to RWH that are relevant at the different scales of farming practice. These are practices and skills to *catch*, *store* and *use* water. For all levels there are different practices and skills as outlined below:

- **General Skills:** Activities or practices that are generally used to help prepare for the main RWH&C practices
- **Catching, Reducing Loss and Holding Rainwater:** Activities or practices that help bring more rainwater into cropping areas and hold it in the soil for longer

- **Storing Rainwater:** Activities or practices that help store rainwater for later use
- **Using Water:** Watering (Irrigation) Practices: Activities or practices that help use the water that has been stored more efficiently.

This provided a framework for considering how the WRC materials under study could be used in the South African agricultural sector, with emphasis on the smallholder farmer, and household food producer, which as noted above is a critical part of the agricultural sector from a transformation and social justice perspective, as well as a food security perspective. However, as noted by the review of the WRC materials, and the contextual, policy and knowledge dissemination process reviews in sections 1.2, 1.3, 1.4 and 1.5 above, materials cannot be introduced out of context, without consideration for the social-ecological dynamics in such contexts. For this reason, materials and tools were needed to understand community and farmer aspirations and stories. Practical demonstrations of the practices would also need to be visualised and made visible, and the WRC materials would need to be made accessible in this context. This also required information on agents and knowledge networks surrounding the practices. Thus, the use of the WRC knowledge was framed within a wider social-ecological context of use. In doing this, it was possible to begin to gain wider insight into the WRC materials and their use in the context of smallholder farming and household food production contexts of practice. This framework, presented in Figure 8 below, provided the foundation for further understanding the contextualisation of the WRC materials and their use.

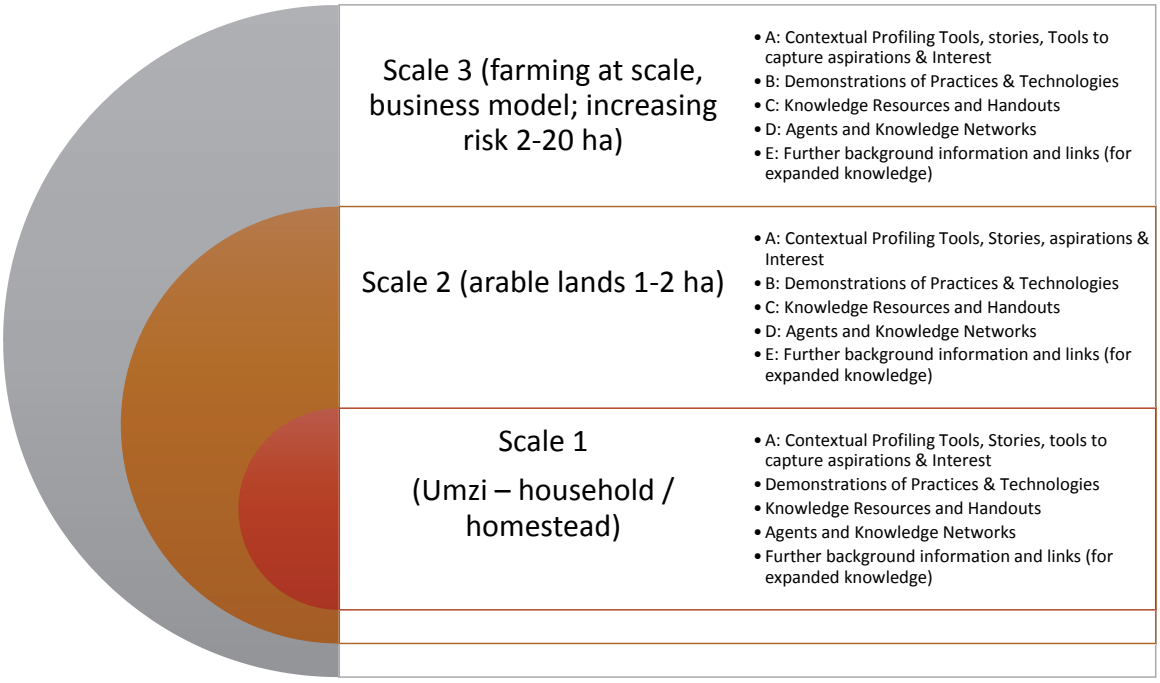


Figure 8. Framework accessing 'Amanzi [Water] for Food' knowledge resources and tools for changing practice and learning (adapted from Denison et al., 2015)

An analysis of the WRC materials shows the following potential match of existing materials to these levels of farming, and the skills needed for RWH at these different levels, and gaps, outlined in Table 5 below:

Table 5: WRC materials gap analysis in relation to farming scales

Farming scale typology	Existing Materials	Gaps
Scale 1: Umzi (household)	A: Stories and case studies available B: Demonstration videos are available for some practices C: Information in handouts (in multiple languages) available in AWUGHS materials D: Some information on agents and knowledge networks available. (Radio interviews?) E: Lots of background information that can be hyperlinked to main AWUGHS texts and WH&C texts and other available materials using a practices framework	A: Contextual profiling tools needed. B: No poster-based materials available; Practical guidelines for setting up and using demonstrations to be consolidated. D: Guidelines needed on how to access knowledge networks and relevant agents for support
Scale 2: Arable lands of 1-2 ha	A: Stories and case studies available B: Demonstration videos are available for some practices C: Information in AWUGHS hand-outs and in WH&C materials D: Some information on agents and knowledge networks available (Radio interviews?) E: Lots of additional background information that can be hyperlinked to main AWUGHS texts and WH&C texts using a practices framework	A: Contextual profiling tools need to be developed B: No poster-based materials available; Practical guidelines for using demonstrations for learning to be consolidated D: Guidelines needed on how to access knowledge networks and relevant agents for support
Scale 3: Farming at scale 2-20 ha	A: Stories and case studies available B: Demonstration videos are available for some practices C: Information in AWUHGS hand-outs and in WH&C materials D: Information on agents and knowledge networks available (Radio interviews) E: Lots of additional background information that can be hyperlinked to main WH&C texts using a practices framework.	A: Contextual profiling materials needed / to be consolidated B: No poster-based materials available but these may not be as important at this scale of farming given increased literacy levels of farmers at this scale. Information on technical support that is required for this level should be clear.

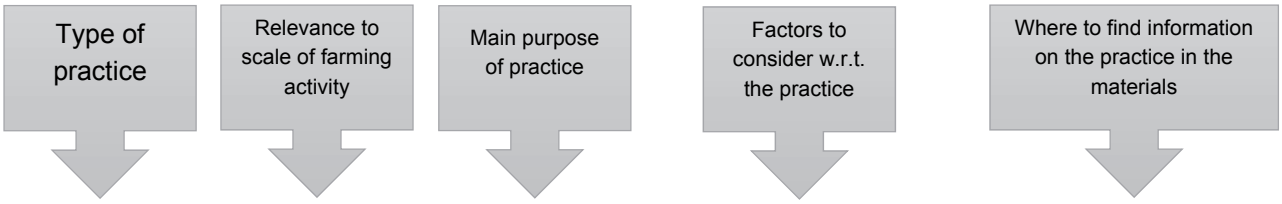
The gap analysis above, and the assessment of available materials, allowed for identification of types of media production that would be needed to complement and extend the existing WRC materials in order to enhance the knowledge dissemination process. This included identifying the need for:

- Video scripting, shooting, editing and narrating of demonstration clips (where adequate demonstration videos do not exist already)
- Photography of demonstration sites and methods – for possible use in posters and on website
- Social media, e.g. Facebook and e-book
- Assisting with mass media output, e.g. print, radio, video (depending on budget)

The differentiating of these three scales of agricultural practice in relation to the RWH&C practices promoted in the WRC materials, helped with identifying how well the different materials speak to the different scales of farming, and which appear to be most useful and accessible. An initial analysis for example shows that:

- The AWUGHS materials are particularly suitable for the Umzi (scale 1)
- The materials produced by the University of Fort Hare are well suited to scale 2
- The IRWH materials are well suited to scale 2 and scale 3 farming practice, but can also be used at scale 1.
- The RWH&C materials moves across the scales, and also covers practices at scale 3, etc.

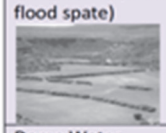
This analysis informed the development of a *navigation tool* that was used for the mediation of the WRC materials with agricultural colleges, and other stakeholders in the learning network formation, reported on in section 4 of this report. The construction of the navigation tool is outlined in Figures 9a and 9b below.



General Activities Applicable to and Underpinning Many of the Key Practices				
Practice (and other names)	**Type and Scale (1,2 or 3)**	**Main Purpose and Description**	**Other Factors**	**WRC Materials: Text (T), Case Studies (CS), Handouts (H)**
Constructing and using 'A-frame'	Preparatory Activity 1 and 2	To set levels and help mark out contours Constructing a simple tool for assessing levels	*Low technology, local materials, low level skills and understandings, low cost, low maintenance	WH&C (**T**: Pp115-121 & **H**), AWHGS (**CS**: Vol.2, Part1, P2-83 and **H**: Vol.2, Part2, Chap.5,H1, P5)
Constructing and using a 'line-level'	Preparatory Activity 1 and 2	To set levels and help mark out contours Constructing a simple tool for assessing levels	*Low technology, local materials, low level skills and understandings, low cost, low maintenance	WH&C (**T**: Pp116,122-123 & **H**), AWHGS (**CS**: Vol.2, Part1, P2-83)
Identifying soil types	Preparatory Activity, All	To identify soils appropriate for different RWH&C practices Fairly simple methods for assessing soil types	Low to **medium technology, some specialised materials/equipment, low to medium skills and understandings	WH&C (**T**: Pp79-108 & **H**),AWHGS (**T**: Vol.2,Part3, Pp.6-3 to 6-10),
Calculating slope	Preparatory Activity, All	To calculate the slope of the land Simple method for calculation of slopes	Low to medium technology, some specialised materials/equipment, medium skills and understandings	WH&C (**T**: Pp113-118 & **H**), AWHGS (**T**: Vol.2,Part2, Pp5-38 to 5-42),
Establishing precipitation (rainfall) amounts	Preparatory Activity, All	To calculate the amount of rain falling on the land. Fairly simple methods for rainfall calculations	Low to medium technology, some specialised materials/equipment, medium skills and understandings	WH&C (**T**: Pp31-33), AWHGS (**T**: Vol2.Part1, P1-23),
Calculating storage requirements	Preparatory Activity, All	To estimate how much rainwater storage is needed. Quite detailed calculations of storage volume needs	Medium skills and understandings	WH&C (**T**: Pp158-160 & 163), AWHGS (**T**: Vol 2 Part 2, Pp 5-80 &5-81)
Calculating irrigation (watering) requirements	Preparatory Activity, All	Estimation of crop water needs Quite complex calculations for estimating water needs	Medium to ***high skills and understandings	WH&C (**T**: Pp161-162), AWHGS (**T**: Vol.2,Part2, Pp 5-70 to 5-79)

Figure 9a: Framework for construction of the navigation tool (details can be found in Appendix A)

This same framework was used to provide access to different types of activities, shown below (NOTE: the full navigation tool is available on the Amanzi for Food website (www.amanziforfood.co.za), and in Appendix A):

Collecting, Reducing Loss and Holding Rainwater				
Practice (and other names)	**Type and Scale (1,2 or 3)**	**Main Purpose and Description**	**Other Factors**	**WRC Materials: Text (T), Case Studies (CS), Handouts (H)**
Saaidamme (Wadi floodwater system, flood spate) 	Harvest, conserve and use. Floodwater harvesting. (3)	Involves the diversion of floodwater from non-permanent rivers into a series of flat basins which are used for cropping. Diverted water from the flooding river is channelled into the fields and completely submerges the land for 1 to 3 days, where it fully saturates the soil.	Medium to high technology, medium skills and understandings, medium to high cost (depending on scale), medium maintenance	WH&C (**T**: Pp 169-170, **CS**: P7)
Dome Water Harvesting (Rock Catchment) 	Harvest, on a large (macro) scale for diversion to where the water is needed (3, possibly 2)	Used to intercept and direct rainwater runoff from impermeable rock domes into a reservoir, or directly to a field where the water is stored in the soil. The method provides valuable drinking water in arid areas. Can be very effective for agricultural use where rock surfaces are located close to agricultural lands.	Low to medium technology, low to medium skills and understandings, low to medium cost, medium maintenance	WH&C (**T**: Pp167-168)

Storing Rainwater				
Practice (and other names)	**Type and Scale (1,2 or 3)**	**Main Purpose and Description**	**Other Factors**	**WRC Materials: Text (T), Case Studies (CS), Handouts (H)**
Dams	Harvest and store Simple storage of runoff in purpose-built ponds. (3 and 2)	Generally fairly large-scale storage ponds from which water can be taken for either crops irrigation or used directly for livestock	Medium technology, specialised equipment, medium skills and understandings, medium to high cost (depending on scale)	WH&C (**T**: P18), AWHGS (Vol.2,Part2, **CS**: P5-85 and **H**: Vol.2, Part2, Chap.5,H1, P11)
Matamo/ipitsi (homestead ponds)	Harvest and store. Simple ponds for homestead gardens (1, possibly 2)	Small-scale storage ponds to catch and store surface run-off. Water used for irrigation or livestock.	Low technology, basic equipment, low skills and understandings, low cost, low maintenance	WH&C (**T**: P18, **CS**: Pp2-6), AWHGS (**H**: Vol.2, Part2, Chap.5,H1, P11)
Underground tanks	Store. Tanks located underground to store surface run-off (1, possibly 2)	Relatively small-scale water storage for irrigating small to medium cropping areas.	Medium technology, specialised materials and equipment, medium skills and understandings, medium cost, medium maintenance	AWHGS (**T**: Vol.2,Part2, Pp5-84 and **H**: Vol.2, Part2, Chap.5,H1, Pp11-12),

Irrigation Practices				
Practice (and other names)	**Type and Scale (1, 2 and 3)**	**Main Purpose and Description**	**Other Factors**	**WRC Materials: Text (T), Case Studies (CS), Handouts (H)**
Drip/trickle Irrigation	Low water-use, highly focussed irrigation (All)	Water-saving. Delivers water directly to the plants, most useful for orchards and other long-term crops, but can be used for vegetables.	Low to medium technology, medium skills and understandings, medium cost, medium to high maintenance	AWHGS (Vol.2,Part2, **T**: P5-95, **CS**:Pp5-97 to 5-102 and **H**: Chap.5, H2,Pp3-5)
Buried pipes	Low water-use, reduced evaporation (1 and 2)	Water saving. Delivers water to crop roots. Mainly used in small-medium scale vegetable production	Low to medium technology, medium skills and understandings, medium cost, medium to high maintenance	AWHGS(**T&H**: Vol.2,Part2, Chap.5, H2,P6)
'Spaghetti lines'	Low water-use. (1 and 2)	Water-saving. Small pipes taking the water from a central pipe to the plants. For orchards or vegetables	Low to medium technology, medium skills and understandings, medium cost, medium maintenance	AWHGS(**T&H**: Vol.2,Part2, Chap.5, H2,P7)
Sponge lines and string lines	Low water-use. (1 and 2)	Water-saving. A trickle irrigation system, using sponge or sting in the holes in the pipes to reduce water flow.	Low to medium technology, medium skills and understandings, medium cost, medium maintenance	AWHGS(**T&H**: Vol.2,Part2, Chap.5, H2,Pp7-8)

Figure 9b. Different types of practice used in the navigation tool (further detail in Appendix A)

From the above it is clear that the analysis of the agricultural context provided a way of beginning to align the materials to the actual contexts of practice, and that this provided a means of supporting selection of materials, and access to the knowledge contained in the materials. This was an important starting point for mediation of the materials in the AOS, as described in section 3.

2.2 South African Government Extension Services

2.2.1 Wider contextual and policy relevant dimensions

As reported in the policy analysis (section 1.3), across the agricultural and water sectors, skills development is emphasised. Skills development is necessary for water resources management, and for water services delivery, as well as for more efficient and sustainable utilisation of water resources (DWA, 2013). In the Department of Agriculture, Forestry and Fisheries, skills development is needed to strengthen provincial decentralisation activities; and extension service activities that are to provide responsive, engaged and change oriented learning support to smallholder farming communities as emphasised in the DAFF Strategic Plan, and the emerging Agricultural Extension and Training Policy (DAFF, 2011, 2015). From a sustainable development and climate change response perspective, skills development, and especially extension services related skills development is emphasised for building a climate resilient agricultural sector that reduces climate vulnerability of the poor (RSA, 2011). There is a general recognition that extension services skills

development requires substantive enhancement, new innovative approaches and that new knowledge needs to be more successfully and effectively mediated at grassroots level.

The National Development Plan (NPC, 2012) emphasises skills development in the agricultural sector, including entrepreneurship training. *This would include the training of a new cadre of extension officers to respond to the needs of smallholding farmers and contribute to their integration into the food value chain*. *The NDP suggests that farmer-to-farmer skills transfer and knowledge networks need to be considered to help develop a new generation of farmers, and with other initiatives move towards a de-racialised agricultural sector.*

Overall, the policy environment stresses more inclusive integration between commercial and non-commercial farming sectors. The aim is to align policy and practice to ways which will enable overall growth to the economy and less 'us' vs. 'them' mentality that is perpetuated between 'commercial' and 'emerging' farmers, promoting instead, a more "common (`us/we/our') vision" (DoA, 2001:12). However, this vision is not easy to implement, and in March 2008, a fifteen year review of agricultural policies and support instruments (1994-2007) was commissioned by the Presidency, and undertaken by the Department of Agricultural Economics at the University of Stellenbosch (Tregurtha et al., 2010). This review identified some less helpful policies including the decentralisation of extension offices. It was said that over time these have become less effective as those employed are not provided with proper training, or prepared adequately to take on broader roles as the sector grew (pg. 61-62). This analysis indicated that there needs to be more accountability and the institution of a feedback system in order to improve on this support if it is to remain (pg. 73) as farmers currently criticise it and feel that they are more skilled than those that are supposed to help them (pg. 61). In discussions with the agricultural colleges it was generally agreed that the commercial farmers make little if any use of government extension services, relying instead on advice from their equipment and material manufacturers and suppliers. Significant to this AOS and its focus, was a finding that the government extension services are therefore generally restricted to advising small-scale subsistence and emerging farmers. A response to this has been the development of the draft National Policy on Extension and Advisory Services to Agriculture, Forestry and Fisheries (DAFF, 2013) the tenets and implications of which are outlined in section 1.2.

Research informing analysis of the National Education and Training Strategy for Agricultural Education and Training and Rural Development in South Africa (DoA, 2005) also pointed out that the context of operation, highlights the need for the concept of agricultural extension to be expanded to issues that were not traditionally associated with agricultural extension. Specifically, it highlighted the need to provide agricultural extension workers with capacity and the skills to assist communities to deal with the effects of rural change, the impact of HIV/AIDS on the rural economic base, and the growing vulnerability of household livelihood systems, which presently are not generally part of the formal and non-formal training of extension workers.

One of the issues raised repeatedly across policy and studies on extension services is the strengthening of extension services. For example, the South African Long Term Adaptation Scenario Report recommends that the extension services need to be *significantly strengthened in number and capacity* (DEA, 2013). The National Framework for Extension Recovery Plan (ERP) (DAFF, 2011) states that extension is a systematic process of working with farmers or communities to help them to acquire relevant and useful agricultural or related knowledge and skills to increase farm productivity. The ERP has as its fourth pillar, a focus on re-skilling and re-orientation of extension services, but this does not give attention to the re-orientation and re-skilling of extension services under complex conditions such as climate change (DAFF, 2011). The need for enhancing the role of extension services within rural agricultural systems is well documented with many pointing to the 'knowledge brokering' role of extension officers. According to Islam et al. (2011), extension officers are referred to as bridge builders, as they link researchers who produce scientific knowledge, and practitioners who produce research based knowledge with rural/smallholder farmers. Being knowledge

brokers, extension officers are also seen as important role players in fostering relationships and creating operational farmers capable of producing tangible results and ensuring ongoing agriculture and success in farmer network alliances.

2.2.2 Importance of the Agricultural Extension Services

As indicated in the policy analysis section, and in the objectives of this project, this AOS is developed to support the dissemination of knowledge amongst key actors in the agricultural learning system. Key amongst these are the agricultural extension services. Globally, and in South African policy (see section 1.3) agricultural extension is a recognized and important mechanism for sharing information, knowledge and innovations derived from formal and farmer innovation research to farmers who use this information. Extension is one of the key tools in promoting socially and environmentally sustainable farming practices. As outlined in section 1.3 and in section 2.2.1 above, the need for knowledge of agricultural, appropriate rural development and sustainable practices is intensifying as the field of agriculture is facing challenges in matching the needs of an increasing population, water shortages, food security, and environmental degradation. This will therefore require farmers to be more knowledgeable about these emerging issues and how to address them.

The most recent DAFF Strategic Plan (2015-2020) (DAFF, 2015) states that the footprint of government support services reaching smallholders has been improving. For instance, in 2010, only 8% of smallholders were visited by extension officers, but this increased to 14% in 2012/13, despite the considerably larger number of smallholders in 2012. This momentum must be increased and other forms of support must improve as well. The DAFF (2015) Strategic Plan for (2015-2020) re-affirms the mandate of the agricultural extension services to foster development of smallholder farmers through improved agricultural production compatible with the natural and other resources available to them. It suggests that climate smart and conservation farming approaches need to be expanded, and this implies is the need to mainstream RWH&C in extension services systems, and extension approaches. Extension officers therefore need new skills and knowledge (e.g. rainwater harvesting and conservation) to deal with emerging issues, and to work with farmers to develop alternative solutions.

Agricultural extension is vital because research does not necessarily reach farmers directly as they do not always have access to Information Communications Technologies which affects the availability of information or knowledge of new practices to rural communities and smallholder farmers. This is a result of often inadequate dissemination of important information and is also linked to the generally low literacy levels of rural communities. The extension services are in the prime position to act as information mediators as they have direct access to farmers and work with them throughout the year. Long-term relationships between farmers and their extension officers and other support providers, such as the agricultural colleges, are essential to ensure continuity of learning and implementation.

However, there can also be issues with the nature of research materials and the packaging of information and knowledge that present difficulties for both farmers and extension services. One major problem in the provision of extension support is the challenge of bridging the technical divide between researchers and farmers. To address this there is the need to be able to identify the existing knowledge and skills of farmers and to be able to present new knowledge and information in appropriate ways so that farmers can translate this into applicable solutions on their farms, a point made in the Burt and Berold (2009) research, reported on above in section 1.5.

Over the years there has been development of many materials on more environmentally sustainable farming practices, including the RWH&C materials produced by the WRC that form the focus of this AOS development process. Despite, this, to date little of this information has reached the intended audience, the farmers

themselves, and it is only through the extension services, together with the colleges and CSOs, that any likelihood exists of wide sharing of the information. The extension services themselves must play a central role in this.

When it comes to sharing knowledge of agricultural water, extension support tends to focus more on irrigation as a means of increasing production. However conventional irrigation systems are often beyond the reach of many small-scale farmers due to costs and lack of availability of a dependable water supply (Denison et al., 2015). The implementation of RWH&C practices as espoused by the WRC materials can therefore go a considerable way to meeting some of the agricultural water needs of farmers in ways which are appropriate for small and medium scale farmers (Denison et al., 2011).

2.2.3 Factors influencing the knowledge and learning of agricultural extension officers

The study by Stevens, Van Heerden, Buys and Laker (2012) captured in WRC Report no TT 539/12 focussing on a detailed analysis of irrigation extension provides some useful insights into the factors that influence the training and actual learning processes of agricultural extension officers. These are summarised below, as they proved useful in informing the development of the AOS, from the perspective of extensionist competences and learning processes:

Extensionists require a high level of both technical and social competences to:

- Mediate between research and researchers, policy intentions, and communities' problem solving needs (i.e. *research interpretation, policy interpretation and community needs interpretation competence*, often *involving interpretations between these that are in relation).*
- Understand and make use of comprehensive *technical knowledge* and skill in both *general and in specialist practice contexts* (e.g. irrigation management and water harvesting practices), and knowledge of human behaviour and socio-cultural settings and practices (i.e. *technical and social competences*). This raises questions as to whether extension officers need to be specialists in particular areas, or if they are generalists working with specialist technical knowledge relevant to specific contexts.
- Address the specific agro-ecological, farming and contextual demands and needs in a particular local and provincial agro-ecological, and social-agricultural context, for example, extension/farmer ratios 1:250-500, and the size and focus of target audiences which are mostly small-scale farmers, except in the Western Cape and the Free State, different eco-topes influencing agricultural practices and more. This points to a high level of *contextualisation competence.*

The study by Stevens et al. (2012) also provides some insights into the gaps in the current system of training of agricultural extensionists, and the learning processes and modalities currently used by agricultural extensionists, which in turn provides useful insight for the AOS process:

- Current courses do not have the information in the required format, and they do not equip extensionists for the tasks they have to perform – there is little practical 'hands-on' training.
- Most extensionists (80%) have certificate / diploma level qualifications and there is currently a strong move towards expanding these qualifications to degree level. Few of South Africa's extension officers have irrigation or water management specialist skills (only 0.8%). Higher level skills in the agricultural extension service context are scarce (only 2% qualified with honours, and 2% qualified with masters degrees).
- Despite considerable experience in the field, many extensionists still lack basic knowledge of specialist areas such as irrigation or water resources management. Specialisation in irrigation and water management does not seem to be a well-supported practice in agricultural colleges and training

as few seem to specialise in this area. Most learning therefore appears to come from 'in the field' or 'on the job' experience, but this is not matched with the necessary knowledge. This is a critical finding informing the AOS, and points to the potential for investigating the potential for a national curriculum development process focussing on an irrigation and agricultural water management specialisation in smallholder farming contexts – at least for those seven provinces where this form of farming predominates.

- The most widely practiced form of irrigation related extension training currently takes place in the context of Diploma courses and /or through short courses. However, it is of concern that few appear to be doing these short courses and almost 50% have not received formal or non/formal training in irrigation. Figures provided for formal/non-formal training in irrigation are: Formal: None 46%, Diploma 41%, B Tech 6%, BSc Agric 7%; Short Courses: Yes 28.5%, No 71%. This shows that there is a potentially important 'gap' to be filled via this Action Oriented Strategy oriented towards water use in smallholder farming support / extension contexts.
- Another very useful insight for the AOS development process is the insights related to the information sources that irrigation extensionists tend to use: 'Popular literature' (Farmers Weekly, etc.) 25%; DoA 18%; Farmers 13%; DWAF 12%; Colleges, etc. 16%; Industry 13%; ARC 3%. From this, it is possible to see that popular literature, and materials and information provided by government departments, and farmers themselves has an important role to play in 'knowledge flow' to extension officers. This has some importance for curriculum development (Component A), but perhaps more so for the media development component of the AOS (Component C and D).
- Training needs and training preferences identified in the Stevens et al. (2012) study show that extensionists by far prefer a combination of formal and in-field experiential learning (45%) with a high level of preference for in-field experiential learning (33%) versus formal learning (18%) and self-directed learning (4%). This shows that the greatest preference is for some formal training, backed with more extensive forms of in-field experiential leaning and demonstration, which, importantly for this AOS, shows that Agricultural College curriculum development work should be 'backed up' or engaged with other forms of knowledge dissemination, as suggested also by Shaxson et al. (2012) in section 1.4 above, where their systems approach to knowledge dissemination is noted.
- From the perspective of training organisations, it was found that Universities are able to meet demand for HET in agriculture, but lack scope for scarce and critical skills and specialisations; Universities of Technology are more responsive to needs (upstream and downstream) in relation to a range of specialisations, but issues of quality, and in-service training needed for graduates are noted. The Agricultural Colleges in 2004 had all their qualifications registered on the NQF, but only 25% of colleges received full accreditation. Later a shift was made to incorporate the Colleges under the CHE / DHET, but again, not all courses were accredited. *This raises the need for more comprehensive qualifications research as noted in section 1 above, especially as there is currently a move towards re-orientation of agricultural college curricula and qualifications within a competence-based model.* Accredited service providers provide some specialist training, but are mostly small (5-10 staff), and they tend to use specialist consultants for specialist areas. These insights into a broader lack of capacity to provide for specialisation areas in agricultural education and training for extension officers, are significant for the wider roll out of the AOS. As noted above, an investigation of the qualifications environment was found to be outside of the scope of this study, but there may be a need to further investigate the qualifications environment, and especially the role of the Universities of Technology as a potential platform of specialist knowledge innovation, but also the formal accreditation systems of the colleges and the changes that are taking place there (see section 4 for recommendations in this regard).

- There are few social learning platforms or discussion forums for agricultural extensionists where they are able to learn and develop their knowledge from others in the field in ways that are both agro-ecologically and socially aligned to the particular contexts in which they work.

This analysis of the context of the South African government extension services and the need for training of extension officers within this system highlighted the following important dimensions which have been considered in the AOS development process. In sum, it is government extension services that generally advise small-scale subsistence and emerging farmers. These extension officers require a complex of technical and social competences, some of which are general and some of which are specialist (e.g. RWH and smallholder irrigation specialist knowledge). In general, the agricultural education and training system for extension officers is not supporting the development of such training, especially the specialist knowledge needed. Extension officers prefer a mix of formal and in-field learning experiences, and they *do* draw on public media and information from the government for informing themselves of new practices. They require *forums for learning how to apply more general and specialist forms of knowledge to specific contexts of practice*, and as the knowledge that they require is likely to be dynamic and contextually shaped, *such forums need to be responsive and dynamic*. The uptake of RWH&C knowledge as intended by the WRC materials, is influenced by this context and these needs of agricultural extension services in South Africa. This, together with the emerging policy imperative for a wider framework for social learning in extension services, motivated the development of **the Learning Network concept** in this AOS.

A decision was made to centre these Learning Networks around 'knowledge hubs' where agricultural knowledge and learning takes place on a regular basis, as these are more likely to be a potential conduit for new knowledge into the local agricultural learning system. As the AOS was also concerned with uptake of the knowledge into the agricultural college learning system, who are also key trainers of extension officers – both in-service and pre-service, and as the Colleges are beginning to take up the responsibility of the upskilling of extension services to Degree level, it was decided that the Colleges should ideally be the 'core' of the learning network concept.

The **learning network concept** in the context of agricultural colleges and knowledge mediation can be illustrated as outlined in Figure 10 below, which for the sake of clarity shows only the principal linkages. As will be shown in Section 3.3, this concept needs to be customised into the specific local context.

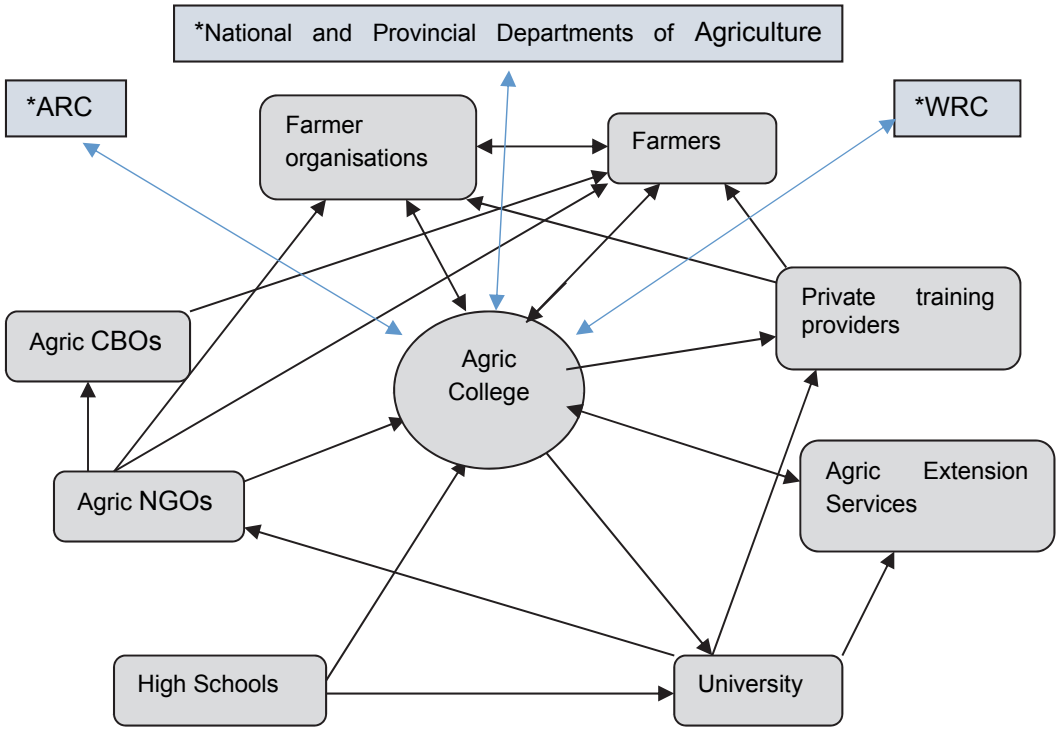


Figure 10: Conceptualised college-based learning network involving diverse actors in the agricultural learning system relevant to smallholder farmers and household food producers

****These organisations [see figure 10], while not necessarily having direct involvement in the networks are critical external partners, and their support is essential as they often provide policy and knowledge resources into these systems to ensure dynamism and relevance.***

The mix of parties will differ in each context, but the idea is that in this way it will be possible to identify:

- The practices relevant to the different contexts and different scales, including the knowledge required and the equipment and materials needed (as outlined in section 2.1 above)
- The specific roles played by the parties, in particular those involved in the formal and informal education and training sectors (extension officers being critical here), in sharing the practices and knowledge (as discussed above)
- The best approaches for sharing these practices and associated knowledge with different people in different contexts (see section 1.4 and 1.5)
- The different kinds of training and support materials that would be appropriate in different contexts (see section 1.5 above)
- How the different parties can support each other in sharing the practices and knowledge (described in more detail in section 3).

This model therefore has potential for providing ongoing renewal of knowledge for extension services, and also to provide ongoing support to extension officers in the form of a locally accessible learning forum, while also influencing the ongoing formal training of extension officers in the colleges. Further insight into the actualisation of this model is provided in section 3.

2.3 Agricultural Education and Training Provision

2.3.1 The broader context and qualifications system

The Agricultural Education and Training System in South Africa is a complex system, with different qualifications being governed by three different quality councils under the South African National Qualifications Framework and the revised National Qualifications Framework Act (RSA, 2008). The sector is also currently in transformation with new qualifications and models being introduced into agricultural colleges. There is also on-going uncertainty related to qualifications and qualifications re-design which is influencing agricultural college curricula. Agricultural education in the diverse sub-groups and sub-sectors is also under pressure in various ways especially from the perspective of access and success. For example, Wedekind (2015) reports that in the National Certificate – Vocational (NCV) in Primary Agriculture, Level 4, in 2011 there were 612 registered scholars, 538 who wrote the NCV examination with only 170 who passed (32%). Additionally, there are no more than 1500 students across the public TVET system registered in agriculture related qualifications, and there is poor articulation from NCV into degree and diploma programmes. There are also problems related to quality and relevance of qualifications. Wedekind (2015) reports that in the context of the 11 Public and Private public agricultural colleges which offer Certificates, Higher Certificates and Diplomas, the qualifications are dated. The quality assurance in this context is done by CERTEC and there are currently interdepartmental discussions underway between DHET and DAFF on the restructuring of these qualifications and their quality assurance under the post-schooling policy framework.

In Higher Education, agricultural programmes are offered by both Universities of Technology and Universities. Wedekind (2015) reports that there are increasing examples of collaboration between colleges and universities, and there are a number of structural changes affecting the college – university relationship, e.g. Saasveld and Lowveld College are being integrated into the university systems. A key point made by Wedekind (2015) is that the wider supply of skills (scientists, marketers, logistics, etc.) into the agricultural sector may not be in agricultural specific faculties, which requires an inter-disciplinary approach to agricultural education and training within the Higher Education system.

Wedekind (2015) reports that the AgriSETA (as well as some other SETAs) play a key role in agricultural education and training. The AgriSETA has 595 registered training providers. In 2011, AgriSeta had 1000 learnerships and 2500 students on skills programmes, most of which were oriented towards scarce skills and critical. However, the AgriSETA currently does not have dedicated qualifications on RWH&C and currently promotes mainly the use of mechanized irrigation systems, as shown by the outcomes of the qualification in Landscape Irrigation cited below:

- Operate a manual irrigation system and schedule the applications to suit the plants water requirements.
- Identify the various types of piping used in irrigation and install these in an irrigation system.
- Utilise the appropriate sprinkler to provide the optimum watering to suit the planted area.
- Utilise manual and automatic control valves to operate an irrigation system.
- Utilise manual and automatic controlled filters to ensure that sprinklers are able to operate at their best (http://www.agriseta.co.za/qualifications)

The implication of this is that RWH&C must be listed as a scarce or critical skills for AgriSETA to allocate funds for education and training associated with this set of knowledge-practices. A case can be made for this based on the policy context, water allocation statistics and the intentions to expand smallholder faming within the National Development Plan (RSA, 2012), especially if also conceptualized within the National Climate Change Response White Paper (RSA, 2011) and the findings and recommendations of South Africa's Long Term Adaptation Scenarios (DEA, 2013).

During this study not much information could be obtained on the recent re-curriculation process associated with the re-accreditation processes linked to the recently defined National Certificate Vocational (NCV) qualifications (except that only 25% of colleges were fully re-accredited)[7]. Within this framework, some colleges have also recently been transferred from the Departments of Agriculture to the Department of Higher Education and Training and are being re-framed as Agricultural Training Institutes, who are beginning to implement competence-based approaches to agricultural education and training. This process is currently only starting. In the roll out of the AOS, this complex and dynamic context of agricultural education and training will need to be taken into account.

To understand the possibilities for knowledge dissemination on RWH into agricultural curricula, there is need to understand the structure of, and strong influence of the changing qualifications environment on curriculum. For example, the NCV qualification for Primary Agriculture is clearly defined, both from a subject and subject guidelines perspective. It suggests a Subject Matrix for Levels 1-4 (see Table 6 below).

Table 6: DHET National Certificate (Vocational) Qualification NQF levels 2,3,4 Matrix of Subjects (2013) (DHET, 2013 www.dhet.gov/za)

Level 2	Level 3	Level 4
Animal Production	Animal Production	Animal Production
Plant Production	Plant Production	Advanced Plant Production
Soil Science	Soil Science	Farm Planning and Mechanisation
Agri-business (0*)	Agri-business (O*)	Agri-business (O*)

An analysis of this qualification shows for example that if water use knowledge for smallholder framers is to be included in the NCV curriculum it will have to be integrated into the subjects. The Subjects also have well defined guidelines provided by the DHET, and in the guidelines for Advanced Plant Production for Level 4 for example, both theoretical and practical work is suggested with 60% of the work being practical. The guidelines suggest application of knowledge in smallholder farming contexts, and also suggest that practical facilities should be available for example for irrigation and water reticulation. This shows that the knowledge produced in the WRC materials can be useful in the context of the NCV curriculum context, if it is carefully targeted at the right level of theory and practical, if practical facilities are provided for, and if college lecturers have the skills to support learners to integrate theory and practice. How this will happen is likely to differ, as college curriculum consultations indicated (explained in more detail below). This example is shown here to indicate how important it is to understand the alignment between the knowledge being produced (e.g. of RWH&C) and possibilities for integration of this knowledge into curricula at various levels, as governed via qualifications. Initially it was our intention to undertake a carefully constituted qualifications review to inform the AOS, but it was deemed to be outside of the scope of this project. This may be as important as a college curriculum review (see below) as it is likely to be at the nexus between new qualifications policy and training organisation curriculum practice that new opportunities for knowledge integration and use could be leveraged (see recommendations in section 4.4)

To make the qualifications landscape and its influence on colleges more complex, in the AOS research, it was found that Colleges were using a 'dual or even sometimes a triple system' of qualifications accreditation – with some qualifications and programmes accredited and part funded by the AgriSETA and some with

[7] A national review is being undertaken by the ASSAF, but at the time of writing this report, the ASSAF review had still not been completed.

qualifications accreditation provided by Umalusi and funded via the DHET NCV qualifications (for level 1-4) system. Adding to this complexity is that knowledge requirements for different levels may also not be the same. For example the requirements for Level 4 (in the example of Advanced Plant Production listed above) are not the same as the Level 4 unit standards qualifications focussing on Plant Production, creating an exceedingly complex qualifications and curriculum environment for colleges. Additionally, those colleges offering level 5 and above training, were accounting to the CHE (Council of Higher Education – level 5-6) for accreditation of these qualifications, creating yet another framework for college curriculum development (the latter being characterised by far more curriculum design independence).

Besides a number of private providers offering AgriSETA qualifications, there are also 17 mainstream FET College providers offering aspects of the AgriSETA unit standards-based qualifications indicating that agricultural training was 'spreading' beyond the 'traditional' agricultural college training sites in the country. Here, however, the typical pattern was to only use of some unit standards, which means that these are being combined into other qualifications frames. All colleges also offer short courses, which are accredited by AgriSETA. At the time of writing this report, the AgriSETA was still in the process of changing the structure and content of their qualifications to the new Quality Council for Trades and Occupations (QCTO) directives and policy (which is set to transform the unit-standard based format of training) under the new NQF Act (of 2008), and that the anticipated processes that the WRC WHC materials had planned for (i.e. using the materials for offering a 'new form' of QCTO based skills programme) are yet to emerge.

Thus, while this (i.e. qualifications analysis) was not a core focus of the AOS, a better understanding of the implications of this complex and changing qualifications environment emerged as an important factor in engaging with the Agricultural Education and Training sector.

2.3.2 *Agricultural colleges[8] and their curricula[9]*

The Republic of South Africa originally had twelve Colleges of Agriculture when the project started (see Annex 2). The twelfth College which was located in the Mpumalanga Province has since been incorporated into the University of Mpumalanga. As per the DAFF norms and standards Colleges are changing to Agricultural Training Institutes (ATI). Currently there are meant to be eleven ATIs (not all are currently ATIs but are in the process of working towards this status) in South Africa that provide both Higher Education and Further Education and Training bands in agriculture. The emerging ATIs are located in six of the nine provinces of the country as follows: Cedara and Owen Sitole Colleges in KwaZulu-Natal, Potchefstroom and Taung Colleges in the North West, Cape Institute of Agriculture Training (CIAT) – Elsenburg in the Western Cape, Fort Cox College, Tsolo College and Grootfontein Agricultural Development Institute (GADI) in the Eastern Cape, Glen College in Free State, Madzivhandila and Tompi Seleka Colleges in Limpopo. Northern Cape, Mpumalanga and Gauteng provinces are the only provinces without ATIs. The eleven emerging ATIs are in principle all administered by and are reporting to their respective Provincial Departments of Agriculture except for Grootfontein in Middelburg which is under the National Department of Agriculture, Forestry and Fisheries (DAFF) as a fully-fledged Directorate. Colleges (currently changing into ATIs) provide agricultural vocational education and training. They offer an Agricultural Diploma as a three year qualification (NQF level 5-7) and the vocational skills training to the farming community and the youth as NQF levels 1-4 qualification in partnership with the relevant Sector, Education, Training Authorities (SETAs). Unlike Training and Vocational

[8] During the writing of this report it was noted that some Agricultural Colleges are being re-named as 'Agricultural Training Institutes (ATIs)'. It was not clear to what extent this has been done across the system as yet. Both Colleges and ATI is used, and ATI is used mainly where it has been confirmed that the Colleges are officially in transition into ATIs.

[9] This section draws on the contextual analysis of the PhD study of Van Staden (in press).

Education and Training organisations, formerly FET Colleges, ATIs deal with practical agriculture aspects such as training agricultural practitioners not only academic graduates, providing first level skills training to farmers, providing short practical courses for farmers and their employees and enhancing production in farming practices.

In 2009, a study to assess the level of compliance of the eleven targeted ATIs (formerly or currently still Colleges) to proposed Norms and Standards was undertaken (DAFF, 2011). The assessment study report revealed that no single College complied fully with the established Norms and Standards albeit in differing degrees. These Norms and Standards were an intended to serve as the main vehicle for ensuring alignment between the programme offerings of these agricultural education and training institutions and the strategic development of the agricultural sector. The main purpose of these norms and standards was to create, “a framework for ensuring consistent quality of AET, the sound management of public funds, and establishing and maintaining equity among the Agricultural Training Institutes” (DAFF, 2011). Based on the approved Norms and Standards (DAFF, 2011) and the Governance and Financing Framework for ATIs, and findings of the compliance study, a Revitalization Plan for the Colleges of Agriculture was developed. The Colleges Revitalization Plan (CRP) was guided by the following critical pillars: Improvement of Infrastructure and equipment, Curriculum review with emphasis on value addition, Accreditation and registration of Colleges, Leadership development and change management, and Strengthening of Information and Communication Technology including Colleges Governance, which was partly addressed by the TACATI project which ran from 2013-2015 and introduced the COLA system and competence-based learning (DAFF, 2015; Chaminuka et al., 2016). Despite the above processes the agricultural colleges have continued to remain a provincial department responsibility and governance structures have followed suite (AgriSETA, 2014). A Cabinet memorandum of 2013 indicating that the National Department of Higher Education and Training (DHET) should incorporate the agricultural colleges as part of their post-schooling institutional mandate, is likely to bring about change to the agricultural college sector (AgriSETA, 2014) although at the time of writing these institutes had not yet been transferred to the DHET.

A mix of qualifications at NQF Level 5-7 are offered at nine of the Agricultural colleges. These qualifications include national certificates, higher certificates, diplomas and degrees in a range of subject areas such as animal production, crop production, agribusiness, irrigation and mixed agriculture (AgriSETA, Prospectus of Taung and Potchefstroom Agricultural Colleges in Van Staden, in press). The qualifications of these Agricultural colleges are accredited by the Council for Higher Education (CHE). However, Madzivhandila College, Tompi Seleka College and Tsolo College’s NQF 1 to 4 short courses and learnerships are accredited by AgriSETA (AgriSETA, 2014) and operate as farmer training centres.

Research shows that the total of first year enrolment is increasing (AgriSETA, 2014). The total 1st year enrolment at these 12 agriculture colleges was recorded for 2012 as 1 361 (AgriSETA, 2014). However, despite the increase in first years the total of graduates seems to be declining (AgriSETA, 2014). A total of 535 students graduated from these agriculture colleges in 2012 (AgriSETA, 2014).

While all agricultural college training programmes are framed by national qualifications, they are fundamentally flexible to contextualisation as the colleges orient their courses towards supporting the agricultural activities practiced in their respective region (DAFF, 2008; PCA, 2014). Before 2005 agriculture curricula were mostly based on teaching commercial agriculture and production as this addressed the needs of the Agriculture Sector at that time (AgriSETA, 2014; DAFF, 2008; DoA, 2005a). Since 2005 there has been a reorientation towards including conservation of natural resources and commercial production (DoA, 2005a) and in 2014 the AgriSETA noted the need to incorporate sustainability and green economy dimensions into Agricultural Education and Training (AgriSETA, 2014).

Competency-based education (CBE) has recently emerged in the agriculture educational and training system in South Africa (AgriSETA, 2014; DOE, 2008; Chaminuka et al., 2016). However, the focus of the agriculture curricula are mostly on competence development for conventional methods of agriculture, which exclude an engagement with climate change, climate change adaptation and water conservation supported farming (DAFF, 2008; PCA, 2014; TAC 2014, cited in Van Staden, in press). After an evaluation of the agricultural education and training curricula of South Africa in 2008 it was recommended that the Agriculture curriculum should be adjusted and upgraded to be more responsive in addressing the critical challenges of the South African agricultural sector (2008). The Transformation of Colleges of Agriculture into Agricultural Training Institutes (TACATI) project reports that,

> ATIs are seen as strategic tools to drive Rural Wealth Creation (RWC), with staff having a variety of skills to support farmers with the skills necessary to improve agricultural production along the whole value chain and access to inputs and output market. For ATIs to become centres of excellence for RWC, effective and significant RWC programmes that are responsive to that need must be developed and implemented. To ensure that this happens, there is a need to improve resources of the ATIs (infrastructure, IT, funding model and human capital) and outreach programmes (community engagements, partnerships, community based research and capacity building) (Chaminuka, Lalendle, Nompozolo, Viljoen, Ceballos-Müller and Brouwers, 2016: 8).

In the scoping phase of this AOS, and based on the objectives of the programme to develop action oriented approaches to knowledge dissemination with Agricultural Colleges, it was found that Agricultural Colleges, together with Universities with Agriculture Faculties or Schools and Universities of Technology could potentially make use of the WRC RWH&C materials in their curricula because they all train extension graduates and farmers.

In the initial scoping of the AOS process, the following AET providers were consulted on how knowledge of RWH&C could be integrated into their curricula namely: Fort Cox College of Agriculture and Forestry (now Fort Cox Agriculture and Forestry Training Institute), Cedara College of Agriculture, University of Fort Hare, Lowveld College of Agriculture (now University of Mpumalanga), Elsenburg Agricultural Training Institute, Grootfontein College of Agriculture and Taung College of Agriculture. These in-field consultations were further informed by internet-based review of curricula (where these existed) and through this, additional information on the Universities of Technology (Mangosuthu and Venda) was found.

Analyses of the curricula of these colleges revealed that they had different contexts regarding the courses and programmes they offered and the competences that they aimed for in their students. For the agricultural colleges the latter were influenced by engagement with the TACATI) project which aimed at introducing Competence-based Learning in the Colleges (Chaminuka, Lalendle, Nompozolo, Viljoen, Ceballos-Müller and Brouwers, 2016). The initial outcome of the analysis was to identify some specific linkages between the WRC materials and the curricula of the colleges consulted (see Table 7 below).

Existing curriculum elements were identified which would lend themselves to the integration of RWH&C components. These were developed into a list (Table 7 below), with some provisos made in relation to the further refinement of these. However, this curriculum analysis together with consultations with Colleges showed that further development of curriculum content focussing on RWH&C needs to be developed with College lecturers, drawing on the summary of the knowledge and practices that are promoted in and through the WRC materials; and a knowledge progression ‘map’ outlining how the water use knowledge for smallholder farmers and household food production can be developed in and across levels. Ultimately this will need to be aligned with qualifications and the knowledge progression standards as embedded in qualifications, and with the practice-based demonstrations within a competence-based curriculum model (see Section 4.4).

Table 7: Curriculum analysis of selected[10] courses and modules to identify potential RWH knowledge dissemination opportunities undertaken near the start of the programme to inform ongoing curriculum development work

Agricultural Colleges		
College	**Courses**	**Curriculum elements** **Materials Component Technical or Facilitation**
Fort Cox	Diploma in Agriculture	Soil and Water Conservation (SS 221) – T Soil Erosion, Reclamation of Degraded Lands, Soil Conservation Techniques, Water Conservation Techniques, Rainwater Harvesting (infield and outfield), Loss of Water in the Field Irrigation Principles (AE 222) – T Sources and types of water, Crop water requirement and Irrigation scheduling, Effect of soil properties on infiltration, drainage, water holding capacity and irrigation, Soil moisture determination, Irrigation systems and their designs.
	Diploma in Forestry	Soil and Water Conservation (SS 221) – T
Grootfontein	Higher Certificate in Agriculture	Veld Management (VBS 111) – T Introductory Pasture Science Agricultural Management 1 (LBS 121) – T Agricultural Technical Services 1B (ATS 120 – or END 110?) – T C, levelling: Farms dams, surveying, soil conservation – Basic principles, dumpy levelling. Farm dams and soil conservation structures: Types of storage dams, storage dams as a soil conservation measure, prerequisites for irrigation and stock water dams, the quality and suitability of building materials, building costs, natural losses of stored water, catchment and run-off, design requirements, contours, small barriers, reclamation of bare patches Crop Production IIB (GWB 241) – T Irrigation: The suitability of soil and water for irrigation. The different irrigation systems. Crop factors and crop water requirements for scheduling. The principles and practices of sustainable irrigation of saline and alkaline soils. Agricultural Management IIIA (LBS 370) – T Integrated Farm Planning Agricultural Extension IA (LBV 351) – F The communication process in rural development, how adults learn, group extension methods, the communication of innovations, working with people, community involvement and leadership. Agricultural Extension IB (LBV 361) – F Environmental Management IIIA (OMG 351) – T Pollution and other environmental problems. Environmental conservation. Environmental management in the agricultural context. Environmental measuring. Drought risk management. Drought management practices.

[10] In this table above curriculum analyses were done from documents that could be obtained from the colleges.

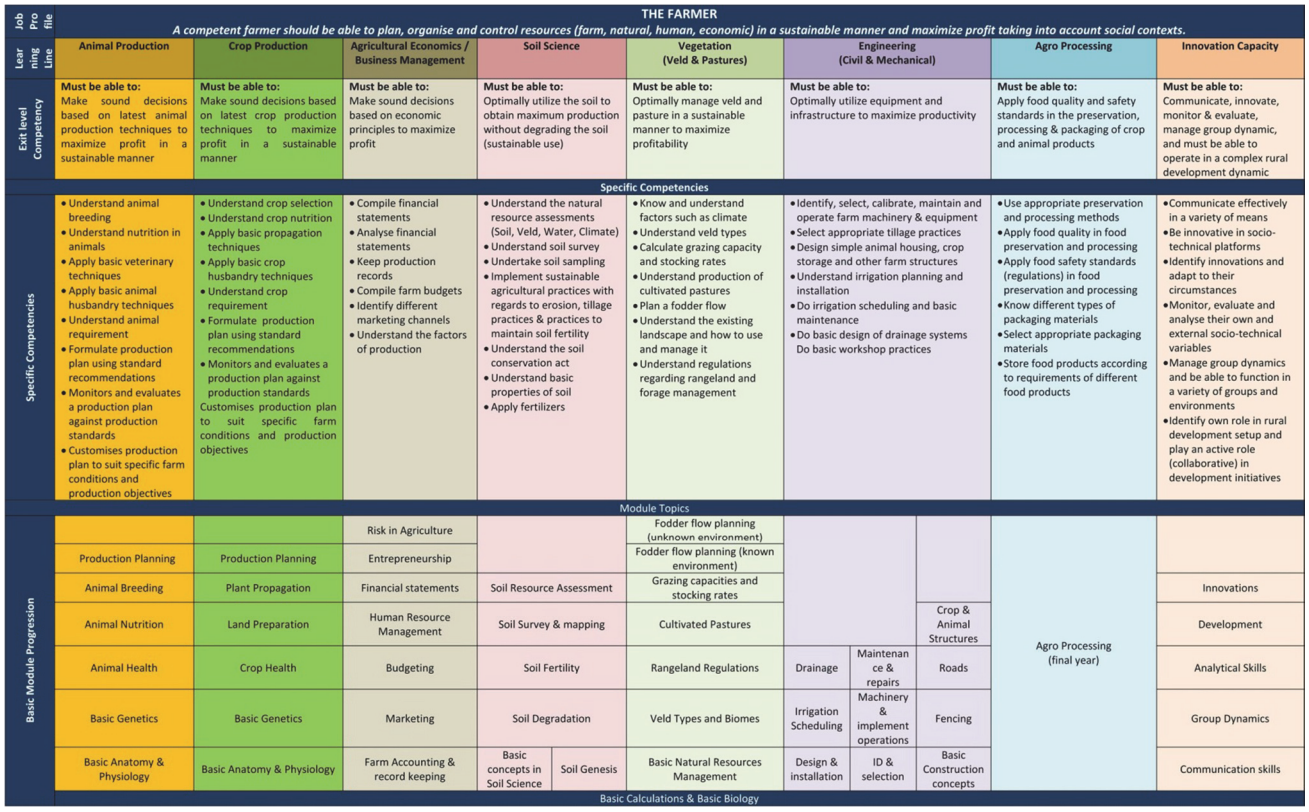
Agricultural Colleges		
College	**Courses**	**Curriculum elements** **Materials Component Technical or Facilitation**
Taung	Diploma in Agriculture in Irrigation	Soil Science (CSSC 118) – T (all) Fundamentals of irrigation (IFIR 116) Natural Resource Management (INRM 116) Soil and Water Conservation (ISWC 218) Irrigation Equipment and System Design (IIED 228) Irrigation Management Practices (IIMP 318) Maintenance of Irrigation Dams (IMID 318)
Elsenburg	Sustainable Resource Management: Landcare, Farm Planning Farmer Support and Development	Sub-programme: Agricultural Disaster Risk Management: lessen impact of natural hazards & related risks in coordinated manner.
Universities and Universities of Technology		
University	**Courses**	Curriculum elements Materials Component Technical or Facilitation
Mangosuthu	National Diploma – Community Extension National Diploma – Agriculture	Agriculture Extension IA, IB, IIA, IIB, IIIA, IIIB – F Extension IA, IB, IIA, IIB – F Land Use Planning III – T Agricultural Extension I and II – F Soil Science I and III – T Communication I – F Agricultural Production Techniques I, II, III – T
Venda	Agriculture and Rural Engineering (BSc?) Agricultural Economics (BSc?)	Principles of irrigation and drainage – T (all) Soil and water conservation Irrigation and drainage system design Land use planning and management Rural water resource development Soil – Plant – Water Relationships and Irrigation Natural resource and Environmental economics –T Introduction to agricultural extension – F Advance agricultural extension education – F

Undertaking a curriculum analysis such as that presented in Table 7 can also provide an erroneous view of curriculum, equating curriculum with 'content in a course'. The design of the AOS took account of possibilities for RWH content to be integrated into courses as part of the curriculum development work, but also worked with a definition of curriculum as being ***'the sum total of all aspects that influence a learning process'.*** Lawrence Stenhouse in 1975 noted that the term curriculum is essentially used to explain systematic attempts to regularise courses of study. He explains further that there are many views of curriculum, notably "curriculum as an intention, plan or prescription", and /or "curriculum as the state of affairs in schools or

colleges, what does, in fact happen" (Stenhouse, 1975: 2). In recent years many curriculum scholars have critiqued a narrow perspective that sees curriculum as 'documents or blueprints only' noting that such a concept of curriculum is technicist, and does not take account of the social-cultural and process-based nature of curriculum. Scholars such as Cornbleth (1991); Grundy (1987) suggest that curriculum is a cultural construction; a *social process* that is influenced as much by social, cultural and structural factors as by 'blueprints' or curriculum policies and documents. For example, in an agricultural college context, the dominant type of farming activity in or near a college would substantively influence the college curriculum, as would the prominence of smallholder farmers in the area, as would the approaches to teaching used by the lecturers. The TACATI report also recommends that: "As a general principle any curriculum that is designed for ATI's should conform to the following five pillars of agricultural sustainability defined by Sumaski and Smyth (1994):

- Enhancement of production (including food security);
- Viability (including financial & rural wealth creation);
- Social acceptance (rural & other development);
- Market demand, decreased risk (of production); and
- Conservation of natural resources" (Chaminuka et al., 2016: 17).

As such, the qualifications and curriculum framework would also influence the actual curriculum taught, for example the current Further Education and Training (FET) curriculum is strongly influenced by the outcomes-based policy of the South African National Qualifications Framework which led to the design and use of Unit Standards to guide curriculum development. The work that was undertaken in the TACATI project is influenced by international trends to redesign TVET qualifications using a competence-based curriculum design. "An essential aspect of Competence-based Learning is defining the final product or occupation, and related competencies for which the student is being trained" (Mulder, 2012, cited in Chaminuka et al., 2016: 17). The product must be identified through engagement with the labour market and other relevant stakeholders. In the case of the TACATI project, the identified final product was the profile of a 'farmer' as outlined in Figure 11 below.



Job Profile / Learning Line	Animal Production	Crop Production	Agricultural Economics / Business Management	Soil Science	Vegetation (Veld & Pastures)	Engineering (Civil & Mechanical)	Agro Processing	Innovation Capacity
	THE FARMER *A competent farmer should be able to plan, organise and control resources (farm, natural, human, economic) in a sustainable manner and maximize profit taking into account social contexts.*							
Exit level Competency	**Must be able to:** Make sound decisions based on latest animal production techniques to maximize profit in a sustainable manner	**Must be able to:** Make sound decisions based on latest crop production techniques to maximize profit in a sustainable manner	**Must be able to:** Make sound decisions based on economic principles to maximize profit	**Must be able to:** Optimally utilize the soil to obtain maximum production without degrading the soil (sustainable use)	**Must be able to:** Optimally manage veld and pasture in a sustainable manner to maximize profitability	**Must be able to:** Optimally utilize equipment and infrastructure to maximize productivity	**Must be able to:** Apply food quality and safety standards in the preservation, processing & packaging of crop and animal products	**Must be able to:** Communicate, innovate, monitor & evaluate, manage group dynamic, and must be able to operate in a complex rural development dynamic
	Specific Competencies							
Specific Competencies	• Understand animal breeding • Understand nutrition in animals • Apply basic veterinary techniques • Apply basic animal husbandry techniques • Understand animal requirement • Formulate production plan using standard recommendations • Monitors and evaluates a production plan against production standards • Customises production plan to suit specific farm conditions and production objectives	• Understand crop selection • Understand crop nutrition • Apply basic propagation techniques • Apply basic crop husbandry techniques • Understand crop requirement • Formulate production plan using standard recommendations • Monitors and evaluates a production plan against production standards Customises production plan to suit specific farm conditions and production objectives	• Compile financial statements • Analyse financial statements • Keep production records • Compile farm budgets • Identify different marketing channels • Understand the factors of production	• Understand the natural resource assessments (Soil, Veld, Water, Climate) • Understand soil survey • Undertake soil sampling • Implement sustainable agricultural practices with regards to erosion, tillage practices & practices to maintain soil fertility • Understand the soil conservation act • Understand basic properties of soil • Apply fertilizers	• Know and understand factors such as climate • Understand veld types • Calculate grazing capacity and stocking rates • Understand production of cultivated pastures • Plan a fodder flow • Understand the existing landscape and how to use and manage it • Understand regulations regarding rangeland and forage management	• Identify, select, calibrate, maintain and operate farm machinery & equipment • Select appropriate tillage practices • Design simple animal housing, crop storage and other farm structures • Understand irrigation planning and installation • Do irrigation scheduling and basic maintenance • Do basic design of drainage systems Do basic workshop practices	• Use appropriate preservation and processing methods • Apply food quality in food preservation and processing • Apply food safety standards (regulations) in food preservation and processing • Know different types of packaging materials • Select appropriate packaging materials • Store food products according to requirements of different food products	• Communicate effectively in a variety of means • Be innovative in socio-technical platforms • Identify innovations and adapt to their circumstances • Monitor, evaluate and analyse their own and external socio-technical variables • Manage group dynamics and be able to function in a variety of groups and environments • Identify own role in rural development setup and play an active role (collaborative) in development initiatives
	Module Topics							
Basic Module Progression			Risk in Agriculture		Fodder flow planning (unknown environment)		Agro Processing (final year)	
	Production Planning	Production Planning	Entrepreneurship		Fodder flow planning (known environment)			
	Animal Breeding	Plant Propagation	Financial statements	Soil Resource Assessment	Grazing capacities and stocking rates			Innovations
	Animal Nutrition	Land Preparation	Human Resource Management	Soil Survey & mapping	Cultivated Pastures		Crop & Animal Structures	Development
	Animal Health	Crop Health	Budgeting	Soil Fertility	Rangeland Regulations	Drainage / Maintenance & repairs	Roads	Analytical Skills
	Basic Genetics	Basic Genetics	Marketing	Soil Degradation	Veld Types and Biomes	Irrigation Scheduling / Machinery & implement operations	Fencing	Group Dynamics
	Basic Anatomy & Physiology	Basic Anatomy & Physiology	Farm Accounting & record keeping	Basic concepts in Soil Science / Soil Genesis	Basic Natural Resources Management	Design & installation / ID & selection	Basic Construction concepts	Communication skills
	Basic Calculations & Basic Biology							

Figure 11. Competence-based generic curriculum framework model developed by the COLAs for the ATI's (Chaminuka et al., 2016: 23). RWH&C knowledge will need to be integrated into this curriculum framework in future should it be more widely adopted (see Section 4.4).

In relation to Figure 11 above, it is important to note that in the COLA process there is still discussion amongst the ATIs on the generic framework as the type of training necessary for a farmer / farm manager is different from that of a graduate who will be employed as an agricultural advisor or extension officer. These occupational profiles would therefore need to be developed for the competence-based model to function adequately as a curriculum model, and the ATIs will have to decide on how these are contextualised in relation to their particular niche areas. Thus, it seems from the COLA report that much more still needs to be done to institutionalise a competence-based model. Also the COLA report notes that introducing a CBL curriculum requires all stakeholders to work together, and a substantive national curriculum innovation process will need to be supported in the ATIs for a full roll out of CBL curriculum design and innovation (Chaminuka et al., 2016).

Other factors also influence curriculum, for example the actual knowledge of the lecturers, the prior knowledge of students coming into the colleges, and/or the availability of practice demonstration sites and so on. For the AOS, the focus was not only on curriculum documents for the curriculum analysis and development work, but it rather sought to produce a more holistic, nuanced view of knowledge and knowledge integration in agricultural college curriculum development contexts using a social-cultural process definition of curriculum that also takes the actual context of smallholder farmers and food producers into account reflecting also a socio-material concept of curriculum (Fenwick, 2012), as well as the roles and competences of farmers who are implementing the RWH&C practices, and the extension officers advising farmers on the implementation of RWH&C practices. The focus was also on the development of the curriculum development competences of the college lecturers as is reported on in Section 3. Here it is instructive to note that the TACATI project also noted that 'developing a CBL curriculum is one aspect in a mirage of issues, but ensuring that they

competences are achieved requires a different type of lecturer. It requires the lecturer to play different roles: that of a facilitator, a trainers, a coach and a networker" (Chaminuka et al., 2016: 24). They recommend using integrated and interactive learning which builds on the trainees' own experiences and the context in which they are working (see Section 3 for the Change Project model adopted in the Training of Trainers programme).

This view of curriculum became necessary too based on the findings associated with a range of related factors that have influenced the fact that despite having the materials in the Colleges, after their earlier distribution to all colleges, with follow up to establish interest in using the materials (which was generally enthusiastic and positive), our scoping process found that the materials were not being used. The responses obtained during the scoping phase for the AOS suggested strongly that the colleges were prepared to integrate the materials both into existing diploma and other courses, and run them as stand-alone short courses. However, major obstacles existed for this to occur, with the main challenges identified by the colleges being:

- The lack of people with the requisite knowledge skills and experience in water harvesting and related activities
- The lack of skills in curriculum adaptation and innovation amongst college lecturers.

Another major obstacle identified during the scoping phase of the AOS was related to very limited, degraded, or lack of appropriate **demonstration sites, materials and technologies for practicals** related to RWH&C knowledge dissemination. For example, at Cedara College, college lecturers indicated that they would need assistance in establishing such structures as Jojo tanks especially at the hostels, although they indicated ability to establish simple structures such as using A-frames for swales. Further discussion showed that there are some Jojo tanks installed in some Agriculture department buildings on the premises which are neither connected to municipal water supply nor set up to harvest rainwater from rooftops (they were filled years ago from a water tanker, but most are empty at present). At Elsenburg College there was a big challenge relating to the numbers of people who need to be trained, and although the College would prefer to focus on the practical aspects, as this is where people tend to learn best, there are not sufficient resources to provide the necessary infrastructure or equipment. The college was planning to develop an 'Agricultural Demonstration and Training Park' at Elsenburg, with support from the private sector. The college noted that it would welcome financial and other support in developing a RWH&C demonstration area. This could include examples of the technologies employed, and the types of equipment, such as for harvesting and storage of water, and for irrigation. As in the Cedara and Fort Cox case, there was a strong appeal for **practice-centred demonstration sites / materials** for teaching purposes. It was also interesting to note in this regard, that none of the colleges visited had **functioning rain water harvesting systems on campus;** yet there is an expectation that their students should learn how to use such technologies.

During the consultations the knowledge flow process was also probed with college staff since there were investigations on what suggestions the organisations had for the most appropriate ways to ensure effective flow and dissemination of the knowledge on RWH&C as contained in the materials from the materials (material developers) themselves eventually to the small-scale and emerging farmers for whom the information is intended. Initially, It was proposed that a RWH&C knowledge flow through an organisational knowledge pathway can perhaps be considered to go through **three main stages**:

1. From the materials (materials developers) to the curricula and lecturing staff in the organisation
2. From the lecturing staff to students (we can identify who these are likely to be)
3. From the students to the farmers (and others?)

This raised the issue of assumptions related to how knowledge 'flow' was to occur using the RWH&C materials. Discussions with staff at Cedara, Elsenburg and Fort Cox agricultural colleges (see below) suggested that there can be different pathways at different levels within each college, and that the levels at which the materials or the information from them is integrated into existing curricula or used to support the development of short courses should not be constrained by the apparent level at which the materials have been developed.

While useful, the focus on **three main stages for the knowledge flow,** as used in the interview situation, was somewhat linear (see above). The three stages do not represent the full knowledge flow, as this should be considered a cyclic process from needs identified in the field to knowledge drawn from practice and developed through experimentation, then captured in the materials, through various mediations (such as the three stages here) and back to the field, where experimentation and practice generate new knowledge to be fed back into the cycle. There was need for a model to illustrate this, and from these initial consultations some initial ideas for a knowledge flow and pathway model was developed – specifically for the technical component of the RWH&C materials though an agricultural college pathway (see Figure 12 below). The facilitation component may have a parallel but slightly different pathway.

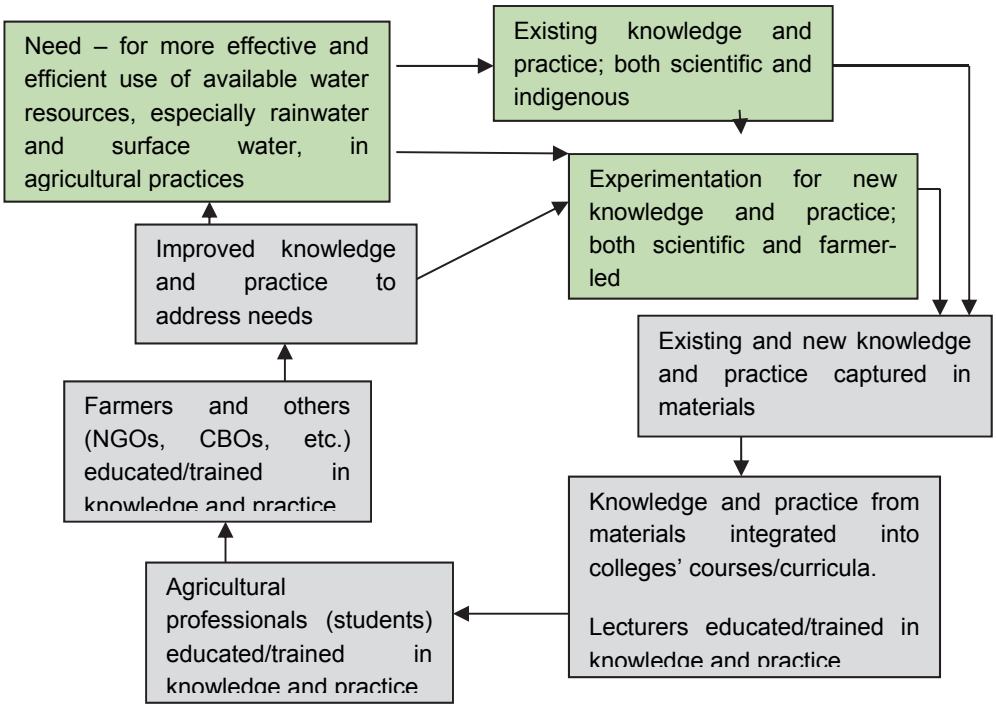


Figure 12: Initial knowledge flows model involving RWH materials and agricultural college curriculum development processes, with links to practice contexts

A further important consideration and insight for the AOS process is that there should be a focus on a meta-strategy for an adaptable approach to curriculum development that facilitates the on-going integration of new information (knowledge and practice). This would also involve a strategy for ensuring that new information, produced through various research activities (such as the WRC projects), is made accessible and available in a way in which college lecturers and others are firstly aware of its existence, and secondly can access it easily. Two such mechanisms were identified during the interviews:

- the 'COLA' project[11] (which is a communities of learning project led by Cedara's principal and involves establishing and supporting eight cross-college communities of learning) – this is an example of an external 'meta-strategy' to facilitate ongoing curriculum development; and
- internal curriculum committees (at Elsenburg college) where ongoing 'curriculum relevance' discussions were held to inform curriculum improvement on an ongoing basis.

These insights indicated that dissemination of the WHC and AWUHGS materials (and other WRC materials) in Agricultural Education and Training Institutions should be seen within the development of a wider model for the ongoing dissemination of any new and relevant information in the agricultural or any other context. Each material cannot be separately mediated into the colleges with its own strategy, rather a systemic approach, including a 'culture of practice' for engaging with all kinds of new knowledge and new knowledge resources and linking them to curriculum needs to be supported for ongoing curriculum renewal and innovation in Agricultural Colleges.

Some of the issues surrounding curriculum innovation for smallholder farming (which is where the WRC materials were targeted) as reported via a series of interviews with colleges include:

- There is a shift from thinking about agriculture in technical terms to educational terms (as agricultural organisations move from the DAFF to the DHET).
- There is insufficient government focus on agriculture, and limited scope for training and support especially in relation to emerging farmers (who use the government extension services most), although this should be the focus according to the policy. The agricultural sector, and the Colleges are not prepared for smallholder agricultural systems.
- There is a lack of budget for infrastructure, so it is not possible to do practical activities and demonstrations in the universities and colleges.
- There needs to be a stronger partnership between DAFF and the teaching and learning institutions
- There are major bureaucratic challenges to changing curricula and developing short courses. The bureaucracy associated with the qualifications system was said to move too slowly to enable rapid uptake of new knowledge in curricula.
- Although there is a policy focus on small-scale, current agricultural curricula are 90% commercial farming oriented.
- Extension officers, most of whom had national certificates or diplomas were now required to have first degrees (B Tech, B Agric, or BSc Agric). Colleges and ATIs were already involved in running in-field capacitation courses for the EOs. This was taking place under the Extension Revitalisation Programme of the national department, EOs and Extension Assistants were being given bursaries to complete a 4th year of study in order to meet this requirement.
- There has been a recent shift to accreditation by the CHE leading to a more competence-based curriculum (at Level 6), with considerable internalisation of information.
- In both Forestry and Agriculture there is no specialisation at degree level, the curriculum is very general. Specialisation takes place later at post graduate level.
- Without benefits there is no motivation for change, so the development of real case studies and functioning demonstration sites must be an essential part of the AOS, it should also help Colleges and institutions to develop practical work. Some of the Colleges interviewed wanted to start with demonstrations of water harvesting at the college campus, and **support for establishing these structures** was requested.

[11] During the life of the programme the research team made numerous efforts to work with the COLA structure on the AOS process. The project was closed in 2015, with the final report released in 2016 shortly before the writing of this report.

- The Food and Agriculture Organisation (FAO) under its capacity building project in the field of agriculture and food security project (capacitating the smallholder farmers and agricultural officials) recently trained officials on Climate Smart Agriculture (CSA). The training covered water harvesting. A link was provided to the CSA *http://www.fao.org/climatechange/climatesmart/en/* . Another link was provided to the CSA sourcebook *www.climatesmartagriculture.org/72611/en*

2.3.3 Options for integrating RWH&C knowledge from WRC materials into the AET curriculum

From the above, the AOS scoping process provided foundational understandings of the AET context, with specific reference to how the RWH&C knowledge could be disseminated via college curricula. These insights helped to inform an 'Options Document' which was subsequently used to engage Colleges in curriculum deliberations on how to begin to approach integration of the information from the WRC materials into the curriculum (outlined below).

Six (4) options were proposed for integrating the WRC materials into the AET curricula, as outlined in Table 8 below. This was included in a document entitled "Possible Options for Integration into College Curricula" which was circulated to all the colleges consulted and used in the Training of Trainers course to provide guidance for college lecturers in adapting their curricula to incorporate the WRC information, as reported in section 3.1.

Table 8: Possible options for integration of RWH knowledge into college curricula

Options	Audience	NQF Level(s)	Benefits	Challenges
1. *Within appropriate existing curriculum course modules – ideally within mandatory (foundational or core) modules*	Pre and In-service professionals, including extension officers and commercial farmers	Any (levels 4-6), although will require some careful selection of and adjustment to elements of the materials especially for level 6	• Formal and secure integration • Appropriate for closely related modules such as 'Soil and Water Conservation' • Requires no re-registration of courses • Minimal disruption to curricula • Relatively little additional training needed for lecturers • Exposure to ideas for all trainees/learners (relevant for <u>all</u> contexts) • Maintaining links between practice and knowledge within one module • Relatively simple to avoid duplication of information • Funded through existing funding mechanisms	• Need to align with NQF, NCV, DHET, CHE and other requirements • Need to 'make space' in curricula by removing existing information • Need careful selection of material for exclusion and inclusion • Possible conflict between new and old information/orientation • Limit to amount of new practices and understandings that can be introduced • Accessible only to those who can undertake full qualification training
2. *As an additional (elective?)*	Pre and In-service professionals, including extension	Any (levels 4-6), although will require	• Formal and secure integration • Opportunity to introduce	• Need to align with NQF, NCV, DHET , CHE and other

Options	Audience	NQF Level(s)	Benefits	Challenges
course module	officers and commercial farmers	some careful selection of and adjustment to elements of the materials especially for level 6	wide range of practices and associated understandings • No need to reduce existing curriculum content • Limited curriculum development capacity required • Maintaining links between practice and knowledge within one module • Funded through existing funding mechanisms	requirements • Exposure to ideas only for those choosing elective (may be interpreted as only relevant for those working with emerging farmers) • May require re-registration – at least of new module • Quite considerable training in new practices and understandings required by lecturers • Possible conflict between new and old information/orientation (in other modules) • Need to avoid duplication of material in other modules • Quite considerable curriculum development capacity required • Accessible only to those who can undertake full qualification training •
3. *Integrated into a number of different modules, not necessarily only those with obvious and immediate relevance*	Pre and In-service professionals, including extension officers and commercial farmers.	Any (levels 4 – 6), although will require some adjustment to elements of the materials especially for level 6	• Formal and secure integration • Opportunity to integrate resource (water) conservation philosophy, principles and practices across range of disciplines/topics • Little (although some) need to reduce existing curriculum content • Probably no requirement for re-registration of qualifications • Funded through existing funding mechanisms	• Some need of alignment with NQF, NCV, DHET , CHE and other requirements • Risk of de-linking practices from knowledge (in different modules) • Possible conflict between new and old information/orientation • Requires high-level curriculum development capacity • Quite considerable training in new practices and understandings required by lecturers

Options	Audience	NQF Level(s)	Benefits	Challenges
				• Accessible only to those who can undertake full qualification training
4. *As 'stand-alone' short courses*	In-service professionals, including extensionists, commercial farmers, NGO personnel. Also emerging and subsistence farmers, smallholders, home gardeners	More appropriate at lower levels (2-5), some adjustment required for lower levels	• Can be tailored to meet needs of particular audiences • Readily adaptable as new information/practices become available • Accessible to wide audience • Can be offered as un-registered, informal courses • Can draw on existing short-course development expertise • Maintaining links between practice and knowledge within course	• Considerable adjustment required for different level audiences (qualifications?) • Quite considerable training in new practices and understandings required by lecturers • Funding issues (especially for non-registered, unaccredited courses)
5. *As additional resource materials*	All	All – Careful selection and adjustment required for different levels	• Opportunity to select most appropriate and relevant information for different needs and contexts • 'Packaging' of appropriate support materials in accessible ways • No major changes required to curriculum • No changes to alignment with official requirements	• Profound understanding of materials, needs and contexts required in order to make appropriate selections • Potential conflict with existing curriculum information • Risk of decoupling practices and knowledge
6. *As a combination of any of the above* •	All	All	As above for each element. Can broaden benefits through appropriate combination	As above for each element. Can reduce challenges through appropriate combination

NB1: This list of options is clearly not exhaustive and any other options suggested by the colleges would be welcome additions.

NB2: An essential requirement for all options is access to working demonstrations of the main practices being introduced. These can either be established on the college grounds or on local farmers' lands. Some of the initial courses could involve students in the practical design, development and establishment of these demonstration sites.

In sum, the AET context significantly influences the way in which the WRC materials can be disseminated into this part of the wider system of agricultural learning. The analysis found that the qualifications and

accreditation system influences what is possible in colleges, yet there is possibility for integrating RWH into college curricula via four different options. There is little detailed information available on the colleges curricula, thus curriculum innovation requires engaged interaction with college lecturers in situ, as well as via wider systems of curriculum innovation support (such as the COLAs, College Principals Association or curriculum committees). Currently, there is currently little consistency between curricula, with each structured in very different ways to the others which makes curriculum innovation in situ also more complex. This is often because agricultural contexts differ, but also because there is / has been flux in the curriculum and qualifications system, and an institutional transfer for many colleges from DoA to DHET and a current re-orientation for some into Agricultural Training Institutes (ATIs). This means that at present there is no easily identifiable 'fixed place' in the curricula for the integration of the information from the WHC materials, and that any integration will need to be very context (and curriculum) specific. Another issue concerns the different levels at which various courses are run, and the notion that information in materials developed at one (often notional?) level is not perceived as being suitable for another level. As mentioned above, this would require a knowledge progression 'mapping' document that can be used to deal with the relevant knowledge at different levels. There is also always some possibility that the new information (in the WHC materials) may in fact conflict with existing information, particularly that concerning water needs and irrigation schedules. Again, care must be taken to ensure consistency between information provided in different parts of the curricula. This may especially be the case where most agricultural training is oriented towards commercial agriculture, while needs for agricultural training and extension are within the smallholder and emergent farming system (also as outlined in the National Development Plan, NPC, 2012). As noted in the interviews, the re-orientation of thinking in the agricultural system towards smallholder farmers and their needs is not strongly established. This affects what is perceived to be relevant 'curriculum innovation'. The emphasis on climate smart agriculture in policy (DAFF, 2015) may help with this problem in the shorter term, especially in relation to the introduction of RWH&C knowledge in the context of smallholder farming.

Attempts to incorporate entire sets of materials into existing curricula may be over-ambitious, and careful selection of appropriate, relevant information, including activities from the materials may be the more pragmatic and manageable approach. Whatever the route taken, however, some room will need to be made within curricula, inevitably involving removal of some existing information. The transfer may take the form of updating or upgrading existing information, which would be the easiest route, but it may in some cases entail the complete jettisoning of existing information, a far more challenging approach. Selection of material to be updated or removed may well prove to be a greater challenge than the selection of the new material to be integrated. This would need to be guided by qualifications and knowledge progression mapping. The development of short courses out of the materials, seemingly the preferred route of the developers, may well prove to be the more manageable. However, the issues of duplication and potential conflict discussed above would still need to be managed. There would also be challenges associated with fitting another course into the colleges' programmes, and the registration and funding of these courses. From the latter perspectives, the integration into existing full courses would be considerably simpler and less disruptive.

What all this means is that a thorough and detailed understanding of the appropriate curricula (and the qualifications guiding their structuring) is essential for effective dissemination of WRC materials via the college system. It also suggests that different modalities may be appropriate for different colleges, which provides an opportunity for piloting a range of modalities. Additionally, there are wider issues to consider such as availability of sites for practical learning, and support for college lecturers to a) develop knowledge of the WHC practices themselves, and b) develop curriculum innovation competences.

2.4 Access to information and support amongst farmers, NGOs and other stakeholder groups

2.4.1 RWH knowledge support for farmers

The most recent national Community Survey (StatsSA, 2016) provides the following analysis of agricultural production in South Africa, which shows that there are large numbers of household food producers in South Africa who could potentially benefit from RWH&C knowledge as contained in the WRC materials. Table 9 provides insight into the number of agricultural households that are involved in specific types of agricultural activity per province, with 873 355 agricultural households involved in vegetable production. Table 10 indicates these per population group, and Table 11 indicates the place of agricultural production, with a high percentage (83.3 percent) of this being home food gardening in the homestead.

Table 9. Number of agricultural households involved in a specific activity by province (StatsSA, 2016)

Province	Livestock production	Poultry production	Grain and food crops	Industrial crops	Fruit production	Vegetable production	Other
Western Cape	12 373	17 120	5 068	394	12 399	37 417	4 808
Eastern Cape	323 763	318 621	178 939	2 200	53 242	157 732	5 183
Northern Cape	28 000	26 319	2 047	118	5 681	7 722	580
Free State	40 874	47 296	21 524	633	43 982	86 097	2 793
KwaZulu-Natal	256 045	310 458	143 477	2 358	55 920	188 442	8 449
North West	78 555	92 222	14 674	426	19 508	35 414	1 344
Gauteng	23 277	48 979	29 646	858	39 470	159 326	8 366
Mpumalanga	76 307	104 713	62 125	1 417	41 399	97 330	7 284
Limpopo	151 018	154 503	117 183	2 553	127 550	103 874	6 111
South Africa	990 210	1 120 233	574 684	10 956	399 151	873 355	44 917

Table 10. Number of agricultural households involved in a specific agricultural activity by population group of household head (StatsSA, 2016)

Population group	Livestock production	Poultry production	Grain and food crops	Industrial crops	Fruit production	Vegetable production	Other
Black African	919 086	1 058 970	547 849	8 844	365 148	772 307	32 712
White	56 639	38 306	22 048	1 922	24 452	68 135	9 856
Coloured	13 559	21 169	3 332	124	7 866	24 058	1 636
Indian/ Asian	926	1 787	1 455	66	1 685	8 855	712
Total	990 210	1 120 233	574 684	10 956	399 151	873 355	44 917

Table 11. Distribution of agricultural households by main place of agricultural activities and province (StatsSA, 2016)

Province	Back yard	Farm land	Communal land	School, church or other organisational land	Other	Total
Western Cape	80.9	15.2	0.9	0.4	2.6	100.0
Eastern Cape	80.8	6.8	9.5	1.1	1.8	100.0
Northern Cape	61.9	24.0	11.1	0.7	2.3	100.0

Province	Back yard	Farm land	Communal land	School, church or other organisational land	Other	Total
Free State	84.2	11.4	2.1	0.9	1.4	100.0
KwaZulu-Natal	84.0	8.1	5.8	0.8	1.4	100.0
North West	78.9	13.9	3.9	0.6	2.7	100.0
Gauteng	89.5	6.7	1.1	1.1	1.6	100.0
Mpumalanga	86.1	8.6	2.9	1.2	1.2	100.0
Limpopo	86.7	7.2	4.5	0.5	1.0	100.0
South Africa	83.8	8.7	5.0	0.9	1.6	100.0

Note: The figures above represent the proportions of all households who responded to the question of main place of agricultural activities (StatsSA, 2016)

In developing the AOS, in addition to the materials produced by the WRC and other materials developers (reviewed in section 1.5 above), the programme also sought insight into major national *practice-oriented* programmes oriented towards providing information and guidance to smallholder and household farmers for RWH. A key initiative in this regard was the 2007 Department of (then) Water Affairs and Forestry 'Programme Guidelines for Intensive Family Food Production and Rainwater Harvesting' (DWAF, 2007). These guidelines were commissioned to support the DWAF Rainwater Harvesting (RWH) programme. The Guidelines were developed out of experience gained during the piloting of the DWAF RWH programme and they provide detailed guidance for the implementation of RWH activities within resource-poor communities. As such they represent a vital stage in the realisation of DWA (now) policies in regard to effective use of rainwater resources to support increased food security among some of South Africa's poorest citizens.

The RWH programme includes a subsidy scheme, the basis of which is to

> ... provide financial assistance in the form of a grant, which can be paid to a Water User Association (WUA) or other Approved Legal Entity (also called Registered Implementing Agents or RIAs), for the capital cost towards the construction of storage tanks for rain-water and related rain-water harvesting works for poor households in rural areas and villages, for the purpose of family food production and other household economic activities. The objective of the DWAF RWH subsidy scheme is to provide access to water to the household to enable poor households to grow fresh food at home, year-round, to create a constant supply of micro-nutrients at home to prevent stunting in infants and toddlers before they reach school-going age (and thus in the years before they can start benefiting from school nutrition programmes) (DWAF, 2007:3).

At a household scale, the 2008-2009 DWA supported RWH programme, implemented by the Independent Development Trust, invested in 20,000 litre tanks in selected households alongside agricultural training in home-food production. Importantly the DWA team provided sufficient storage of 20,000 litres/household which facilitated food production during the four dry winter months, and included other infiltration and conservation methods (such as swales, mulching, etc.) in the training. The programme included substantial food production training conducted by implementation agents and partner NGOs to turn water availability into food production. The RWH programme was widely seen by locally involved organisations in KZN, Limpopo, Free State and the Eastern Cape, to be a successful initiative with full payback of capital investment in as short as a five-year cycle, and substantial social benefits in terms of nutrition, self-worth and reduction of hunger. The success of the RWH programme at household level was largely attributed to the fact that the DWA-funded implementation teams engaged anticipatively through local NGOs with both water provision and knowledge exchange (farmer training), and strove to ensure that the water and agricultural components, albeit modest in investment, were implemented together under one programme.

According to the DWAF (2007) report on this initiative, the RWH programme was clearly going a long way to addressing some of the challenges facing people producing food in resource-poor contexts, and (according to the guidelines being very successful in this) it is interesting that the planning and implementation process identified (p7) although including a reference to 'awareness raising', does not have a clear educational component.

A very similar programme, perhaps an extension of the DWA programme, being funded through several mining companies Corporate Social Investment (CSI) programmes, does however have an education component, and uses handouts from the WRC AWHGS materials (de Lange, *pers. comm*, August 2013).

Importantly for the practices such as those promoted in the WRC materials, is the need for structural and financial support to implement some of the practices at scale and for longer term sustainability. Given that many smallholder farmers and homestead food gardeners are living close to the poverty line, the issue of structural and financial support *in addition to* the issue of knowledge dissemination needs to be considered. Significant here is that under Section 61 and 62 of the National Water Act, the Minister of Water and Environmental Affairs may give financial assistance in the form of grants and subsidies for the capital costs towards the construction of bulk irrigation infrastructure and rainwater harvesting tanks for resource poor farmers and poor households. The objective of financial support to resource poor farmers is to ensure reliable and equitable supply of water for sustainable economic and social development including eradication of poverty. 'Resource poor farmer' is not clearly defined but can be considered as those people whose livelihoods partly or completely depend on farming or food production regardless of the scale; who have limited access to resources; and whose linkages to input and output markets are not well developed.

The DWA Subsidy for Resource Poor Farmers covers six categories:

1. Grants on the capital costs of bulk water distribution infrastructure including canals, weirs, pipelines, pump stations, storage dams and related water metering,
2. Subsidy for operation and maintenance of water works, water-resources management and depreciation. This subsidy is phased out over five years by scaling down by 20% annually,
3. Grants on acquisition of water entitlement for irrigation which includes the purchasing of water rights for RPF from willing sellers,
4. Grants for socio economic viability studies and investigations, project planning and proposals, technical feasibility studies and hydrological studies,
5. Grants for the training of WUA management in water use efficiency and management, dispute management and related technical issues, and
6. Grants on rainwater harvesting tanks for food security through family food production and other household productive activity.

The RWH programme subsidies (see above) fall clearly under the sixth category, and are considered to be very effective. However, the overall performance of the RPF subsidies would seem to be less encouraging. Typically, the RPF subsidy allocations have been relatively small compared with the applications submitted (pers. comms, P Mgedezi, 2010, and DWA, 2011). In 2008-09 the subsidy of R40 million was used primarily for Item 6, benefiting 500 households in a successful RWH and food production program based on 20,000 litre storage tanks and agricultural training. In 2009-10 the R22 million allocation was mainly used on two major irrigation projects benefiting 438 project beneficiaries. In 2010-11, the allocation was reduced to R10 million and contrary to policy which focuses on agricultural water, was allocated to water-services through the distribution of 5,000 litre roofwater tanks linked to township development in water-scarce areas. This policy error was noted by DWA and reversed the following year.

Information obtained during the AEO scoping from the DWA Institutional Oversight Directorate who oversee the RPF subsidy shows the budget for smallholder farmers support is progressively shrinking with only R9 Million having being budgeted for 2013-14. When compared with subsidy applications reportedly submitted to DWA at the same time, this is some 5% of the value of applications on the table. When compared with targets emanating from the National Development Plan (NPC, 2012) which articulate an annual expansion of 30,000 ha/annum of smallholder irrigation, the current financial allocations for bulk water provision to these farmers are very small (approximately 0.6% of investment needed to give effect to this aspect of the NDP), showing a major disjuncture between policy and fiscal practice. Clearly this wider structural and financial support context will have an influence on the success or failure of the knowledge dissemination process, as knowledge, education and learning on its own is not an adequate condition for wider transformation. Knowledge dissemination and guidelines need to be distributed *in tandem with* wider structural and fiscal provisions for the implementation of RWH practices amongst resource poor farmers.

Analysis of stakeholder information and access systems indicated that farmers obtained from a range of sources, notably: farmers associations, NGOs and CSOs, government extension services, LED officials, other farmers, community radio, and at fairs and farming activities. This drew attention to the need to scope information access within a wider networked stakeholder system.

2.4.2 Stakeholder groups and access to information and potential to use WRC materials

The analysis of the two sets of materials in Section 1.4, indicated that one set, the AWHGS materials are particularly appropriate for the non-formal sector, while the WHC materials are more appropriate for the formal sector (the training colleges and other educational institutes). However, subsequent to this initial analysis, it was found that information from both sets of materials could be appropriate in a range of contexts.

Policy and contextual analysis identified a large number of stakeholders involved in agricultural developments and in sustainable development and climate resilient development pathways who should be involved, perhaps at different levels or depths, in consultations regarding the development of the dissemination strategy and the potential use of the two sets of RWH materials and the associated knowledge and competences promoted by them. Table 12 below outlines the different stakeholder groups identified (besides the ATIs already discussed above), and the associated use potential of the WRC materials with suggested strategic approaches to engage them in the knowledge dissemination process.

Table 12: Stakeholder groups, use potential of WRC materials and suggested strategy for engaging them in the knowledge dissemination process

STAKEHOLDER GROUPS	USE POTENTIAL OF WRC MATERIALS
Members of the National and Provincial Agricultural Education and Training Forums ***(NAETF and PAETFs)*** **(these were subsequently found to be somewhat inactive; but alternative AET Forums were identified (e.g. COLAs, Extension Suite Online).**	WRC materials can be used for supplementing existing AET activities and information and for developing the competence-based models being promoted within the ATI system. Suggested strategy – to involve <u>them knowledge dissemination partnership / media strategy activities.</u>
Relevant officials from the national and provincial government agricultural departments **(including from the extension and advisory services; and from sectors dealing with rural development and climate change). May also include extension officers from**	WRC materials can be used for in-field extension training; the possibility exists that provincial and national government departments will send extension training agents on the courses as they have training budgets. Suggested strategy – to include extension services in in-service professional development / <u>*Training of Trainers for Extension Agents / Community Learning Facilitators*</u> course for extension staff to learn to use the WRC materials 'in-field'.

STAKEHOLDER GROUPS	USE POTENTIAL OF WRC MATERIALS
other government departments (e.g. DWA; Department of Land and Rural Affairs). They provide in-field extension services.	
Agricultural commodity groups **(although as most of these are concerned with high-level commercially produced commodities, this may not be entirely appropriate).**	Potential exists for these groups to send extension agents on training. Suggested strategy – to involve them in ToT course for extension staff to learn to use the WRC materials 'in-field'. Potential also exists to form a knowledge dissemination partnership / media strategy activities with key commodity groups where relevant.
Agricultural Research Council (ARC) **– publishes on a wide range of topics. Their publications include: Booklets; CDs; Factsheets; Leaflets; Journals and Bulletins; Pamphlets and research articles; Training manuals; Posters. These publications are highly valued and used frequently by farmers and extension officers.**	Potential exists to form a knowledge dissemination partnership / media strategy activities with the ARC, and to integrate key content knowledge from the WRC materials into ARC communication systems and products.
Agricultural and education sector consultants and training service providers **– these have been found to provide an important 'in-field' training function (accredited training). Also training of extension officers.**	Potential exists for these groups to send their trainers on training. Suggested strategy – to involve them in the ToT course for extension staff and other water knowledge mediators to learn to use the WRC materials 'in-field'. Also to work with this group to get the WRC programme and materials accredited (in partnership with AgriSETA) and to potentially include the WRC materials in their suite of accredited training programmes in future.
Agricultural, food gardening, rural development and educational NPOs, including farmers associations **– these have been found to have an important 'grassroots' training role.**	Potential exists for these groups to send their learning facilitators on training. Suggested strategy – to include them in the ToT course for extension staff and other water knowledge mediators to learn to use the WRC materials 'in-field'. These organisations are also potentially important partners for the community-based radio and local level media engagements. Suggested strategy – to form knowledge dissemination partnerships / collaborative media activities with these organisations.
AgriSETA – plan for and fund accredited training; develop new qualifications and skills programmes. **And, associated with the AgriSETA are: Department of Higher Education and Training; South African Qualifications Authority / Quality Council for Trades and Occupations**	Potential exists for the WRC materials and their associated training programmes to be integrated into the AgriSETAs Sector Skills Planning, and skills programme offerings; and for AgriSETA to support Agricultural Colleges to offer these as short courses. Suggested strategy – to engage DHET, QCTO and AgriSETA in high level strategic planning for occupationally directed training, curriculum innovation in ATIs, and a new skills programme that draws on WRC materials.
National and Provincial Departments of	Potential exists for these groups to send their learning facilitators on

STAKEHOLDER GROUPS	USE POTENTIAL OF WRC MATERIALS
Water Affairs – **offers training and extension services in rural areas, and works with Catchment Management Forums, and has various programmes promoting and facilitating RWH and water conservation. Also have national communications channels.**	training. Suggested strategy – to involve them in the ToT course for extension staff and other water knowledge mediators to learn to use the WRC materials 'in-field'. Also potentially important partners for the community-based radio and local level media engagements. Suggested strategy at this stage is to form knowledge dissemination partnerships / collaborative media activities with these organisations.
National and Provincial Department of Environmental Affairs **(especially those dealing with climate change). These will be consulted in the longer term, related to the roll** out of climate change programmes.	Potential exists for these groups to send their learning facilitators on training. Suggested strategy at this stage is to develop an in-service professional development / *Training of Trainers and Extension Agents / Community Learning Facilitators* course for extension staff and other water knowledge mediators / environmental educators / climate change in-field support staff to learn to use the WRC materials 'in-field'.
Water Research Commission (WRC); **While this is a WRC project it is important to link up with 'like-minded' programmes in the WRC – such as the Green Village Consultation, the WRC programme on mediation of water knowledge (based at the ELRC), a new WRC programme on mediation of water knowledge to community groups and others that appear to share a similar interest in mediating water knowledge to communities. Here there is need to avoid duplication of effort.**	WRC materials can be used to support other similar training and capacity building interventions supported by WRC. Especially the course that has been developed for water knowledge mediators by the ELRC under another WRC programme, can be amalgamated with the objectives for Component B. Suggested strategy – to adapt the course methodology of the WRC ELRC course for water knowledge mediators into an in-service professional development / *Training of Trainers and Extension Agents / Community Learning Facilitators* course for extension staff and other water knowledge mediators / environmental educators / climate change in-field support staff to learn to use the WRC materials 'in-field'. WRC also has media (e.g. Water Wheel) that can be used to disseminate core content of the WRC materials. Strategy – to engage 'like-minded' WRC projects and programmes in knowledge dissemination partnership / media-based activities.
South African Local Government Association (SALGA) **(national and provincial), in particular in relation to the knowledge hub and various publications.**	Also potentially important partners for the community-based radio and local level media engagements. Suggested strategy – to form knowledge dissemination partnerships / collaborative media activities with these organisations.
Community representatives from agricultural and rural development programmes **involving rainwater harvesting, and women farmers / rural farmers associations**	Key partners for the community-based radio and local level media engagements. Suggested strategy – to form knowledge dissemination partnerships / collaborative media activities with these organisations and with farmer groups.
Community radio stations and media-oriented NGOs and organisations **(e.g. Rhodes University Journalism Department); and other key media organisations (e.g. Farmers Weekly Magazine)**	Key partners for the community-based radio and local level media engagements. Suggested strategy – to form knowledge dissemination partnerships / collaborative media activities with these organisations and with farmer groups.

This initial analysis indicated main stakeholder groups and potential ways of engaging them in using the WRC materials. However, this required further investigation in terms of their particular interests, and existing forms of communications use. A decision was made to focus in more depth on those that were most affected by the RWH&C materials and their knowledge, where the knowledge would most directly influence their practices (Stakeholder groups 1, 2, and 3 in Figure 13 below). Further contextual analysis helped to provide a clearer understanding of the communication channels preferred by these groups, outlined in Table 13 below.

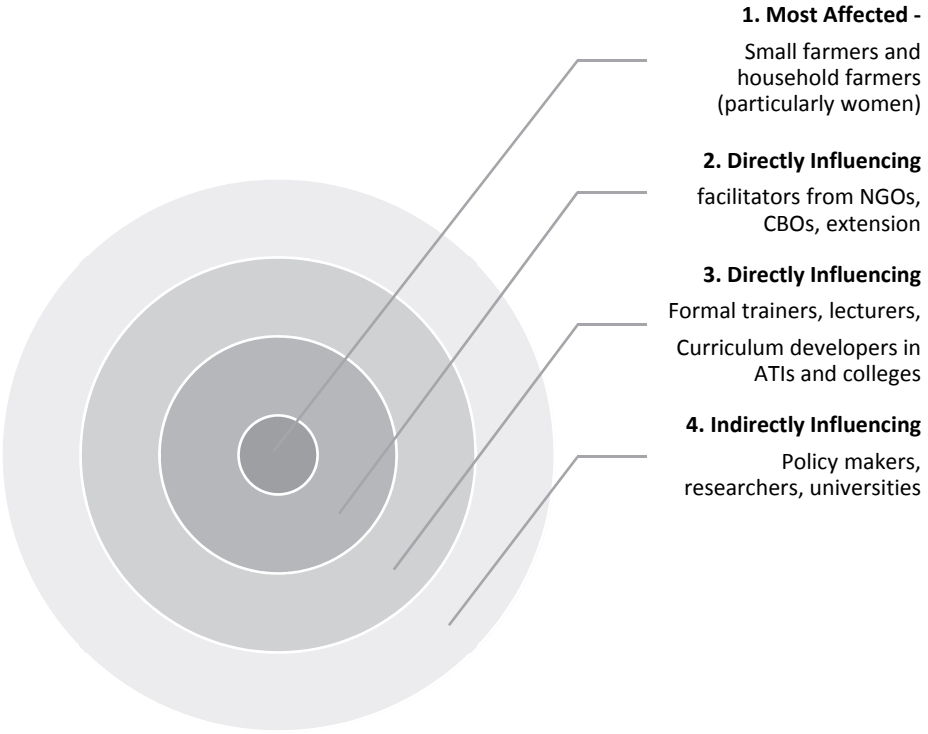


Figure 13: Stakeholder groups most affected by the RWH&C knowledge in the WRC materials

Table 13: Summary of the main ways in which the key stakeholders access information and support

Stakeholder Group	Information Sources	Support
Large-scale Commercial Farmers	• Trade journals (Farmers Weekly, etc.) • Suppliers of fertilisers, pesticides, machinery, livestock, etc.) • Fellow farmers within Associations or informally • Internet • Produce price apps (such as for maize, wheat, citrus, livestock, etc.) • Commodity groups • Local, regional and national radio and television • Local, regional and national newspapers • Agricultural research organisations • Agricultural colleges – initial qualifications and subsequent short courses •	• Farmer Associations • Suppliers of fertilisers, pesticides, machinery, livestock, etc.) • Commodity groups • Agricultural research organisations

Stakeholder Group	Information Sources	Support
Small-scale and Emerging Farmers	• Agricultural extension services • Produce price apps (such as for maize, wheat, citrus, livestock, etc.) – recent development and limited scope • Suppliers of fertilisers, pesticides, machinery, livestock, etc.) – relatively limited scope • Trade journals • Local, regional and (to a lesser extent) national radio and television • Local and regional newspapers • Fellow farmers within Associations or informally	• Farmer Associations • Agricultural extension services • Local and District Municipality local economic development departments (in some cases)
CSOs	• Internet • Trade journals/magazines • Higher Education Institutions (HEI), including Agricultural Colleges, through formal training and short courses • Research Organisations • CSO Networks • Local, regional and national radio and television • Local regional and national newspapers	• CSO Networks • Higher Education Institutions (HEI), including Agricultural Colleges, • Research Organisations • National and provincial departments of agriculture
Agricultural Extension Officers	• Internet – especially Extension Suite Online (ESO) • Higher Education Institutions (HEI), including Agricultural Colleges, through formal training and short courses • Trade journals • Local, regional and national radio and television • Local regional and national newspapers	• National and provincial departments of agriculture • Agricultural Colleges • Research organisations
Agricultural College Lecturing Staff	• Internet • Trade journals/magazines • Higher Education Institutions (HEI), especially for post-graduate studies • Agricultural research organisations • Local, regional and national radio and television • Local regional and national newspapers • Lecturer/college networks • Communities of Learning and Action (COLA) – now discontinued	• National and provincial departments of agriculture • National department of education (in process) • Research organisations • Higher Education Institutions

This analysis showed the importance of organisations such as farmers associations, research organisations, government departments, local municipalities and local government development agencies, and networks. This indicated that the knowledge dissemination system in / for the agricultural learning system is complex and is not a one-way transfer process, but is rather better framed via an engaged, networked process of learning and interaction amongst a diversity of stakeholders. This consolidated the initial concept of establishing a Learning Network approach for the action oriented knowledge dissemination strategy. The learning network concept is introduced in Section 3.1 above, and is discussed in more detail in Section 3 below.

2.4.3 Design of a Training of Trainers Course to use WRC materials (amongst a multi-stakeholder group).

Based on the analysis above of the multi-stakeholder system of learning that seemed to be visible on the ground, together with the need to foreground and actively support the use of the WRC materials, a Training of Trainers Course was designed to support members of learning networks to use the WRC materials, and to apply this knowledge to their contexts of practice *in-field.* This led to the design of a Training of Trainers course that could be run within a Learning Network of diverse stakeholders where **all could learn and share expertise in relation to the core knowledge of the WRC materials** (namely the RWH practices in the smallholder and homestead food gardening practice contexts), but which would allow them to *apply the knowledge to their particular context of work (e.g. extension services, LED support services, etc.).*

A Rhodes University accredited Training of Trainers (ToT) course was therefore designed to be offered within the learning network system. The course was designed to be offered in two streams, using the same core content but different assignments, developed at different national qualification framework (NQF) levels. The certificates offered were in:

- *Training of Trainers Certificate of Competence in Curriculum Innovation and Changing Practice* (12 credits at NQF level 6), and
- *Training of Trainers Certificate of Competence in Environmental Learning and Changing Practice* (12 credits at NQF level 5)

The Course, although run as a single training process, thus had 2 Streams; one for the formal educators, and the other for the informal trainers. Both groups were able to share the learning experiences in the contact sessions and apply these to their own areas of work. In this way they were also be able to share their own experiences and ideas with each other. In order to achieve these certificates participants were required to successfully complete tasks/ assignments, appropriate to their context and the level of certification.

The ToT was designed to mediate the use of the WRC materials, combined with the additional materials that were produced to assist with accessing and using the WRC materials placed on the specially designed amanziforfood.co.za website, providing various forms of access to these materials. The key objective of the course was met by training the trainers how to use the WRC materials to:

a) Enrich their own knowledge of RWH&C practices, and be able to see the validity and value of this knowledge for supporting household level and smallholder farmers to enhance food production,
b) Use the materials to strengthen the links between theory and practice by applying them to the co-development of productive demonstration sites,
c) Use the materials as a basis for curriculum development and innovation, and thus
d) Successfully integrate the use of the materials into their teaching and learning programmes.

Additionally, the course was also designed to support network members to deepen their knowledge and experience of RWH&C practices in local food production systems. This course was developed as a key mediating process to support the use of the WRC materials on RWH&C practices into the diverse agricultural activities and practices of the various stakeholder groups who were participating in the network. However, not everyone in the network was forced to complete the course, they could participate in sessions, but choose to complete the assignments, thus allowing for a range of types of participation and learning in the network.

The ToT course was designed to support *applied knowledge dissemination, while also* supporting participants gain a deeper understanding and practical use of RWH&C knowledge contained in the materials. The phases of the course followed the form of five module sessions, outlined in Figure 14 below.

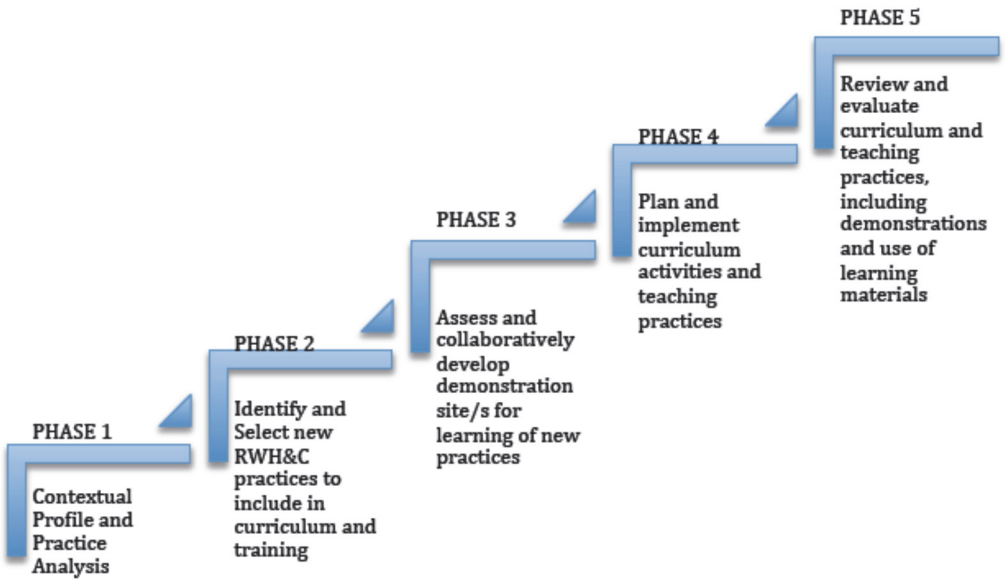


Figure 14. Training of Trainers Course Design (five phases to support applied knowledge dissemination and uptake)

As shown in Figure 14, in phase one, course participants were supported to undertake a contextual profile and investigate if any RWH&C practices are being utilised in their area. The purpose of this phase is to situate the knowledge in local context. Phase two involves identifying and selecting new / self-chosen RWH&C practices (from the range in the WRC materials) to include in their contexts of practice. The purpose of this phase is to extend existing practice and knowledge. Phase three focussed on practical utilisation of these selected practices in the implementation of collaboratively developed demonstration sites (with network members collaborating). Phase four, involves planning and implementing curriculum activities and extension or peer teaching and learning practices to support others to gain knowledge of the new practices. Phase five involves reflection on the activities engaged in, and review and evaluation of the curriculum innovation and teaching or training and demonstration practices. These phases were developed into training modules, with change project assignments, reported on in more detail in Section 3.1 and 3.2 below.

2.5 Communication and Media

2.5.1 Relevant media options for potential for dissemination of WRC materials

In South Africa television and radio are well established media platforms. There is also a vast and growing number of internet based, or Web 2.0 media communication platforms, and social media platforms. Another form of media that has high impact is television but due to the cost of television production it was decided that the programme could not focus on television, and this medium was therefore not reviewed.

In terms of traditional print media, the programme was particularly interested in the types of print media that reach smallholder and household farmers and government extension officers (other than Farmers Weekly and government information services which were considered in the section on extension services above in section 2.3). Thus, an approach was made to the Independent Publishing Media organisations that focus on community newspapers, who provided the following contextual information.

Box 3: FACTS ABOUT THE INDEPENDENT PUBLISHERS SECTOR

Circulation

87 newspapers are published weekly and print 1,220,950 copies weekly or (4,883,800 monthly)
38 newspapers are published fortnightly and print 417,600 copies fortnightly or (835,200 monthly)
55 newspapers publish monthly and print 830,500 copies monthly usually in the last week.
This is a total of 6,549,500 copies per month

Languages

97 publish in indigenous languages or a combination of indigenous and English/Afrikaans

Ownership

60% of titles are black owned
18% are owned by women

Distribution area

Predominantly in rural and disadvantaged areas throughout South Africa
• AIP publishers can translate advertising into all South African languages
• AIP in a joint venture with a mobile company is piloting SMS alerts and mobi-sites which, with data bundles, will complement print advertising.

Figure 15 below shows the reach of the AIP links to community newspapers.

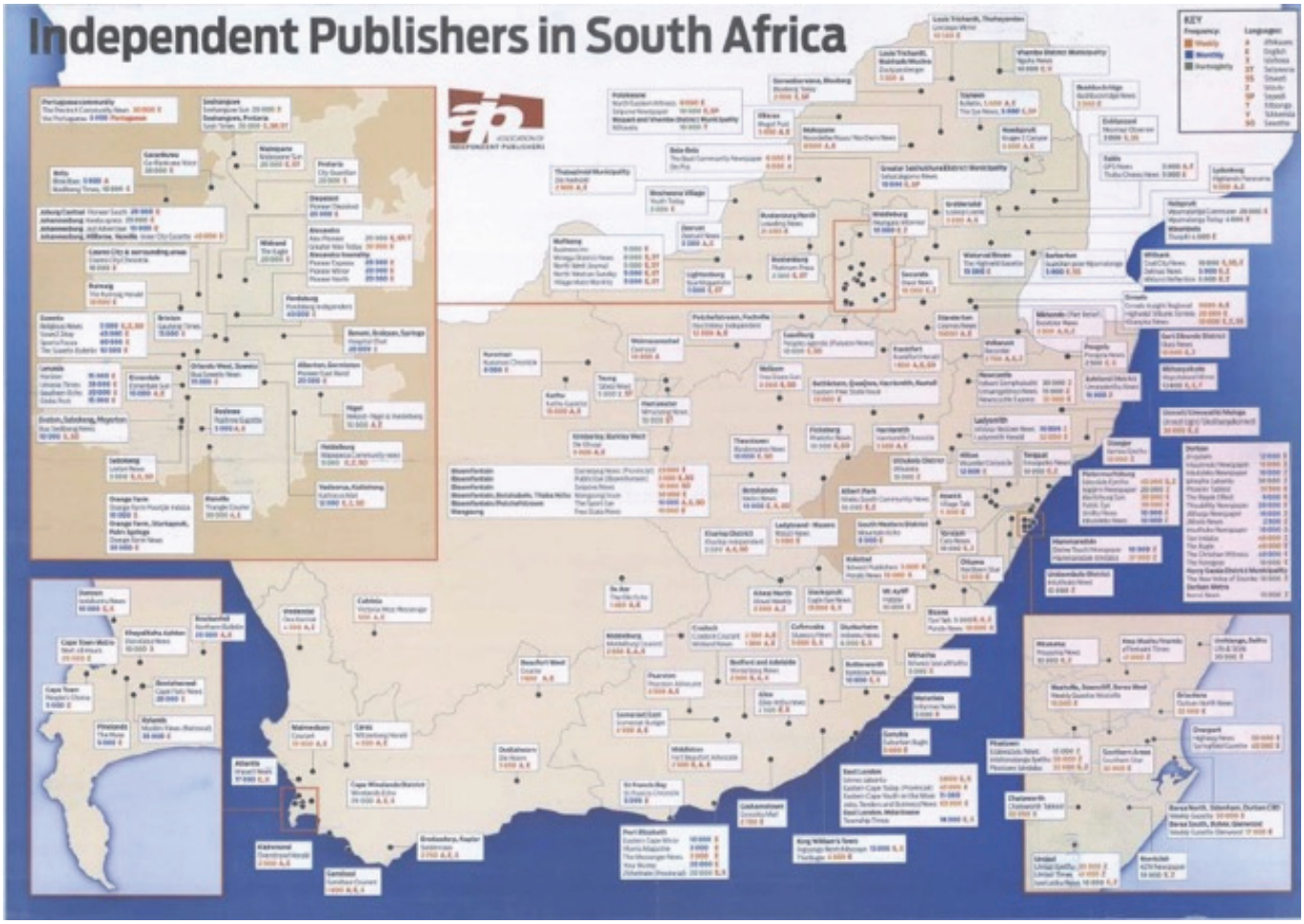


Figure 15. IAP distribution reach in South Africa

According to Vallabh (2014), the advent of Web 2.0 has opened up spaces for new forms of social engagement and learning, including learning and skills development mechanisms. Many of these engagements operate outside of formal educational systems, but also seem to provide viable tools for learning. The semantic web has undergone a shift from Web 1.0, which provided a mechanism for sharing information digitally, to Web 2.0, which embeds and integrates social processes of producing, sharing and reviewing (more than) information. This has particular implications for learning and knowledge production.

Compared to more traditional one-way media (for example, magazines, TV, etc.), Web 2.0 technologies have potential to increase opportunities to connect to wider communities of learning, access a greater number of learner and teacher generated content, communicate in a variety of ways, share and challenge ideas, and co-create content and learning support materials in a variety of forms (see for example Downes, 2006; Conole et al., 2006; Kennedy et al., 2006). These emerging platforms facilitate and enable both receiving and co/production of learning content for those who have access. Barlow (2008) and Conole (2008) suggests that Web 2.0 and its related technologies create a social space extending beyond physical locality, and facilitates interaction between like-mined people (Vallabh, 2014).

Vallabh (2014), drawing on Hart (1992) and Schnack (2008) suggests that meaningful participation in Web 2.0 requires giving attention to the quality and depth of participation, rather than new or novel ways of simply being involved in learning processes. While virtual learning environments and other forms of technology-enhanced learning create new and innovative ways of potential participation for the learner, there is a need to consider how these forms of participation are constrained as well as enabled to truly determine if and how learning is enabled through these forms of technology. Significant to this AOS is the insight from Vallabh (2014) that different communities of practice bring preferred forms of knowledge construction, access and learning choices to bear within their online learning environments, and learning processes, and within their learning resources. There are also challenges that inhibit access and use of these platforms. Livingstone (2008) notes that, “[b]eing able to use the internet is of little value in and of itself … [r]ather, its value lies in the opportunities that it opens up” (Livingstone, 2008, pp.114). Learners need to be able to access, navigate, communicate and negotiate effectively. Soneck et al. (2012) add that digital literacy can be developed either through online activity or through formal skills development, and that each stimulates the development of the other.

UNICEF, in 2012, undertook a study on **media access and literacy** in South Africa, with the following main findings that are were of interest to this AOS:

- South African residents lead as one of the highest users of mobile technology and mobile social networking on the continent. However, stationary Internet and computer ownership lags
- South African adolescents and youth are the first adopters of mobile technology, with 72 per cent of 15 to 24-year olds “having a cell phone.”
- South Africa is the leading innovator, in Africa, in social networking, microblogging and content creation.
- There is a pronounced digital divide in South Africa with regard to ICT ownership, access, and use, divided by race, socioeconomics, and geography.
- Since the growth of ICTs, many South Africans living in urban and rural communities are able to explore, share, and access digital information through mobile and computer Internet connectivity. From 2005 to 2009, the number of South Africans owning, renting and/or having access to a mobile phone increased by 20 per cent, and the country now experiences (in 2012) a 100.48 per cent mobile penetration amongst its total population of 50 million (2011 figures).
- The low cost of SIM cards and the availability of cheap handsets and of prepaid subscriptions have also enabled resource-limited users the opportunity to communicate and access information digitally.

- The mobile industry in Africa has become an enabler of economic development; mobile services have emerged in agriculture, banking, education, and healthcare. Expanding quickly, with over 620 million mobile connections as of September 2011, Africa bears the second largest mobile market in the world. In the last ten years, the number of mobile connections in Africa has grown an average of 30 per cent per year and was forecast to reach 735 million by the end of 2012. South Africa houses the third largest number of mobile subscribers in the continent, after Nigeria and Egypt. Young people are the primary adopters of mobile technologies in South Africa; nearly 72 per cent of mobile ownership occurs among 15 to 24-year olds (UNICEF, 2012: 1-5).

The 2015 General Household Survey Report produced by Statistics South Africa (StatsSA, 2016), offers the following insights into media usage, especially **internet use** patterns:

> Nationally, only 3,5% of households did not have access to either landlines or cellular phones … 53,5% of South African households had at least one member who had access to or used the Internet either at home, work, place of study or Internet cafés. Access to the Internet using all available means was highest in Gauteng (65,7%), Western Cape (63,3%) and Mpumalanga (55,7%). The lowest was in Limpopo (39,6%) and KwaZulu-Natal (42,3%). Nearly one-tenth of South African households had access to the Internet at home. Access to the Internet at home was highest among households in Western Cape (21,4%) and Gauteng (15,6%), and lowest in Limpopo (1,3%) and North West (3,6%) (see Table 14 below). … Using mobile devices to access the Internet comprises access on cellular telephones or using mobile access devices such as 3G cards. It is clear from Table 14 that mobile access to the Internet has made it much more accessible to households in rural areas. Whereas only 2,1%, 3,7% and 3,1% of households respectively had access to the Internet at home, at work and elsewhere, more than a third (33,7%) had access through mobile devices. Mobile devices also created opportunities in urban areas where larger proportions of urban and metropolitan households had access to the Internet through mobile devices in Western Cape and Gauteng (StatsSA, 2016, pg 54-57).

Table 14 Households' access to the Internet by place of access, geotype and province, 2015 (StatsSA, 2016, pg. 57)

Place Internets accessed	Geotype	Province (per cent)									
		WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
At home	Metro	25,2	10,8	NA	10,1	8,2	NA	16,4	NA	NA	16,0
	Urban	14,4	4,9	7,0	4,5	6,0	6,5	10,6	7,9	3,7	7,5
	Rural	12,6	1,2	4,5	4,1	1,1	0,9	10,2	6,0	0,5	2,1
	Total	**21,4**	**5,2**	**6,3**	**6,1**	**4,9**	**3,6**	**15,6**	**6,8**	**1,3**	**9,6**
At work	Metro	22,7	19,9	NA	13,9	21,7	NA	24,5	NA	NA	23,1
	Urban	13,9	12,2	11,6	9,7	20,7	12,5	14,6	15,5	15,7	14,4
	Rural	4,7	1,1	4,9	3,8	4,7	4,1	11,7	5,7	2,8	3,7
	Total	**19,1**	**9,8**	**9,7**	**10,0**	**14,7**	**8,2**	**23,1**	**9,9**	**5,8**	**15,0**
Using mobile devices	Metro	63,7	53,1	NA	56,7	36,3	NA	56,9	NA	NA	54,7
	Urban	39,4	50,3	51,6	45,2	48,8	50,6	58,7	63,1	50,5	51,1
	Rural	12,3	29,5	33,4	36,1	28,8	39,9	54,7	45,5	31,9	33,7
	Total	**53,6**	**41,9**	**46,4**	**47,1**	**36,2**	**45,1**	**57,1**	**53,2**	**36,3**	**47,6**
At Internet Cafes or education al facilities	Metro	15,5	13,6	NA	6,8	9,5	NA	16,7	NA	NA	14,9
	Urban	9,5	8,1	2,2	7,0	9,5	6,3	6,9	7,1	2,4	7,0
	Rural	0,8	1,3	2,6	6,6	4,2	5,3	1,2	5,0	0,9	3,1
	Total	**12,9**	**6,9**	**2,3**	**6,9**	**7,4**	**5,8**	**15,3**	**5,9**	**1,2**	**9,3**

Of interest is that the figures related to internet access had increased from 40,9 per cent in 2013, to 53,5 per cent in 2016, showing that internet access and use is increasing rapidly.

From a **social media** perspective, the South African SA Social Media Landscape 2014 Report Executive Summary published on the www, provides the following insights into social media use patterns:

> Facebook has become the biggest social network in South Africa, seeing its strongest growth yet in the past year [2013] – and overtaking Mxit for the first time. This was one of the key findings of the SA Social Media Landscape 2014 research study, by World Wide Worx and Fuseware. The study showed that Facebook has 9,4-million active users in South Africa, up from 6,8-million users a year ago [2012]. Mxit, the previous market leader, has remained stable at a little more than 6-million users (see next section), as it feels the effects of competing instant messaging services like WhatsApp and 2Go, as well as from the growth of social networking on phones. Twitter saw the highest percentage growth among the major social networks, from 2,4-million to 5,5-million – showing 129% growth in 12 months…The most significant finding, aside from the growth itself, was the extent to which social networks are being used on phones in South Africa … No less than 87% of Facebook users and 85% of Twitter users are accessing these tools on their phones. WhatsApp is presently [2014] the most popular app in the Android, Apple and Windows app stores, with Facebook in second place in the Android and Windows stores, while Instagram takes the Apple store runner-up slot. The report highlights the intensified use of social media by South African corporations, revealing that 93% of major brands use Facebook, 79% use Twitter, 58% YouTube, 46% LinkedIn and 28% Pinterest. Fewer than 1 in 10 use Mxit, Foursquare or Instagram. The survey also shows that the measurement of social media effectiveness remains relatively unsophisticated. On Twitter, 83% of companies measure effectiveness by number of followers, while only 48% conduct sentiment analysis. On Facebook, 87% measure number of fans and 79% number of posts and comments, while only 54% are assessing the tone of those posts through sentiment analysis.(http://www.worldwideworx.com/wp-content/uploads/2013/10/Exec-Summary-Social-Media-2014.pdf).

In 2015 further detail was provided on **the use of Facebook** in South Africa. Some of the detail is included below:

> The SA Social Media Landscape 2015 report, released by World Wide Worx and Fuseware … showed that Facebook remained the most popular social network in South Africa, followed by YouTube and Twitter… Of a total of 11,8-million South African users – 22% of the population – 8,8-million access it on their mobile phones. This means that targeting Facebook users is not a matter only of marketing on the Facebook web site – its mobile properties are probably more important. … More important than the operating system numbers, however, is the split between feature phones and smartphones … Five million Facebook users still use feature phones. While smartphones only just dominate – at 5,6-million – it is clear that a large Facebook user base is still on a basic device… The 13-18 age group remains the single biggest on Facebook, with 2,5-million users. (http://www.worldwideworx.com/facebook/)

Due to this trend, and the significant role of mobile phones in enabling access to internet resources, the project was also interested in exploring the potential of social media, especially Facebook and short media messaging systems (SMS) as these are increasingly accessible in rural areas, especially amongst youth. The detail of how this aspect of the AOS were developed are reported on in section 3.4.

2.5.2 *A focus on community radio*

Broadcasting in South Africa has shifted significantly since 1994, with Gross advertising revenue for South Africa's broadcasting industry estimated to have increased in value from just over R2 billion to close to R8.5 billion between 1994 and 2006 (NBA, http://www.nab.org.za/content/page/broadcast-industry). This growth reflects massive transformation in the industry. Besides the larger public broadcasting corporations (mainly SABC), since 1994 the Independent Broadcasting Association (IBA) has processed hundreds of community radio licence applications from diverse groups and sectors of South African society. Over 100 Community sound services are now in existence and although the sector has struggled to access advertising and other forms of financing it is recognised as being a crucial part of the South African broadcasting landscape – in providing diversity for listeners and much needed skills for the commercial radio sector.

When a media landscape is dominated by private media platforms, community and commercial radio stations orient their content for a niche audience, for example their programmes may be broadcasted in a local language of the area (Balancing Act, 2014). In Africa, broadcast radio is seen as the dominant medium due to its wide swath and noticeable geographical reach as opposed to other media platforms such as television and the print media. It is a far more preferred platform of communication due to its flexibility in facilitating and embracing participatory type of communication (Myers, 2008).

Broadcast radio, in South Africa can be traced back as early as 1923 (De Beer, 1998). South Africa has different kinds of radio stations, namely, community, commercial, public broadcast service and national radio stations. Community radio, which was seen to be most relevant to the main producers being targeted by the AOS is a crucial part of the South African broadcasting landscape, providing diversity for listeners and the development of much-needed skills for the commercial radio sector. However, community radio, by its nature, struggles to access advertising and other forms of financing. There are an estimated 15,4-million radio sets in South Africa, with community radio garnering almost 8,6-million listeners a week. Today the country has more than 165 community stations (see list in Appendix D) that broadcast in a number of languages with content as diverse as the country itself. Their scope and reach varies enormously – from the 416 000 in Johannesburg who make up the audience of Jozi FM to, to the 32 000 people who listen to Overvaal Stereo in the farming communities of the Free State province (South Africa Info, 2016).

Many community broadcasters are represented by the National Community Radio Forum (NCRF), which was formed in 1993 to lobby for the diversification of the airwaves and to promote the development and growth of the community radio sector. It has 120 members, of which 88 were on air in 2012. The NCRF assists community radio stations by facilitating workshops focused on the training of presenters. Today, most community radio stations in South Africa are affiliated with the NCRF. The South African Community Radio Information Network (SACRIN) project is a satellite transmission and receiving system that links NCRF affiliated community stations around South Africa to shared programming. There were 37 community radio stations sharing programming through the SACRIN network in 2005.

In recent years there has been an indication of 33.6 million radio listeners in South Africa with most listeners having to listen to Public broadcast service across the country. In the Eastern Cape, RAMS Oct 14/March 2015 listenership surveys indicate that 71% of listeners listen to Pubic broadcast service, while 29% listen to community radio, with 23% listening to commercial radio (Wits University School of Journalism, 2015). The report further indicates that the country had, at that time, a population of as many radio listeners as there are TV viewers, 3 times more radio listeners than Facebook users and twice as many radio listeners than newspaper readers.

Initial scoping for this AOS indicated the following actions and responsibilities to consider in creating a Participatory Radio campaign with WRC content:

1. Ideally the radio station will produce its own programming, but it will still need clear guidance on scripting content and fact-checking. Who will provide this on a regular basis?
2. The station(s) producers will need some familiarisation on content and objectives, in a way that makes the content specifically relevant to their audience.
3. Programmes should be broadcast at least weekly, with time for further follow up calls and SMS's that can be responded to later in the week or in the following week's slot.
4. The radio programmes should include a discussion format with a studio expert. Radio stations need to have a list of potential interviewees and contacts to invite as studio experts. This can be a direct link to the trainers/facilitators who are working in the field.
5. Including farmers in the studio discussions, whether in studio or on the telephone, increases the interest and engagement of farmers who are listening by up to 50% (Farm Radio International, www.farmradio.org).

2.5.3 Communication and branding

Early on in the AOS development process, there was a question of how the identity of the project could link very clearly to how the audiences and diverse stakeholders identified in the contextual and stakeholder analysis process would perceive the overall message and become familiar with the activities and objectives of the knowledge dissemination process. Should there be a recognisable 'campaign' or 'brand' under which the various activities will fall, so creating an identity whilst also clearly demonstrating the purpose or key message? At the start of the AOS process, documents were branded via the WRC Project K5-2277 title. This was seen to be useful for the WRC and contracted partners, but was seen to mean very little to the target audiences.

A project name is useful once content is being produced and shared with audiences across different media and channels. What will be on the top of the handout? What do radio programmers announce prior to a report from the field and in-studio discussion? What do farmers call or SMS to speak about? Who do facilitators call, look up online or email with questions, what is in the title? It was noted that these are the moments when a clear sense of identity will be useful, whilst also addressing the key message.

The name or phrase should be relevant in different languages. The concept of '**Water for Food'** was seen to be a quick way of understanding the key message behind the WRC materials and their objectives, and it was decided to work with this as a key concept to help identify the project. A decision was made to translate the first word of the concept and this became **'Amanzi for Food'** which seemed to be both clear and popular, with the strapline and co-branding indicating the link to the rainwater harvesting and WRC. The strapline chosen was *"Sharing knowledge of the conservation and use of water for food production".* However, during the life of the project the WRC felt that this should be extended to include the WRC and smallholder farmer focus. The proposed change to the strapline is therefore *"Sharing WRC knowledge of the conservation and use of water for smallholder farming and household food production".*

It was noted that the AOS would be dependent on coherent branding and clear communication on the central message of the RWH&C practices. Thus careful work was undertaken to appropriately brand the programme. It is well known that a clear branding signal is a helpful communication tool, as it facilitates easy access and recognition for the users of a programme to a range of complex and related materials, ideas, concepts and products (in this case the RWH knowledge and practices) for smallholder farmers and household food producers as contained in the two sets of WRC materials.

To develop the branding for the programme, two phases of brand design were engaged 1) initial concepts, and 2) further development of one of the branding concepts for 'Amanzi for Food'. The branding has been set up to help to structure the main elements of the programme and its communication objectives, and to enable

accessibility to the core contents of the WRC materials (based on the practices and scales framework outlined above). The branding process as explored in the programme is outlined below:

The first phase of the process was to explore a range of options, after which the one that seemed best for the programme was further developed. Five options were initially designed with option 3 (below) chosen for further development (see Figure 16 below).

Figure 16. Initial possible brand marks designed for further development

Option 3 was selected for further development, but recommendations were made to adapt it / further develop it. From here, examples of ‘roll out’ of the brand were developed, for further approval and expansion. The following ‘final logo’ and brand identity was selected as this was also seen to be compatible with the WRC logo and brand.

Figure 17. Final brandmark with strapline. The ‘strapline’ ‘Sharing WRC knowledge on agricultural water for food production for smallholder farmers’ was chosen to convey the specific purpose of the initiative. Note: the strapline was later changed to ““Sharing WRC knowledge of the conservation and use of water for smallholder farming and household food production”.

The main brandmark was then expressed via some of the visual products and materials to illustrate how it might work in practice. A style was then set for the website, and for printed publications and materials, to guide further development of the AOS processes and materials as shown below.

Figure 18. Visualisation of how the brandmark would work in practice

The branding design process was therefore important to establish a clear communications tool for mediating the programme. The intention was to establish a link between Amanzi for Food, cropland rainwater harvesting, homestead gardening water use and helped therefore to make clear the key message contained in the WRC materials.

In the next section of the report, the actual mediation processes using the conceptual and practical tools developed during the contextual profiling or scoping phase of the AOS development process are described in further detail.

3 ACTION ORIENTED STRATEGY DEVELOPMENT PROCESS

3.1 Mediation of WRC Materials with Agricultural Colleges and Universities

3.1.1 Training of Trainers

- *Training of Trainers within a Learning Network Structure*

The mediation of WRC materials with Agricultural Colleges and Universities took a number of approaches, including the initial contextual profiling and scoping processes reported on in section 2.3 above, and establishing learning networks around the colleges which combined with the Training of Trainers (ToT) course led to the development of curriculum innovation change projects and shared productive demonstration sites where the WRC materials were used to activate and co-construct knowledge of RWH practices for food production in smallholder and homestead food production sites. While it is possible for each of these processes to be implemented separately, the ToT course had the advantage of organising and focussing the learning network on collective learning around a common motive while anchoring the other dimensions. Due to limited budget it was decided initially to work with activating learning networks and running the ToT programme in two sites to begin with. The college representatives consulted at both Fort Cox and Cedara during the scoping process were keen on this idea and provided further ideas regarding the key stakeholders who should be included in their networks. One such learning network was successfully established, and named the Imvothu Bubomi Learning Network by the members of the network. Despite numerous assurances that they would be willing to establish a network, in the end the Cedara team appeared unable to establish the network despite their initial willingness. The reasons appeared to be linked to priorities in the colleges, and the need for approval from top management. While the top management were supportive, it seemed that the institutional conditions were such that it was not possible for them to host a network in the end; possibly due to the fact that they were involved in the wrapping up of the COLAs and the TACATI programme.

In response the project Amanzi for Food project team started to establish a learning network and ToT programme in the North West Province instead of KZN. Some progress was made in establishing this ToT programme and learning network, but it was not possible to proceed to the phase of productive demonstration site development in this site. Due to limited time and resources, it was not possible to implemented a fully-fledged ToT based on the full model with all five phases developed in depth, hence other formats of the ToT programme were also pilot tested. The second learning network established in the Potchefstroom / Taung college cluster context was strongly supported by the Principal of the North West Colleges of Agriculture / ATIs, Mr Dipepeneng Serage. His motivation was to strengthen college engagement with climate smart agricultural practice, of which RWH&C is a key activity and focus. A one-day initial ToT was run with the NW ATIs with support indicated for a more extensive ToT for staff at the two colleges, for supporting productive demonstration facilities on or near the College grounds, and for involving the local Agricultural High School in Parys, and making links with the Agricultural Research Council (which has offices on the College premises) and the local university (North West University). This emerged as a key outcome of the shorter Training of Trainers intervention (reported on below). The formation of this learning network and its activities is being supported by van Staden (2016), who has started working with college lecturers to firstly undertake a more comprehensive curriculum analysis in relation to the principles of climate smart agriculture and RWH&C for smallholder farmers. This work will allow for alignment of the curriculum review with principles of competence-based learning, and will therefore create a strong platform for a more extensive ToT using the WRC materials. At the time of writing this report, the curriculum review had been planned and was being undertaken via a participatory approach with the College lecturers. This process of working with the North West ATIs has

therefore been built into a Phase 2 Amanzi for Food programme proposal, and the PhD candidate is being supported by the SARChI Chair at Rhodes University to continue the research.

Figure 19. Potchefstroom / Taung Colleges ToT workshop (developing into a Learning Network)

- *Overview of the ToT course*

The ToT course and its five phases, introduced briefly in section 2.4, was designed to provide a 'core means' of disseminating the WRC materials on RWH&C through engaging participants in reflection on their current practices, questioning the challenges they were facing in their work regarding water availability and access, and developing solutions that worked for their contexts. The timeframe over which the ToT process was implemented for the full five modules was over a 12-month period, which included a contact session (Learning Network Meeting) once every one to two (2) months. This was also in accordance with the Rhodes University short course policy for a 12 credit course framework.

The guiding principle for the Training of the Trainers Course is that of 'work together work away', in which the partners in the Learning Network, under the guidance of the course tutors discuss the issues associated with the focus of each phase (see below), and then use the outcomes of these discussions, and their learning from them, back to their work context and undertake tasks/assignments. The Course orientation is strongly informed by the 'Spiral Model for In-Service Professional Development' (Figure 20).

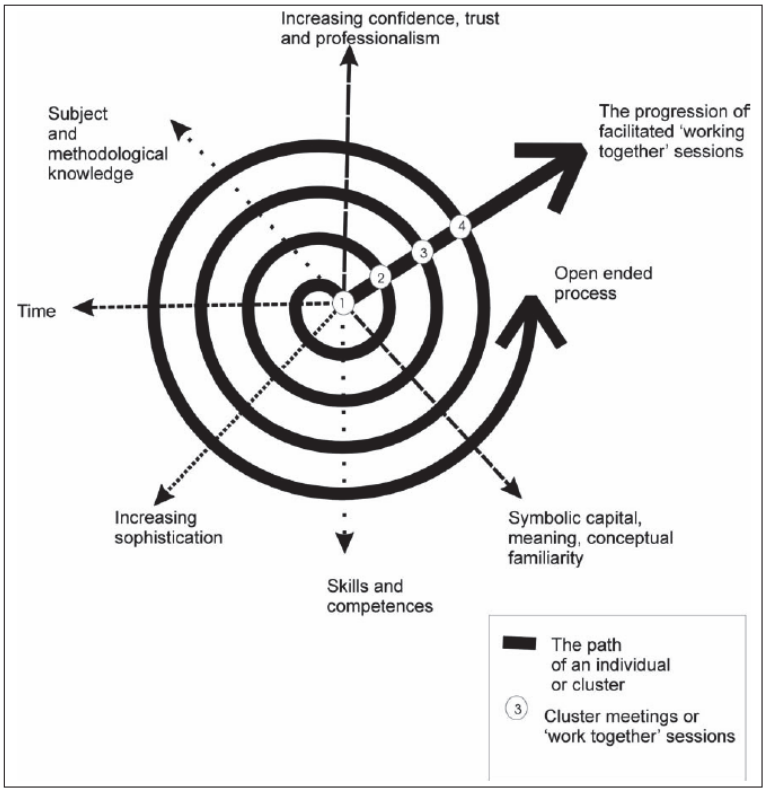


Figure 20: Spiral Model for In-Service Professional Development (Janse van Rensburg & Lotz-Sisitka, 2000)

The five course modules were developed in response to the participants' initial aspirations, with content developed closer to each module delivery using the latest known capacity needs, and linking relevant college and university curriculum references to rainwater harvesting with relevant sections of the WRC materials.

The course is focussed very much on the use of the WRC materials, in a variety of forms, in particular:

- ***Info-cards*** – providing short summaries of the key practices as identified in the materials. Available for download from the website (www.amanziforood.co.za)
- ***Handouts –*** with more detailed information – most handouts taken directly from the materials. All handouts provided for the course participants, and available for download from the website
- ***The full WRC Materials –*** provided in hard copy to all course participants (although more copies still needed), and available through the website

The focus for each course module includes:

Module 1

- Introduction to the WRC materials, their objectives and the main practices covered in the WRC materials
- Use of a 'Navigation Tool' (focussing on the main practices in the WRC materials, and their application to different types of farming, as described in Section 3.1 above), to identify specific practices and where in the WRC materials to find information on them
- Farming scales, farmers' aspirations and other factors influencing choice of practices
- ***Application to own curriculum context****:* Selection of practices and supporting information from the WRC materials

Module 2

- Teaching and learning methods for a community engaged approach to agriculture and RWH&C food production and learning
- The teaching and learning approaches in the WRC materials
- ***Application to own curriculum context:*** Review of existing curricula and training programmes in relation to their coverage or RWH&C practices as presented in the WRC materials and the navigation tool; discussion on availability and the importance of practical demonstrations

Module 3

- Productive Demonstration Sites
- The use of 'Teaching Gardens'
- ***Application to own curriculum context:*** Collaboration on developing the sites and using the WRC materials in the development of the sites
- Recording and documenting the development of the sites

Module 4

- Developing curricula and training programmes
- ***Application to own curriculum context:*** Use of the WRC materials or supporting information in curriculum development and planning how to integrate these into own Subject and/or curriculum contexts
- Sharing the WRC information more widely through the website, radio and cellphones
- Expansive Learning and ongoing engagement in productive demonstration site development

Module 5

- ***Application to own curriculum context and learning network:*** Review and evaluate curriculum development practices, as well as teaching and learning options and possibilities developed in the project
- Evaluate the use of the demonstration sites and WRC materials in the learning as means of strengthening integration of theory and practice
- Identifying ways forward for strengthening the learning and the use of the demonstration sites and WRC materials for learning based on existing experience and progress

Assignments

In order for course participants to achieve a Rhodes University Certificate of Competence, it was necessary for them to undertake a number of individual assignments and one group assignment. The assignments were not mandatory for all course participants and some elected not to go for certification, in which case they did not need to complete assignments. Those who either chose not to undertake the assignments, or who did not submit all assignments, or did not achieve the required level in the assignments they did submit, would receive a Letter of Attendance.

The summary boxes below (Figure 21) shows the structure of the course, and the assignments (written assignments) for each of the modules.

Phase 1/Module 1: Summary

Amanzi for Food

Stream 1

Universities, Colleges …

Task 1:

A review of your existing curriculum to identify and describe the farming systems you are promoting and how these are including RWH&C practices or not and/or how this can be done

Food growing, food security and children's nutrition

The farming system and how to integrate RWH&C practices

Review of our existing practice in this area

Stream 2

Farmer training providers…

Task 1:

A review of your existing practice and context to identify the farming systems you work with and how RWH&C is currently practiced in your context and/or how this can be done

Phase 2/Module 2: Summary

RWH&C practices

Stream 1

Task 2

Review the RWH&C practices in the WRC materials and describe how you could integrate it into your curriculum. You can use the options paper as a guide. Planning of demonstrations in your context.

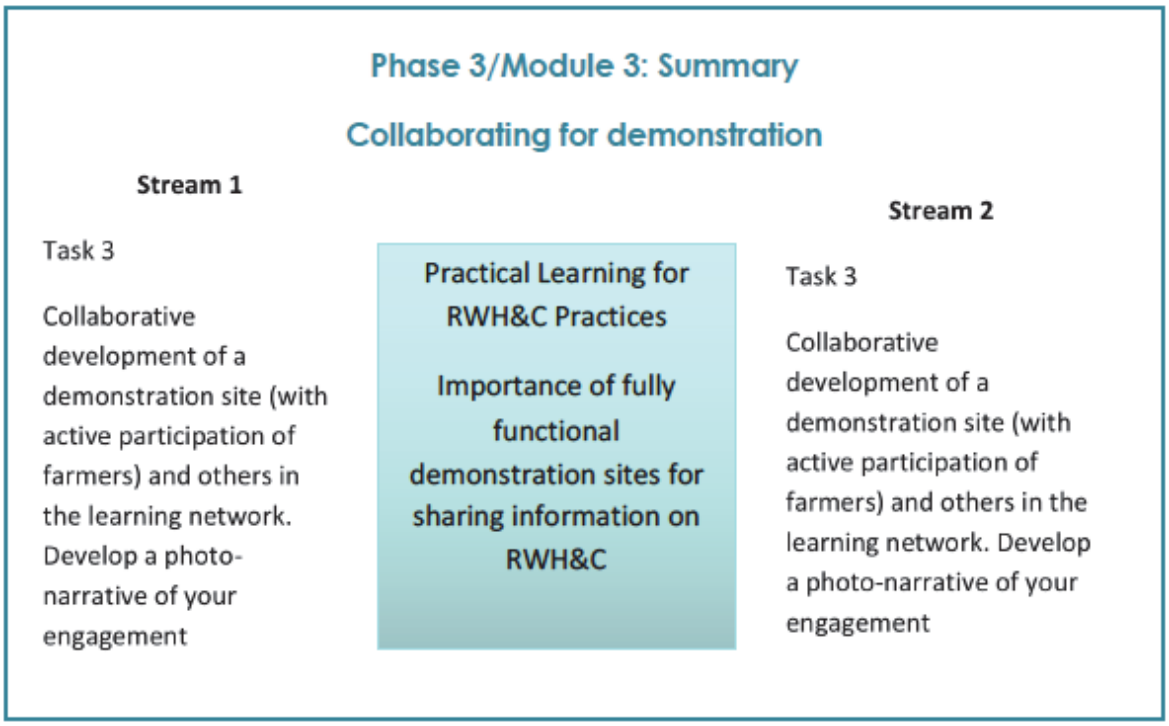
Learning approaches: integrating theory and practice

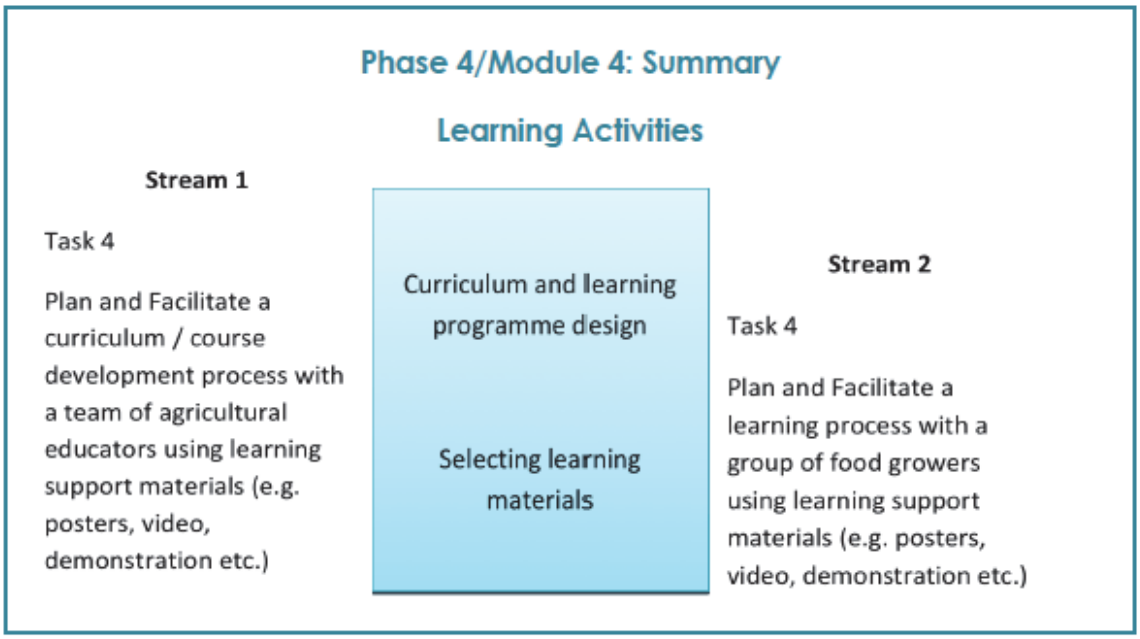
Experiential and social learning

Stream 2

Task 2

Review the RWH&C practices in the WRC materials and describe how you could integrate it into your training programmes. Planning possible demonstrations in your context


Phase 3/Module 3: Summary
Collaborating for demonstration
Stream 1
Task 3
Collaborative development of a demonstration site (with active participation of farmers) and others in the learning network. Develop a photo-narrative of your engagement
Practical Learning for RWH&C Practices
Importance of fully functional demonstration sites for sharing information on RWH&C
Stream 2
Task 3
Collaborative development of a demonstration site (with active participation of farmers) and others in the learning network. Develop a photo-narrative of your engagement


Phase 4/Module 4: Summary
Learning Activities
Stream 1
Task 4
Plan and Facilitate a curriculum / course development process with a team of agricultural educators using learning support materials (e.g. posters, video, demonstration etc.)
Curriculum and learning programme design
Selecting learning materials
Stream 2
Task 4
Plan and Facilitate a learning process with a group of food growers using learning support materials (e.g. posters, video, demonstration etc.)

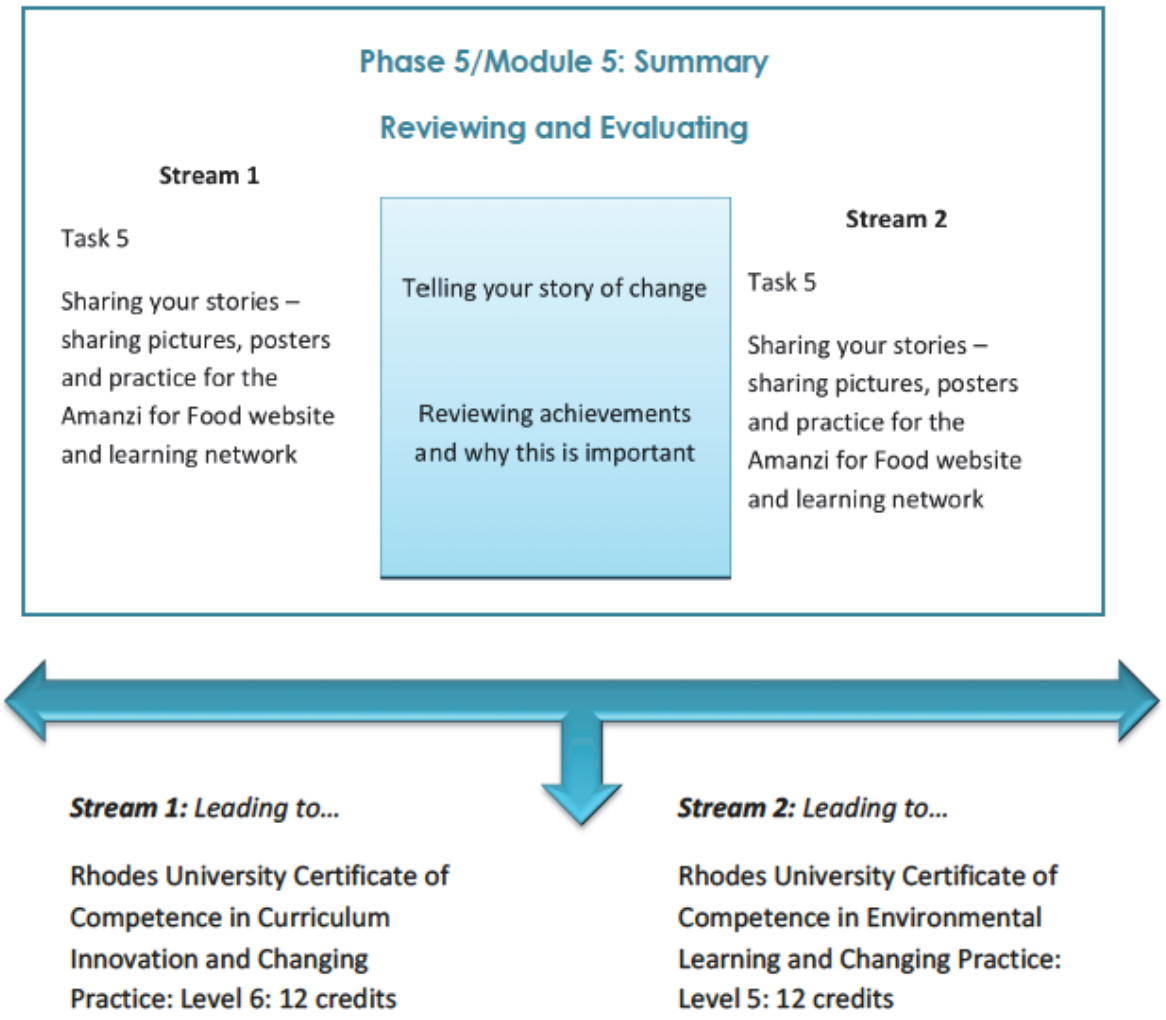


Figure 21: Summary boxes outlining the ToT course assignments and accreditation structure

- *Full implementation of the ToT course within the Fort Cox ATI and Imvothu Bubomi (IB) Learning Network*

Figure 22. Members of the Imvothu Bubomi Learning Network, including Fort Cox College Lecturers, and lecturers from the University of Fort Hare

All 5 modules of the course have been implemented with the Fort Cox-based Learning Network, known as *Imvothu Bubomi* (Figure 22), with the final module completed in April 2015. Aspects of these modules have

been used for shorter ToT interventions with other colleges as reported on below. Detailed reports have been produced on the facilitation and outcomes of each of the ToT modules, and these include in-depth evaluations by the participants. These provide strong evidence of the knowledge mediation within the ToT modules and how participants, including the college personnel have responded to this. To summarise the reports:

Module 1: This opened with an introduction to the ToT course, and what it was intended to achieve. The purpose and importance of the WRC materials and their mediation via the Amanzi for Food project was then discussed, with particular emphasis on its potential contribution to food security at household and smallholder farming levels. There was then a discussion on the different farming practices with which the participants were involved, or which they knew were taking place in their area. The idea of RWH&C practices was then introduced, with the recognition that these don't take place in isolation but contributed to a range of farming practices. A number of RWH&C practices already being used by farmers in the area were identified, and further discussions and activities based on these.

From there the participants were introduced to the use of the 'navigation tool' (Appendix A) as a means to access particular information in the WRC materials (as outlined above) that they might need in relation to any practice in which they were interested. They worked in groups to apply the navigation tool to search for information in the WRC materials. All participants had a good idea of how to use the navigation tool, and no one had any problems with the modules' contents. The navigation tool is available on the website under the banner of Catch Store and Use Water (http://amanziforfood.co.za/catch-store-and-use-water).

Figure 23: Group work on identifying RWH&C practices in the WRC materials using the Navigation Tool

Module 1 evaluation summary: Many of the participants expressed that they learnt about new RWH&C practices, **most of which they had never heard of before**. Participants were grateful for the opportunity of getting together in the Learning Network and learning from each other. Participants stated that they contributed by sharing their knowledge and experience on various farming practices in the class and group discussions. Participants found the ToT module valuable because of all the new RWH&C practices they learnt about and when sharing experiences and knowledge with cross-section of farming community stakeholders. Participants found the ToT module valuable because farmers should know about more RWH&C practices to use water to produce food and there is a space to share information between the different people in the agricultural sector.

Figure 24. Participants working in pairs to clarify RWH&C practices

Facilitators of the ToT module from Rhodes University were surprised that very few members of the network had any in-depth knowledge of RWH&C practices. This affirmed the initial findings of the consultative process which explained that the WRC materials, while appreciated, had not been used as people had very little knowledge about the practices. This can be explained by the fact that this is not a knowledge area that has historically been promoted in agricultural college curricula due to the more traditional emphasis on irrigation systems and their operation and management (as is also the case in the AgriSETA training context).

Module 2: The focus of this module was on teaching and learning, and what are the most appropriate ways to share information on RWH&C practices. After a brief recap on the most important RWH&C practices identified in Module 1 the discussion turned to how people learn, and in particular the key teaching and learning methods in agriculture. Participants formed three groups (lecturers, extension officers, farmers) and in these groups discussed a number of questions related to how they themselves learn, and how they teach others.

Figure 25: Group discussion of teaching and learning methods in agriculture

This activity provided valuable information on the most widely used methods for sharing information, as outlined in Table 15 below:

Table 15. Main approaches to learning used by participants

Questions	Lecturers	Extension Officers	Farmers
Q1. a) How we learn best:	• Internet • Training course materials • Experimental projects • Research	• Studies/ Lectures • Experimentation • On-site observations • Experience (involvement in practical activities) • Reading literature	In the rain water harvest we as farmers, we have learnt how to control water and how to use water properly without wasting it.
b) How we teach:	• Lecturing (visual aids) • Practical (mulching – vegetables, runoff) • Experimental projects • Demonstrations		Share in meetings, discussions
c) Methods most helpful:	• Experimental projects • Community engagement	• Experiment/trials • Visits to sites • Presentations (farmer days, seminars)	Get knowledge in the field by experience
d) Where we get information:	• From farmers • Sharing experiences	• Online • Learning networks • Radios (media) • Educational organisations	
Q2. Who are the learners/trainees?	• Students • Farmers • Extension officers • Educators	• Farmers (e.g. communal, emerging and commercial), • Community and Colleagues	
Q3. a) Type of learning opportunities:	• Field visits • Research projects • Oral presentations • Practical • Assignments	• Practical experience • Exposure (e.g. shows) • Networking • Programmes (funded)	

Questions	Lecturers	Extension Officers	Farmers
b) Methods in our teaching:	• Lecturing • Oral presentations	• Onsite observations • Experiments/trials • Practical involvement	We share with others through: • Meeting in forums or associations • Phones – we also phone in on radio shows • Agric shows • Facebook and Twitter
Q4. Information sources:	• Books • Journals • Training materials	• Manuals • Posters • Magazines • Articles	We share in training

Module 2 evaluation: Participants felt that they got a better insight into how the networking system is working and they found the opportunity to share their ideas and stories with others very valuable. They indicated that they are learning about more RWH&C practices, and that old traditional practices (such as Gelesha) should be reintroduced and put into practice again. Participants also noted that they were developing curriculum reviewing skills which they did not have before. The list of different sources of information and going through the assignments was found to be useful for the participants.

Facilitators in the Rhodes University team were surprised to find that none of the lecturers in the network had previously been engaged in a practically oriented approach to curriculum reviewing. They also noticed that the concept of curriculum held by lecturers was a technical view, which seemed to see curriculum more as a prescriptive document rather than a contextualised social process. Lecturers themselves were surprised that they could review curriculum based on the new knowledge that they were gaining from the process as well as from the interactions and dialogue with farmers and other members of the network. This affirmed the earlier finding in the college deliberations where it was reported that lecturers lacked curriculum development skills, which can be traced back to the history of curricula being 'prescribed' in a technical manner which expected lecturers to implement the prescribed content. Thus it would seem that a limited concept of curriculum has impeded understandings of curriculum development, and the potential for situated curriculum innovations.

Module 3: The focus of this module was on the development of the productive demonstration sites, and their importance to college curricula and training programmes, especially to bridge the theory-practice gap that was identified in the early consultations. This followed on from the strong emphasis on practical demonstrations as a key teaching and learning method, identified by participants in Module 2. Further detail on these practical demonstrations as developed via the ToT and learning network interactions is provided in section 3.1.3 below.

Module 3 evaluation: Participants reflected that the objectives of the training session for Module 3 were met satisfactorily based on the engagement with the concept of the productive demonstration sites and their planning (the planning on which demonstration sites to develop was done in the session with the participants). Another noticeable feature of Module 3 is that participants were 'easily' reaching for the WRC materials and using them as resource materials for the planning of their demonstration sites. They used these to find out how to go about the RWH&C practice that they were planning, i.e. to find practical guidance, but also to find

more in-depth information. The navigation tool was used for accessing the materials where they needed new or more information.

Facilitators reflected that use of WRC materials was progressing well and with more 'ease of use' as many participants referred to content in the materials as they needed it during various sessions of the ToT module. Facilitators also noted that this was complemented by participants engaging with each other on the topics of choice and that the materials were shared more widely by this approach (i.e. they consulted each other and the materials to produce wider knowledge of the practices they were interested in). Additionally, facilitators noticed that participants were engaging with each other (from different constituencies) in-between the ToT module trainings, which was a good sign that the network was being found useful. The facilitators however, reflected that more such contacts and engagements seemed to be needed, more so in the collaborative planning and development of demonstration sites that were underway. This is because the demonstration sites were 'productive' demonstration sites, and were selected for their viability and their already in progress possibilities (i.e. they were already present in the community and needed to be developed further). Facilitators reflected that this helped to link the curriculum plans of the colleges to community contexts and knowledge, facilitating a more community-engaged approach to curriculum development and planning. The following citation from one of the lecturers gives evidence to the curriculum and community links intended for the demonstration site proposed for Fort Cox College:

> Vision for future use and sustainability of the site:
>
> The main objective for the erection of this site is the *demonstration of the farm pond rain water harvesting technique firstly to the college students and also to the farmers in the neighbourhood or any other interested groups*. Together with the pond shall come a complete irrigation system that includes water conveyance, tank storage, and distribution, all tailor made for meeting the crop water requirements of a cropping area. Preliminary studies will be carried out about the viability of the system prior to the actual demonstrations.
>
> *The initial stages of the erection of the site shall involve the active participation of students* taking a course in irrigation principles. As part of their practical engagement with the course students shall own and man the site through the system installation, cropping and irrigation phases of the initiative. The group is yet to work out a sustainability plan for the site during the initial stages of site development. An ownership transfer strategy shall be finalised which will include *the engagement of students taking projects aligned to rain water harvesting and/or irrigation as well as College's farm employees at all the stages of RWH site development*. This shall serve to buffer labour requirements needs of the site during holidays when students are away from the college. The group members shall continue to be the main custodians of the project to keep it in motion and ensure its effectiveness. There shall also be a monitoring and evaluation plan to be drawn up by the group that will keep the progress of the site operations in check and also measure the site's achievements against its objectives. (Personal Communication, July 2015)

The above aspirations were eventually met to a great extent as the demonstration site development at Fort Cox College involved students, and ideas for its utility were informed by farmer needs during ToT course sessions and focus group discussions of such sessions. Figure 26 below shows the outcome of the RWH&C productive demonstrations established at the Fort Cox ATI, as a result of the focussed work in Module 3.

Figure 26. Farm pond, elevated tank, and drip irrigation integrated into one system at Fort Cox ATI during the Amanzi for Food ToT programme.

Module 4: This module was intended to further extend and consolidate what was by now an emerging process of curriculum development as lectures had already improved their knowledge of RWH&C practices, they had looked at the curriculum to see what they were / were not doing with RWH&C knowledge and practice, they had considered how to teach RWH&C knowledge and they had already started to actively plan productive demonstration sites with local partners to provide for opportunities for integrating theory and practice. The module helped them to reflect on this progress being made with their curriculum development work and to begin to link it more specifically to the Subjects where the RWH&C could be integrated and included, and to consider how this could be taught and assessed using the WRC materials and the demonstration sites that were being planned and developed. The group completing the Certificate in Curriculum Development were also exposed to curriculum theory, and a generic model for curriculum development (Figure 27 below) which helped them to reflectively review what they had been doing already, and to consider what still needed to be done. Engaging with the model involved discussion of some key principles underlying curriculum development, namely:

- Knowing the audience (the learners/students)
- Building on people's exiting knowledge and experience
- Where possible involve the audience in the development of the curriculum

The ways in which these principles can be applied in the different contexts of the course participants were discussed. Each stage in this model was discussed in relation to the integration of RWH&C practice as was

already in progress by participants – as outlined above. The model therefore was helpful for reflections on the progress being made on curriculum development.

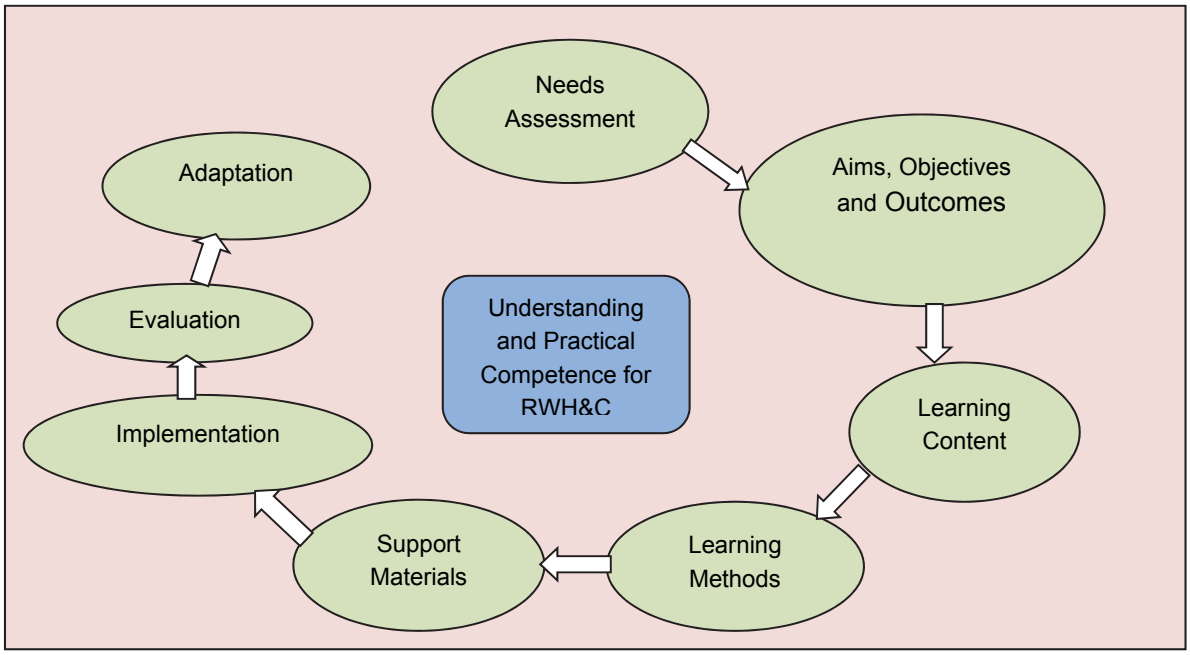


Figure 27: A Generic Curriculum Development Model

From the evaluation: The main outcome was greater awareness of the way in which RWH&C practices could be incorporated into existing curricula (colleges and university) via use of the materials and the demonstration sites to increase food production and productivity at various scales and farming systems in their learning network. An example of curriculum development work done in this context is included below in Figure 28. The example in Figure 28 is taken from the assignment of one of the College lecturers.

Name of curriculm document/practice and year	General and topic/s overview, level of implementation	RWH&C content or issues(explicit)	RWH&C content (implied)	comments
Fort college prospectus 2013	Soil and water conservation course 4th semester (P.87)	Water conservation techniques, Rainwater harvesting (infield and exfield), and Loss of water in the field.		Construction of RWH structures not being done
Fort college prospectus 2013	Introduction to agricultural engineering- P63.	Tillage operations; Conservation agriculture Crop residue as mulch	Ripping as a practice that breaks plough pan and allows water infiltration to higher depths	Concepts covered in depth
Fort college prospectus 2013	Introduction to soil science- P65		Soil moisture	Reflects the importance of soil moisture to plant growth and hence the need for RWH
Fort college prospectus 2013	Irrigation principles- P70	Sources of water- rainfall, runoff, underground water,	Soil moisture relationships, available water, evapotranspiration, flood irrigation	Some of the flood irrigation techniques can be used in RWH

Table 1. Curriculum options and review from a RWH&C perspective

Figure 28. Extract from a course assignment showing curriculum development options for integrating RWH&C

Facilitators reflected that the use of the model *as a reflective tool* helped the lecturers to see that they had already made progress with curriculum development, and this gave them confidence to further refine the curriculum development work related to the RWH&C practices. Curriculum development was therefore made more accessible to the lecturers and less of a 'foreign or far removed practice, normally done by others'. This also helped to consolidate a concept of curriculum as a 'contextualised social process' and not a 'blueprint' to be implemented. By centering understanding and practical competence of RWH&C at the heart of the curriculum model, lecturers were also able to quickly grasp the meaning of a competence-based approach to curriculum development, indicating that this approach can help with the development of curriculum development competence for CBL in ATIs.

Module 5: The final module of the Training of Trainers course provided an opportunity for some deep reflection on the learning throughout the course, and within the Learning Network itself. The module comprised a series of reflections on different aspects of the course and the WRC Amanzi for Food project. By this time the productive demonstrations had been developed around five practices (see below in section 3.1.3), engaged and expansive learning around implementation of new RWH&C practices was taking place around the Lloyd Garden (a community garden in the area) and in other sites (e.g. Keiskammahoek), the NEDA (Nkonkobe Local Economic Development Agency) was supporting farmers, and college lecturers were engaging with farmers and the farming networks in the area around the development of RWH&C practices. Closer relationships had also been established between Fort Cox and the Universities of Fort Hare and Rhodes University, and the Dohne Agricultural Research Institute. As part of the media component of the project (see section 3.4 below) the local radio station had also become involved and lecturers and other members of the network had been reporting on their work via the radio, with community 'call in's' coming in.

Reflections were therefore focussed on the whole Learning Network process. These included:

- ***Reflection on the Forte FM radio broadcast:*** The module followed shortly after the first radio broadcast where members of the learning network and the project team discussed rainwater harvesting practices on the station's Ezolimo farming programme. The feedback from the programme had been very positive, and Ngeletshedzo Makhaga, the Fort Cox college lecturer on the panel said "…one underestimates what they know before you get tested…", meaning that she didn't realise how much she knew and how much she could link to her work. Mrs Lumka Maso, the farmer on the panel, enjoyed being on the show and people have contacted her subsequently her to ask her questions, she indicated that people can come and visit her demonstration site.
- ***Reflection on the importance of RWH&C and the practices:*** The focus of this reflection included the need to respond to climate change, and the value of RWH&C practices in this. In particular, the emphasis was on how RWH&C can contribute to maintaining food security in the lights of climate variability. The responses included: erosion control, as sources of clean water, improving soil quality and moisture, reducing costs of production and ploughing, strengthen community in working together, it can improve vegetable production and extend the growing season, it can supply water to livestock in livestock production. The RWH&C practices important in participants' teaching and farming activities were identified as: Gelesha, tied ridges/matanyana, mulching, diversion furrows, fertility pits, ponds, maybe Saaidamme (although this was not a practice known in the Eastern Cape). One simple practice considered very important for those interested in RWH&C practices and related to Climate Smart agriculture (a holistic, conservation-oriented approach to agriculture adapted to climate variability) was that of going out while it was raining to watch the way that water moved over the ground. This made it much easier then to see how best to channel the water to where it was needed.
- ***Reflection on the value of the learning network:*** The main values identified were the increased collaboration between members, which could support not only RWH&C practices but also many other

initiatives undertaken by network members. The network fostered teamwork between farmers, extension officers and college staff.

- ***Reflection on access to and use of the WRC RWH&C materials:*** The emphasis was put on the two sets of books that all the members received as well as the Amanzi for Food website that accesses the WRC materials (www.amanziforfood.co.za). The importance of the Amanzi for Food Facebook site was raised and how it can link to the website and other interesting articles. Hand-outs were also seen as very important resources for accessing the materials especially for the farmers. The extension officers emphasised the importance of hand-outs for farmers that they can access through the web in the office. Another important consideration is to also provide hard-copy WRC materials for the farmers and extension to use. The question was raised of the desirability of putting the information into videos. The response was that as much video recording as possible would be taken at the demonstration sites to get the right footage.
- ***Reflection on the integration of the information into participants' work:*** The Keiskammahoek demonstration site has integrated RWH into the demonstration site and they have done some research there with the control side of the plot. A farmer discussed how he is integrating RWH into his demonstration plot, he is busy studying the materials to add practices into his garden. He representative of the Nkonkobe Economic Development Agency (NEDA) added that he had given some information from AWHGS to a farmer he knows. The Fort Cox lecturers added that they are integrating it into their curricula; one of them has started on her soil and water conservation course using the RWH&C materials. Another has used practices such as mulching and ridges in her practicals with students. The Fort Cox College Rural Development Centre has started making a manual for RWH&C. Amanzi for Food is also a catalyst for community development and collaboration between institutions and organisations in the agricultural sector. The outcome of all this work is food security and improved nutrition.
- ***Reflection on sharing the learning with others:*** The question was asked how do people share information? The responses included: Internet (Facebook and websites), books, learning network and meetings, radio, workshops, demo sites and hand-outs, doing, indicating that the Amanzi for Food approaches to activating knowledge dissemination were all being used in practice.
- ***Reflection on how to further develop understanding of and skills in RWH&C:*** Everyday practice was identified as the main way to strengthen understanding and skills. Another way of developing a greater understanding is writing about experiences and sharing this through various avenues. It is important to reflect on and change various practices to work better for you rather than following it step by step from a book that is not taking your context into consideration, for example in Mrs Maso's garden the tied ridges were adapted to work for her garden size and slope.
- ***Reflection on turning understanding and skills into action:*** It was important to explore and try out skills to grow a greater understanding. It was suggested that there could be an 'Information Day' at Lumka Maso's garden. This suggestion was added to the list of milestones. It is also important to engage with agricultural policy processes; for example, the Department of Agriculture was developing a conservation agriculture policy and RWH&C should be central to this policy but this needs to be followed through to make sure that it is located firmly in the policy. After that the policy, including the RWH&C components needs to be implemented and put into action. Curriculum reviews, usually carried out at 5 year intervals are important opportunities for integration of RWH&C understanding and practices into the curricula.
- ***Reflection on the advice to give others who are interested in learning about and implementing RWH&C practices:*** Rainwater harvesters should be seen as innovators who can lead the changes in agricultural practices to meet the needs for food security and to address climate change and other challenges. It was however emphasised that it is important to find out the history of the person and the place before giving advice and that one needs to be confident in giving support and advice. A

college lecturer said that she would refer people to the website to learn more about different RWH&C practices and take them to the demonstration sites. An extension officer would invite people to the network to share their experiences and stories with a diverse group of people.

Module 5 evaluation: The objectives of the training session for module 5 were met satisfactorily based on the coverage of the programme content, reflexivity with respect to participants' learning needs and progress. The use of WRC materials and the WRC Amanzi for Food website was encouraged and seemed to be progressing well as many participants referred to content material during various sessions of the module training. At the end of the ToT programme, a number of participants were engaging with each other in-between module trainings in the demonstration site development process. Specific curriculum development outcomes and the learning progress of the College Lecturers is reviewed in more detail in the next section (as found in the course participants' assignments, projects and portfolios of evidence) (see also Weaver, 2016; Pesanayi, 2016).

- *Reflections from ToT engagements with other colleges*

As indicated above, and as can be seen from the results of the curriculum innovations process, the intensive engagement with this model of curriculum development within the IBLN has led to substantive outcomes. As indicated above, there was an intention to expand this to a second Learning Network with Cedara as the 'hub' of the COLA network. This did not work out as planned, despite many efforts on the side of the RU team. Also, the process as described above was labour intensive, and required regular interaction with the network. The fieldwork budget of the project was also not high, and a decision was therefore made to, instead of engaging as intensively with another learning network, to rather undertake a series of shorter one or two-day ToT curriculum development workshops with a range of other colleges to test the insights, outcomes and processes, and to deliberate the principles of the emerging recommendations for the AOS. Thus, three other shorter ToT curriculum development workshops were held with a range of College types:

- The Potchefstroom / Taung College Cluster, which included a lecturer from the Agricultural High School in Parys (which offer Level 5 and 6 diplomas and are re-orienting some qualifications towards a degree offering)
- The Lovedale TVET College (which specialises in agricultural training at Levels 4 and 5)
- Lowveld College which is being amalgamated into the new University of Mpumalanga and which will offer Agricultural Degree Programmes (Level 7)

Thus, overall, a number of training institutions / organisations were engaged by the Amanzi for Food mediation of WRC RWH&C materials using selected aspects of the ToT programme, namely:

- Fort Cox College of Agriculture and Forestry (through extended ToT course and full scale development of practical demonstrations within the learning network)
- University of Fort Hare (Through ToT in the IB Learning Network)
- University of Mpumalanga (former Lowveld College) (through a ToT curriculum development workshop)
- Lovedale FET College (through a ToT curriculum development workshop)
- Potchefstroom Agriculture College and Taung Agricultural College (through a curriculum development workshop, with ongoing support being provided for curriculum review)
- Grootfontein (through a ToT curriculum development workshop)
- Cedara Agriculture College (through curriculum development consultations with the COLA)

Some insights from these engagements are reported on below.

North West Colleges / ATIs: On July 14th, 2015, Amanzi for Food hosted a full-day curriculum workshop (ToT workshop) focussing on climate change and water conservation farming at Potchefstroom Agricultural College, Potchefstroom. The purpose of the workshop was to bring lecturers and managers together to learn about and identify opportunities for curriculum development towards Climate Smart Agriculture, based on their request. The 19 workshop participants represented Potchefstroom Agricultural College and Taung Agricultural College. Revision of the colleges' curriculum was scheduled to begin in September 2015 and Mr Serage (Head of the Colleges) thought that this can be an opportunity to integrate RWH into the curricula of both colleges. Taung College wanted to use other irrigation methods instead of using the conventional methods. However, lack of training and knowledge was identified as a key constraint. The Taung College needed input into the Diploma in Agriculture in Irrigation to integrate RWH&C into the curriculum urgently. Taung urgently needed training in Irrigation Practices and practical assistance. According to Mr Serage none of the Diplomas or individual subjects' curriculum include Rain Water Harvesting or Conservation practices or adaptation to climate change in relation to Agricultural Practices. *This ToT workshop raised the possibility of integrating RWH knowledge via a wider focus on climate smart agricultural practices within the immanent curriculum revision process of the Colleges, an issue that has been taken further by Ms Van Staden's PhD study* (Van Staden 2016) *(see section 4.3).*

Lowveld Agricultural College (University of Mpumalanga): This college had been visited by a project team member at the beginning of the project which led to a one-day curriculum development ToT workshop. A diversity of key agricultural education and training lecturers, project management and professional development staff in the University of Mpumalanga and irrigation industry stakeholders were brought together by the University and participated in a one day ToT curriculum development workshop on RWH&C presented by the Amanzi for Food team (Figure 29).

Figure 29: Participants in the ToT at the University of Mpumalanga

During this ToT workshop participants were exposed to the website and materials (posters, WRC RWH&C texts) which they used to review the content of rainwater harvesting and water delivery in the curriculum and

to map the way forward. The participants gave some very concrete recommendations which generally show a lot of interest in integrating rainwater harvesting in the University Agriculture curriculum including a demonstration site for teaching students who will probably be going into extension, in the University grounds/buildings level and through a Training-of-Trainers course-based approach for universities. From this workshop a recommendation was made to establish a wider learning network involving local extensionists, hydrologists, the local ARC offices and farmers.

Figure 30, below, provides an indication of some of the ideas generated for inclusion of RWH&C in the curriculum, which currently has no direct reference to these practices.

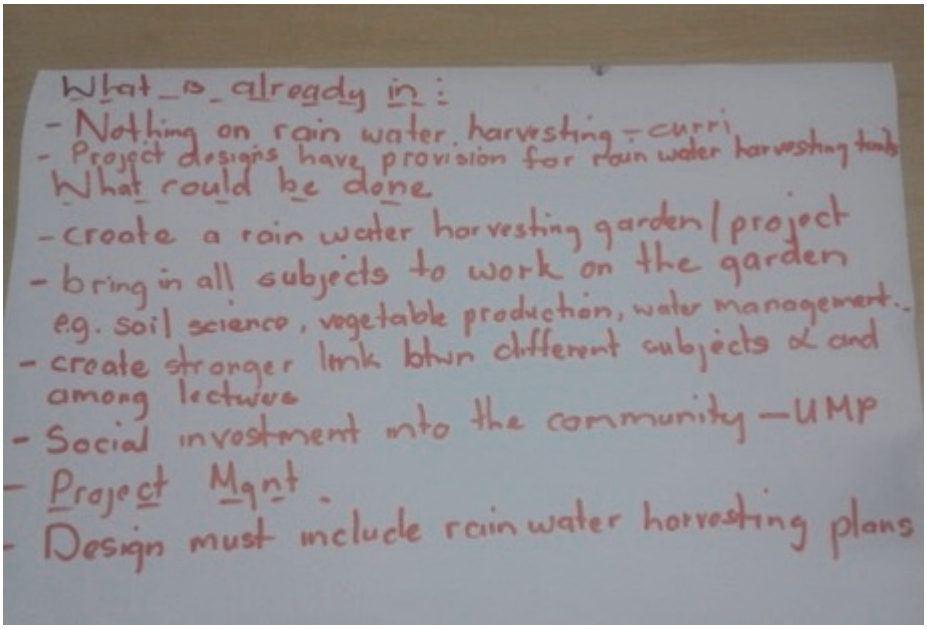


Figure 30. Workshop material showing curriculum change proposals during the one day ToT workshop at the University of Mpumalanga

This ToT workshop showed the potential for college lecturers, working in partnership with stakeholders to initiate and conceptualise the kind of curriculum innovation most needed in the area in relation to RWH&C practices, and how this could be integrated into the wider curriculum offerings. It confirmed the general finding across the programme that there is interest in curriculum design for including RWH&C in college curricula, and that the options document designed for the programme and the navigation tool developed in the Amanzi for Food programme were useful means of activating the curriculum design process. It also confirmed that such a curriculum design process benefits from external stakeholder inputs, and that the learning network structure provides such a means for curriculum design.

Lovedale College (a TVET college offering agricultural education): Some 20 participants from the college, including the principal, attended the ToT workshop in which they were introduced to the WRC Amanzi for Food project, and the WRC materials, both in hard copy and via the project website. They were already aware of the importance of water in food production and the challenges faced by local farmers in accessing adequate water for their crops, and were extremely interested in the potential for RWH&C in helping meet this need, and in integrating teaching about this into their curricula. The workshop opened up the space for discussion concerning the need to develop locally relevant curricula, moving away from the conventional curricula, developed a considerable time ago, and which were becoming increasingly irrelevant in relation to the contemporary farming context and needs.

The response to the ideas being promoted by the WRC materials and the Amanzi for Food project was overwhelmingly positive with a demand for further training on the basis of the ToT course. The participants were also very keen to establish a productive demonstration site in the college grounds. Interestingly the college grounds incorporate a section of a historic water-transfer system. This system, apparently established in the early 19th century (1835 was the date suggested), takes water from the nearby Tyumie river, along a narrow concrete lined canal, through the college grounds, where it had been used previously to irrigate crops, then through the town of Alice, where smallholders could take the water for their gardens, then back to the river. The canal (or furrow) has become blocked in places (especially in piped sections under roads), and the college staff were keen to find funding to restore its functionality. Later discussion with the NEDA representative revealed that NEDA (a member of the learning network) had applied to the Development Bank of Southern Africa (DBSA) for funding to restore the entire canal. The prospect of linking a productive demonstration site to such a historic system is very appealing.

3.1.2 Curriculum Innovation Projects

Fort Cox College of Agriculture and Forestry (now Fort Cox ATI) and Lowveld Agricultural College (now University of Mpumalanga) both implemented curriculum innovation change projects during the AOS development process. These projects involved improving the teaching of students in rainwater harvesting and conservation by both increasing and improving practical teaching and learning tasks.

At Fort Cox College three lecturers teaching the same cohort of students worked as a team to innovatively circumvent the problems of a time-table that did not have enough weekly time slots to allow for continuity of practical work for each lecturer's course delivery. The WRC RWH&C materials helped the lecturers to open up opportunities of developing and using a RWH&C demonstration site as a space for each lecturer working with students to ensure continuity of practical tasks needed by each of the three concurrent courses (soil and water conservation, horticulture and agricultural engineering). This coordinated approach was described by

> *So those are the areas and integration that was a good part when we were failing … we used to want to know how to solve the issues … of the practicals. But due to this set up of the rainwater harvesting the three of us could work… our students could do more than one thing in one day so it helped that way. ... I think teamwork is improving. Because every other person would work on their corners and that's it. You know I still believe we can do more. But the thing is the angle at which you approach even other people it's more important. My example will be when we started this we were to resolve the issue of CBL integration, me, and (colleagues names) we know of rainwater harvesting.* (Personal Communication, March 2016)

one of the lecturers as follows;

- *Curriculum development outcomes at Fort Cox College of Agriculture and Forestry*

The model used for curriculum development support, as shown in the Module 1-5 outline of the ToT course, supports an applied, reflexive, community-engaged model of curriculum development (not a technical model of curriculum development that integrates new content). Through this, lecturers participating in the programme were capacitated to design curricula based on enhanced knowledge, practice and community engagement around RWH&C, effectively implementing a competence-based learning model *in practice.*

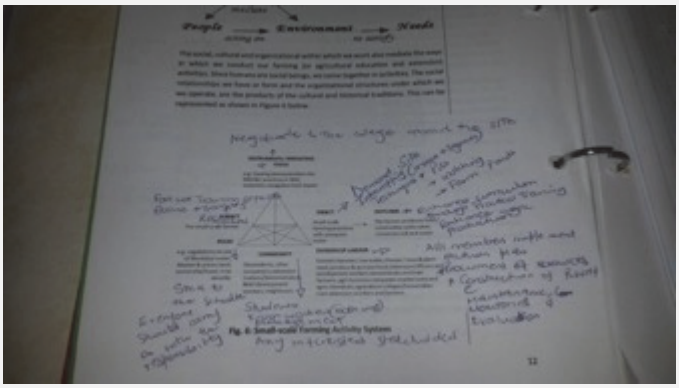
This approach to curriculum development has allowed lecturers to:

a) enhance their own knowledge of RWH&C using the WRC materials,

b) integrate this knowledge with locally available productive demonstration sites to ensure that theory and practice is integrated into their actual teaching, and
c) learn from this to ensure that an integrated approach to RWH&C is adopted for their curriculum development work,
d) undertake actual curriculum development work based on their expanded knowledge and experience, and
e) expand their use of WRC materials for curriculum development and support,
f) implement a more community-engaged approach to curriculum development that enhances curriculum relevance, especially in a local pro-poor context and framework
g) develop insight into what a competence-based learning model of curriculum involves *in practice.*

Evidence of this is found in the assignments completed by the lecturers on the ToT course. Three examples are outlined in a results analysis of the assignments that were completed by the three lecturers from Fort Cox College that completed the whole ToT programme.

Table 16. Results Analysis of College Lecturer's Assignments on the ToT programme (see also Pesanayi, 2016)

Participant A (NAME : Ngeletshedzo Makhaga, Lecturer, Soil Science): Agricultural Education / Training Institution: Fort Cox College of Agriculture and Forestry)	
Results	**Details of changes observed**
Enhanced knowledge of RWH&C	The lecturer's knowledge and appreciation of the significance of RWH&C was enhanced as shown by her progress in the assignments and also by her quick engagement with facilitating the development of a RWH&C demonstration site with team members in Keiskammahoek. The application of RWH&C knowledge into teaching and practical work indicates internalisation and externalisation of new RWH&C knowledge and practices.
Integration of knowledge into development of productive demonstration sites	There is evidence of integration of her knowledge of RWH&C into the development of productive RWH&C demonstration sites as shown by her engagement with others and with course texts (see photo below) during the training of trainers course.  *"My role in this collaborative team was to organize the meetings for planning and implementation of the demonstration plot plan. I also became responsible with procurement of seedlings and transportation thereof and supervising the completion of the whole demonstration plot project. I was fully involved in the*

	construction of the RWH technique and the planting at the site" (L Makhaga, Assignment 3). *"Being a skilled person in agriculture, I was then given an overall role of leading the technical implementation of the infield rain water harvesting technique"*
Actual contribution to development of productive demonstration sites for teaching and learning	Led the development of a homestead productive demonstration site meant for collaborative learning by farmers at Keiskammahoek in the Amahlathi Local Municipality. She was successful in planning together with the farmer whose plot was used (Mrs Lumka Maso), and also in mobilising the local Extension officer (see photos below):  *Demonstration site assessment and selection (L Makhaga at centre), with Extension Officer in overalls on her right, Mrs Maso on the extreme right of photo, and other farmers*  *Construction of the In-Field RWH&C technique (10 March 2015)* The garden was observed towards the end of April 2015 already productive with crops and functional RWH&C structures Colleges in her team for RWH&C demonstration site in Keiskammahoek made her the secretary of the Learning Network.
Changes made to College Curriculum	The lecturer has started documenting the RWH&C works so that she can use the photos and videos in her teaching: "*In the course offering, I will create a facilitative method of learning where in after transferring the knowledge of RWH&C techniques students will be given an opportunity to select and try out the technique they prefer. Therefore the students will have to plan and implement the technique. The productive demonstration plots in the farmers' plots will also be used as a reference; hence they will be documented thoroughly to ensure that there is material available for future trainings*" (L Makhaga, Assignment 3).

	The participant has started working with the curriculum review committee on "*integration in the existing curriculum, i.e. fitting it in the courses that implicitly covers RWH&C, courses such as soil and water conservation (SS 221 and SWC 211) and Irrigation principles (Fort Cox prospectus, 2015). I believe that the above mentioned courses must cover RWH&C in depth rather than the way it appears in the curriculum now. An example is that in SS 221 and SWC 211, RWH&C is covered only as the examples or introduction that the application. In some courses (e.g. SWC 211) the component of RWH&C is thought of being under soil conservation technique, which might not even be proved. In irrigation we only see rainfall as a source of irrigation water which is doubtful that the RWH&C techniques are addressed. At the wing of informal training (Rural Development Centre) RWH&C can be integrated as a short course which will enhance the knowledge and the skills of the farmers, extension officers and the educators" (L Makhaga, Assignment 4).*
Expanded community interaction and civic engagement	The lecturer collaborated (and continues to collaborate) with farmers in Keiskammahoek (Mrs Maso, Dairy Farmer from Seven Stars Dairy Project in Keiskammahoek and an Individual garden farmer in the local village led by Mr. Mabonda, Dairy Farmer from the local village), and extension officers (Mr Siguqu and Mr Menze) helping them with technical knowledge and rainwater harvesting skills, and also with sourcing of seedlings for their garden. She is also reaching out to Agriculture students at University of Fort Hare (e.g. Mr Ngesi) and University lecturers. The expansion of community engagement had its dilemmas regarding perceived power relations between the lecturer and the farmers, which the lecturer humbly managed by tactfully refusing to play a role of expert that she was 'expected' to play by farmer colleagues. This helped the famers to develop a mode of power that was useful for their transformative learning and agency.
Links with universities and other knowledge partners	The lecturer is linked with the University of Fort Hare regarding RWH&C networking through involving students and lecturers from the University in her demonstration site as detailed in other sections of this profile.
How WRC RWH&C materials were used	The lecturer used the WRC RWH&C materials to compare different methods and practices, and for learning new knowledge: "*The information on the construction of furrows was taken from the technical manual and farmer hand-outs called 'Water harvesting and conservation volume 2 part 1', page 143 on the Water Research Commission materials. The other information was from the internet. As we read through the books we did the comparisons between all the techniques listed and infield caught our interest. The handbook provided us with relevant in-depth information that covers different types of the RWH&C techniques. The WRC materials also include the advantages and disadvantages of all the techniques covered and it provides the step to step details of constructing such RWH&C techniques. I found the WRC hand books very useful, it has enhanced my knowledge on the RWH&C techniques and it made my practicals very easy*." (L Makhaga,

Assignment 3). The picture below shows students using the WRC materials.

Participant B (NAME : Louise Madikiza, Lecturer, Horticulture **–** Fort Cox College of Agriculture and Forestry)	
Enhanced knowledge of RWH&C	The assignments done by the candidate during the Amanzi for Food ToT course indicate that she has enhanced her knowledge of RWH&C practices in context, and its role in enhancing her curriculum and teaching effectiveness. Research by students in the WRC project has revealed that there is continuous engagement with RWH&C knowledge practices on the ground during teaching and student practical learning processes.
Integration of knowledge into development of productive demonstration sites	She has contributed ideas on harvesting run-off in a restricted land area, and the possible recycling and quality treatment of sewerage water which is available in a plant situated by the proposed rainwater harvesting site at Middledrift (by Keiskamma river) that she is involved with other stakeholders in the Amanzi for Food Learning network. She also integrated her horticulture expert knowledge with rainwater harvesting knowledge practices in the demonstration site to show how vegetable production can be improved by RWH&C.
Actual contribution to development of productive demonstration sites for teaching and learning	The lecturer was involved from the beginning in joint planning of the demonstration site at Middledrift with team-mates from Nkonkobe Economic Development Agency (NEDA) and the Middledrift Extension office. She has made joint visits to the demonstration site with her team mates and other members of the learning network. She also forms part of the team developing a demonstration site at the Fort Cox College of Agriculture and Forestry.
Changes made to College Curriculum	"*There are two options that have been suggested as vehicles for the integration of the RWH&C practices into the curriculum. Firstly, the RWH&C practices will be incorporated into the current curriculum of academic programmes through courses such as Soil & Water Conservation. This course will teach students the whole range of RWH&C practices that are commonly practiced in South Africa while the other related courses such as irrigation principles and production courses (field crops, fruits and vegetables) will only infuse related RWH&C practices. Integrating the RWH&C techniques into the current course offerings augers well with the new line of thought in the curriculum development arena*

	which emphasizes on horizontal and vertical integration of concepts rather than treating the courses individually. In addition, the college is focusing on improving the practical aspect of the program as such there is a proposal for streamlining the 35 courses to fewer courses so that there is more room for the practicals. The short courses on RWH&C at the Fort Cox Rural Development Centre will be offered as a standalone course and as a topic in production courses that will be offered targeting farmers, educators and the extension officers" (L Madikiza, Assignment 4) *"… various methods will be used to teach the content such as … group discussions, videos, posters, photos as well as guest lectures from specialists and practicing farmers on RWH&C. In addition, students will be given opportunities for field excursions to sites where RWH&C is practiced as well as be hands-on RWH&C techniques through practicals and research projects and demonstration sites development".*
Expanded community interaction	The lecturer has linked with the Nkonkobe Economic development Agency (NEDA) and the Middledrift Extension Services to work together on a demonstration site at Middledrift which is planned for commercial tomato production in liaison with a farming conglomerate ZZ2 in Limpopo. A group of farmers is planned to initially work on the project and eventually be supported to take over business operations.
Links with universities and other knowledge partners	By virtue of association of Fort Cox College with the University of Fort Hare, the lecturer is collaborating with colleagues at University of Fort Hare's Agriculture School in developing RWH&C; *"The collaboration will continue after the RWH&C learning network workshops have ceased. The collaboration will help to pool resources such as expertise in various aspects of the RWH&C, vegetable production, group dynamics, financial…. Other organizations in the community will be identified during the social facilitation who could also be possible partners in providing expertise and tangible materials required in the project".* (L Madikiza, Assignment 4)
How RWH&C materials were used	The participant used WRC materials as a knowledge resource to enhance understanding of the whole range of RWH&C practices (see quote below) and to make selections of what could be used in improving RWH&C content and teaching in the curriculum, developing the rainwater harvesting demonstration site and how. "*The learning content for the RWH&C practices will include the whole range of practices that are recommended by the Water Research Commission, as represented in Denison et al. (2011) and Stimie et al. (2010). For example, Denison et al. (2011) provides a summary on pages 13 to 18 covering the description of thirteen practices, their main purpose and the type of water harvesting system involved. The same practices are further described in detail in Water Harvesting Conservation manual, part 1 on pages 129 to 170. The recommended RWH&C techniques are diversion furrows, trench beds,*

mulching, stone bunds, tied ridges, swales, terraces, fertility pits, greywater harvesting, ploegvore, dome water harvesting and saaidam. In addition, there are other useful practices such as conservation tillage, small earth dams and sand dams which although not explained in the manual are deemed useful techniques for rain water harvesting. What is seen as also useful and which could be added to the RWH&C content is the topic highlighted from pages 21 to 39 which is dealing with the global water crisis, water in South Africa and how the water crisis is being addressed globally and in South Africa. This topic would form as an introductory chapter on RWH&C as it addresses the underlying issue of water distribution and availability, the climate change, pollution, etc. which would form a basis for the need for rainwater harvesting. All the above RWH&C practices would be covered in Soil & Water Conservation course which would be the backbone for the RWH&C in the college curriculum. Teaching the students all the common RWH&C practices is necessary because the students come from different areas of the province and beyond therefore particular techniques may not be applicable to all situations. Secondly, different types of RWH&C practices are suited for different scales of farming for example homestead gardening (small scale), medium scale and large scale. Since the students work with farmers at all levels of farming, it is reasonable option to expose the students to a wide knowledge of RWH&C practices to enable them to choose what would be feasible for the particular farmer's situation. Beside, many RWH&C practices do not work in isolation, they complement each other, for example, diversion furrows work with storage structures, deep trenches and other topics such as knowledge on contouring. Therefore dealing with these together provides a complete package. The table below summarises the proposed content" (L Madikiza, Assignment 4, June 2015).

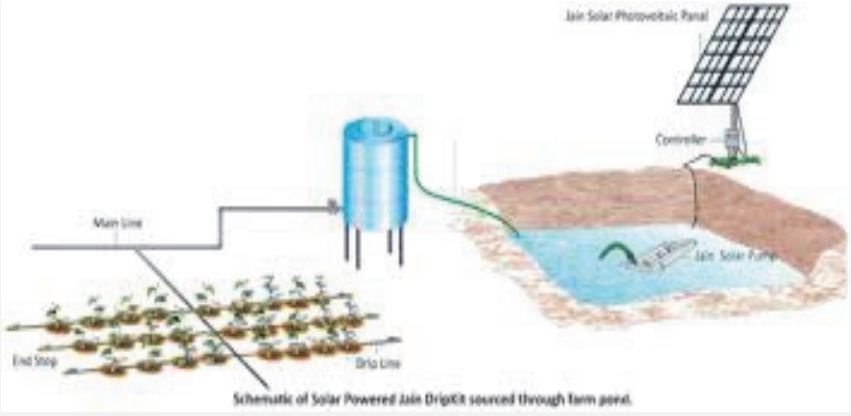
A summary of proposed RWH&C content

Content	Source /Materials	Comments
Water in the world	Denison et al. (2011, pgs. 21-40).	To be infused in Soil and water conservation
RWH&C methods	Denison et al. (2011, pgs. 13-18; 129-170 & handouts (presented after page 185) & Stimie et al. (2010, pgs.58-108).	Partially covered under soil and water conservation course
Soils	Denison et al. (2011, pgs.79-104	Topic already covered under two courses under the current curriculum: Soil Classification and Soil fertility and Plant Nutrition
Water harvesting and conservation planning	Denison et al. (2011, pgs. 109-126)	To be infused in vegetable production course especially practicals

Participant C (NAME AND POSITION: Mr Chamunorwa Matambo, Lecturer, Agricultural Engineering & Production Courses – Fort Cox College of Agriculture and Forestry)

Photo: Mr Chamunorwa Matambo, Lecturer at Fort Cox College of Agriculture and Forestry (Centre), with colleague from University of Fort Hare on the right (Mr Richard Moyo, Agricultural Engineering lecturer and Amanzi for Food course participant), and Prof Yrjo Engeström from University of Helsinki (left) discussing how curriculum review processes on RWH&C can benefit from expansive learning processes.

Enhanced knowledge of RWH&C	The lecturer's knowledge of RWH&C has been enhanced considerably as he claimed to have known very little on RWH&C at the beginning. His knowledge of RWH&C is also evidenced by how he plans to go about the teaching: "*The use of photographs and videos is one step towards a true learning experience. These shall be employed for the teaching of farm ponds as a RWH technique to college students. Of utmost importance will be the demonstration site to be erected at Fort Cox College of Agriculture and Forestry. College students, high school students, agricultural professionals, and farmers will all converge at this site for an extra-ordinary learning experience in the construction, observation, guided manipulation and use of the site. The demonstrations shall include all the technicalities involved in the construction of farm ponds as well as the setting up of an irrigation system. College students will be conducting practical and experimental projects from this site which will fall under formal assessments of student achievement of the diploma qualification*" (C Matambo, Assignment 2).
Integration of knowledge into development of productive demonstration sites	The lecturer has used knowledge acquired in the course to the development of their demonstration site. Below is a diagram of the RWH&C demonstration site design made for the FCC (C Matambo, assignment 2), using knowledge from the WRC RWH&C materials of combining RWH&C techniques in this case farm pond, solar panel to power water pump, elevated water tank and gravity conveyance to drip irrigation system:



Schematic of Solar Powered Jain DripKit sourced through farm pond.

Actual contribution to development of productive demonstration sites for teaching and learning

The lecturer **led** the team made up of colleagues from Dohne Research Station (2), a farmer from Perksdale (Mr Mhlobo Mcata) and colleagues from Dohne Research Institute to develop the FCC demonstration site

Mr Matambo suggested the site for the demonstration site (on lower end of a well-vegetated catchment in the FCC farm) and also initiated the construction process by facilitating engagement of a front-end loader to dig a farm pond (see photo below).

-

Photo above: A Tractor-Loader Backhoe (TLB) digging out the farm pond at FCC (C Matambo, Assignment 3).

With the rains that fell in the last two weeks of July, the farm pond was filled with water, which he has been monitoring regarding water retention / infiltration (see photo below.

Changes made to College Curriculum	Mr Matambo has been made coordinator of Amanzi for Food processes at Fort Cox College of Agriculture and Forestry. The lecturer is working with second year diploma students to do trial experiments on water conservation on grass-covered areas and cleared areas as controls. "*There lies a good opportunity to engage more students in experimental projects that are RWH&C related. The fact that the experimental projects and the Soil and water conservation course are done in the second semester (which culminates into the rainy season) is an advantage that can be manipulated in the teaching of the RWH&C since practical engagement can most conveniently be carried out during this period*" (C Matambo, Amanzi for Food Assignment 1) The lecturer is liaising with the Head of Department of Agriculture to ensure that the 5-year curriculum review process which is currently taking place in 2015 at Fort Cox College of Agriculture and Forestry will capture rainwater harvesting more explicitly.
Expanded community interaction	The lecturer is operating in an expanded community of practice where he interacts with University of Fort Hare on curriculum development matters, and also with farmers, and extension workers. He is also responsible for bringing on board lecturers in the pasture section to expansive learning on RWH&C which they had considered not relevant.
Links with universities and other knowledge partners	Mr Richard Moyo a Lecturer at University of Fort Hare facilitates a session on collaboration on RWH&C with a community garden group at Lloyd Village (see photo below), who were represented at the Amanzi for Food Training of Trainers course. The University works closely with Fort Cox College of Agriculture and Forestry, and chairs their Academic Board. 

	As part of his Masters in Agricultural Engineering Course, Mr Matambo has embarked on a thesis on rainwater harvesting which is an off-shoot of the learning acquired from the Amanzi for Food Training of Trainers Course. The Masters has also led to him doing assignments which have linked him more closely with colleagues in the Amanzi for Food course, such as Lumka Maso of Keiskammahoek Dairy (part of the Amadlelo Agri projects) thus enhancing collaborative learning on rainwater harvesting.
How RWH&C materials were used	The lecturer engaged with the WRC materials to look for combinations of RWH&C techniques that would suit the demonstration site aspired for at Fort Cox College of Agriculture and Forestry, and also to analyse his existing curriculum.

The vignette below illustrates how Fort Cox College worked with WRC materials in their specific context.

> The two sets of WRC materials were used by the Fort Cox College of Agriculture and Forestry as library reference resources which students accessed and as a source of teaching notes by lecturers. The Fort Cox college context allowed for this because there were three agriculture lecturers who had undergone a training-of-trainers course together on RWH&C and had used the materials during the course sessions and as they were doing assignments. It became easier for them to access the specific RWH&C knowledge practices they needed in the WRC materials because of the mediation done through a 'navigation tool'. This team work also helped the lecturers to use practical ideas from the WR materials to resolve a long-standing time-table problem which limited their individual course practical time with the same cohort of students by using each practical session to cover key aspects required for continuity of the aspired-for practical tasks and outcomes in each of their three courses. The supportive college management made it possible for these lecturers to work with the WRC materials on curriculum innovation and demonstration site development and use.

3.1.3 Shared productive demonstration sites

The Imvotho Bubomi Learning Network developed productive demonstration sites collaboratively in community and institutional sites in Nkonkobe and Amahlathi Local Municipalities. Productive demonstration sites were established at Lloyd Village, Fort Cox College and Keiskammahoek. In addition, the project also worked with 'smaller demonstrations' or 'teaching gardens'. The principle behind the demonstration sites was to address the theory-practice gap in agricultural education with regards to RWH&C as identified in the scoping phase. It was also to show the relevance of the RWH&C practices to smallholder farming contexts and also to support crop and vegetable production, and to offer students 'real world' demonstration platforms for practical learning. In order to illustrate the AOS development process around shared demonstration sites, three examples are provided here which show different approaches but all have a collaborative approach.

Demonstration sites were developed out of the reviews undertaken in Module 2 of the ToT course. This followed on from the strong emphasis on practical demonstrations as a key teaching and learning method, identified by participants in Module 2, and in previous consultations with colleges. Previously identified potential demonstration sites [accessible in the area] were discussed regarding confirmation of sites and clarifying what can be demonstrated on these sites in terms of the RWH&C practices that participants had been exposed to in Module 1, and via the WRC materials (and navigation tool). Participants were given the

opportunity to propose additional sites and give input to what their thoughts here were. Participants agreed on the following important attributes for the proposed demonstration site activities: Relevance to the area, accessibility, doable demonstrations, and productive site.

The need to document and record the development and use of the sites was discussed, with emphasis on photographic, video and aural records, and written documentation. This was so that the experience of this learning network could also be made available to other colleges to 'model' how the WRC materials were being used for curriculum innovation. All of these were also seen to be vital to the further development of supplementary materials such as posters, videos and sound-clips. A 'story-board' was been developed by the project team as a framework to guide the recording and documentation of the productive demonstrations which were later used to develop posters and video's and stories of practice change.

To develop the demonstration sites, participants in their learning network groups, went through the following process:

- Identify the practices that are to be implemented (using the navigation tool to access the WRC materials)
- Identify the infrastructure that will need to be developed
- Identify where this should go, and on what scale
- Identify requirements (materials, equipment, people) for the development
- Identify what can be provided from within the group and what additional may be required
- Identify roles and responsibilities within group
- Develop a plan, with clear time-frame, for development of the site
- Agree on means of communication between group members

Figure 31. Lloyd Village group with their facilitator planning the productive demonstration

Following this activity the whole group was shown the use of a small scale 'Teaching Garden' to demonstrate aspects of RWH&C and the use of compost to conserve rainwater as communicated in the WRC materials. Participants took part in planting a few mixed vegetable seedlings as a small-scale demonstration garden. The WRC materials (handouts) were used to guide these activities, and participants were supported to think about how these materials can be used if they were doing the same with other learner groups.

Figure 32. Course participants engage with the Teaching Garden

Lloyd Village in Alice: The first demonstration site to be established was at Lloyd Village in Alice where all agricultural actors shared knowledge and material resources, their time and collaborative effort (ilima in isiXhosa). A fenced cooperative garden exists in the village with 18-23 members, mostly elderly women. With very little to no crop farming taking place in the fields around Lloyd Village and in homestead grounds, the Lloyd village garden was seen to be a very important local food production space which was poorly serviced from a RWH&C perspective, and was therefore identified as a potential productive demonstration site (see also Pesanayi, 2016). Abandonment of fields in Lloyd Village was explained as follows;

- Lloyd Village garden member 1: I have a land that side and I was farming there – it is about 3 hectares.
- Researcher: Are you still farming it?
- Researcher: When did you last farm there?
- Lloyd Village garden member 1: It is about 3 years back because it is too dry there. But I still have the impression if it is raining lots to take the tractor and go there. I was making very well there with maize, beans and butternuts. I have a small dam there but not very big. But when it is so dry, I leave that water in the dam for the cows, they always drinking there. So I don't want to dry it out. (Personal communication, 6 February 2015; in Pesanayi 2016)

Water scarcity is considered a major limiting factor to vegetable and crop production to the extent that it can even prevent the first steps of land preparation (such as ploughing) at some parts of the year or season when food production could occur. Besides the dry conditions, farmers are also struggling with capacity to farm and to establish RWH&C practices that they can use. As expressed by one woman farmer:

- Garden producing farmer: "You can see that we are old now. Do you think we can dig amadanyana? ... Our young people do not want to go into the garden unless you pay them (Personal communication, April 2015, in Pesanayi, 2016)

Figure 33. Lloyd Village farmers (mainly elderly women)

There are also other tensions associated with the site, most notably a pump that was provided for pumping water in earlier times, but the pump has been moved to another community setting, leaving the elderly women (Figure 33) with little choice but to use a 'bucket and drum' approach to watering their crops (Figure 34).

Figure 34. The bucket and drum approach for watering the Lloyd Village garden used by elderly women

In response to these issues, lecturers and students from the University of Fort Hare (Agriculture, Engineering and the Agricultural Rural Development Institute), the Alice Extension Office, Nkonkobe Economic Development Agency (NEDA), and local garden farmers (also called food producers) worked together to design and implement the rainwater harvesting and conservation demonstration site at Lloyd village which included building a number of small ponds (lined with plastic) and putting in gulleys to lead water to the small ponds (see Figure 35). In the first year these worked very well, but more recently the plastic has been ruptured by moles, and the elderly women are finding it difficult to keep the gulley's clear. Thus, more sustainable solutions to the water provisioning are needed in this site in the longer term.

Figure 35. Lloyd Village Garden Demonstration Site (after the drought and winter period). The picture shows the buckets used, as well as the small ponds and furrows that were put in to assist the elderly women to respond to water problems

The RWH&C practices demonstrated on this site have proved to be an effective learning and knowledge dissemination centre for the network as evidenced by the application of similar rainwater harvesting practices by another farmer who had visited the site and had only joined the network much later after the training of trainers had been completed. This farmer has used the knowledge shared via engagement with this demonstration site to change her own farming practices, as shown in the two images below where she is

using the building of ponds and furrows, with mulching techniques to improve her farming practice, as she too has major challenges with obtaining water for her garden (Pesanayi, 2016).

Figure 36. Farmer applying insights gained from the demonstration site in Lloyd Village to her own garden

The Keiskammahoek demonstration site has also integrated RWH&C into their normal site production activities, and they have also done some research there with the control side of the plot. This site was developed in collaboration between the homestead garden farmer, neighbouring farmers, a lecturer from Fox Cox College and local extension officers. The demonstration site team shared knowledge in ways that nurtured symmetrical power relations applying the principle of “we are all learners and educators” learnt from the learning network and training of trainers course. Through this collaboration the participants agreed to implement tied ridges and basins as the appropriate technique for the site. Within a few weeks of rainfall capture, the garden showed better production compared to previous performance (Pesanayi, 2016; Weaver, 2016). This is shown in the figure below which was communicated through the Imvotho Bubomi Learning Network WhatsApp group:

Figure 37. Vegetable production in the Keiskammahoek family demonstration site after implementation of rainwater harvesting and conservation (note the tied rides and mulching). On the right are Mr and Mrs Maso owners of the garden.

A farmer discussed how he was integrating RWH&C into his demonstration plot, and that he was busy studying the WRC RWH&C materials to add practices into his own garden. The Fort Cox College lecturer who was part of the team reported that she learnt about the real challenges that farmers face and was able to apply the ideas she learnt in this processes into her improved lessons with students on integrating rainwater harvesting and also in developing and using the demonstration site at the college itself.

The demonstration site at **Fort Cox College of Agriculture and Forestry** was designed using practices different from those used at Lloyd Village and Keiskammahoek but applying the same principle of applicability

to farmer contexts. The demonstration site had a relatively larger farm dam of 10 m x 10 m x 1.5 m deep connected to a raised tank and from there a drip irrigation system leading to a horticulture production plot (as shown in Figure 26 above). This design was inspired by the WRC RWH&C materials and other knowledge drawn from Xhosa indigenous knowledge such as *gelesha* (Denison and Wotshela, 2009). Students were involved in the construction of the demonstration site and hence were part of the problem identification and solution building (Figure 38). This site has been used as a site of learning rainwater harvesting as an alternative to the normalised irrigation water systems which dominates the agriculture curriculum but with little relevance to small-scale farmers with no resources or access to the technology. The impact of collaborative demonstration site development and use in a learning network context was described by one lecturer at Fort Cox College as follows showing how lecturers, students and farmers were jointly involved:

> *But now we had to go out there the way we were trained in this network, because we chose techniques that we want to apply. We applied in-field this side which to me it's easily done and affordable. Even students in their small gardens they can do that. There is Keiskammahoek where now we take the students there… but practically we would implement it here. And where we implemented it it's where there is a pond. They saw the pond filling up; they saw the pond drying up due to the lack of rainwater. And they used the same water. So practically they have seen, they have felt and they have done it. So they know it can be done even after. (Personal Communication, March 2016 cited in Pesanayi, 2016)*

Figure 38. Students and college staff working on the productive demonstration site development

As shown by these examples, collaborative learning around rainwater harvesting and conservation demonstration sites fosters exchange of ideas and relevant knowledge among the different agricultural participants, which includes helping smallholder farmers to adapt to a changing climatic environment, and agricultural educators and extension agents to understand, appreciate and respond to farmers operating realities. Learning from demonstration sites works by people seeing tangible evidence of what is in place, listening to the narratives of what people experienced and also doing (Pesanayi, 2016). However, a key issue is to make decisions around the most appropriate type of RWH practice for the context, and there is also need to consider techniques that are preferred by people, as expressed by this extension officer in dialogue with the researcher, also a participant in the learning network:

> *Extension Officer:* You see when you talk about water harvesting, we have to go down to the technique as I understand there are different techniques of water harvesting because if we say where do we rank it, well if you say you going to buy tanks for the people then we are going to rank it high but if you going to come with the Madanyana, you see where people have to do it themselves, we know them so then the rating will be lower for such things so yes … Yes, so the dynamics around that

are that people have to go and do, if you have one hectare then you have to make sure that you do it physically yourself, you see, do you have human power for that, are the people willing to sweat to do that, those are the things.

Researcher: So it is the type of the practice that is the key issue?

Extension Officer 1: And also mostly we are dealing with the older people so that is also a challenge (EOSA1, Personal Communication, 15 July 2014, in Pesanayi, 2016).

3.1.4 Lessons learned and proposed way forward

- *Lessons Learned*

The AOS development process through mediation of WRC materials in Agricultural Colleges and Universities provided some important lessons for any future work on materials dissemination on rainwater harvesting. These lessons are based on the collective learning approach which provided a good forum for all the subsequent work that was realised through this project with these education and training institutions. The lessons are listed below;

1. The colleges are currently in a transition to ATIs which involves re-design of curriculum towards a competence-based learning approach. Few lecturers have curriculum development experience in competence-based approaches which are difficult to implement without a focus on practice. The curriculum innovation ToT process developed in the Learning Network Structure, which focussed on curriculum review and development of productive demonstrations seems to allow for the development of the kind of curriculum development expertise required for this shift in the college curriculum. Competence-based approaches to curriculum need to be mobilised via a focus on practice.
2. Few lecturers have knowledge of RWH&C practices as this is not a 'normal' focus of college curricula as most colleges focus on larger scale agricultural production systems, despite policy being re-oriented to include smallholder farming practices. The WRC materials are therefore very useful in supporting college lecturers to gain new knowledge of these practices. There is a keen interest amongst the colleges to integrate this knowledge, and a call for substantive ToT programmes. A substantive ToT process, however, requires time and resources, especially if the productive demonstration practices are to be developed as integral to the knowledge dissemination process in ways that reflect the system innovation approach to knowledge dissemination outlined by Shaxson et al. (2012).
3. The design of feasible 'options' for integrating new knowledge of RWH into the curricula of colleges provided a useful approach to begin to deliberate how knowledge of RWH could be integrated into the existing curriculum, thus opening a pathway for further integration of this knowledge into agricultural curricula and curriculum review processes. Practical engagement via the productive demonstration site development helped to 'realise' the knowledge in practice, and make more visible the implications of integrating such knowledge into college curricula. Significantly, the 'Options document' (described in Table 8) or curriculum support tool proved to be useful and relevant for use in all College types (Provincial Agricultural Colleges and FET Colleges offering Agriculture), as well as Agricultural Schools and Schools offering Agricultural Sciences, and Universities offering Agriculture. The exception being Option 4 not being relevant to Schools as they do not offer short courses.
4. Several important pointers were developed in relation to curriculum integration, with perhaps the most important being that it is critical to be aware of the challenges of integration in some circumstances, and seek the most appropriate locations for the information within the curricula modules or Subjects. Here it is also important to note that curriculum change is not simply about 'adding new bits of information' but rather involves conceptual changes, learning changes, and often also value-based

changes. The process of curriculum integration should therefore not be reduced to a technical 'linking up' approach, but should be broadly and carefully constructed within a more holistic and systems oriented perspective that also develops the competence-based learning approach being put forward for college curriculum renewal. Thus it is the 'system of knowledge' represented by the WRC materials that is as important as the specifics of how and where such knowledge and values can be integrated into the curriculum. This provided further impetus for the curriculum design model that foregrounded a more relational, systemic and integrated approach to knowledge flow.

5. A critical issue to consider in curriculum innovation in colleges is the contextualisation of knowledge and the real world 'application' thereof. As noted above, lecturers have limited and fragmented knowledge of RWH&C practices, and the colleges tend to train for 'ideal circumstances'. The reason for such limited and fragmented knowledge can be traced back to how the lecturers themselves were schooled, and is well-articulated by Temu, Rudebjer and Chakeredza (2010, p. 1) as follows;

   > *Small-scale farmers integrate biophysical factors with social, economic, cultural and environmental considerations in their day-to-day decisions to manage complex farming systems. This approach contrasts with the traditional organization of knowledge and institutional structures at universities, where reductionist approaches prevail, leading to production of graduates with insufficient competence in the analysis of complex systems. ... Universities need to pay increased attention to understanding integrated systems.*

6. **An interactive, community engaged process model**, **implemented within a learning network over time, supported by a ToT programme** appears to be most successful in enabling in-depth engagement with the knowledge in the WRC materials involving:
   - A local **contextual profiling** research process carried out by the project team to deliberately learn the context of the farmers, extension system and agricultural colleges and universities. This process generated important information regarding what was taking place on the ground regarding water for food at farm level, and extension and curriculum practices regarding agricultural water which informed the project's formative intervention strategy;
   - A thorough **curriculum analysis** was done to find out different options that colleges and universities had for using the WRC rainwater harvesting materials. While it was initially not easy to access most the curriculum documents, a process of continuous engagement created the trust to share the documents. Documents eventually analysed included prospectuses and course outlines;
   - A **training of training course** designed for these participants' challenges was found effective in responding to their needs and aspirations as it mediated the knowledge in the WRC materials as a stimulus for learning and experimentation with what appeared to work in their contexts and jointly using navigation tools and creating new tools (see below) for testing and implementing sustainable water for food through contextualised rainwater harvesting and conservation practices. This ToT course enabled agricultural college lecturers to learn from and work with farmers, extension officers, enabling a form of collective learning, each as both educator and learner;
   - It was found that the process of finding specific needed information in the WRC materials by the agricultural actors was complex because of the large volume of information process, so the project developed a **navigation tool** which was very useful in summarising the contexts of the WRC materials in combined narratives and pictorial graphics of most of the practices which appeared suitable for the diverse potential users, with page references leading to the WRC books (described in section 2.1 above);
   - The different agricultural actors, led by college lecturers, were given an opportunity to collectively, in teams, select rainwater harvesting practices that they wanted to implement in a **productive demonstration site** at given places and farmer and college contexts. Fort Cox Agricultural

College participants together with agricultural technicians from Dohne Research station selected a combination of rainwater harvesting and conservation practices that were informed by small-scale farmer realities and needs. These practices were addressing both crop and vegetable production and pasture production, and included a 10 m x 20 m x 1.5 m deep farm dam to capture water from a naturally sloping and vegetated catchment, and connected to a raised reservoir tank for receiving water either pumped from farm dam by solar-powered pump or brought manually. The gravity feed was connected to a system of drip irrigation directed at horticultural plants which were also under a mulch. The lesson to be carried forward here was the combination of practices which included small-scale farmer-friendly applications, working and learning collectively between agricultural educators, research technicians and students.

- *Way forward*

  - **Support curriculum innovation processes and capacity development for lecturers** that have been started at Fort Cox Agricultural and Forestry Training Institute and use the lessons learnt there to share experiences with other agricultural colleges who are embarking on curriculum review and innovation within a competence-based model of curriculum change;
  - **Provide support for learning networks and an extended ToT programme** to targeted sites of interest using the tools and approaches developed within this project. There are already several colleges and universities which have shown interest in the more extended ToT process which include Potchefstroom/Taung College, University of Mpumalanga, Lovedale College, among others. Some modalities for future engagements, drawing on what has been learned from the process so far include:
    - engagement with the college management in deeper commitments to ensure ownership of the programme locally. In the Fort Cox College case it was possible to sign an Memorandum of Understanding with Rhodes university which has been implemented through joint research publications, college-wide RWH&C seminars and consolidated use of the RWH&C demonstration sites for teaching and learning;
    - In the many and varied interactions with a number of agricultural and other colleges over the past 3 years, it has emerged that very considerable motivation is required for college staff to move beyond their current practices and engage with curriculum innovation. In this they certainly need the full support and sanction of their principals and other senior staff. Such a process would also undoubtedly be strengthened by policy driven imperatives for inclusion of RWH&C into agricultural curricula. The development by the DoA of a policy on Conservation Agriculture, may provide this imperative as will the further expansion of the CBL approach in colleges, and the incorporation of climate smart agriculture in colleges.

These insights and recommendations are expanded in the AOS (Volume 2).

3.2 Mediation of WRC Materials with other stakeholders

3.2.1 Training of Trainers (to use WRC materials)

As indicated above, with RWH&C learning materials and practices being central to the formation of the proposed learning network, the Amanzi for Food team introduced and facilitated a Rhodes University accredited Training of Trainers (ToT) course for two main groups – college lecturers and other learning facilitators (extension officers, NGOs, LED officers and others involved in the mediation of RWH knowledge to smallholder farmers and household food producers). As reported on above in section 2.5, the course was offered in two streams, both with the same content but different assignments, at different national qualification framework (NQF) levels. For the extension officers, NGOs, LED officers a 12 credit ToT option was awarded

at NQF level 5 for network members that completed the assignments as outlined in Figure 21 above. Of interest was the fact that some farmers who joined the Learning Network were also interested in the ToT process, and in completing the certificate. The certificate was offered as way to incentivise the participants who committed their time and effort to the course process. Not everyone chose to complete the certificate, but they continued to be part of the Learning Network sessions and the productive demonstration site development.

One of the farmers, in particular, was eager to receive his certificate and worked very hard to meet the requirements of the accreditation. He constantly messaged one of the team members to receive news about the certificate progress. The certification ceremony was held on 15 October 2015 and six participants achieved full accreditation with an additional nine participants receiving letters of participation (see figure 39 below). The six people who received certificates in the IB Learning Network were; a farmer, an extension advisor, a Nkonkobe Economic Development Agency employee and three college lecturers. Letters of participation were given to those who did not meet the requirements in their assignments or did not submit all their assignments, although they did participate in most of the contact sessions during the course. There were three participants (two researchers and an extension intern) who were close to achieving competence but had a few mishaps resulted in them not achieving adequate competence for certificates; they did still receive letters of participation.

Figure 39. Farmer Mcata with produce in his garden, also receiving his level 5 Certificate (below centre)

Figure 40: A collage of all the participants receiving their certificates or letters of participation from the Dean of Education at Rhodes University

3.2.2 Learning and practice innovation projects

As indicated above, a systems approach which proposes a 'continuum' of knowledge dissemination approaches, contexts and relations (Shaxson et al., 2012) was used for knowledge dissemination in the Amanzi for Food Programme, implemented via the learning network. Knowledge co-production and social innovation needs positive and strong engagement between individuals to take place and the ToT course and learning network structure allowed for the interested stakeholders *to work together* enabled this to take place. Assignments and the practical demonstration sites provided insight into the learning and practice experiences of the range of stakeholders involved in the learning network as shown in the results analysis of the three participants that obtained full certificates on the ToT course (stream 2).

Table 17. Results analysis of stakeholder assignments

Participant A (Farmer: Perksdale, Middledrift)	
Results	Further detail
Enhanced knowledge of RWH&C	The farmer's knowledge and appreciation of the significance of RWH&C was enhanced as shown by his responses and discussion in the assignments. The course reinforced his understanding of Gelesha as seen in assignment 2.
Integration of knowledge into development of productive demonstration sites	There is evidence of integration of his knowledge of RWH&C into the development of productive RWH&C demonstration sites as shown in his site plan in his assignments.
Actual contribution to development	*The farmer and his wife are part of a farmer co-operative and he was willing to*

of productive demonstration sites for teaching and learning	*host learning network members at his farm site.*
Changes made to farming practice	He has implemented tied ridges into his field and has been using Gelesha for many years in the area. There is also the plan for having *amadanyana* in his fields and to practice mulching.
Expanded community interaction	The farmer has a small team joining him in the demo site implementation. He also has a close relationship with a lecturer from fort Cox College so this lecturer has brought students to his field to see the demonstrations.
Links with other knowledge partners	The farmer is linked to Middledrift DRDAR extension officers, Fort Cox College, other farmers in their co-op and from other areas.
How WRC RWH&C materials were used	The materials are well used is his assignments and he knows how to use the navigation tool. He mentions the use of hand outs and videos being a way of sharing the information, along with the Amanzi for Food teaching gardens, meetings, drawing, etc. These are given as the methods used to share information: *"The farmers use the methods of holding meeting…"* and *"Demonstrations using the WRC Amanzi for Food teaching garden producing of vegetables, viewing of videos in the team talk get together."* (Assignment 4, P.3.)

Participant A (Farmer: Keiskammahoek)	
Enhanced knowledge of RWH&C	The farmer's knowledge and appreciation of the significance of RWH&C was enhanced as seen in her responses and discussion in the assignments.
Integration of knowledge into development of productive demonstration sites	The demo site shows that there has been an integration of RWH&C practices into her garden. During Module 5 contact session. She shared: "…*it* (water) *is coming to my furrows that I make there and the water is going there…"* Infield RWH&C (Amadanyana) and mulching are also evident in the demo site.
Actual contribution to development of productive demonstration sites for teaching and learning	The land is hers and so the main resources were contributed by her and time into the planning and implementing of the site. Her actual contribution was also that of an implementer and initiator for the demo site.  Mrs Maso on the far right with extension, College lecturer and other farmers (10.03.2015).
Changes made to farming practice	She became more aware of the water use in her farming activities, she went out in the rain to see where the water goes and added furrows to her garden. Infield water harvesting and mulching is practiced on the demo site.

Expanded community interaction	The farmer is part of a farmer co-op group with whom she meets on regular bases. She has a close relationship with a lecturer from Fort Cox College and with her respective extension officer who visit her and the demo site. This extension officer was not originally a member of the learning network but now he has used the WRC materials and seen the Amanzi for Food resources. She included in her assignment that having a Facebook page will keep people updated on RWH&C so a discussion can start around it with a wider group: *"We can have this information to the farmers by trying to get more copy and have weekly meeting where we discuss on issues resolving this water harvesting issues and to create a Facebook page that will keep on updating about rain water harvesting."*
Links with other knowledge partners	The farmer is linked to KKH DRDAR extension officers, Fort Cox College, Dohne Research Institute, other farmers in her co-op and from other areas.
How WRC RWH&C materials were used	The materials were used to compare different RWH&C techniques by the lecturer that helped plan the site and the materials were used to calculate distances between tied ridges/amadanyana, etc.

Participant A **(**Extension officer & controller: Middl**e**drift)	
Enhanced knowledge of RWH&C	The extension officer's knowledge and acknowledgement of RWH&C was enhanced as shown by his responses and discussion in the assignments. The course reinforced his understanding of these practices and what is appropriate for what level of farming: *"These are chosen for I view them to best fit the different farmer's needs and circumstances in the various areas of operations, varying from home gardens/backyard gardens, community gardens (Zenzele) and fields (amasimi) and their levels*". (Assignment 4, P.2.)
Integration of knowledge into development of productive demonstration sites	There is evidence of integration of RWH&C into the development of the demonstration sites as shown in his site plan in his assignments, especially by the practices that he selected as of interest and to be included in this site: "*RWH&C practices that will be included will be tied ridges, mulching, diversion furrows, gelesha, roof water harvesting, fertility pits and pitting (ploegvore) each of these practices has its advantages and is best used in certain circumstances*" (Assignment 4, P.2.)
Actual contribution to development of productive demonstration sites for teaching and learning	In his plan, he indicated that his contribution would be in the social facilitation of the project*: "to ensure that the project is known and the project members that is the youth of ward 16 in Middledrift are guided to select themselves and with their roles in the project being clearly stated to them*." He would also play an advisory role in the implementation of the site.
Changes made to training practice	The advisory role he plays in his community and workplace allows him to inform and show people about RWH&C practices.
Expanded community interaction	The officer shared the practices with the wider group of extension officers so that they could share with their respective wards that they work with. His focus was on sharing this with the crop growers he works with.

Links with other knowledge partners	He is linked to other extension officers in his office as he is the controller and from other offices in the area, and with Fort Cox College through various projects and in this network as well as the municipal development agencies and researchers from Dohne Research Institute and farmers.
How WRC RWH&C materials were used	The materials are well used is his assignments with content and ideas of how they will be used: "*The learning content from the WRC materials to be used are handouts, going through the case studies or going through sharing stories of success and using the information in the form of text, reading it and explaining it to the audience in the endeavours to get them understand and follow the content entailed in both these materials*" (Assignment 4, P.2.)

As can be seen from the above, there was linking of the WRC materials content to local indigenous knowledge and practices, and a willingness to use local farming sites for wider demonstrations. Through the assignments and participating in course sessions, participants felt that they received a better insight into how a networking system works and they found the opportunity to share their ideas and stories with others very valuable. They indicated that they are learning about more RWH&C practices, and that old traditional practices (such as Gelesha) should be reintroduced and put into practice again among local farmers (Pesanayi, 2016). Trainers and farmers developed skills in designing RWH&C practices for functioning systems that they work with. The farmer that achieved competence in the course was active in designing a functioning RWH&C system which he hoped to implement further. All participants who finished the course identified the importance of integrating these practices into their work so as to attempt to overcome challenges that face food growers all the time. Water is a recognised issue for many involved in food production whether it be on a smallholder or a commercial scale, the recent drought emphasised this. The implementation of RWH&C practices into productive demonstration sites helped participants see the true value in what they had been learning.

3.2.3 Shared productive demonstration sites

As described in section 3.1.3 the productive Demonstration sites were *shared* in the learning network, and provided the catalyst for expanding relational functions where it was possible to move from informational functions (direct or narrow forms of transmission of content) to systems functions (knowledge co-production and situated innovations) (see also Weaver, 2016; Pesanayi, 2016).

The WRC RWH&C materials were a useful common tool for mediating knowledge and skills on new rainwater harvesting techniques in the implementation of shared productive demonstration sites among agricultural actors from different backgrounds and orientations as well as the college lecturers as described above in section 3.1.3. The contents and approach of the WRC materials offered new information on a diversity of rainwater harvesting techniques that helped the agricultural actors to weigh and consider what would work for them in their own contexts, especially simple tangible approaches that could be practically applied on the farming sites.

For example the discussion of *gelesha* provided a familiar tangible approach based on Xhosa traditional farming practices with which the local Xhosa farmers, agricultural educators and extension officers in the learning network found it easy to associate. The concept of *gelesha* together with the wetting front indicator, provided as a teaching demonstration, unlocked the meaning of seeding and conserving water.

Another interesting aspect was to also share demonstration site information from other places. Here the practices of a farmer in Zimbabwe, Zephaniah Phiri were shared in a case study format (from semi-arid rural

southern Zimbabwe) which provided a climatic context similar to that in the Amanzi for Food project area. This case shares and demonstrates that the farmer innovator operates in the same challenging realm as other small-scale farmers; “when Phiri first began he found it very difficult to grow crops successfully, as he had few material resources and there were often periods of drought” (Denison et al., 2011, p. 3).

This includes practices such as construction and use of deep contours that capture and conserve water rather than draining it away like the structures promoted by the colonial authorities during the tine that he started the rainwater harvesting works. In this way the case also provides a challenge to colonial, neo-colonial and globalised narratives on farming interventions in variably-stressed environments. The structures in the Phiri crop fields are deep and long contours which have ensured that the farmer innovator’s agricultural season is extended throughout the year. This tangible example is a success story that has been adopted and adapted by many farmers in similar environments. While the example shows the perceived challenges relating to laborious structures at the beginning, it was found important and useful especially in the Lloyd case where the smaller structures which were tried out initially, while they also extended the growing season remarkably when drought struck, lost water than would have happened with larger structures such as those of the Phiri experience. The farmers after assessing the performance of their structures realised that larger structures like those provided in the Phiri experience would serve then better than their smaller ones. In another farmer context where crop production was taking place in a larger field, the farmer quickly saw the potential of large Phiri-like structures. This helped with the evaluation of the local demonstration sites.

The ToT experiences developed in the IB Learning Network site were shared more widely, and a request was made by the Agricultural Development Research Institute (ADRI) to share some of the practices with a wider group of farmers. A group of 80 farmers were trained using a one day ToT programme, where they were exposed to the work of the farmers in the IB Learning Network. A request was made for further training in RWH&C practices. Individual farmers in the area also became interested in the practices via the sharing of what was happening in the IB Learning Network and they were invited to visit the demonstration sites.

Figure 41. Tied ridges, furrows and mulching practices adopted by a farmer (in her homestead and larger farming site) who visited Lloyd Village demonstration site, and who later joined in the IB Learning Network and started sharing the practices via the local farmers association.

The LED office also started to promote use of RWH&C practices in their programme to support emerging farmers. Below is a picture showing in-field RWH by a farmer who has recently started smallholder commercial farming, supported by the NEDA officer who completed the ToT programme and who also supported the demonstration site development in other sites, including those involved in the farmers' association.

Figure 42. NEDA supported demonstration sites which constituted an expansion of the original set of productive demonstration sites.

Figure 43. NEDA supported small farmers programme begins to use RWH&C approaches in their support to farmers. This picture shows use of in-field RWH with mulching also being introduced in parts of the garden.

3.2.4 Lessons learned and proposed way forward

From the above, it is clear that the practices focus, especially the use of the productive demonstration site, and the collaborative development of these that was catalysed within the ToT programme was a critical element for expanding the learning of RWH&C practices amongst the farming community. Here the support of the extension services and the NEDA office was particularly important, as well as the University of Fort Hare who helped farmers practically with some of the more difficult aspects of the RWH&C practices.

The farmers' association also became an important knowledge dissemination mechanism, and farmers started visiting the demonstration sites, learning from other farmers who had been part of the initial implementation.

Through the work of the NEDA (LED) office the knowledge was further disseminated to additional demonstration sites in the local area, where other farmers were also able to make use of the knowledge and experience developed in the earlier demonstration sites.

Linking to indigenous knowledge and farmers' cultural knowledge of RWH&C was also a key factor as this created engaged dialogue around a range of RWH&C practices, and allowed farmers to link new practices to their experience and existing cultural knowledge.

Farmers were excited to learn new techniques, and were willing to use the materials to do so. They made use of the WRC materials, and especially found the navigation tool very useful to find the information that they wanted. Extension officers also used the navigation tool to share the information with other extension officers.

Thus, overall, the strategy used to mediate the WRC materials with other stakeholders who were in the learning network with college lecturers, was to emphasise the practices, existing local culture and experience, but to introduce new practices via the network interactions, the development of demonstration sites, and use of the navigation tool. Linking into wider structures such as the farmers' association also seemed to be important, as was sharing experience and knowledge from elsewhere and farmers exchange visits. This process mirrors learning theory that suggests that learning needs to be situated and linked to learners' prior knowledge, as it is from here that new knowledge and experience can develop. Thus, from this key lessons learned are:

- Sense-making and meaning-making are situated processes that take place in real-life contexts through demonstration of relevance and co-engagement,
- Access to relevant content needs to be mediated via local contextual needs, and tools for accessing new knowledge in these contexts need to be available in order for quick reference to be made to RWH&C practices of interest by busy practitioners (here the navigation tool was found to be particularly useful), as shown by the discourse of this research technician who also participated in the ToT programme:

  > *"WRC books such as Water Harvesting and Conservation and AWUHGS were used to decide on the suitable practice. The navigation tool was used to find information about these practices*." (Personal Communication, Assignment 3, March 2015).

➢ *Way forward:*

- Further translation of materials into local languages (other than some of the handouts only) will help farmers to engage more with the materials,
- The concept of the productive demonstration site appears to be very powerful in beginning to catalyse interest in the RWH&C practices. Further development of these sites in productive food growing landscapes needs to be developed to show a wider range and varied options for RWH&C in order to

strengthen them as sites of wider learning by more agricultural actors, and so that the benefits of the different RWH&C practices in the different contexts can be evaluated and upscaled. Here the support of the extension services and LED offices appears to be vital as they have the mobility and capacity to support the emergence of the productive demonstrations and also to link various farmers to each other at a local level to share knowledge of the productive demonstrations.

- Integration of the practices into local LED strategies, such as the smallholder farmer support programme also appears to be critical as shown in the IB Learning Network context.

These are elaborated in Volume 2 of the AOS.

3.3 Mediation of WRC Materials in Learning Networks

3.3.1 The importance of multi-stakeholder learning forums

As can be seen from the above discussion in sections 3.1 and 3.2, the use of a learning network structure was central to the initiation and sustained engagement of a systemic approach to knowledge dissemination and flow. The Learning Networks structure had a marked and positive impact on both the access to information of key stakeholders in the sector, and on the support they were able to receive from each other.

Despite being connected to some extent through the demands of their work the agricultural actors in Nkonkobe Local Municipality and a group from neighbouring Amahlathi lacked a forum for collaborative learning at the start of the programme. The lack of local learning forums has been noted elsewhere as an impediment to farmers' learning (Mukute, 2010). As part of the project set-up process, the research team worked with the extension officers, farmers, agricultural educators, research technicians and local economic development agricultural specialists to explore the potential for the establishment of a learning network forum in the area, based on the contextual analysis as reported on in section 2 (see also Weaver, 2016; Pesanayi, 2016; Lupele, 2016; Sithole, 2016).

As can be seen from the reporting in Section 3.1 and 3.2, the learning network forum became an ongoing collaborative learning space upon the commitment of its members, where the ToT helped to establish the innovation practices in the learning network around the WRC resource materials on RWH&C (Figure 44). The Imvotho Bubomi (meaning 'water is life') Learning Network which formed in Nkonkobe became a mutually-supportive research and learning commons at which representatives from all agricultural parties could deliberate how to strengthen co-operation and information sharing between them to improve their RWH&C knowledge practices.

Figure 44: A group sharing ideas and discussing solutions in module 2 of the ToT course

The learning network forum also clarified both the contributions each member could make towards increasing the practice of RWH&C, and what was needed by each party, in terms of information support materials and interactions in order to achieve this as can also be seen in section 3.1 and 3.2 reporting above. The idea here was to develop a broadly consistent approach to RWH&C within the network, while maintaining the necessary flexibility to meet the needs of the different contexts. The learning network therefore provided an essential platform for dissemination of RWH&C practices and knowledge through the mediation of the WRC RWH&C materials.

The Imvothu Bubomi Learning network established with the Fort Cox College at its hub brought together a wide range of stakeholders, including almost every group identified in the initial stakeholder mapping outlined in Table 12 above. However, it did not include large-scale commercial farmers, although some of the emerging farmers are beginning to operate at scale, or any CSOs, although these were approached in the early days of the project. There is real potential for both these groups to be brought into the Learning Network over time, and this would considerably enhance its effectiveness. As the Learning network is firmly geographically located there is no direct representation from provincial or national government offices, although it is to be hoped that the connections to these, through the local agricultural extension offices, for the farmers and others, should also be improved.

The Learning Network, as established, included representatives from:

- Agricultural College
- Agricultural Research Institution
- 2 HEIs
- Emerging farmers and farmer associations
- Agricultural extension services (from 2 offices)
- Local Municipality Economic Development Agency

As indicated in section 2.1 the concept of the learning network was used as a way of accessing the agricultural actors in the Nkonkobe Local Municipality and in other areas where the Amanzi for Food project intended to work. The initial concept as illustrated in Figure 10 had the Agricultural College in the centre of the learning network showing its connections to other agricultural learning systems from the perspective of the colleges from data generated. The diagram below is an improvement of the concept of the learning network as mapped out in Figure 10. The improvement emerged from a better understanding of the connections using empirical data provided by the research participants and through observations, and also recognising the

central role played by farmers, the local economic development agency and the university together with the agricultural college in the network rather than the latter alone.

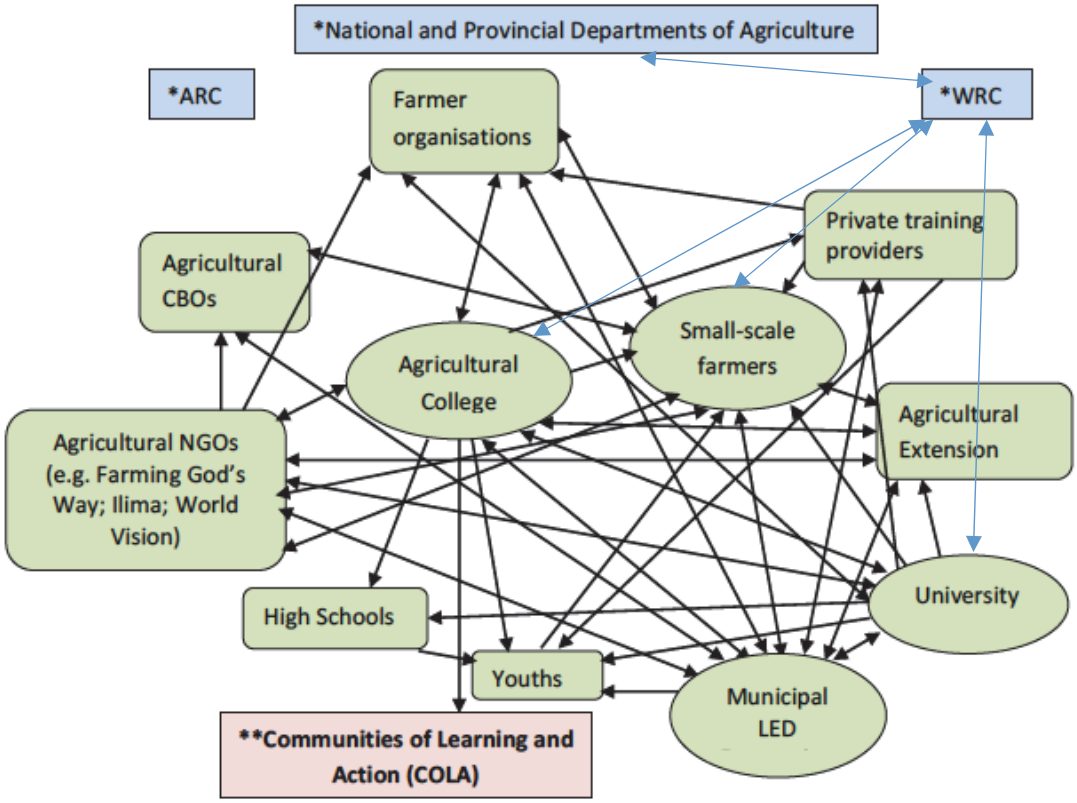


Figure 45. Imvotho Bubomi learning network growth and interactions that occurred over the life of the Amanzi for Food programme, where the learning network interactions emerged. A key shift in the design of the learning network was the interaction between colleges and smallholder farmers, both of which appeared to become 'central' to the learning network's success (Pesanayi, 2016).

Key:
*These organisations, while not necessarily having direct involvement in the clusters are critical external partners, and their support is essential.
**Agricultural Colleges work with each other in these COLAs, a process through which they share ideas for different aspects of their work, including their curricula. The principal of Cedara heads the COLA, with which Fort Cox is also involved. The COLA therefore provides an opportunity to take the lessons learned through the work with these two colleges to all other colleges (towards the end of the programme it was noted that the COLA system may have changed to be taken up by the quality management heads of the Colleges).

The network map with 11 connection nodes shown in Figure 35 above, is shown such that a node scoring between nine and ten connections was regarded a central connection with expansive boundary-crossing learning potential (Engeström, 1987 [2014]). Engeström's expansive learning theory suggests that new human activity can emerge via such boundary-crossing processes, which are multi-voiced and involve multiple actors, each with their own histories and experiences, and practices and contributions that can be made to the new activity, if all agree that it is a worthwhile activity to pursue. The full scope of the expansive boundary crossing learning potential is being explored in the PhD study of Pesanayi, one of the researchers on the progamme (Pesanayi, 2016). The network map in Figure 35 also shows the connectedness of the agricultural learning systems, showing that farmers, the agricultural college, the university and NEDA, together with the WRC via the materials, appear to have the greatest relevant nodal connections in this learning network system. Using this insight, and the data presented above, it seemed that in this context, they

carried the greatest potential for facilitating collective boundary-crossing learning, and were the focus of boundary-crossing laboratory workshops in Pesanayi's study (Pesanayi, 2016). These workshops were focussed on collective meaning making, focussing especially on the boundary crossing relations that were needed for farmers to welcome the demonstration site development and participate in the ToT at the College, and college lecturers and universities to work more closely with communities in mediating knowledge and improving their curricula. The experience in the IB Learning Network confirmed that for a learning network to be successful, the participants need to be flexible, responsive and continually actively learning from one another (Pesanayi, 2016). Furthermore, it is important for the partners to strike a balance between inside (experiential and internal knowledge) and outside (external research knowledge) knowledge to form successful collaborations (Lieberman, 2000).

3.3.2 Interaction across traditional knowledge dissemination boundaries

As shown above in Figure 35, the learning network allowed for interaction across traditional knowledge dissemination boundaries, and addressed some of the limitations of one-way knowledge flow. Collaboration between agricultural educators with a science background, farmers with indigenous and local knowledge practices and extension officers at the confluence of science knowledge and farmer practical knowledge, the meaning of rainwater harvesting and conservation was encountered in contextually relevant ways. These agricultural actors together with the Amanzi for Food researchers and using of WRC RWH&C materials acted as formative interventionist researchers to unpack the meaning in the WRC materials in order to develop new common knowledge (Pesanayi, 2016). Engeström (2007) describes these processes of collaborative encounter and transformation through formative intervention as follows,

> By bringing the products of science and art into a new type of formative contact with productive practice, learning activity introduces a new creative moment into the activities of science and art themselves. ..., learning activity never leaves its instruments qualitatively intact. It is not just consumption of instruments given from outside. (Engeström, 2007: 126)

A network can be a very effective learning resource when the network is designed in a way that learner differences, such as their diverse competencies, are accepted and utilised (Cousin and Deepwell, 2005) and individuals act as nodes and encourage information flows in the broader network (Wenger et al., 2011). The Imvotho Bubomi learning network was brought together as a diverse group with many different competencies and interests in their line of work thus creating a rich environment for learning to occur. A networked learning community is an important platform for participation of the various partners for learning and change to occur (Pesanayi, 2009; Mukute, 2010). This approach went some way towards addressing the limitations of the Research, Develop, Disseminate and Adopt (RDDA) approach is that it makes the assumption that the knowledge produced from a research process can be developed into a resource material package and disseminated to consumers (farmers and agricultural training institutes in this case) with automatic adoption. The experience of this project shows that use of resource materials is best done via activating the knowledge in relation to context and practice and the interests and motives of the diverse actors who have an interest in the knowledge. Knowledge dissemination is a fundamentally *social* process (Weaver, 2016; Pesanayi, 2016). The learning network created a transformative social learning forum at the boundaries of knowledge practices, and enabled crossing these boundaries as evidenced by lecturers interacting with farmers and then changing their curriculum practices because of what they learnt together, and farmers, extensionists and the LED officers introducing new practices based on their learning interactions with college and university lecturers.

The Amanzi for Food experience shows that social learning creating fora for interactions between agricultural practitioners and professionals allows for collaborative creation of solutions to water for food problems, with WRC materials acting as knowledge mediation resources, activated into use via the learning network and ToT

programme and tools. Shorter ToT sessions with other emerging learning networks show potential for similar knowledge boundary crossing processes (Weaver, 2016; Pesanayi, 2016).

3.3.3 Real-world curriculum and practice innovation

As can be seen from the reporting in Sections 3.1 and 3.2, the focus on practice in the Amanzi for Food programme was critical to the success of the knowledge dissemination process. Initial scoping showed a low level of practice in the colleges, and lecturers, farmers and extensionists not having adequate knowledge of RWH&C practices to implement these. The practice analysis, and the navigation tool helped with accessing knowledge of the practices, which allowed participants in the various ToT activities to evaluate existing practices, gaps, and potential new practices that appeared to be feasible in local context. The collective engagement around the productive demonstrations appeared to be significant for building common knowledge of the practices, and a wider capacity to share the knowledge. Significantly, this also began to demonstrate some of the foundations of a community engaged, competence-based model for curriculum innovation in colleges.

While the reporting in sections 3.1 and 3.2 have provided descriptions of the practices, they have not commented on some of the hidden dynamics of adopting a practices focus. Kemmis (2009) suggests that the shape of the practitioner's practice is not only 'given' by the people actually performing the practice (e.g. the members of the learning network constructing the furrows and small ponds in Lloyd Village). Such practices are also pre-structured and prefigured in discourses (for example, how knowledge of the practice is represented in texts and curricula, as was seen in the use of the navigation tool and the handouts from the WRC materials and the ToT course curriculum), in social relationships (for example, through experiencing the social relationships and assistances provided by the university and lecturers in the construction of the ponds and furrows), and in material-economic arrangements (like not being able to afford the pump which was earlier used for watering of the gardens, and the generally low levels of income of the elderly women farmers). As was seen in the Lloyd Village RWH demonstration site, the practices worked well while conditions were favourable but once the moles ate the plastic and harder labour was required to keep the furrows clear, the practices were no longer as helpful as they had initially been. Thus these 'often hidden' dimensions of practices need to be carefully considered in the mediation of knowledge of the practices. Knowledge flow is often not enough, and most times there is need to strengthen and support the knowledge flow with structural elements, as was the case in the NEDA supported expansion of the practices in the smallholder farmer programme, where farmers were supported in other ways, not only with knowledge. The IB Learning Network case, does, however, show that much can be achieved with collaborative action and learning, but at times this may also not be completely adequate (Pesanayi, 2016; Weaver, 2016).

3.3.4 The importance of new knowledge in learning networks

The reporting in section 3.1 and 3.2 also show that one of the key factors that held the IB Learning Network together was the collective interest in the new knowledge of RWH&C practices that was made possible via the mediation processes with the WRC materials. While the materials with their information had been disseminated to the colleges prior to the start of the project, this remained *inactive in the college.* This was because College lecturers indicated that they did not have knowledge of these practices, and they lacked curriculum development skills to integrate this into the curriculum. The ToT process was therefore needed to activate use of the information in the materials. Importantly too, the new knowledge, to be meaningful, needed to be related to the prior knowledge of the learners in the network, and the first module of the ToT therefore involved situational analysis, and gap analysis to see what was already known about RWH&C. This, together with the use of the navigation tool, which provided access to new practice knowledge, allowed for a gap analysis and for participants to make decisions as to what new knowledge would be most useful and usable in their contexts of practice. They were then able to make use of the information in the WRC materials, and to

relate it to local circumstance, need and aspirations. This then catalysed further interest in the materials, which were then used by an ever widening group of participants, and eventually also in the teaching programmes of the colleges, by the extension officers in their workplaces, by the NEDA officials in their smallholder farmer support programme, by more members of the farmers' association and others, and in the training of extension officers. New knowledge is vital to support the emergence of new practices, but from this it is clear that such knowledge needs to be *activated* into use via mediation processes that allow for contextual engagement and mobilisation of prior knowledge. Activation of new knowledge, as shown in this project, can lead to further interest in new knowledge, provided that the activation of the new knowledge in the first instance is seen as being relevant to the interests and contexts of practice. This type of learning can also be described as a situated, *expansive social learning process.* Professor O'Donoghue, following a mediation process using practical demonstration of drip irrigation systems with learning network members reflected as follows:

> Using a 'strategy as practice' approach in our curriculum work it was possible to clearly model the competences that were emerging in a practical learning sequence to activate new knowledge in relation to prior knowledge. For example, working in a teaching garden project at the college it was possible to see how earlier conversations around the Xhosa cultural practice of *gelesha* enabled an emerging grasp of the retention role of humus and the capillarity, water ingress and retention that become apparent with the use of a wetting front indicator. Here learner's understanding developed as relational threads of heritage and practical demonstrations of new knowledge of RWH&C practice articulated to produce an agricultural extension competence to model and explain ways of optimally retaining and delivering water for food production. Insights into student's emerging practical competence came through in student inferences that there would be weed reduction in the composting of dry dung and that mulching a composted garden would enable organic soil processes to be protected from desiccation (O'Donoghue, pers. comm, July 2016).

3.3.5 Lessons learned and proposed way forward

- *Lessons learned*

When farmers are brought together with extension officers and agricultural educators in a collaborative learning environment there is a levelling of power relations and a mobilisation of different knowledge which enables informed adoption and adaptation of the knowledge in WRC RWH&C materials.

A learning network approach provides for commoning activities which are a traditional way of working among African farmers (*ilima* in isiXhosa), where people work together to mobilise and focus their knowledge and labour on one farmer's field before moving together to the next one.

Learning networks need to be supported, at least initially with a strong, structured, yet contextually relevant intervention that helps to build common knowledge and engagement around common areas of interest (this was done by the ToT course and use of the WRC materials).

- *Way forward*

Expanding learning networks for activation and uptake of RWH&C knowledge in agricultural learning systems. While the learning network model appears to be a productive mechanism for systemic knowledge dissemination, it also requires ongoing interactions and engagement and a considerable amount of time and investment from those concerned. Learning network activities should therefore be carefully framed and supported in ways that support the interests of all involved in the learning network, e.g. curriculum innovation in colleges, smallholder farmer development for LED officials, food production for farmers, and so on. This

was shown in the initial interest in the learning network, which dropped off over time. However, new members joined as they became interested in the focus of the network activities.

Reflection on keeping the learning network alive: All the participants were in favour of the continuation of the IB Learning network. A senior extension officer indicated that the learning network should still exist because the need for RWH&C is still dominant. A lecturer urged that the team needs to stick together and see the fruit which will happen over time, through various input and collaboration with people because it's existence may galvanise other networks. Another lecturer further suggested that when the network has something to show they can re-invite previous participants who had left the network.

These aspects are taken up in the AOS (Volume 2).

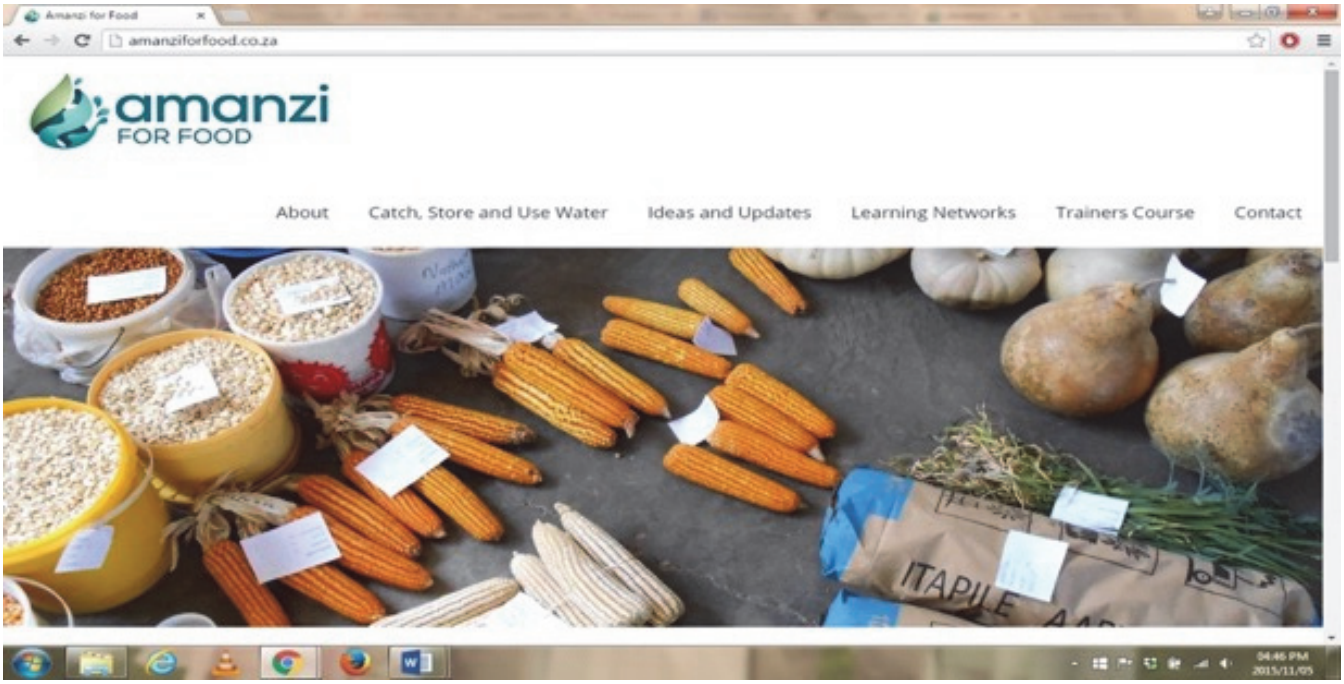
3.4 Mediation of WRC Materials using diversity of media (website, radio, community, video, newspapers, agricultural shows, etc.)

3.4.1 Use of WRC materials using a web platform

The *Amanzi for Food* website and blog went live in February 2015 after a careful process of developing the site. It was key for the site to be accessible and easy to navigate in a way that a diverse audience could obtain various information required as it was created to make the WRC materials more accessible to users in an easy to follow way breaking the RWH&C practices into categories. These categories are designed so that any agricultural practitioner can identify themselves in the way that they plan to use the information in their practice. The website was designed to have the following features:

- Information on the WRC materials
- Accessible structure for downloading the WRC materials framed by the farming scales and the specific practices under the user friendly concept of 'Catch, Store and Use Water'
- Ideas and updates – to carry ongoing news and blogs, think pieces and other material of interest
- Learning Networks – to carry information on the learning networks and their activities
- Trainers Course – to carry the course materials and information on the course
- Contact details – to allow for interaction and enquiry
- Links to a Facebook page, and to other related internet sites

The website was designed using a user-friendly WordPress platform and the Amanzi for Food branding (Figure 46). Amanzi for Food researchers were trained to update the website so that regular information from the field and the project could be included on the website on a regular basis.



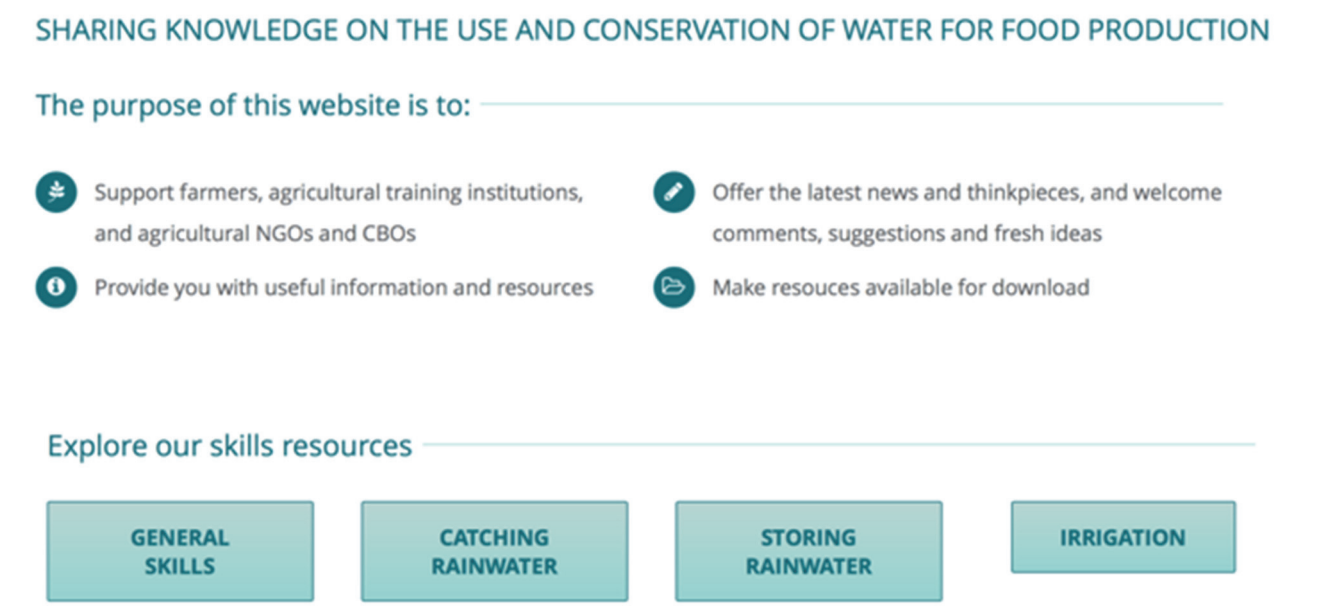


Figure 46. Screenshot of the Amanzi for Food website (www.amanziforfood.co.za) showing the purpose of the website (with icons designed to facilitate access to various features of the website)

A full WRC 'Resources Library' was put on the website (Figure 47), containing all of the information from the two sets of WRC materials. One of the issues experienced is that the files in their original format were too large to upload in one file, and the materials were therefore broken down into smaller PDFs for easier downloading.

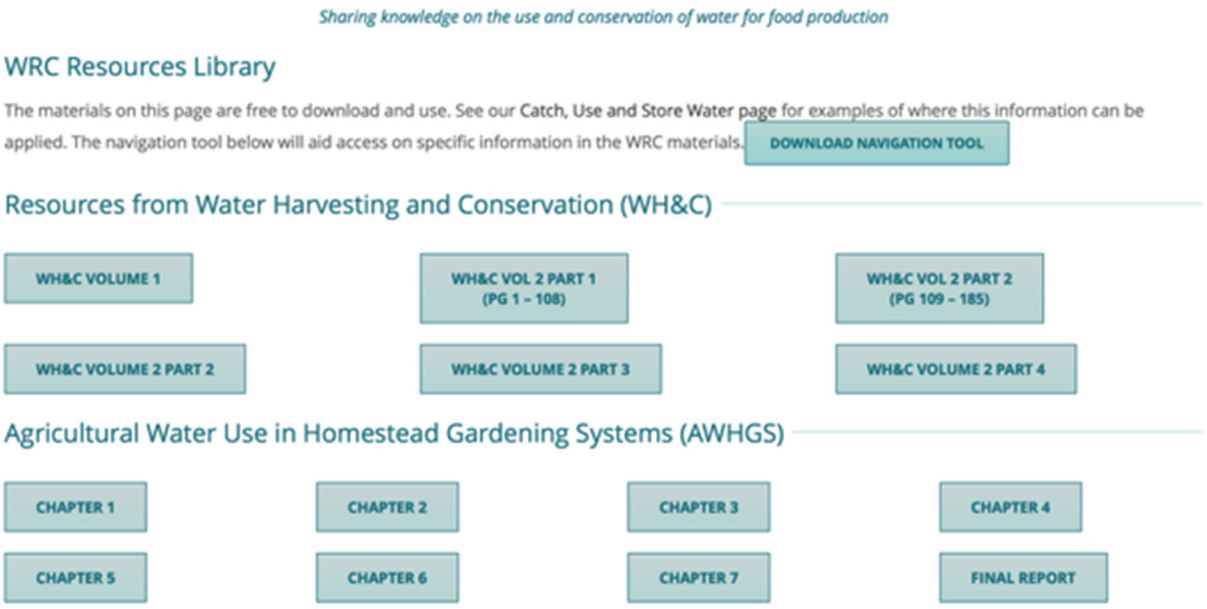


Figure 47: Access tools provided on the website to get to and download the two sets of WRC materials

Further access was provided via the farming scales framework and via the individual practices (Figure 48 & 49), each of which was summarised and illustrated as shown in the screen shots below:

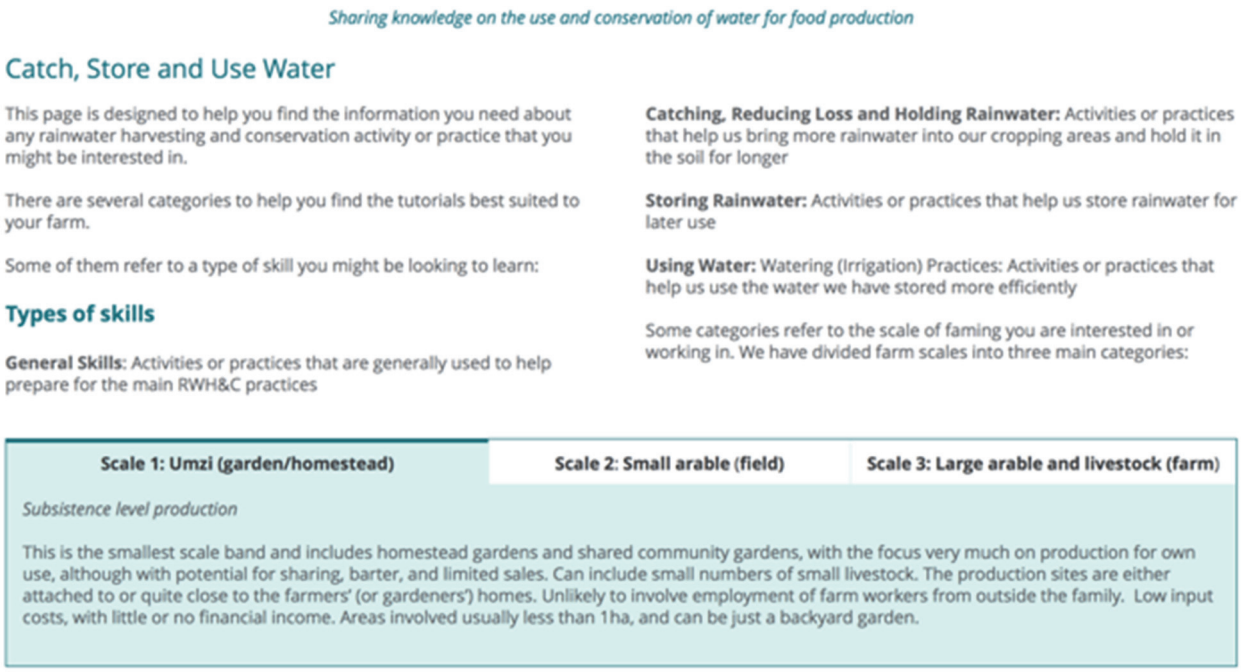


Figure 48. Further access tools on the website (reference to types of skills and farming scales)

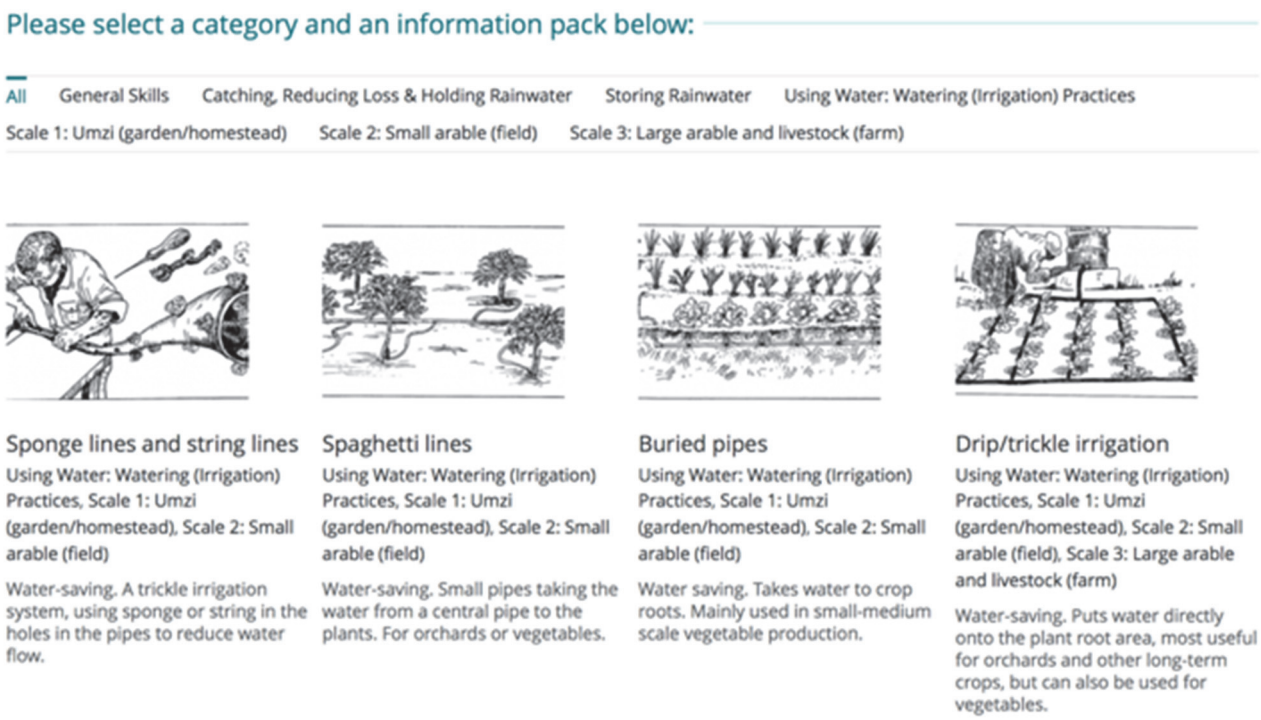


Figure 49. Screenshot showing access to each of the practices on the website

Specially designed ‘postcards’ were produced for each of the practices to allow for a first level of access to the practices which was then further linked to handouts and to the more in-depth materials as show in Figure 50 below.

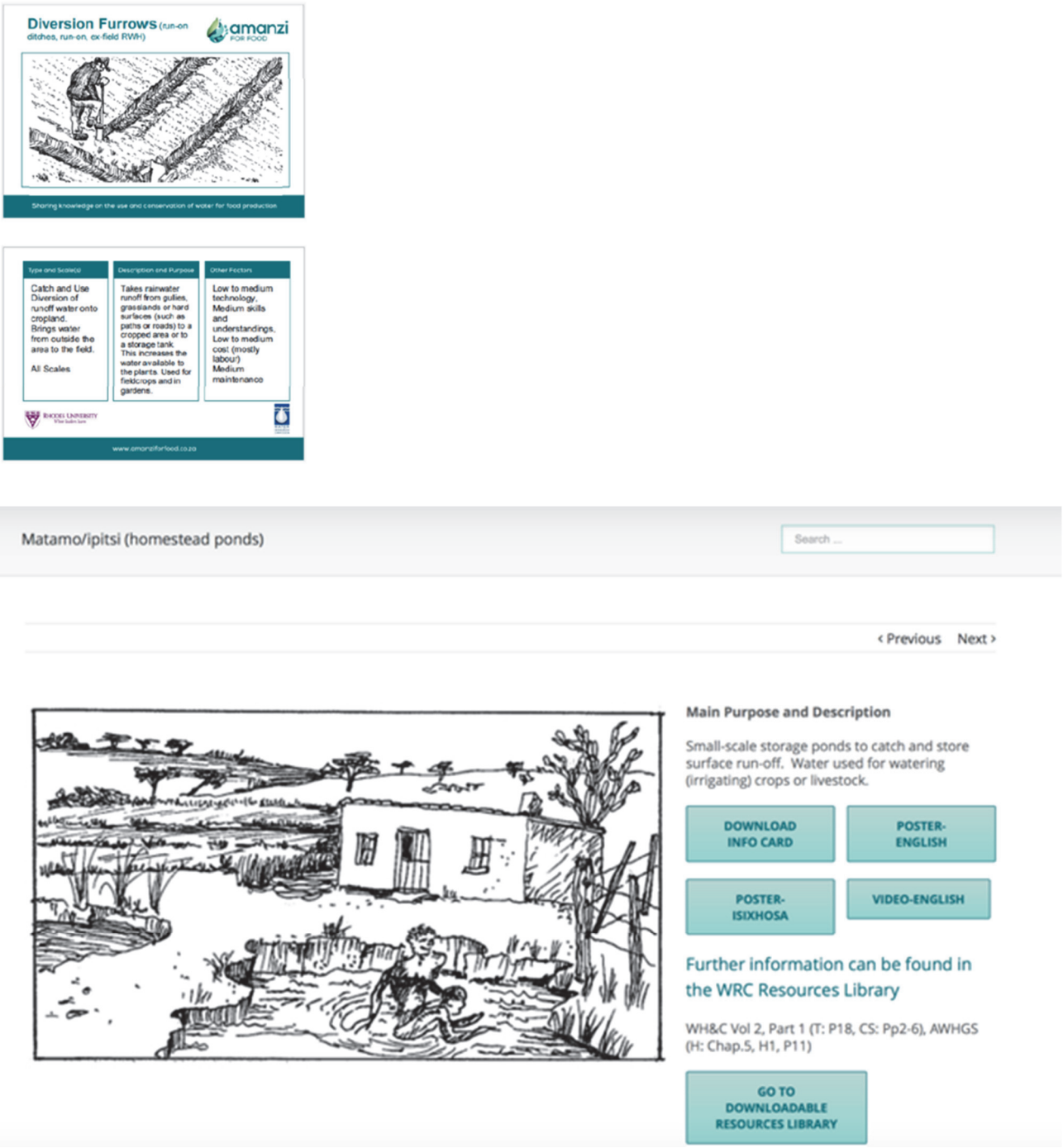


Figure 50: Practice info cards and associated layers of access to the WRC materials provided on the website

One of the supplementary materials produced were a set of short video clips, hosted on YouTube (see Figure 51; Appendix C). These videos were aimed at visualising the RWH practices for use in colleges. They responded to research findings in the scoping phase that there were few South African video-based materials easily accessible on RWH&C. One of the challenges of producing video-based materials is the time and cost involved. The project budget did not include adequate budget for professional video production, and a low cost route was therefore taken. This involved working with journalism and education faculty students, and the Amanzi for Food team and IB Learning Network members who agreed to demonstrate some of the practices in the WRC materials. The short video clips took a number of months to produce, but have proven to be helpful in sharing 'authentic experience' of the practices in video graphic formats. Only four practices could be

illuminated via this methodology due to the complex processes and costs associated with videography and film-making without a professional production budget. Videos were also produced using two languages (English and isiXhosa).

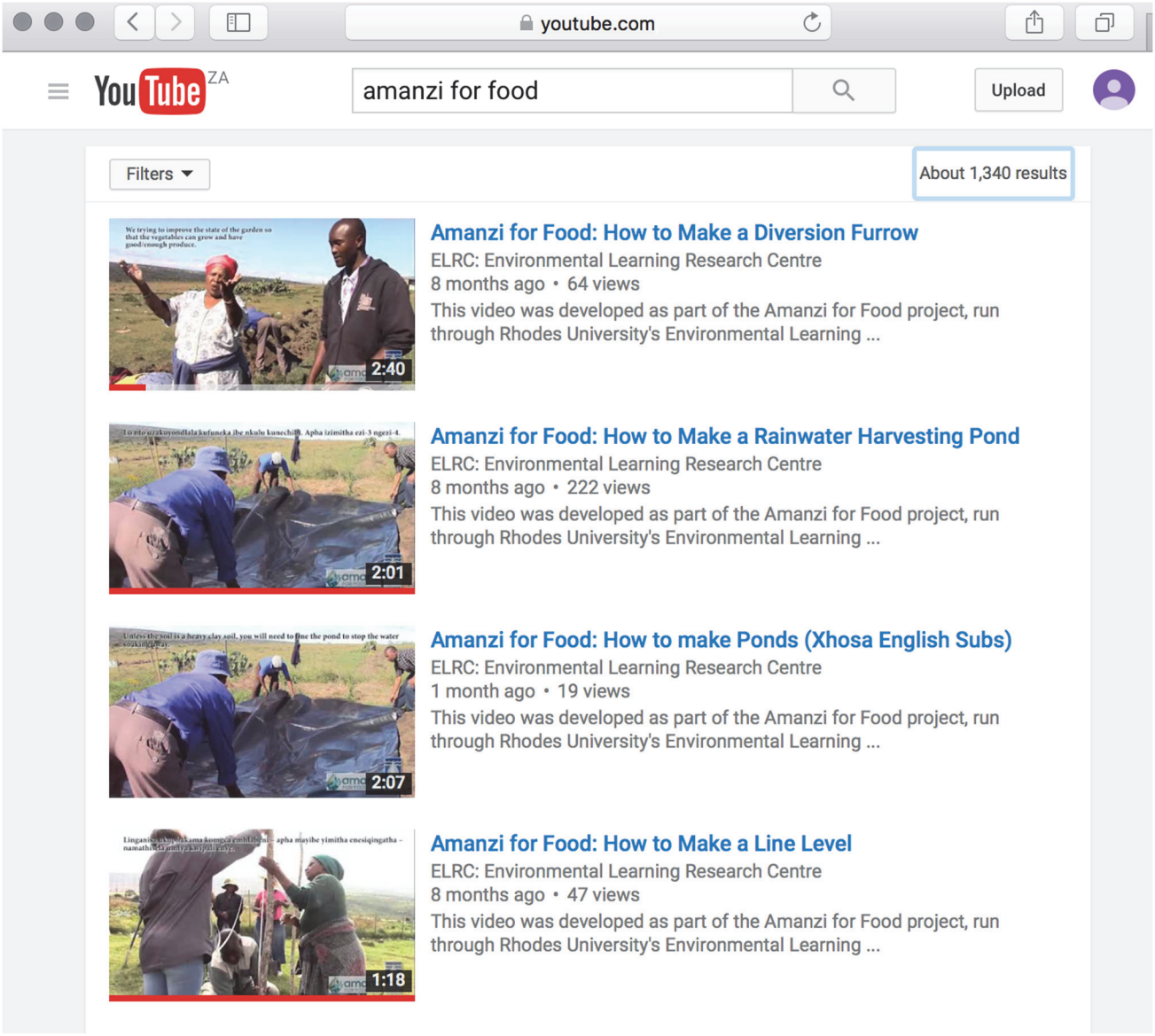


Figure 51. Amanzi for Food You Tube video clips (see Appendix C) made to help mediate the practices (short video's using low cost approaches) https://www.youtube.com/watch?v=OxuNSr3Kq60

Using picture-based stills of the same procedures, a set of six posters were produced, also in two languages, with potential for adaptation to other languages (Figure 52; Appendix B). The posters were designed to illustrate a RWH practice and the steps involved in developing the practice. These were linked to the postcards and the practices on the website as outlined in Figure 50 above. Figure 52 below shows the English and isiXhosa versions of one poster. The posters are downloadable on the website in both Word and PDF formats. The Word format allows for language customisation.

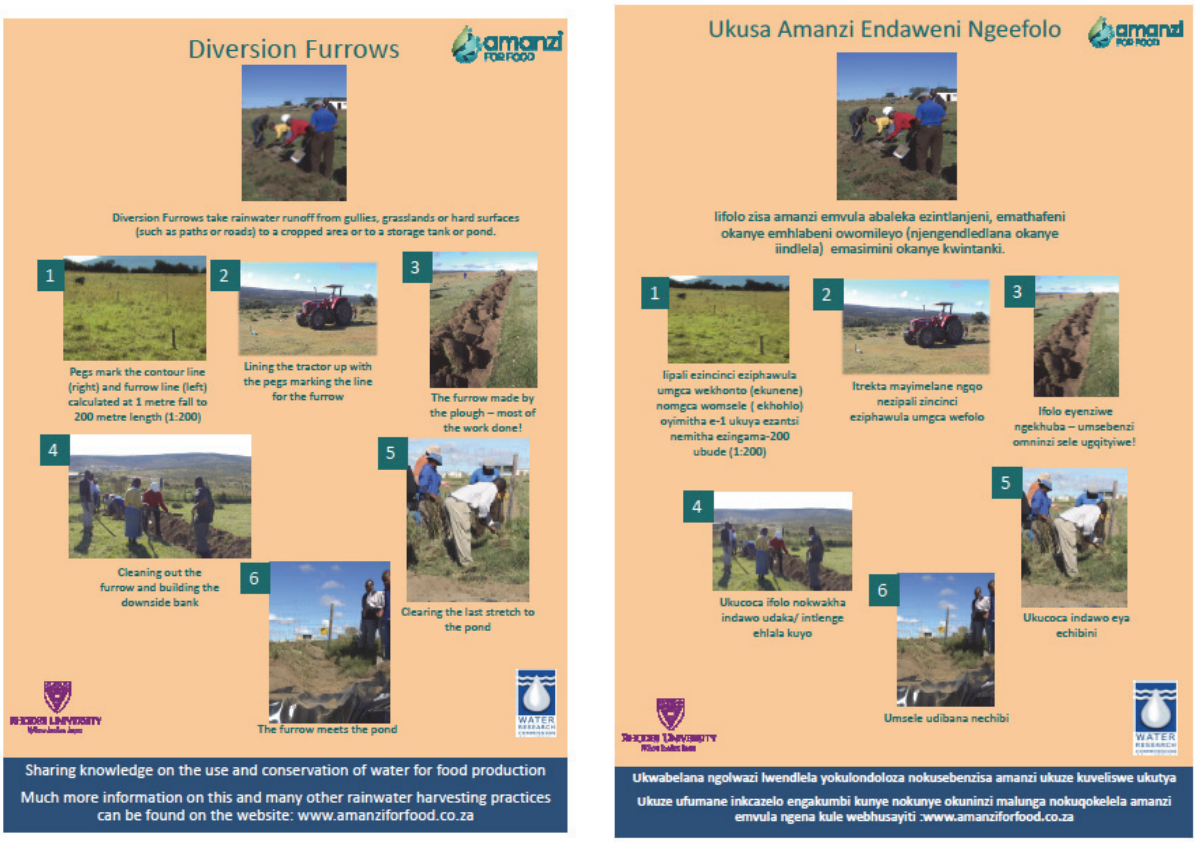


Figure 52. Sample of posters produced (in English and isiXhosa) – see Appendix B

Thus for each practice the following access materials were produced:

- Downloadable 1-page info card (illustrated)
- Posters (in English and isiXhosa) (posters for only 6 practices were produced and tested)
- Short YouTube video clips were produced (produced for only 4 of the practices)
- And specific links to the more detailed handouts and/or information in the WRC materials was provided, which could be downloaded from the WRC Resources Library.

This shows the work that went into creating a multi-layered access system to the knowledge contained in the WRC materials. The website was used in the ToT programmes, and participants in the learning network were trained to use the website, and were encouraged to use the website on an ongoing basis.

The website offers perhaps the most promise in terms of providing ongoing access to the WRC materials for all agricultural colleges, university faculties of agriculture, agricultural high schools and others. However as shown by the short ToT workshops, there will need to be proactive engagement with these to not only make them aware of the site (a process which has started with the colleges already), but to also encourage them to become active users of the site. This will include sharing of their own ideas and experiences of RWH&C practices and the teaching and learning thereof on the blog.

The blog site became more active as the programme unfolded, and a number of think pieces and reports from the field were captured in short articles on the website. These proved to be particularly useful tools for attracting people to the website, especially when they were also posted on the Facebook page, which was

linked to the website. Figure 53 shows some of the blogs produced and posted on the website. A total of sixteen such posts have been put up on the website since the website went live.

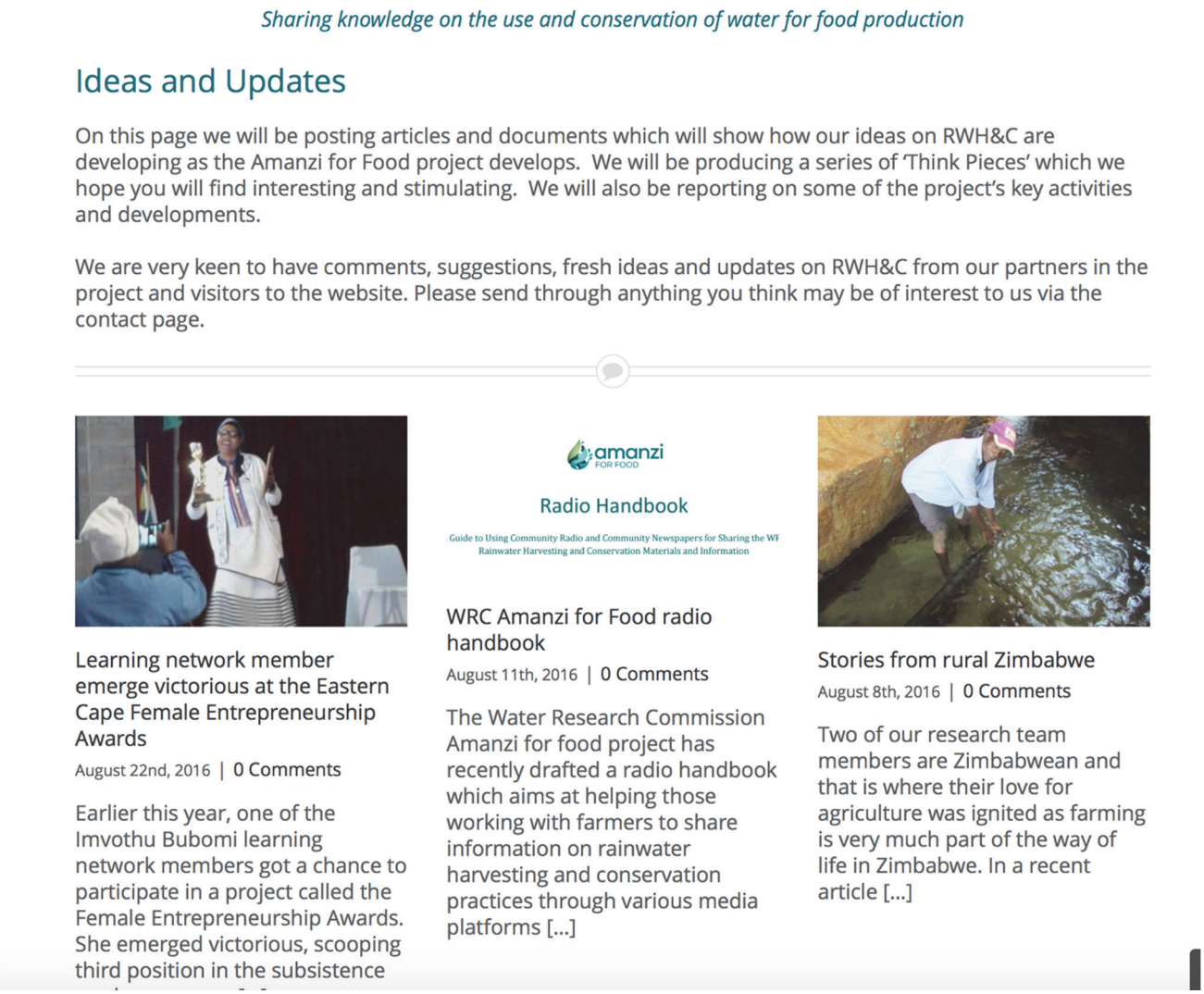


Figure 53. Screenshot showing some of the Amanzi for Food blogs

As noted above, the website was also linked to a Facebook page (Figure 54), which over time has steadily being getting more visits, especially so after radio programmes. The Facebook page has been most useful for making links between the Amanzi for Food knowledge resources and activities and other associated programmes. Shown in the screenshot below, is a link to a Manstrat Agricultural Intelligence Solutions post.

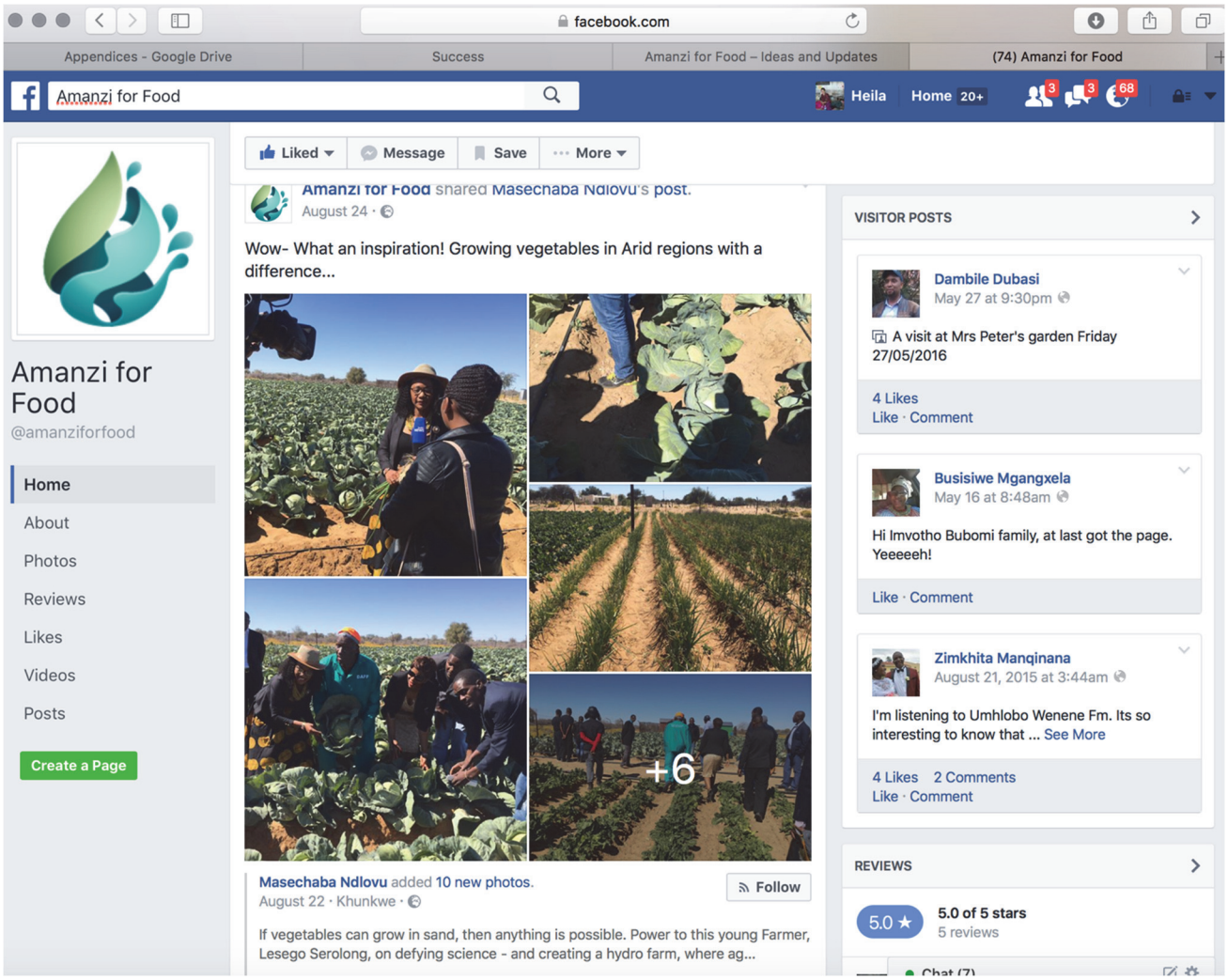


Figure 54. Screenshot of the Amanzi for Food Facebook page (https://www.facebook.com/amanziforfood/)

From the above, it is possible to see that the website provided a modern means of providing access to the WRC materials in various formats. The website also allowed for building knowledge exchange links between the WRC materials and associated initiatives. The website, blog and Facebook page can be used to continue to integrate the use of the materials for curriculum development purposes with the ToT course, as this appears to provide the necessary support for College lecturers to undertake the curriculum development work while also using the WRC materials. For agricultural trainers, the website is a place where resources can be downloaded and given to farmers who want to learn more about RWH&C practices and how to implement them into their system.

In addition to the Amanzi for Food programme website, efforts were also made to share the WRC knowledge via other suitable web platforms. Key here is that the *Amanzi for Food* website will be linked to Extension Suite Online® and the new Agrisuite Online® that are electronic internet support systems for agricultural advisory services and farmers (Manstrat, 2015). The ESO system comprises many members and covers a wide range of information, making it easier for extension advisors to access specific information to address a diverse range of farmers' problems (Van Zyl, 2014). While ASO is designed for tablets and smartphones and the target audience is farmers for easy access to key information. Both these platforms are very important for disseminating knowledge into the training and farming circles. The team that runs these systems from Manstrat agricultural intelligence solutions have acknowledged the importance of the WRC work that *Amanzi*

for Food is promoting and so there is a plan to link the sites to one another. This should increase the amount of trainers and farmers that can access the information around RWH&C practices for agricultural activities throughout the country through gaining access to their users too. To facilitate this link, the Amanzi for Food team have worked with Manstrat to align the information from the WRC materials to the format and commodities focus of the Manstrat website.

The website also includes a system of monitoring downloads to the website, which allows a tracking of visits to the website, and time spent on the website. The data presented in Figure 55 shows this monitoring system, and shows that the website is more regularly visited after radio programmes that share knowledge of RWH&C practices and farmers stories of using the materials (see section 3.4.5 below). The tracking data also shows whether the visitors to the website are new visitors, or visitors that have previously visited the website. From the data shown in Figure 55 it seems that the site is attracting new visitors. It also shows when there are 'peak' visits to the website (e.g. after a radio programme). It also shows what parts of the website are being visited, and this allows a tracking of the downloading of the materials.

	Page	Pageviews	Unique Pageviews	Avg. Time on Page	Entrances	Bounce Rate	% Exit	Page Value
		117 % of Total: 100.00% (117)	96 % of Total: 100.00% (96)	00:02:37 Avg for View: 00:02:37 (0.00%)	45 % of Total: 100.00% (45)	60.00% Avg for View: 60.00% (0.00%)	38.46% Avg for View: 38.46% (0.00%)	$0.00 % of Total: 0.00% ($0.00)
1.	/	16 (13.68%)	15 (15.62%)	00:01:45	15 (33.33%)	26.67%	31.25%	$0.00 (0.00%)
2.	/about/	12 (10.26%)	7 (7.29%)	00:05:23	0 (0.00%)	0.00%	25.00%	$0.00 (0.00%)
3.	/ideas-and-updates/	9 (7.69%)	4 (4.17%)	00:00:39	1 (2.22%)	0.00%	22.22%	$0.00 (0.00%)
4.	/portfolio-items/swales-bunds-contour-ridges-berm-n-basin-contour-ditches/	7 (5.98%)	6 (6.25%)	00:01:48	5 (11.11%)	60.00%	57.14%	$0.00 (0.00%)
5.	/appointment-of-a-new-senior-agricultural-advisor-at-alice-department-of-rural-development-and-agrarian-reform-office/	6 (5.13%)	6 (6.25%)	00:00:00	6 (13.33%)	100.00%	100.00%	$0.00 (0.00%)
6.	/catch-store-and-use-water/	6 (5.13%)	4 (4.17%)	00:01:11	0 (0.00%)	0.00%	16.67%	$0.00 (0.00%)
7.	/portfolio-items/trench-beds-deep-trenching-fertility-trenches/	6 (5.13%)	6 (6.25%)	00:00:00	6 (13.33%)	100.00%	100.00%	$0.00 (0.00%)
8.	/downloadble-resources/	5 (4.27%)	4 (4.17%)	00:01:00	0 (0.00%)	0.00%	40.00%	$0.00 (0.00%)
9.	/rainwater-harvesting-and-conservation-practices/	5 (4.27%)	3 (3.12%)	00:00:07	1 (2.22%)	100.00%	40.00%	$0.00 (0.00%)
10.	/contact/	4 (3.42%)	3 (3.12%)	00:03:48	0 (0.00%)	0.00%	0.00%	$0.00 (0.00%)

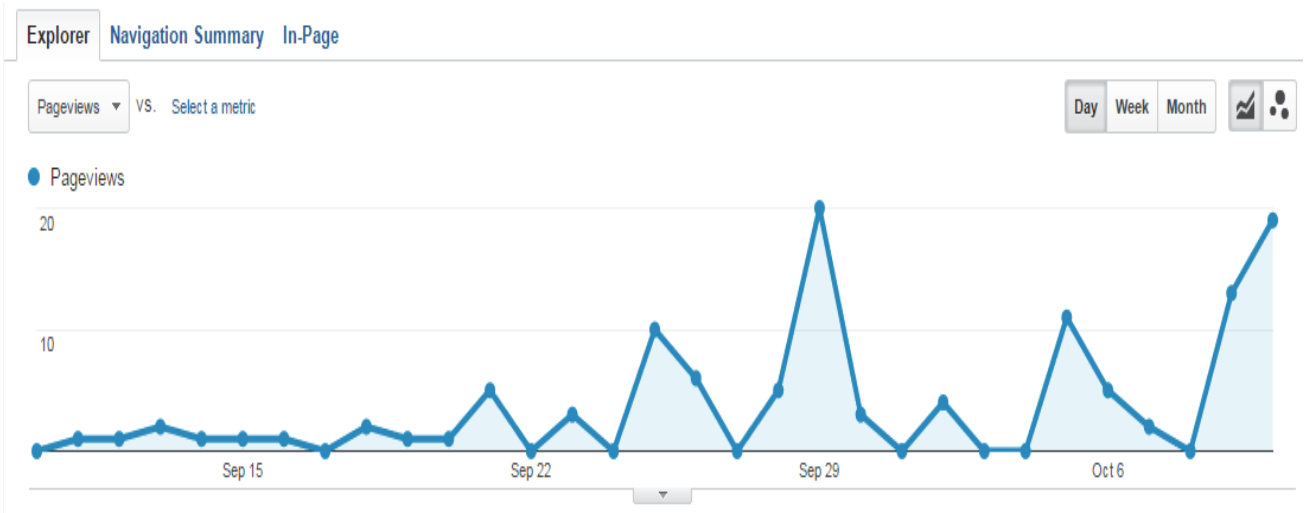


Figure 55. Monitoring of visits to the Amanzi for Food website and downloads

3.4.2 Use of WRC materials enhanced by social media

As discussed in section 2.5 above, social media is a way that many of the younger generation communicate and find new information about the things they are interested in. The Facebook page was opened along with the website and blog site in February 2015 with the purpose of sharing the new blogposts and ideas around RWH&C practices. Additionally, the page can be used as a communicative platform for conversations around these practices and a space for people to ask questions and interact with one another. The *Amanzi for Food* team has been updating the page and responding to questions and queries around conservation agriculture. The Facebook page has also been useful for sharing information on RWH more generally, and for sharing information from other parts of the world, and on the project's activities. Figure 56 below shows some of the posts on the Facebook page.

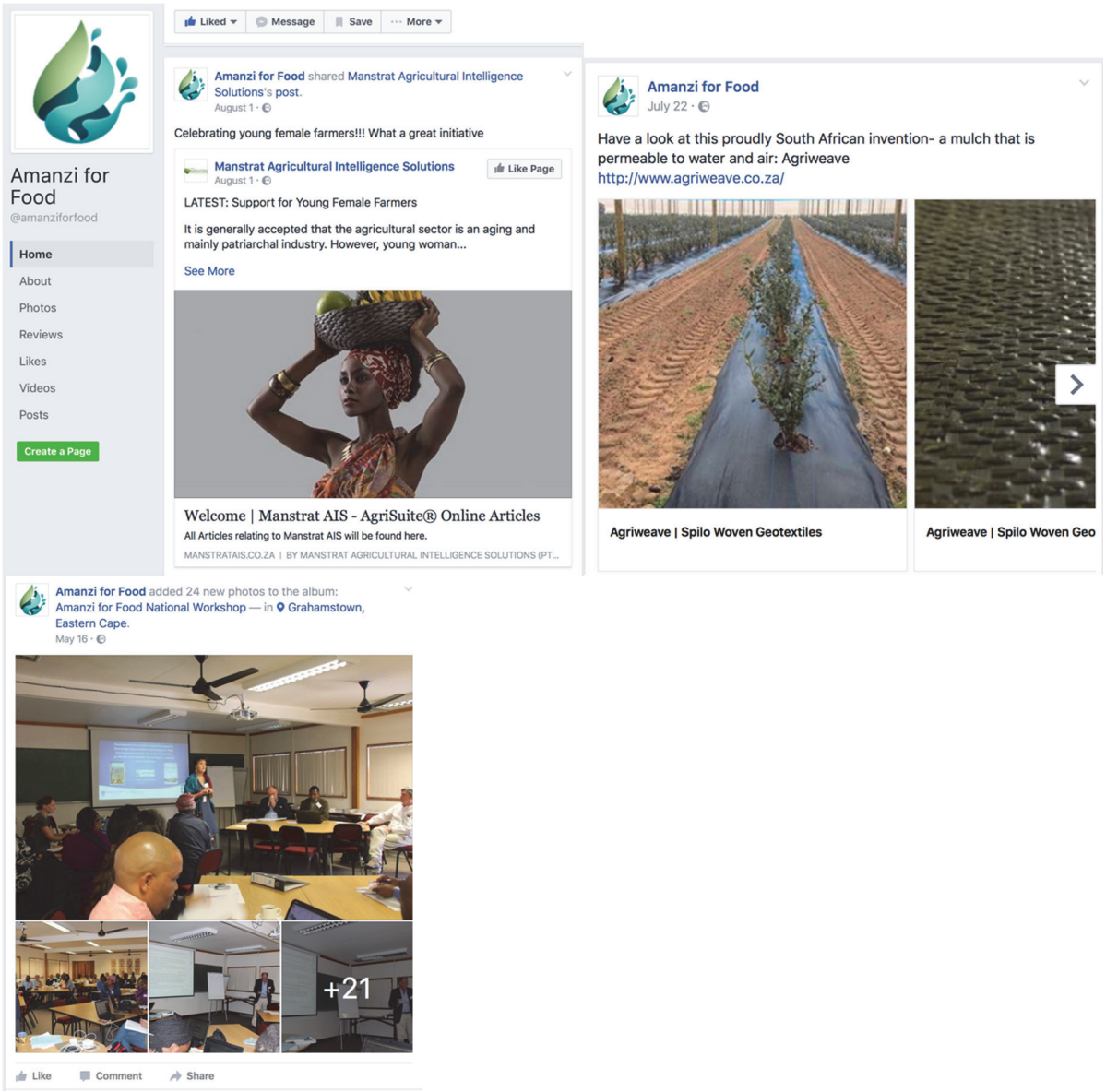


Figure 56. Samples of posts on the Facebook Page

After various events there is more activity on the page. For example, after radio broadcasts there is always an increase in activity on the page (see Figure 57 below). There are more likes and followers to the page, Figure

57 shows the number of Facebook likes against the date. The figure shows that from September last year 2015 to February 2016 the increase in likes only began to rise in February 2016 around the time the first radio show was broadcasted. In March the likes decreased as there was no show.

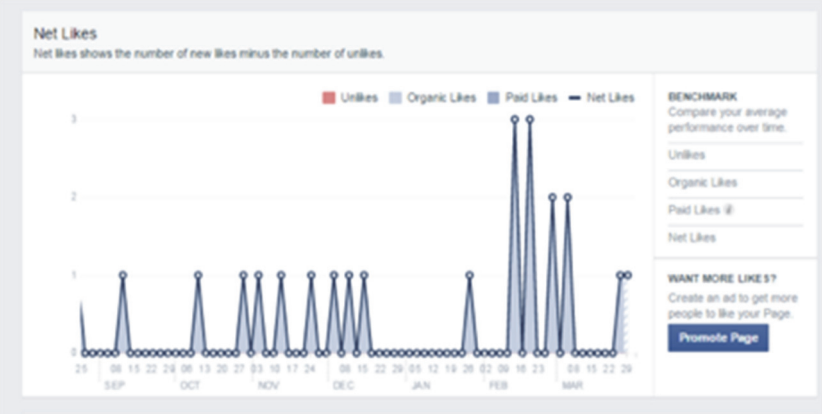


Figure 57: Facebook visits (2015-2016)

On occasions there have been some comments on the Facebook page following the radio broadcasts. Such as one from a Lovedale College student who asked the panellists when they will be able to go to the college and teach them about this as the student is currently studying farm management and has seen the need for it in their course. These comments are addressed by members of the network and since that comment, Lovedale has participated in some training initiatives put forward by the learning network.

Another form of social media that was used was Short Message System (SMS) communication using mobile phones. This proved to be particularly successful in keeping communications active within the IB Learning Network and relates to the point made in section 2.5 about increased use of mobile phones for communications in rural areas via applications such as WhatsApp, which proved to be the most accessible and used mobile phone app in the IB Learning Network site. This communication platform was used throughout the programme, including up till the most recent site visit, where it was used to support participation of learning network members in a seminar at Fort Cox ATI offered by the Amanzi for Food team on drip irrigation for homestead food gardens. Participants shared this SMS platform for communicating and staying in touch with each other, for sharing new insights and events, and for reporting on and monitoring their own RWH&C practices, as shown in the picture below, sent in by a farmer who shared her farm for the development of a productive demonstration site. Below, via sharing this picture of her fields, she reports to the rest of the network on the success of the RWH intervention for her food production.

Figure 58. A photograph sent to the Imvothu Bubomi WhatsApp group of the demonstration site, showing the tied ridges and mulching.

3.4.3 Use of WRC materials enhanced via radio broadcasts and guidelines for radio use

- *Use of WRC materials in producing radio scripts*

As also discussed in section 2.5, in order to convey and disseminate messages across an audience, radio is seen a flexible medium and important player in the development of a community (Piper, 2009). This is brought up due to its immediacy in providing up to date information that reaches many people even those in remote areas. Community radio sees it's listeners beyond objects to be educated to but rather, participants in the learning process leading to the transformation of the community it serves (Cammaerts, 2009). The focus in the Amanzi for Food programme was to target community radio stations (see section 2.5) given the contextual nature of agricultural practices and those most affected by RWH&C knowledge (see figure 13). Given this, the most accessible community radio network was identified as that associated with the activities of the IB Learning Network in the Fort Cox College area, also because there was an emerging system of activity associated with the RWH&C knowledge from the WRC materials as reported on in Sections 3.1 and 3.2 above (see also Lupele, 2016).

The disseminating of RWH&C practices from the WRC materials was done through the IB Learning Network in hopes of expanding and sharing their knowledge to the wider community. This was done through a local community radio station in the area, Forte FM that was chosen after a radio listening survey from those familiar with the area. This was also followed by participants in the survey indicating news, religious programmes, agriculture and music as most preferred programmes on radio. The list below shows the most common radio stations in the area highlighted during the radio listeners survey:

The most popular radio stations in the area were:

- Umblobo Wenene FM (commercial, isiXhosa, Eastern Cape),
- SA FM (SABC, English, national),
- Tru FM (SABC, English and isiXhosa – youth focus – Bisho, Eastern Cape),
- Algoa FM (commercial, English, Port Elizabeth region),
- Radio Sonder Grense (RSG) FM (SABC, Afrikaans, national),
- Forte FM (community, isiXhosa, regional).

After having an understanding of the type of content and audience the radio station targets it was possible to formulate radio scripts for the shows (see Appendix D). The radio station worked with in the Amanzi for Food

programme has an agriculture show with a magazine type of format which Pennington (2000) describes as a programme with a variety of items such as news (in this case agriculture news), discussions or in depth features.

The Radio Audience Measurement Survey (RAMS) of the Fort FM radio station provided a listenership figure of 151 000 as of March 2016. RAMS considers this figure to be valid from 1st April 2016 to 31st March 2017. The station broadcasts from 0600 hours to midnight daily with a format of 60% talk and 40% music and covers a wide range across four districts in the Eastern Cape (The Media Connection, 2016).

After having a sense of what kind of agriculture content appeals to the audience, practical based content with technical how to guidelines, programme scripts were formulated. These were based on content from WRC materials on RWH&C practices and the common RWH&C practices in the area that the network members were implementing, integrating new knowledge with existing practice and knowledge. Pennington (2000) describes this process with the emphasis of bringing out an element of real lived experiences, in this case real lived experiences of RWH&C practices. The programmes were oriented around the purpose of educating through sharing content from WRC materials by panellists who had real lived experiences of implementing and using RWH&C practices. The common RWH&C practices that where considered by the network members from the WRC materials when planning for the radio scripts were:

a) Gelesha
b) Amadanyana
c) Mulching
d) Drip irrigation
e) Ponds
f) Diversion furrows
g) Infiltration pits

Other than emphasising the common practices from the materials, the radio scripts were also structured in a way that enabled the panellist to share descriptive knowledge on how a listener can prepare for the implementation of these practices and for the food production season in general (see Appendix D). These preparation practices that where aimed for broadcast where:

a) testing soil type
b) calculating rainfall
c) making an A Frame and line level
d) calculating slope
e) the notion of catching, storing and using of water (as used on the website)

There were nine programmes broadcasted between 2015 and 2016, seven in studio and one out studio with Forte FM in Alice and one in studio with Umhlobo Wenene in Port Elizabeth. These programmes were crafted in light of preparing the listener to plan ahead and implement RWH&C structures for the preparation of rainfall. This was due to the focus on the drought situation in the country. Furthermore, each radio programme was crafted with the outcome of not only promoting the use of WRC materials but also the promotion of food security and nutrition through the use of RWH&C practices (see Table 18 below) (see also Lupele, 2016).

Table 18. An overview of how each programme broadcast in 2016 was structured, giving an indication of the way in which the radio programmes were planned and implemented (see also Lupele, 2016)

Programmes and Dates	Aim/Emphasis of the show	Outcome of show	Who will be on the show (Panellist)
Programme 1: <u>15/02/2016</u> Introduction of Amanzi for Food and what is already known	• Introducing **Amanzi for Food a**nd why we are on air in **connection with current drought situation** • Link with previous on air programmes and thank those who participated • Aimed **at thinking ahead while embracing the current crisis.** • An emphasis on both new and **traditional practices** and bringing them to light • Put modern RWH&C practices and Traditional RWH&C into a conversation by the panel • Invite listeners who are enjoying fruits of rainwater harvesting to call in and share their stories. • Introduction of a range of possible practices from information available in the WRC material and how this can be accessed. Emphasis on catch, store and use	• Help **set the tone** for the agenda on where the follow up shows will go. • Made farmers realise that they have to **think ahead.** • Created and **built a listenership** and kept them captivated to the programme because of first introducing something they are familiar with • Emphasised that RWH&C is not something new and that it has been around across generations through giving **own personal accounts by panellist** of practicing these practices. • Asked audience to call in (either during or following the show) with information on any rainwater harvesting practices including traditional practices they might be implementing. • Responded to calls and gave synopsis of the next show which was based on the common practices of the area	Small-Scale Farmer with practice on traditional rainwater harvesting practices Lecturer – to provide listeners with what Amanzi for Food is **Amanzi for Food RU rep**
Programme 2: <u>22/02/2016</u> Selected common practices	• Open with identification of the main practices raised by callers • Select 2 or 3 practices, including traditional and more modern • Provide more detailed information on the selected practices	• Provided basic information from the materials and asked for experiences of these practices from callers • Opened discussion of adaptation of the practices to different contexts • Invited callers and gave a synopsis to the listeners of what the show was on popular practices	Smallholder and homestead farmer – Farmers field school personnel, IK expert) **College lecturer –** technical details of the practices from the WRC materials **Amanzi for Food RU Rep**
Programme 3: <u>29/02/2016</u> More selected common practices in detail. Idea of collaborative working and	• Aimed at giving detailed information on 2 or 3 further practices, identified by callers. • Discussion of the kind of support that might be needed and where this support can be found	• Technical information was given on each of the chosen practices from WRC Amanzi for Food material • Listeners were given information on where they can get this information, i.e.	**Agriculture Student** implementing RWH&C practices **Mrs Madikiza Lousie** (Lecturer – Fort Cox College of Agriculture and Forestry)

Programmes and Dates	Aim/Emphasis of the show	Outcome of show	Who will be on the show (Panellist)
learning	• Introducing concept of working together in learning networks	WRC Amanzi for Food website (with books on it), extension offices in Middle Drift and Alice, NEDA, etc. • Panellist shared personal accounts of the practices they were currently implementing. • Invited callers and gave a synopsis to the listeners on what to expect in the next show	**Amanzi for food RU rep**
Programme 4: <u>11/04/2016</u> Learning about implementing practices through working together with different AfF stakeholders	• Linking Farmers/ Listeners to WRC info hotspots. • Emphasize importance of networking and learning together, respecting each other's knowledge.	• Recap on what came out of the shows so far • Each panellist give an account on how they can help farmers access this WRC materials on information on RWH&C	**Extension officer –** provided technical support **NGO officer –** provided technical support **Amanzi for Food RU rep**

- *Use of WRC materials in preparing for radio broadcasts and guidelines for radio use*

Prepared radio scripts or frameworks were sent beforehand to the panellists and radio station management so as to familiarise themselves with it. The radio presenter was encouraged to familiarise him or herself with the programme content by visiting the WRC Amanzi for Food website in order to have an in depth discussion with the guests in studio.

For each programme the guests in studio where selected in ways that would give useful discussions on the programme theme, for instance a panel would consist of a smallholder or homestead farmer who would give descriptive practical use of RWH&C practices; an educator or extension to give the technical support of various practices and preparations for the implementation of the practices and often an Amanzi for Food team member to assist if needed. This created a variety of input and so the listener could relate to the guests in studio one way or another.

Figure 59: Amanzi for Food team with network members during a live broadcast on Forte FM

The guests in studio were mainly those from the IB learning network who had been part of the ToT process or joined the network at a later stage. They used WRC materials which they were given during the ToT and the WRC Amanzi for Food website (which carried these materials) in preparation of the broadcast they were part of. The dialogue below illustrates a conversation with one of the panel members (smallholder farmer) after the second radio programme she was part of in 2016:

> Question: “You were given radio programmes scripts prior to the show, how did you prepare for the show? “
>
> Response: “For now I prepared it on my own. I just studied for it and used my own knowledge that I already have”.
>
> Question: “Did you use any of the WRC Amanzi for food materials, website or books?”
>
> Response: “Not yet the Amanzi for food website because I had challenge with my phone with internet but I used both books that I was given by the network.”

On the other hand, others didn’t use the WRC materials as they had internalised the content and were implementing them in their daily life, the content had become part of them and so it was easy to recall and give responses to questions they received in studio. It was also interesting to see the link between the radio programming and the responses to the radio programmes on the Facebook page. Here is one example below:

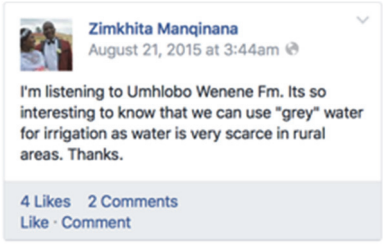


Figure 60. Facebook comment responding to a radio broadcast (at 3.44 am in the morning!)

A radio programming guidelines document has been prepared as one of the support materials for the Amanzi for Food programme (Appendix D) which can be used more widely by other radio stations interested in radio programming focussing on the WRC materials. Reflections on the radio programming process and the use of community radio are provided below, but one of the key recommendations from the national workshop was to include media professionals in learning networks and the ToT programmes, so that they too become part of the stories that are unfolding, and so that they are more able and prepared to produce reporting on the activities. Media officials also requested closer relations with interested farmers and actors in the networks as they often struggle to find relevant content for their radio programmes, and relevant sponsors for the slots allocated to agricultural matters (Lupele, 2016).

3.4.4 Use of WRC materials using community newspaper channels

As reported on in section 2.5 community newspapers also hold potential for substantive knowledge dissemination at a local level, as collectively they produce *6,549,500 copies each month*, often in vernacular languages with the majority of these being black owned, and distributed in rural and disadvantaged areas in South Africa, where most homestead food gardeners are active. As indicated in Section 2.5 a key access route to these publishers is via the Independent Publishers Association, which the Amanzi for Food interacted with to explore this route for knowledge dissemination.

Almost everyone involved in the Imvothu Bubomi Learning Network and in other ToT programmes claimed to use their local community newspaper for information on what was happening in their area, including for accessing information on agricultural activities in the area. One of the main advantages of community newspapers, as with local community radio stations, is that they work in the dominant local language, making information accessible to very many people, including those with more limited educational backgrounds. An added advantage is that these texts are also often used in schools, accessing the youth in communities (IAP, pers. comm, 2015). Community newspapers therefore have real potential as channels for sharing information and experience on RWH&C, and the WRC materials themselves. Although this route was not pursued extensively by the project team, the potential, certainly at a local level, is quite considerable. Community newspapers, again similarly to local radio stations, have a strong imperative to involve their readers in dialogue on issues and matters of interest pertaining to their local area, and agriculture is one of the key interests and activities in all rural areas.

To explore this avenue, the project team submitted an article (see Figure 61 below) introducing the Amanzi for Food project, the concept of RWH&C and the WRC materials to the central co-ordinating API office from which the article was sent out to all member newspapers. The article was in English, with the expectation that local editors or journalists could or would translate it into their local language. Only two of these newspapers (one from Limpopo Province and Grocotts Mail in Grahamstown, the teams home town) made direct contact with the project team, but it is possible that others also carried the article, although the API do not have a system in place to assess the take-up of such syndicated articles. There was no subsequent information on reader response, and it is assumed that the newspapers did not receive any such response. On the face of it this could be considered a rather negative response, but, as with the experience with local radio, it is probable that it is necessary to take the time to develop a relationship firstly with the editors and journalists to encourage them to publish such articles, and secondly with the readers before they feel confident enough to enter a dialogue. It is also possible that the editors and journalists themselves, unless they have a particular interest in the topic, may not be inclined to do the work of translation. To extend the impact of this knowledge dissemination route, it is probably advisable to translate any articles into the appropriate languages, to relieve the journalists of this burden. This is likely to be a quite time-consuming process, but it could yield good results over time.

Bringing in the amanzi

By LAWRENCE SISITKA

Rainwater harvesting could be a vital tool in South Africa's efforts to combat the current drought.

South Africa is a water scarce country at the best of times. 2015 saw severe droughts affecting large areas in many provinces leading to the loss of livestock on a massive scale and to unprecedented loss of staple crop production. These droughts are continuing in some areas. The forecasts regarding the probable impacts of climate change in Southern Africa are not good. They suggest that such terrible droughts are likely to occur with increasing frequency.

It is therefore critical that we find ways to make the most efficient use of our limited water to try and ensure some measure of food security for our ever-growing population. One promising approach that should contribute to this is carefully catching, harvesting, storing and using our limited rainwater for food production. This is the focus of the Amanzi for Food initiative currently being undertaken for the Water Research Commission (WRC). It must be said that rainwater harvesting cannot provide all the answers to the lack of water in the country, but it can make a real contribution to improving the situation.

For over ten years, the WRC has been funding teams of researchers and practitioners in South Africa to conduct research into rainwater harvesting and use. Much information has been gathered and many useful training materials produced.

The main work of Amanzi for Food is to make the valuable information in these materials available to all stakeholders. These include the farmers themselves (on all scales, from homesteads to commercial farmers), agricultural NGOs, agricultural extension services, agricultural and other FET colleges, agricultural high schools, universities and the private training sector.

It uses different media, according to how the different stakeholders traditionally get their information, including printed media and community newspapers like this, the internet and radio. The information is available in different forms such as infocards, handouts, posters, videos and original materials. These are all downloadable from the website. Amanzi for Food also supports the use of rainwater harvesting and collection information in teaching programmes of schools, colleges and others. It has also worked with farmers and others to develop demonstration sites to show how to use some of the practices.

To find more information and learn more about the project and how you might become involved please explore the website, www.amanzifor-food.co.za and/or Like us on Facebook: *AmanziforFood*.

Amanzi for Food is also very interested in learning about rainwater harvesting practices that farmers are using in your area, and would love to hear the stories of farmers who are doing this. The practices can be traditional or modern, or even a combination of both – all are interesting and important. These stories can be sent to *Grocott's* (editor@grocotts.co.za) or to the Amanzi for Food email – *info@amanzifor-food.co.za*. Then they can be uploaded onto the website to be shared with many people across the country. If possible, please send some photos showing what is happening in the stories.

** Lawrence Sisitka is a horticulturalist and field biologist who regularly collaborates with the Rhodes Environmental Learning Research Centre on projects related to community engagement and community development – especially those concerning natural resource management and conservation training.*

Farmers from Lloyd Village near Alice in the Eastern Cape working with an extension officer digging a pond to hold rainwater for their vegetable garden. Photo: Supplied

Rainwater harvesting cannot provide all the answers to the lack of water in the country, but it can make a real contribution to improving the situation.

Making the most of waste

STAFF REPORTER

Many of us spend money employing garden services and builders to maintain and improve our homes or business premises. But it's absolutely free to stop those same services potentially harming our environment. It costs us nothing to tell these service providers that we want them to dispose of waste responsibly. If it's garden waste – take it to Complete Compost. If it's building or household refuse – take it to the Municipal dump. It's that simple.

Grahamstown could be so much cleaner and greener. And it costs you nothing to insist that your builder or garden services follow the two rules above.

The best builders and garden services, who care about Grahamstown, already follow these rules.

They will go that extra mile to dispose of your rubbish properly. This item wouldn't be necessary if builders and garden services weren't habitually despoiling our town – in all probability with your rubbish. If they realise that they risk losing your custom, they will take your rubbish where you tell them.

Anyone can also improve their garden and do their bit to save the environment by making compost at home. There are hundreds of sources of advice online such as: www.recyclenow.com/reduce/home-composting/making-compost

Recycling Made Easy

Eco Bin Solutions – a newly established company in Grahamstown – is offering a great recycling service. For a small monthly fee you get peace of mind knowing that none of your recyclable and compostable items end up in the dump.

Membership includes a weekly collection of up to four bags – or as arranged with EBS. It helps if you separate your WET and DRY waste into separate bags.

Why? If items are wet, their recycling value drops. And if tainted with toxic stuff, it poses a health threat to the waste handlers. EBS makes recycling and composting easy for you. Simply use two bags. Put your clean/dry recyclable items – glass, plastics, tins, paper/card – into one bag. Put your biodegradable (garden and food waste) into another bag. They collect at a time that is convenient for you every week – just NOT on the same day as municipal waste collection.

You should have a third container at home for items that EBS cannot take: electronic, medical and other hazardous waste. Our Municipality should be helping with this.

Find more information at www.ecobinsolutions.co.za or *info@ecobinsolutions.co.za* / *sales@ecobinsolutions.co.za*; or call St John Ritchie on 083 535 6248 / William Milne on 083 303 0203 / Leslie Ginn on 082 652 4158.

WESSA kicks off with Wetlands

STAFF REPORTER

Tuesday was World Wetlands Day. Rhoden's Fred Ellery is a passionate researcher on environmental matters – particularly wetland rehabilitation – and will give the first lecture of the year for the Wildlife and Environmental Society of South Africa (WESSA). Keep an eye on *Grocott's Mail* for the date and time. The Grahamstown region has a number of wetlands, all of them precious for the way they boost our supply of clean underground water and harbour special plants and animals.

Future speakers at WESSA events include Pierre Pistorius from NMMU, who is doing vital work in monitoring the vast populations of gannets and fur seals in Algoa Bay and the plummeting numbers of African penguins. He will be the guest speaker at the WESSA AGM 2 April.

The WESSA team will have a table at SAIAB during SciFest next month and are keen to meet people wanting to help with improving the environment.

Figure 61. Copy of the article submitted, as published in one local community newspaper

3.4.5 Use of WRC materials at Agricultural Shows, Fairs and Networks

During the course of the project the Amanzi for Food team attended three (3) agricultural shows following invitations from the organisers, the Agricultural Extension offices. The intention in the beginning was to introduce the project to local farmers and others in the sector, and later, to share some of the information and experiences generated through the project's work, particularly with the Imvothu Bubomi Learning Network.

At the first Agricultural Show the Amanzi for Food flyer was distributed among, mostly, farmers attending the show. The information in the flyer was in both English and isiXhosa. Team members engaged in discussion with a number of farmers and others, some of whom expressed considerable interest, and a few of whom became part of the Learning Network. At this stage the website had not yet been established and contact details of team members were provided to everyone who was interested. At subsequent shows the team were invited to set up displays and make presentations on the project's work, the website and other media (including the radio broadcasts) and the WRC materials. Attendance at one show was used as an opportunity to field test the posters that had been produced out of the development of a key demonstration site, as a result of which changes were made to the poster design. One main benefit of attendance at the shows was the opportunity they provided for direct personal contact with the farming community, and the potential for raising the profile of the project, RWH&C and the WRC materials. The posters (See Appendix B), developed to show the RWH practices were particularly useful for events like the agricultural shows and fairs, although they could have been developed in a larger format (banners) for this purpose (Figure 62).

Figure 62. Amanzi for Food posters at an Agricultural Fair, attracting the attention of local farmers and government officials

Copies of the key WRC materials were taken to all shows in order that farmers could gain a sense of the richness of the information available in them. One of the main challenges was that while a good number of farmers did show interest, there was limited information in the form of printed materials that could be provided to them on the day, and they were encouraged to visit the website, which may not have been possible for some. In addition, the team did not have materials, such as banners or other promotional material which may have attracted more people to the project stand. Despite these limitations, it was clear that agricultural shows, which are very well attended by local farmers and others, provide real opportunity for sharing of ideas and materials, but there does need to be an adequate supply of appropriate materials in appropriate languages, and a sufficiently high profile to draw people from the displays of vegetables and livestock and the many other attractions available at the shows.

The Amanzi for Food team also started to interact with other agricultural networks, such as the Virtual Livelihoods School Africa (southern Africa chapter), captured in the blog post in Box 4 below.

VLSA-Amanzi for Food small dams training

Lima Rural Development Foundation as the secretariat of the Virtual Livelihoods School Africa: Southern African Chapter (VLSA-SA) in conjunction with Mahlathini Development Foundation has a brief of providing a networking, information sharing and up-skilling platforms for NGOs in the livelihoods and food security sectors and presently consists of a loose network of around 20 NGOs. The main activities for VLSA-SA are seen to be:

- Promotion of inclusive food security through the establishment of a community of practice
- Sharing of knowledge and field experience in the implementation of projects; Joint implementation of projects within a pre-designed systemic framework using an action research approach to enhance innovation and learning while piloting new ideas, processes and methodologies
- Capacity building; farmer support programmes, creation of sustainable livelihoods and training of trainers and
- Documentation of best practices for strategic planning and policy processes.

One of the aims is thus to provide learning opportunities for field staff of NGOs and their partnering farmers. With similar goals to the VLSA-SA, a collaboration with the Water Research Commission's (WRC) Amanzi for Food programme started, where together, they provided a training in rainwater harvesting and conservation (RWH&C) practices focussing on small earth dam construction for networked members in KwaZulu-Natal.

Thirty participants from 15 different NGO's joined the training in March 2016. Day one of the two day training comprised of a theoretical introduction to RWH&C practices via the WRC's Amanzi for Food website and an introduction to the construction of the small dams and ponds while planning for practical implementation.

The second day was where participants got to put their theoretical learnings into practice, slope and aspect were demonstrated using a line level where diversion furrows were marked and constructed along with a small earth dam, with a capacity of 4000 litres. Along with these RWH&C innovations, a treadle foot pump was set up and used to pump water from a nearby small stream to the garden and pond.

The two day training was successful as NGO participants went away with practical knowledge around rainwater harvesting, storage and conservation for improving livelihoods and food security in a rural context. Future trainings will take place due to the success of this programme, the Amanzi for Food team looks forward to working with VLSA-SA again in the future.

By Lawrence Sisitka and Erna Kruger (Mahlathini Development Foundation)

3.4.6 National Workshop with Stakeholders

Another key activity near the end of the project was a national workshop with stakeholders. This workshop was attended by 30 people from across South Africa representing Universities, Agricultural colleges, Extension services, Local economic development and Non-governmental organisations among others. The aim of the workshop was to share what has been done regarding developing and Action Oriented Strategy for dissemination of WRC Rainwater harvesting materials and knowledge. The workshop had significant outcomes including the consolidation of new enabling strategies for integrated curriculum innovation and collaborative extension approaches. Participants indicated a need to scale the project upwards in the project area and most importantly outwards into the rest of the country through the proven networked approach complemented by a proven Training of Trainers approach which can be modified in content and duration.

The workshop offered the following perspectives on the way forward for the AOS and its distribution:

- *For extension services* it was agreed that extension provides an important linkage between farmers and research and extension agents could continue to use the WRC materials to identify RWH&C practises that are applicable to different farmers. They also have a role to play in continuous monitoring and evaluation of these engagements. It was suggested that a ToT be offered in all provinces, targeting at least one extension officer from each extension office, to disseminate the concept to other extension workers, and also link with other local institutions and stakeholders. The

Amanzi for Food knowledge dissemination activities should be incorporated into existing programmes of the department and should not be a stand-alone programme as it might conflict with other existing programmes within the department. It was also recommended that RWH&C should be included at all policy levels, and include various agricultural scientists at all levels and in all agricultural programmes. The current model of change projects and portfolio of evidence (POE) used in the Amanzi for Food programme ToT was seen to be good, and it was recommended that it be sustained, however there is a need to include other disciplines such as livestock and pastures and not only limit the use of the materials to crop production. It was suggested that a cluster model for the TOT will be desirable and like in the Learning Network, the focus should not only be on people involved in agriculture but other people outside agriculture who might find RWH&C important.

- *For Local Economic Development and Farmer-led Change Projects* it was noted that most learning organisations are not practically based and therefore the practice-centred model of the Amanzi for Food programme should be expanded at LED support level. The pooling together of resources and working together between different stakeholders to create working gardening systems and demonstrations was seen to be a great strength and a productive way forward for LED development. It was also noted that there was a need also shift focus to the economic benefits of farming in order to attract young people, and not only focus on crops, but other opportunities for water harvesting such as keeping small livestock such as chickens, ducks, pigs as income generating activity. The initiative of governments to promote cooperatives in local communities and schools can also be incorporated into the training system, and links should be made with the Department of Education programme to strengthen school gardening and link to school feeding programmes and home gardens. Linking the RWH curriculum development to school gardening processes could also further promote community level engagement with RWH&C and food production. Working more closely with the schools was seen to be a potentially strong avenue for community-based social learning, as communities could partner with schools to do build good demonstration sites and places to introduce ideas such as RWH, permaculture, greenhouses. Farmers associations can 'adopt' schools, introduce the RWH techniques to schools and communities, and via this approach, resources could be pooled from Department of Education, Agriculture, LED and communities. There was also a need to promote value chain approaches and longer term development to set up stable local economies, by designing longer term integrated systems, promoting community savings groups, and supporting farmers' associations and cooperatives to become more independent and take on activities for themselves.
- *For the learning network and media* it was suggested that it was possible to replicate the learning network model in other provinces and adjust it to suite local context of each province and partner with local existing institutions in communities. The project can be widely advertised to various municipalities and NGOs by directly reaching out to these institutions. The mix of formal and informal training and learning within the learning network was seen to be a strength, and especially also including media to be part of the training and the learning networks, as this could expand the learning network and will require co-engaged approach of conversation with media and through this also activate new ways of learning through media as was demonstrated in the Amanzi for Food Programme.
- *For colleges, ATIs and further curriculum innovation* it was noted that RWH&C needs to be included in the curriculum and questions of how to include and integrate RWH&C are important. It was noted that these need to be aligned with quality management structures and procedures and with new competence based models. It was also noted that there should be clear communication on why it is critical to incorporate RWH&C into the curriculum**.** From this perspective it was noted that colleges and ATIs need to address issues of food security and sovereignty even at household levels and shift focus from just commercial side of agriculture to include subsistence agriculture and involve decision

makers and farmers on how to do this, what needs to happen, and what has been done already as this might speed up moving the process forward.

Figure 63. Participants at the Amanzi for Food national workshop, May 2016.

3.4.7 Lessons learned and proposed way forward

- *Website development and use*

As indicated above, considerable thought and planning went into constructing the website so that it could provide user friendly access to the WRC materials at a variety of levels of access. This required considerable effort and time, and website design competence, as well as communication competence. Essential to a functioning website are mechanisms to attract people to the website, and in the Amanzi for Food project it was found that the ToT (where people were trained to use the site), Facebook and radio programmes were the strongest attractors to the website. Another lesson learned is that the materials to be placed on the website were too megabyte (MB) heavy to upload as one file. This has implications for how materials are produced, i.e. thought must go into their web-accessibility when produced.

- *Social media*

As indicated above, Facebook and WhatsApp SMS systems were the two main social media platforms used in the Amanzi for Food project. This is because a) they were found to match the national trends in relation to social media usage, and b) they were also found to be used in the local context of the main learning network implementation site. Both of these social media platforms proved to be important for extending the learning network engagements, and thus access to, and wider dissemination of the WRC materials at wider level, and at local communication level in grassroots community context, where the RWH practices were being implemented. A further lesson learned is that managing these systems of communication requires dedication, and indeed a dedicated communications person, which in the Amanzi for Food programme was being provided mainly by the Rhodes University students who were doing their research in the context of the programme. This is because the communication mechanisms require nurturing to gain popularity and uptake.

- *Radio broadcasts*

Identifying the Appropriate Stations: Based on experiences reported on above, community radio appears to provide real opportunities for the sharing of information on RWH&C practices, and about the available WRC materials and information. To establish how community radio functions for such knowledge dissemination, considerable effort was taken to identify the radio stations most used by the prospective audience for the WRC Amanzi for Food broadcasts in the IB Learning Network context. In the immediate area of the IB network project activities, it was clearly the local community radio station, Forte FM, with many people also listening to the provincial station Umhlobo Wenene FM. Although activities were conducted with both, for reasons outlined above and below, the more successful were those involving Forte FM. One key feature of both these stations is that they have regular dedicated agricultural programmes. Such programmes, in particular those on community radio are likely to have a fairly regular, consistent listenership. This provides the opportunity to develop a relationship with farmers and others involved in or simply interested in agricultural issues. Another key feature is that they are both primarily isiXhosa language stations, making them accessible to everyone in the rural areas where the IB Learning Network was active. One constraining factor, in relation to Umhlobo Wenene was the time of the broadcast, which for many was not convenient, whereas the Forte FM programme timing was considered much more appropriate. Despite this, however, some responses were received from the 3h45 in the morning broadcast on Umhlobo Wenene (shown for example in figure 60 above), indicating that there are radio listeners at all times of the day and night.

Building Relationships: The WRC Amanzi for Food team spent considerable time and energy building positive relationships with the station manager, the programme manager and two successive programme presenters from Forte FM. This relationship building was not conducted at a distance, through telephone calls or emails, although these were both used in the early stages to set up initial meetings, the relationships were developed in person, face-to-face. It was only following the first meeting with the radio station team, that their enthusiasm and willingness to provide airtime for the project became evident. The relationship was maintained through telephone calls and emails, and also through courtesy visits whenever possible. In fact the series of programmes aired in 2016 was the result of such a courtesy visit at which the idea was discussed with the station manager. It was also the strong and positive relationship with the station which led to the manager agreeing to send the presenter of their current affairs programme to Lloyd Village where RWH&C practices were being implemented at the time.

In contrast, the only communication with Umhlobo Wenene's programme director was by email and telephone. No meeting was possible, and all arrangements were made at a distance. Although this may not be the sole reason for the lack of feedback or follow-up on behalf of the radio station, following the broadcast, it was perhaps a critical factor.

Relationships also need to be built and maintained with the audience. The initial broadcasts through Forte FM in 2015 initiated this process, but being spaced at approximately one month apart, and then followed by a fairly lengthy hiatus, the relationship was quite weak. A strong relationship with the audience only began to be built seriously in 2016 with the series of 4 programmes, originally scheduled for successive weekly programmes (although this schedule was disrupted for different reasons[12]).

It is critical to maintain such relationships over time, and the plan is for the Imvotho Bubomi Learning Network, to plan for regular broadcasts throughout the year.

[12] These reasons included the appropriation of the programme slot by a local politician at very short notice, disturbances at the University of Fort Hare, and a public holiday.

A corollary of the need to build and maintain relationships, both with the station and with the audience is that it takes considerable time. A one-off radio broadcast is very unlikely to have any significant impact.

Establishing Credibility: The development of strong relationships with the station and the audience is essential in establishing the credibility of the ideas that are being shared, and of the project itself. Credibility is vital for the ideas to be taken up and interest to be generated in the concept of RWH&C and in the WRC materials and information. This credibility is enhanced through the involvement of a wide range of people in presenting the ideas, as panellists from different sectors (educational, extension, farming) each carry different credibility with different sectors of the audience. As with the building of relationships, the development of credibility takes considerable time.

Need for the Programme Presenter to Understand the Project: It is vital that the presenter of any programme featuring the project has a reasonable understanding of what it is all about. This showed itself in the early days at Forte FM where the original presenter, although very enthusiastic and supportive, did not have a particularly good grasp of the project in the beginning or agriculture in general, although she developed this later. This lead to some misunderstandings, particularly when she was required to translate listeners' questions. This, of course was not such an issue when the panel included isiXhosa speakers (see below).

The presenter who took over the agricultural show in 2016 was also, initially, quite uninformed about the project, although being qualified in agriculture he had a good understanding of the sector. Following the first broadcast he visited the project website and Facebook page and became far more informed about the initiative, which lead to a considerable improvement in how he presented the following programmes.

The presenter for Umhlobo Wenene was also not familiar with the project, but the studio guest 'Chamu' appeared to have a better grasp of RWH&C practices, which mitigated the situation considerably.

The main lesson here, is that it is essential to ensure that the presenter is very well briefed about the topic and the project prior to any broadcasts. While every effort was made to do this, it is also incumbent on the presenter themselves to conduct some research into the topic. The development of specific questions for the presenter to ask the panellists in the earlier broadcasts, made a strong contribution to overcoming any lack in their understanding. This was strengthened further by providing the questions separately from the programme outline.

Where Possible Include a Range of Panellists: The use of panels comprising a range of people, including WRC Amanzi for Food team members, college lecturers, extension officers, farmers and students proved immensely valuable. This not only enabled different perspectives to be aired, but perhaps also ensured a wider listenership, as one reason for people listening to specific programmes, was that they knew someone on the programme. It was quite clear in discussions with members of the Learning Network that information provided by someone they knew, or someone like themselves (such as a fellow farmers) carried more weight, and was considered more valid, than information from a stranger, with whom they had little connection.

In the Amanzi for Food case, having a mixed panel also meant that isiXhosa speakers were included in all but the very first broadcast, making interaction with the listeners more immediate and meaningful (see below).

From the station's perspective, the fact that through the different panels more women were involved in the agricultural programme, which had traditionally been very male dominated, was very welcome.

A powerful and perhaps unexpected corollary of this was that the involvement of a range of panellists, mostly from the IB Learning Network, also introduced them to working in a radio studio, and to the use of radio for sharing information with their peers. This was a very empowering experience for almost everyone, as no-one had prior experience of this.

Use of the Principle Language of the Station and the Audience is Essential: One of the main lessons learned is that in working with community radio, it is essential to have a local language speaker with a strong understanding of the project and its aim to make the WRC RWH&C materials accessible included on all panels when presenting the project and its work.

Maintain Focus on the WRC Materials and Information: One of the main challenges in developing the radio programmes was to ensure that the main focus of the WRC Amanzi for Food initiative was maintained. There was a strong, and probably inevitable tendency for the panellists to be seen as RWH&C experts, rather than as mediators of the WRC RWH&C materials. All questions from listeners reinforced this view, as panellists were asked a range of technical questions, rather than questions on accessing the materials. It was therefore necessary to ensure the panels did include people with some technical expertise, alongside those, such as farmers, with personal experience of RWH&C practices. The approach adopted to maintaining the broader focus was to respond to the technical questions as well as possible, but then to direct people to the WRC Amanzi for Food website where they could find further detailed information on the topic in which they were interested. Alternatively, the questioner was encouraged to contact the team directly or through the Facebook page for further information. As can be seen from the feedback sections (above) people did make such follow-ups quite often.

Provide a Range of Contact Options: Although the website and Facebook page are accessible to many people, they are not easily accessible to many others, particularly the farmers with little connectivity. A dedicated landline was secured, and a dedicated cellphone for SMS and calls was set up, in order to provide more options for follow-up contacts. To date these have not been heavily used, but it is clearly important to provide as many options as possible.

A further development will be the identification of WRC Amanzi for Food information hubs in the area. These will probably include the Fort Cox Agricultural College, the agricultural Extension offices at Middledrift and Alice, and the Nkonkobe Economic Development Agency. These should enable people to call in or walk in and both receive advice and be helped to access the website and the WRC materials and information. In this way the radio programmes will help people gain direct access to the WRC materials, despite them not having internet access themselves.

- *Community Newspapers*

As indicated above, community newspapers are potentially an important mechanism for sharing RWH&C knowledge as they have a wide reach, also in vernacular languages. The approach adopted which is to share articles via the IAP central office who sends them to all community newspapers appears to be an easy to use system, but there is little feedback from this system. As indicated above, translation into main vernacular languages prior to sending out the material may facilitate wider distribution and sharing of the knowledge, as would sharing stories of practice, as these appear to have strong resonance in the field of practice.

- *Agricultural Fairs and Networks*

As indicated above, agricultural fairs and networks are also important means of knowledge dissemination. For agricultural fairs there is need to produce appropriate publicity materials to attract people to the core message and ways of accessing the information. Besides the posters, it may be helpful to develop visualised stories of practice which could be complemented by the you tube video materials and an easy to use version of the navigation tool and access to the website materials and other learning networks.

Overall, in the time available, the Amanzi for Food project was able to *establish* a media-based foundation for extending the learning interactions. The *scope and impact* of the media-based foundation is only just beginning to show and more time is needed for an interactive media approach to reach its full potential

4 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion: Knowledge Dissemination Process and Outcomes

As indicated in Chapter 1, the objective of the project was to develop a strategy for achieving effective knowledge dissemination and practical training to encourage productive water use for food crop production amongst smallholder farmers and food growers in South Africa.

There is a substantial body of available research-based training information on agricultural water management in the public domain produced especially by the Water Research Commission (WRC) which responds to the multi-faceted crop-production challenges faced by small growers. However, as also found in the initial scoping of this project, even when the materials containing the research-based information are disseminated to relevant organisations, there is no guarantee that the content will be mobilised or activated into use.

Evidence across this report on the development of an action oriented strategy for disseminating two sets of these materials shows that **knowledge dissemination requires an engaged social learning process**, and development of models, access tools and processes for supporting knowledge into use. Evidence also shows that there are currently inadequate models available in South Africa, and in the agricultural learning system, on how to activate the use of research-based materials on agricultural water management into use in the agricultural learning system, especially in contexts where commercial extension services are not active, which is amongst the poor and marginalised farming communities who are establishing farming practices at smallholder and/or household food security level. This project therefore sought to develop an action oriented strategy and system oriented knowledge dissemination model that allowed for knowledge dissemination *via* a Training of Trainers programme which activated knowledge uptake and use in a Learning Network structure where all stakeholders in the agricultural learning system (College and University lecturers, extension officers, NGOs, research organisations, local economic development officers and farmers themselves) can co-learn to use the WRC materials in their context of practice. The knowledge dissemination process was expanded via use of a range of internet and social media platforms including a website, radio, YouTube videos, SMS systems and Facebook site.

As argued in chapter 1.1 an action oriented strategy requires a ‘strategy-as-practice’ approach to research and development (Jarzabkowski et al., 2009), which brings human actors and their actions and interactions to the centre stage in the strategy development process, where strategy becomes the process whereby multiple actors engage in situated practices to accomplish an activity. In the case of this project, the activity was to integrate RWH&C knowledge into agricultural curricula, and in the learning support practices of extension services, NGOs and other relevant stakeholders in order to eventually influence the practices of farmers on the ground.

Social learning is interested not only in the cognitive gains that accrue from learning, but the actual social and practical changes that result from the learning; and also how such change can be facilitated through learning interactions and knowledge exchange. The 'Amanzi for Food' programme confirmed that this can be done in the context of establishing and working with available science-based knowledge resources in a social learning network context where the emphasis is on activating the knowledge amongst a group of co-operating actors in the agricultural learning system. The model of process developed in the 'Amanzi for Food' programme also shows that there are different mediation agents involved in knowledge dissemination in the agricultural learning system, in a non-linear ‘knowledge flow’ process. In developing the action oriented strategy for the uptake of research-based knowledge and training, the ‘Amanzi for Food’ programme worked with the

framework for knowledge co-production processes involving researchers and practitioners working together on knowledge and practice problems or innovations developed by Shaxson et al. (2012), who define these in a continuum.

The learning network approach developed in the 'Amanzi for Food' programme reflects the more systemic approach to knowledge dissemination, training and uptake in the Shaxson et al. (2012) framework. It works with the theory of expansive learning developed by Engeström (Engeström, 1987 [2014], 2007, Engeström & Sannino, 2010) which proposes a series of learning actions that need to be worked through by a group of collaborating people in a learning network context in which they work together to change their activity (in this case farming practices) and through this process also develop their transformative agency. Interactions on the programme shows a more complex knowledge flow pattern than was initially produced out of the scoping process (see figure 63 below) where the red arrows show a wider range of interactions in the agricultural learning system knowledge flow than those more traditionally found in the agricultural learning system. The red circle in the diagram shows the ‘point of focus’ for the knowledge flow system created in the Amanzi for Food programme.

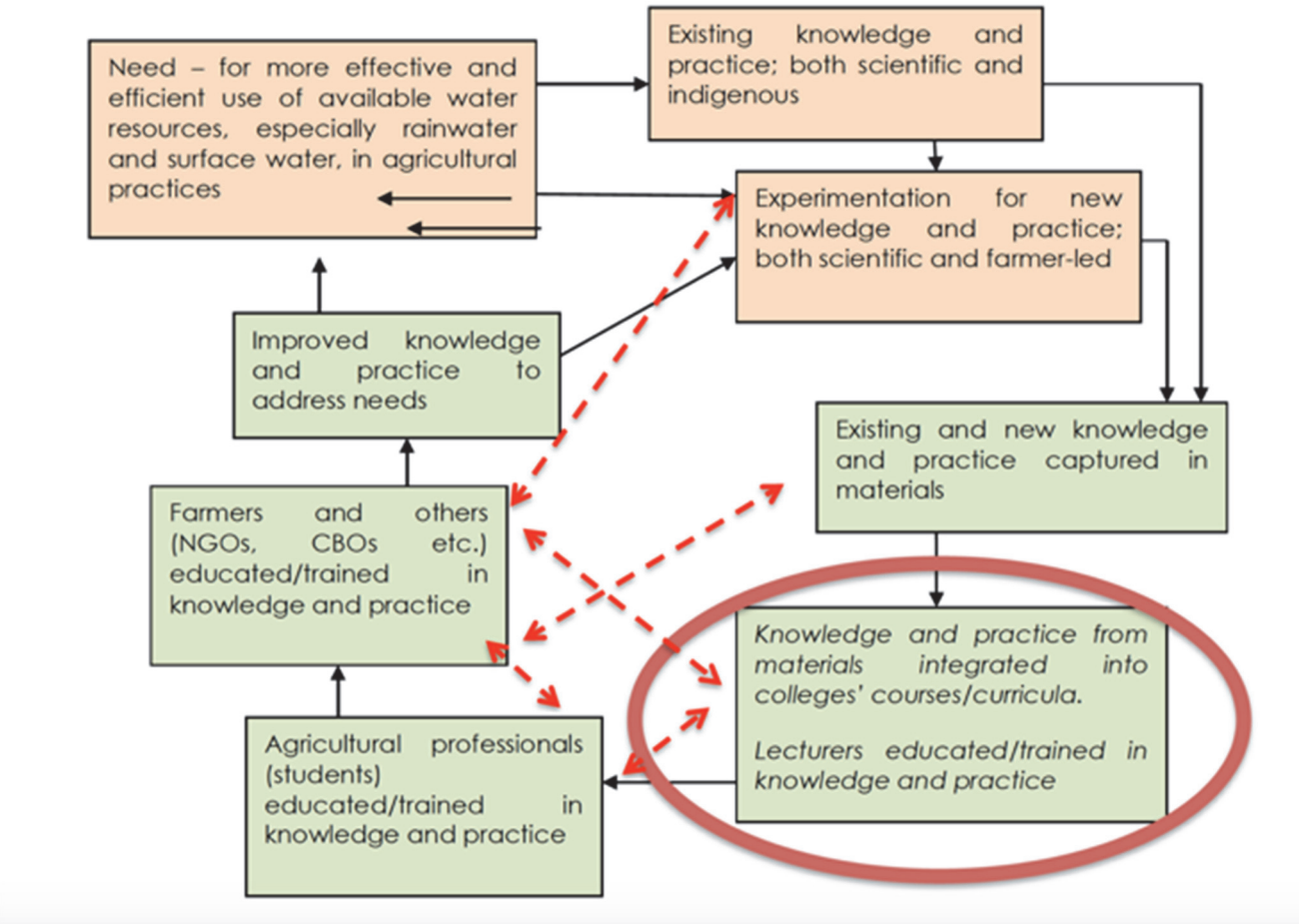


Figure 64. Revised knowledge flow model for the agricultural learning system

While progress was made in the ‘Amanzi for Food’ programme to develop the model and approach for an action oriented strategy for knowledge dissemination and uptake, the project could, due to the comprehensive approaches required, develop in-depth praxis of this approach mainly in one context (the Fort Cox ATI Context in the Eastern Cape). However, via sharing of this practice, the project was also able to raise interest in the uptake and use of the research-based knowledge and learning network model in other learning network

contexts such as the Lowveld ATI context (new University of Mpumalanga) and the North West Potchefstroom and Taung ATI contexts where initial discussions have taken place to establish such learning networks, and in the KZN area in work with the Mahlathini Organics organisation and the Umzimvubu Catchment Partnership where some initial workshops on the Amanzi for Food programme materials were run. There is interest too in extending the training of trainers amongst farmers and within Farmers Associations, but this should ideally be done within the local agricultural learning systems so that ongoing support can be provided.

The model and the action oriented strategy developed by the 'Amanzi for Food' knowledge dissemination approach thus shows high potential for expansion to these and other contexts, with potential for further development of the model and approach as it is upscaled into a wider system of interconnected learning networks. There is demand for activating the knowledge on agricultural water management practices within a systemic approach in these institutional contexts, as well as amongst other NGO and university-based service providers who are supporting smallholder farmers and farming at household levels. During the final project workshop, stakeholders who had participated in the programme argued strongly for national expansion of the networked approach and were in agreement that the knowledge resources disseminated were highly relevant for South Africa's development, and that the approach was multi-actor focussed and therefore reached a range of stakeholders with real practice-based outcomes (i.e. improved farming practices and food production). There was also agreement that there is need to develop more in-depth understandings of this model and how it works in practice, and to assess the value created by this model in more depth.

There is still inadequate understanding of the value creation that this social learning network model produces for ATIs, for extension services, for LED officials, for farmers' associations, for farmers and women groups, and for youth. As indicated above, in this programme the proposal is to focus not only on women farmer groups as primary audience for the activated research-based knowledge, but also on youth groups to establish how youth organisations in communities who are participating in the learning networks could potentially use the research-based knowledge to establish smallholder agricultural practices and production systems with support from the learning network. Especially the role of youth appears to need further attention in the knowledge dissemination process in the agricultural learning system, as it was found in the course of developing the AOS that the youth have a key role to pay in supporting food production, yet they are relatively absent from this practice, leaving mainly elderly people with the difficult task of managing food production on their own.

As can be noted from the details of the report above, this project was implemented at a time when both the extension services and the agricultural training colleges are in complex processes of transition and change. In such a context, the system-based knowledge flow model which was centred around a learning network, a ToT that accommodated a range of diverse participants and development of productive demonstration sites, appeared to allow for significant development, innovation and change *despite* these situations of flux and uncertainty. One could therefore propose that this systems-based knowledge flow model allows for more flexible engagement with organisational flux and change.

4.2 Findings of this research

One of the key outputs of the Action Oriented Strategy development process, is the development and pilot testing of a systemic, innovation centred **model of process for knowledge dissemination**. The knowledge dissemination, training and uptake model as established in the 'Amanzi for Food' programme involves the following elements:

1) CONTEXTUAL PROFILING to identify active role players in the agricultural learning system, with the local ATI as 'hub' or core learning institution. Multi-actors may include: ATI lecturers, local university staff in agriculture or development faculties, local research partners, NGOs, CBOs, Farmers Associations, Municipal

LED officers, Youth organisations, and relevant Faith Based Organisations. The criteria is to identify those partners with an interest in supporting better agricultural water management practices in local smallholder and household food production sites. The process also analyses what the existing knowledge of multi-actors is with regards to water use and management practices. As shown in this study, not many in the Agricultural Learning System appear to be familiar with RWH&C knowledge that is available for smallholder farmers and homestead food producers, due to this not being present in existing agricultural training programmes in colleges.

2) ESTABLISHMENT OF MULTI-ACTOR LEARNING NETWORK involving the active role players (multi-actors) where multi-actors are invited to deliberate on their current roles and involvement in agricultural water management for smallholder and household food production systems, and to identify how they might become more involved in such practices – in the case of this project, the main RWH&C practices that are supported by the two sets of WRC materials that were the focus of the project. It was recognised that the focus in on particular practices can narrow a wider social-ecological systems focus in agricultural education and training, but evidence in the project shows that this focus also provides a good starting point for further learning within a wider social-ecological systems perspective which can be expanded upon via ongoing learning network interactions.

3) TRAINING OF TRAINERS PROGRAMME – which was a key 'activating' mechanism for bringing the knowledge into use. Offering a changing practice Training of Trainers (ToT) programme in which multi-actors in the learning network are supported to i) review their current agricultural water management practice engagements, ii) identify potentially new practices they would like to engage in from the range of options associated with the three main practices outlined above; iii) make use of research-based knowledge to inform their decisions (WRC materials), iv) plan the practical development of productive demonstrations of improved agricultural water management, v) work together to develop one or more productive demonstrations and vii) evaluate and reflect on this collaborative work, and viii) extend knowledge of their practices to others via use of local media channels and ongoing meetings of their learning network. All actors can participate in the Training of Trainers course, and may choose a certification route (in which they complete a Change Project relevant to their role and responsibility in their organisation) or a participation route in which they join the ToT sessions, but do not complete the written part of the Change Project – they can still implement a practical change project or support others to do the same, as was found to be the case in this project. This allows for flexibility of participation in the ToT course process.

4) EXTENDED MEDIA DEVELOPMENT, ENGAGEMENT AND COMMUNICATIONS: Providing support for extended media engagement and sharing of knowledge of agricultural water practices via an internet platform which provides varied forms of access to the materials, community radio and newspapers, SMS communications using WhatsApp, and via local forums (e.g. agricultural associations, agricultural shows, etc.) and other internet-based communication systems (e.g. the on-line ExtensionSuite Online system of knowledge sharing) was also found to be important for i) extending the network activities, ii) facilitating expanded communications, iii) and making the materials and the use of the materials in practice more visible to others, thus generating interest in the knowledge and the knowledge dissemination process (as used via shorter ToT sessions).

This process takes place, typically over a 18 month period after which the learning network takes up ongoing activities via locally appointed network co-ordinators. In the K5/2277 Amanzi for Food project, a website infrastructure for knowledge sharing and dissemination focussing on Homestead Water Use and Food Production (Stymie et al., 2011) and Rainwater Harvesting and Conservation (Denison et al., 2011) was established and set up (www.amanziforfood.org.za). As reported in section 3.4.1 this involved creating access tools and routes into the materials produced by the WRC, and additional mediation materials to facilitate

access and use to the materials. It also involved creating a portal for the Training of Trainers programme and materials, and a platform for informal networking and communications (blogs and news items, links to a Facebook page and other relevant websites). This website infrastructure will be used in this programme can therefore be used to expand the knowledge that is being shared on this platform to include further WRC materials that are targeted at the same audience.

One of the ways of evaluating social learning processes, according to Wenger et al. (2011) is to consider the value that has been created by the social learning processes. Wenger et al. (2011) suggest that there are potentially 5 cycles of value creation in social learning initiatives, that are useful to provide a final reflection on the outcomes of the action oriented strategy development process.

1) Cycle 1: Immediate value whereby interactions and activities are observed and identified as valuable: Immediate value in the knowledge dissemination process was observable in the IB Learning Network and amongst participating farmers. However, not enough is known about why some people left the network, why some re-joined later, and why some did or did not complete the full ToT programme, why some were more active members of the network and why others were more passive members of the network. Data shows that the knowledge that was activated into use was of value to the farmers as it helped them to water their crops, to the college lecturers as it helped them to engage with curriculum innovation that was aligned with the competence-based model being implemented into the ATIs, and because it allowed for greater stakeholder engagement. For the LED officials it was valuable as it provides knowledge-based support to their smallholder farmer development programme.

2) Cycle 2: Potential value of improved knowledge capital. In this cycle the value is in possessing knowledge that may be useful in the future. Based on the evidence in the AOS development process, it is possible to suggest that value was created for all concerned in the project (both short and longer term ToT processes) as they have obtained wider knowledge of RWH&C practices for application in smallholder farming contexts. Evidence shows that there is a valuing of this knowledge in the agricultural learning system, but that wider skills development is needed for curriculum innovation to integrate this knowledge. It was also found that this knowledge is increasingly being valued under the new policy emphasis on supporting smallholder farmers, and under increased concern for impacts of climate change on agricultural production, and need for adaptations which would include RWH&C practice.

3) Cycle 3: Applied value found in changes in practices. In this cycle the value is in using knowledge to do something, particularly to do something new or different to what has been done before. Here it is possible to see from the evidence presented that the productive demonstration sites (introduced and supported via Module 3 of the ToT course) were a powerful mechanism for realising changes in practice in the college demonstration sites, as well as in community gardens and in the food production systems of individual farmers. Changes were also found to emerge in the curriculum and teaching practices of those lecturers that completed the ToT course, and in support for the knowledge integration processes from ATI management as they realised the value of the knowledge of achieving competence-based curriculum outcomes.

4) Cycle 4: Realised value found in performance improvement. In this cycle value is observed by noticing that doing something differently as a result of new knowledge has yielded positive results, has achieved the desired outcomes of the actions. Two types of performance improvement can be noted as having emerged from this initiative 1) curriculum development improvements although these still need to be more widely mainstreamed, hence the demand for more substantive engagement with the knowledge via a ToT processes, 2) on-farm improvements in food production due to greater availability of water, although this emerging impact was reduced with the drought conditions, and other factors such as inadequate infrastructure support to produce more permanent pond structures, and adequate labour for maintaining the furrows (in the Lloyd garden case).

5) Cycle 5: Reframing value found in redefining success. In this cycle the value is observed when the participants have developed a new understanding of what success and value is – in the case of this initiative, improved agricultural water use and conservation for smallholder farming and household food production. Here the biggest challenge relates to the reframing of the agricultural curriculum to be more inclusive of smallholder farmer needs. Some progress was made in this direction, but much more work will be required to integrate the types of practices included in the WRC materials into mainstream agricultural curricula. A promising route for this would be via i) making the competence-based nature of learning the practices more visible and ii) to integrate these practices into the framework of climate smart agriculture and to also mainstream them within wider modules on irrigation systems management which can be reframed to be more inclusively 'agricultural water management', and iii) via promotion of community engaged models of curriculum innovation. At a smallholder farmer support level, there is need for reframing the scope of support provided to farmers by extension services to include a stronger focus on agricultural water management, and to integrate this focus into smallholder farmer support programmes. In particular, there is need to engage in more depth with the contradictions that exist in agricultural policy and education between promotion of large scale agricultural practices and the increased demand for supporting smallholder farmers and household food producers, and for bringing youth into the agricultural learning system in ways that are aligned with their aspirations for modernised development paradigms.

4.3 Recommendations: Training of trainers within a learning network structure

The agricultural sector especially in areas of education and training should encourage learning network structures or forums to form and meet occasionally to discuss new practices being implemented in the area and addressing challenges that are faced by food growers in the area. This recommendation can be broken into two three related issues.

- *Need for ToT programmes embedded in networking forums with opportunities for collective learning*

Firstly, there is a need for more networking between different agricultural stakeholders in the sector. There are very few platforms for agricultural actors to meet and discuss their work and common local issues. Due to this lack of communication between isolated stakeholders, there is a need for collaborative engagement where networked learning is encouraged within the agricultural sector. The experiences from the ToT course show that the ingredients for successful dissemination of WRC RWH&C materials lie in reflection on one's current knowledge practices in relation to other possibilities and especially to farmer realities; in the collaboration between farmers, agricultural educators and extension services; and the doing of a change project on developing a productive demonstration site suited to own context. In addition, the certification of the course with credits was a motivator of many of the people who did the whole course including assignments across the five modules of the course.

It is therefore recommended that a ToT approach which brings agricultural actors from diverse backgrounds and especially farmers together with agricultural educators and extension officers be expanded to other learning network sites as it offers an excellent forum for collaborative learning of what farmers really experience and therefore allows for responsive and adaptive transformative actions from colleges, universities and extension services, and among the farmers.

Although the course-led cultivation of a community of practice was successful, it may not be viable on a regular basis and in all contexts as there would be a need for an initiating phase with dedicated actors willing to support and drive the initiative. This can be time and resource heavy and adequate resources need to be allocated to this process.

Although the ToT structure did encourage and enable the participants to fully engage with the WRC resources as they needed to do so to complete their assignments and engage in course activities. However, there are other opportunities where networking can be encouraged and this is important for collaborative and social learning other than the formal course structure.

- *The significance of productive demonstration sites for realising knowledge in practice*

The significance of the concept of productive demonstration sites in the ToT process has been elaborated in some detail in sections 3.1 and 3.2, especially as the productive demonstration sites help to realise the knowledge in practice, and also address the theory-practice nature of agricultural training, while also developing the competence-based approaches that are now being promoted. In future ToTs this concept should be further developed to include a wider range of productive demonstrations, and more attention can be given to researching the viability of these productive demonstrations in local contexts. This could be a useful assignment / task for college students, especially as ATIs are now also becoming more engaged in research. Tools for monitoring the productive demonstration sites, and the knowledge flows needed to maintain these should be developed to extend the current tools in the Amanzi for Food programme.

- *Need for effective communication channels and tools*

Secondly, there is a need for better communication channels and tools for these different agricultural actors to communicate. WhatsApp, Facebook and the Radio broadcasts have all been very effective communication channels that learning network members have used in the Amanzi for Food programme. The agricultural sector should be utilising these media tools and platforms in order to reach a wider audience for agricultural learning of practices especially with sustainable agriculture in mind with climate variability as a challenge farmers are facing.

Actions to be taken by different stakeholders:

- **Extension**

Extension services are already located in the communities in which they work and deliver trainings regularly. Incorporating training of trainers in collaboration with other organisations such as the Agricultural Colleges is recommended as it was found to work in the Amanzi for Food project. What this means for extension services though is an alignment of extension functions with other departments, directorates and stakeholders at national, provincial and local levels.

Extension policy is increasingly oriented towards requirements for extension services to reflexively engage farmers in a participatory, social learning approach and to respond to farmer needs, of which water provision is a critical need. Active support for training of trainers within a learning network structure therefore helps extension services to be pragmatic and achieve farmer successes and extension key result area successes at the same time. It is recommended that the extension services therefore support uptake and use of RWH&C knowledge amongst extension services via the engaged social learning ToT approach developed in this programme.

- **Colleges (Agricultural Training Institutes) and Universities**

As was shown in the Amanzi for Food knowledge dissemination programme, colleges have access to knowledge resources from the WRC and other knowledge providers. The problem seems to be to activate these knowledge resources into use via curriculum innovation. As was found in this programme, the colleges already have student and farmer training programmes which can innovate to include key aspects of RWH&C.

Training of trainers helped colleges lecturers to conceptualise such curriculum innovation using WRC materials. Development of productive and curriculum-integrated demonstration sites which model RWH&C practices, such as was done at Fort Cox College, shows that it is possible for colleges to host and facilitate the training of trainers of collective agricultural actor groups within a learning network structure, and achieve curriculum innovation outcomes that are also competence-based. As one lecturer put it,

> ...*the learning network has revived the relationship between the farmers, extension officers and researchers*. Extension officers are an engine to the community farmers and therefore such *relations have been strengthened*. Amanzi for Food did not only *reconcile relations* but also has brought to light the water conservation strategies and this has brought answers to the long asked [water] question of the small scale farmers. (Personal communication, in Pesanayi, 2016)

It is recommended that colleges plan for facilitating such training of trainers' programmes as part of their formal curriculum planning, curriculum innovation, and community outreach programmes. Universities can work in complementary roles with the Colleges or initiate their own training of training programmes as recommended here. Critical to the ToT process is the collaborative review of curriculum and practice, and development of shared demonstration sites that help to activate new knowledge that is introduced from sources such as the WRC. The farmer field schools that some Schools and Faculties of Agriculture or Rural Development Institute (such as University of Fort Hare) in Universities are a good forum for formative intervention approaches in conducting training of trainers. Colleges should also put resources aside for supporting productive demonstration site development on RWH&C in community contexts surrounding the college as this provides a learning source for students, while also benefitting communities. Colleges are also well positioned to negotiate partnerships for local agricultural development with LED structures and extension services as was found to be the case in the Amanzi for Food programme. As learning organisations, when situated within a learning network, they can have relevant impacts in the local context, while also innovating with new knowledge resources.

4.4 Recommendations: Further knowledge dissemination

As shown in this project, knowledge dissemination is not a technical transfer process, but involves an engaged social learning process using a diversity of processes and media. As mentioned above, in the time available, the Amanzi for Food project was able to *establish* an inter-active media based communication system that appears to have potential to expand the use of the WRC materials in interesting ways. As noted above, more time is needed for this system of communication and knowledge dissemination to expand in scope and impact.

The website proved to be an important 'holder' of the materials for quick access and demonstration. As indicated above, constructing the website required careful attention to access tools and features to enable access to the materials which were good, but bulky to download. Even though there is now enhanced access to the materials via the website, there is still a strong need in the field for hard copy materials, especially produced in summary versions in vernacular languages for farmers in rural areas.

The navigation tool – a key access device – was especially helpful in helping farmers and lecturers and all concerned to find their way into the materials. It was also helpful for structuring the access system on the website. It is therefore recommended that attention be given to the way in which materials can be accessed by users and that appropriate access tools be produced. The navigation tool has great potential to be developed into an App for farmers, with links to the website. This may be an interesting next step in the development of tools to create access to the materials.

Experience in the project has to some extent reinforced the dominance of radio as the preferred medium of media communication in rural areas, but it has also highlighted the growing trend towards the use of mobile phone applications such as WhatsApp, and internet services such as Facebook or Twitter for communicating with friends, fellow farmers and colleagues. Facebook and WhatsApp were found to be quite interactively used in the Amanzi for Food project, and attracted both farmers and youth to the site, as well as extension officers and other interested parties. There is further potential to use and monitor the use of channels such as community newspapers. Overall a more substantive, longer term monitoring system needs to be put in place for tracking the extended value of these media-based tools, and it is recommended that a researcher in a journalism faculty be identified to take up a more extensive study on the use and impact of these tools. Within the time and budget, the Amanzi for Food team were only able to obtain preliminary insights into the efficacy of these media.

When formulating scripts for the radio it is important to come up with radio content that addresses different practices in more detail. The programme content should be oriented more at educating the audience, meaning, it should emphasise the in depth practical elements of rainwater harvesting practices. When crafting radio programmes it is also ideal to orient content from WRC materials with environmental themes in current news such as drought.

Actions to be taken by different stakeholders:

- **Extension**

In line with the DAFF (2015/16) strategic plan for supporting smallholder farmers, it is recommended that

- Extension officers actively engage with and support productive demonstration plots at different scales especially *umzi* (household garden), 1-2 ha arable crop lands, 2-20 ha farming plots and pasture development according to the farming practices in the communities they work in. The cropping programme needs to deliberately support such integrated production plots by refocussing some of the existing investments into materials and production resources, i.e. training, inputs, crop security and promotion through media and agricultural shows. At the national Department of Agriculture, Forestry and Fisheries the rainwater harvesting research products from the Directorate of Water Use and Irrigation Development can only find application through extension services;
- Area extension offices are ideal sites act as nodes for continuous action-oriented dissemination of RWH&C knowledge and skills as they host farmer association meetings and are places of convergence for farmers;
- Local extension officers continue working actively in the learning network through collaborative work with agricultural college lecturers, local economic development agencies

- **Colleges (Agricultural Training Institutes)**

The Colleges hold a good vantage point in that that they have both formal student training and non-formal farmers training programmes in the rural and agricultural development centres. They can therefore act as nodes for continuous dissemination of RWH&C knowledge from the Water Research Commission, linking this to resource materials from farmers' experiential and indigenous knowledge through formative interventionist processes that mobilise the various knowledges.

- **Universities and researchers**

The role of universities as knowledge generators gives them a mandate to disseminate RWH&C knowledge through research and publications in novel ways that are mutually beneficial to both the academy and the communities of farmers, extension officers and agricultural college educators. Use of the RWH&C materials can strengthen local applied research and praxis and can provide further support to Colleges (ATIs).

- **Local Economic Development agencies**

In the municipal tier of government, local economic development agencies have programmes that support local economic development and many of these in the rural areas depend on the agricultural sector for delivery of local economy traction. It is the interest of such programmes to ensure water security for cop, horticulture, livestock, pasture and fisheries production especially in present times of climate change and variability. Rainwater harvesting becomes a crucial opportunity for rain-fed farming systems in drylands. The LED hold a key to sustaining coordinated local(ised) knowledge-dissemination and should actively support learning network formation with colleges, and farmers as they provide an important bridge between colleges, farming associations and farmers, especially also for demonstration site development.

4.5 Recommendations: Further research and materials development

As indicated in Chapter 2, agricultural education and training in the diverse sub-groups and sub-sectors is in flux with transfers between the DAFF and DHET underway, and with initiatives to restructure curriculum towards a competence-based approach and with integration of some colleges into universities. The development of the AOS and the work with college lecturers using the WRC knowledge in this project has shown that, for wider mainstreaming of the knowledge, there is need to also understand the alignment between the knowledge being produced (e.g. of RWH) and possibilities for integration of this knowledge into curricula at various levels, *as governed via qualifications*. Initially it was our intention to undertake a carefully constituted qualifications review to inform the AOS, but it was deemed to be outside of the scope of this project. It is recommended that the issue of including smallholder farmer production needs, including RWH&C practices as promoted by the WRC materials, be taken up in further research to provide insight into a more systemic approach to the integration of this knowledge into the agricultural learning system.

In the programme only six of the practices were illustrated using the posters, and only four of the practices were demonstrated using YouTube video materials. Further research is needed to examine the use and effectiveness of these additional visualisation materials in the ToT and learning network context. Similarly, further research is needed to inform the use of the website as a learning tool. Especially important is further research to track the relationship that appears to be exist between diverse forms of media – e.g. radio programming, Facebook, and website use and the impact of this on the knowledge dissemination process.

As indicated above, the navigation tool was found to be a particularly useful tool for creating access to the materials. There is potential to turn this into a mobile phone App which can be more widely used to provide access to the WRC materials. There is also need to have summary materials available in hard copy and in vernacular languages on the main practices being promoted by the WRC materials.

There is also need for further research into the value creation dynamics of the social learning system and processes as established in the Amanzi for Food model, especially the more complex dynamic of reframing value, which is intimately tied up with addressing key contradictions in the agricultural sector and in the relationship between the agricultural sector, societal transformation, and issues emerging at the food-water security nexus within a context of advancing climate change and associated risks to farming practices and human well-being.

As indicated in chapter 1, the development of the AOS was framed as a form of strategy-as-practice research. There is a call for strategy-as-practice research to develop and substantiate outcomes that may better explain or inform strategy praxis. Jarzabkowski and Spee's (2009) review notes that as the strength of strategy-as-practice research is in its rich understanding of situated phenomena, its criteria for outcomes are better suited to ideographic research which can explain underlying structures and patterns of action. However, they suggest that further research is needed in strategy-as-practice research into the study of outcomes and how outcomes are understood via different units and levels of analysis. They note that an outcome of an action

oriented knowledge dissemination project, such as the Amanzi for Food project, may not be the same for an individual in terms of their own advancement as an outcome for an organization. They argue that the issue of what type of outcomes are being examined, and the level of analysis for those outcomes is not always clear in strategy-as-practice research, since practice is often multi-layered and complex to 'unravel' analytically. They recommend five categories of outcomes, which link to the micro, meso and, to some extent, macro levels of praxis. These five categories, personal, group, strategizing process, organizational and institutional outcomes could add a new lens for further analysis of the action oriented strategy as it unfolds further. Combining this with the Wenger et al. (2011) framework for value creation analysis could potentially provide a good methodology for more in-depth evaluation of the Action Oriented Strategy roll out and process.

Actions to be taken by different stakeholders:

- **Extension**

A key responsibility of extension services is to monitor and evaluate farmers needs and services provided. It is therefore recommended that extension services include a focus on appropriate RWH&C practices in their extension services monitoring and support programmes, and that knowledge of how farmers are responding to this be shared within the local learning networks and with colleges and universities and the LED units. Improving knowledge of RWH&C amongst extension services, and their knowledge and experience of responsive social learning approaches to extension could also form a focus for further research (Sithole, 2016).

- **Colleges (Agricultural Training Institutes) and Universities**

The transitioning of agricultural colleges to agricultural training institutes places demands on them to research and publish. Through engaged research and praxis approaches as developed in the Amanzi for Food programme, opportunities for further knowledge generation can be developed amongst students working with lecturers, farmers and extension services as they try out various RWH&C adoptions and adaptations. The colleges' community engagement mandates can be executed as the college responds to farmers' contexts and needs. It is recommended that universities extend their research mandates to examine locally needed and relevant RWH&C practices and their sustainability and further development. This can feed into ToT programmes, and into locally relevant RWH&C resource materials development to mediate learning. If situated in a learning network, this can be shared amongst smallholder farmers, with these farmers and their extension officers participating in the materials design, taking cognisance of literacy, gender and other good resource development guidelines in collective learning contexts.

- **Local Municipality Economic Development agency**

The local municipal development agencies have a great potential to anchor networking forums and processes as demonstrated by the Nkonkobe Economic Development Agency (NEDA)'s smallholder farmer development programme. The LED provides crucial practical contexts for locally-produced value chain economies that support local farmers. More user-oriented research into these value chains is needed, included how it could attract youths into farming and rainwater harvesting for food security, income generation, and business development. Further research into the sustainability and ongoing maintenance of RWH&C practices is also needed.

Volume 2: '*An Action Oriented Strategy for Knowledge Dissemination and Use in Agricultural Colleges and Local Learning Networks for Homestead Food Gardening and Smallholder Farming'* which accompanies this report is a short summative document that provides easy-to-access guidance on how to implement an AOS in a wider range of contexts and is based on the key lessons learned and processes tried out in the development of the AOS as reported on in this document, Volume 1.

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APPENDICES (on the CD Rom at the back of this report as well as on the website www.amanziforfood.co.za)

Appendix A: Navigation tool (also on www.amanziforfood.co.za)

Appendix B: Posters (also on www.amanziforfood.co.za)

Appendix C: You Tube Videos (https://www.youtube.com/watch?v=OxuNSr3Kq60)

Appendix D: Radio Handbook and Scripts (also on www.amanziforfood.co.za)

Appendix E: Website and Branding Materials (www.amanziforfood.co.za)

Appendix F: Abstracts of PhD theses and Masters dissertations

Appendix G: Publications and Knowledge Dissemination

Appendix H: Archiving of data