Knowledge Brokering and Dissemination of Irrigation Management Guidelines for Training of Extension Advisors

Report to the
Water Research Commission

by

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- Extension advisors from the following provincial departments: Limpopo, Northwest, Mpumalanga, KwaZulu-Natal, Eastern Cape, Free State, Western Cape, Gauteng and Northern Cape
- Lecturers and academic staff of the remaining eleven agricultural colleges
- Lecturing staff and heads of departments of universities of technology and Mpumalanga comprehensive university
- Agriseta accredited trainers, Community Works Programme officials and consultants
- Commodity extension advisors and trainers

We thank you for your time and effort allotted to this project – we appreciate your contribution.

LIST OF ACRONYMS AND ABBREVIATIONS

AET	Agricultural Education and Training
AgriSETA	Agricultural Sector Education Training Authority
ARC	Agricultural Research Council
ATIs	Agricultural training Institutes
ATRs	Annual Training Returns
CE@UP	Continuous Education @University of Pretoria
CHE	Council for Higher Education
CPUT	Cape Peninsula University of Technology
CUT	Central University of Technology
DAFF	Department of Agriculture, Forestry and Fisheries
ERP	Extension Recovery Plan
FEDIC	Farmer Entrepreneur and Incubation Centre
FET	Further Education and Training
HEQC	Higher Education Qualification Council
HET	Higher Education and Training
IDC	Industrial development Corporation
NDA	National Department of Agriculture
NDP	National Development Plan
NEPAD	New Partnership for African Development
NPC	National Planning Commission
NQF	National Qualification Framework
PPP	Public-private-partnership
QLFS	Quarterly Labour Force Survey
RPL	Recognition of Prior Learning
SAB	South African Breweries
SAQA	SA Qualification Authority
SARIA	South African Regional Irrigation Association
SASAE	South African Society for Agricultural Extension
SASRI	South African Sugar Research Institute
TOR	Terms of Reference
TSB	Transvaal Suiker Beperk
UFS	University of the Free State
WRC	Water Research Commission

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1. Introduction

South Africa faces particular challenges regarding water supply. Parts of what was already a dry country have become noticeably dryer over the past 30 years. Rising temperatures and changing rainfall patterns will have further consequences for food production and water supply. The National Development Plan 2030 proposes the advancement and expansion of agricultural development through effective land reform and growth in irrigated agriculture. This goal however requires skilled and well trained agricultural advisors to support smallholder farmers with decision making on opportunities open to them.

For many farmers but especially smallholder farmers, extension advisors play a pivotal role in building capacity through programmed learning and access to information. Appropriate training of extension advisors is urgently required that can respond effectively to the needs of smallholder farmers and to enable them to successfully integrate into the food value chain. The better the extension service - the better the smallholder operation.

This report starts by providing the rationale for brokering and dissemination of the learning material, which is followed by an overview of agricultural education and training pathways in South Africa. A brief description of the current training programs offered at agricultural colleges and universities of technology approached precede syntheses of the bilateral discussions and workshop outcomes. Finally, concluding thoughts and the way forward for the implementation and uptake of the learning material is provided.

2. Rationale for brokering and dissemination of irrigation management training guidelines for extension advisors

In South Africa extension services play an important role in the investment of human and social capital required for sustainable agriculture development. The policy environment for the agricultural sector in South Africa at this point in time is dominated by three important policy issues: land reform, black economic empowerment and the strategic vision for agriculture. Agricultural education and training has an indispensable role to play in all of these strategic policy issues. It is generally recognised that agricultural advisors and extensionists provide an important link between research output and solving of farmer perceived problems. All types of farmers, but especially smallholder farmers are dependent on trustworthy and competent extension advisory services as a source of knowledge and information. Various discussion forums organised by the Water Research Commission between 2000 and 2003, in which a wide range of farmers participated, have highlighted that the extension link has deteriorated in recent years and become less effective. In 2005 a consultancy project was undertaken for the Water Research Commission to establish a database of extensionists who are active on

smallholder irrigation schemes in South Africa and also to determine the current status of training presented by tertiary institutions to extension workers. This consultancy illustrated that many educational programs and curricula offered by tertiary education and training organisations in South Africa (universities, agricultural colleges, technicons/universities of technology) were inappropriate and not aligned to the skills and knowledge required by extension advisors to do their work properly. In many cases this results in a lack of confidence and self-esteem amongst extension advisors, decline in credibility and therefore withdrawal from the community, which they must serve (Stevens and van Heerden, 2007). An urgent need was therefore identified to restore the self-esteem of these individuals and to improve the service delivery of the extension profession.

A first step in rectifying the situation was to define the “knowledge profile” for training of extension advisors, or the basic knowledge required to advise farmers effectively on irrigation management (Stevens & van Heerden, 2007).

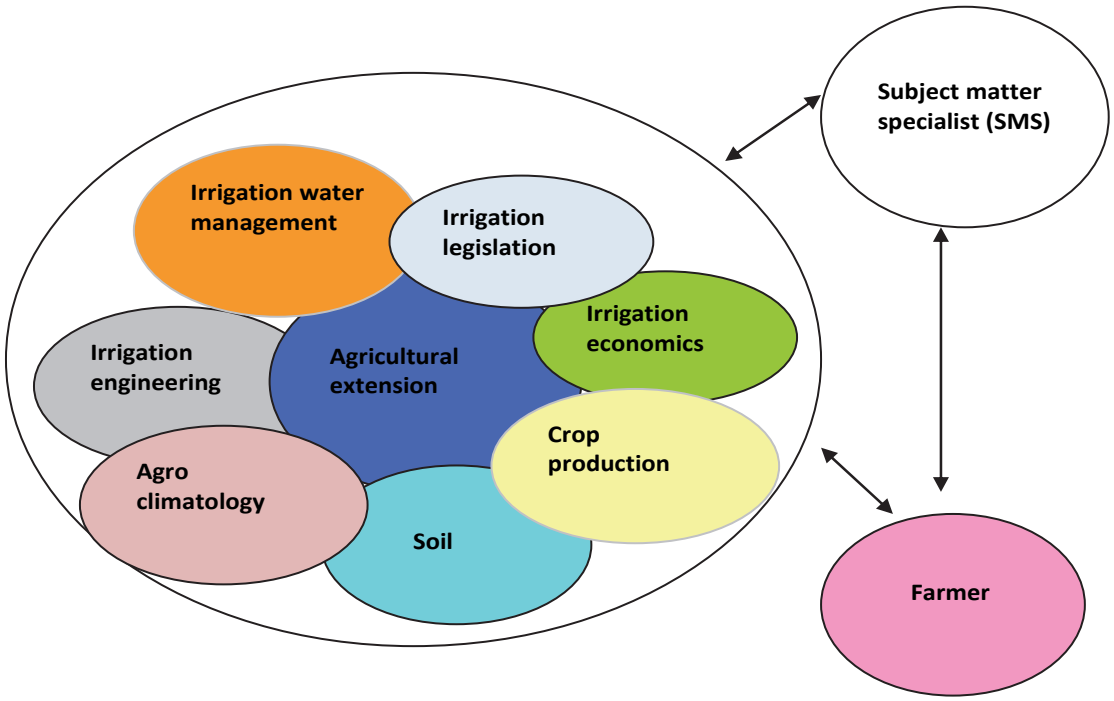

Figure 1: Conceptual framework of the "knowledge profile “of an irrigation extension advisor (Stevens & van Heerden, 2007)

This conceptual “knowledge profile” of the irrigation extensionists as illustrated in Figure 1, does not imply that extensionists should become subject matter experts in each of these identified technical learning areas, but rather that adequate technical knowledge and competence in each of these learning areas is a prerequisite for credible extension service delivery to irrigation farmers. This was followed by a WRC project which started in 2006 and was led by the University of Pretoria. Learning material (93 modules) was developed for the eight learning areas identified to form the “knowledge profile” of the extension advisor

(Stevens et al., 2012). A synopsis of the technical and extension learning modules as it appears in the learning package are included as Annex 1. This training material includes the main elements required to inform irrigation water management on farm level and have been divided into technical and extension related modules. The aim of the learning material is to support tertiary education organisations, commonly demarcated as Further and High Education (agricultural colleges, universities of technology and FET colleges) offering agricultural educational programs on a NQF 5 level (new level descriptor NQF6*). Secondly the learning set was also developed to support AgriSETA accredited training providers (which also include agricultural colleges) offering short courses to farmers in irrigation management. This comprehensive set of training guidelines consists of nine parts, and is ready to help build the necessary practical skills and applied competencies required of irrigation extension advisors to assist irrigation farmers. This learning material is intended to empower learners not only to acquire certain skills and competencies but al so to understand principles underpinning those skills and competencies. Thirdly the learning material also fills a major gap in addressing in-service training requirements of extension advisors, as agricultural colleges are expected to develop their technical capacity to such a level that they can act as Centres of Excellence (DAFF, 2015). This anticipated role of agricultural colleges is aligned with the vision for 2030 of the National Development Plan, namely to train a new corps of extension officers for practical support to smallholder farmers (National Development Plan, 2012). In terms of the role of agricultural colleges and universities of technology, urgent reviewing of existing curricula to meet the skills and competency levels required by extension advisors, smallholder and subsistence farmers will be required.

The next focused drive in the process to equip extension advisors with the necessary knowledge and skills required by the new generation of extensionists was this project. It involved disseminating the research output (set of learning material) to agricultural colleges; universities of technology; AgriSETA accredited training providers; FET colleges; commodity organisations involved in irrigation agriculture development; provincial Departments of Agriculture involved in extension delivery to farmers; and international irrigation advisors and professionals. This report reflects activities and discussions held with various stakeholders involved in agriculture education and training to raise awareness of the training material, but also to encourage and catalyse the possible inclusion into existing curricula and use for practical training of irrigation farmers at irrigation scheme level. This was achieved through

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**The National Qualifications Framework (NQF) Act No 67 of 2008 replaced the South African Qualifications Authority (SAQA) Act No 58 of 1995, and this had migration implications to higher NQF levels – from an eight level framework to a ten level framework.*

Level	***Old NQF***	***New NQF***
5	*National Certificate/National Diploma*	*Higher Certificate*
6	*Bachelor Degree/Advanced Diploma*	*Advanced Certificate/National Diploma*

a series of discussion forums and interactive meetings held with staff of agricultural colleges, universities of technology, Agriseta accredited trainers, commodity organizations (e.g. SASRI, TSB, SAB), the newly established comprehensive University of Mpumalanga (formerly known as Lowveld Agricultural College), Department of Cooperative Governance and Traditional Affairs (DCoGTA) responsible for the Community Works Program, extension advisors from various provincial departments and international irrigation professionals and practitioners.

3. Overview of agricultural education and training pathways in South Africa

Labour markets all over the world have changed in recent years, and jobs requiring higher skills have expanded. In a globalised economy, more workers in all occupations have to obtain higher levels of qualifications and skills. However, in agriculture, an increasing number of occupations require a combination of sector specific skills and competencies that allow employees to interact effectively with clients, solve problems and develop new skills. In South Africa agricultural education and training is offered on a formal and non-formal basis, although the terms “formal” and “non-formal” are replaced, they are used in this report.

3.1 Demand and supply of skills

Agriseta in their Sector Skills Plan for South Africa (2010) grouped the agri-sector in four key target groups namely:

- Commercial farming sector (primary agriculture) with an estimated 925 000 employees) - of whom 350 000 are employed on a temporary basis (seasonal or contract workers).The Quarterly Labour Force Survey (QLFS, 2013) shows that South Africa had 50 332 farmers in 2009, but this declined to 34 905 by 2012 – a decrease of 15 427 in just three years.
- Emerging farming sector (primary agriculture) with an estimated 650 000 beneficiaries needing support to improve their efficiency and profitability and grow and expand their ventures into commercially viable enterprises.
- Secondary agricultural enterprises (upstream and downstream enterprises) with approximately 300 000 employees.
- Department of Agriculture – particularly support needed in the development of extension officers and addressing of scarce and critical skills categories within national, but particular provincial agriculture departments.

Creating jobs is one of the key challenges facing the South African economy. The National Planning Commission for example believes that agriculture has the potential to create one million new jobs by 2030. This target is set in the context of the sector shedding almost one million jobs over the last three decades. Many of these losses occur within the skilled job categories (Liebenberg, 2013).

Farmers are generally employing more skilled workers. The share of paid workers in agriculture with an education level higher than primary schooling (grade 7 and more) has increased significantly from what it was in 2008. This fact is relevant for both the commercial (formal) and informal agricultural sectors (Figure 2 and Figure 3). In the commercial sector it has grown from 43% of the total number of paid workers in 2008 to an average of 55% for the rest two quarters of 2013. In the informal sector the same metric has changed from 40% to 49%, an increase of 8.6%.

Formal agriculture

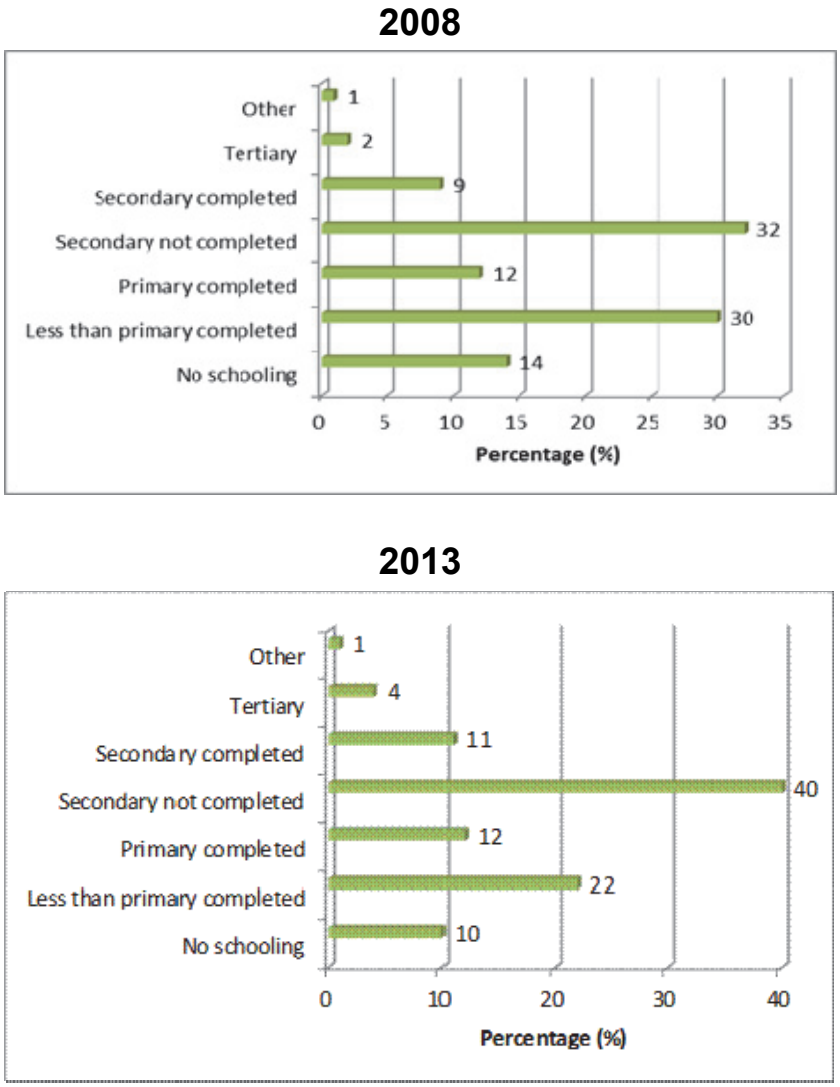

Figure 2 : Education level of Formal Agriculture 2008 *vs* average for 2013 (QLFS, 2013)

Informal Agriculture

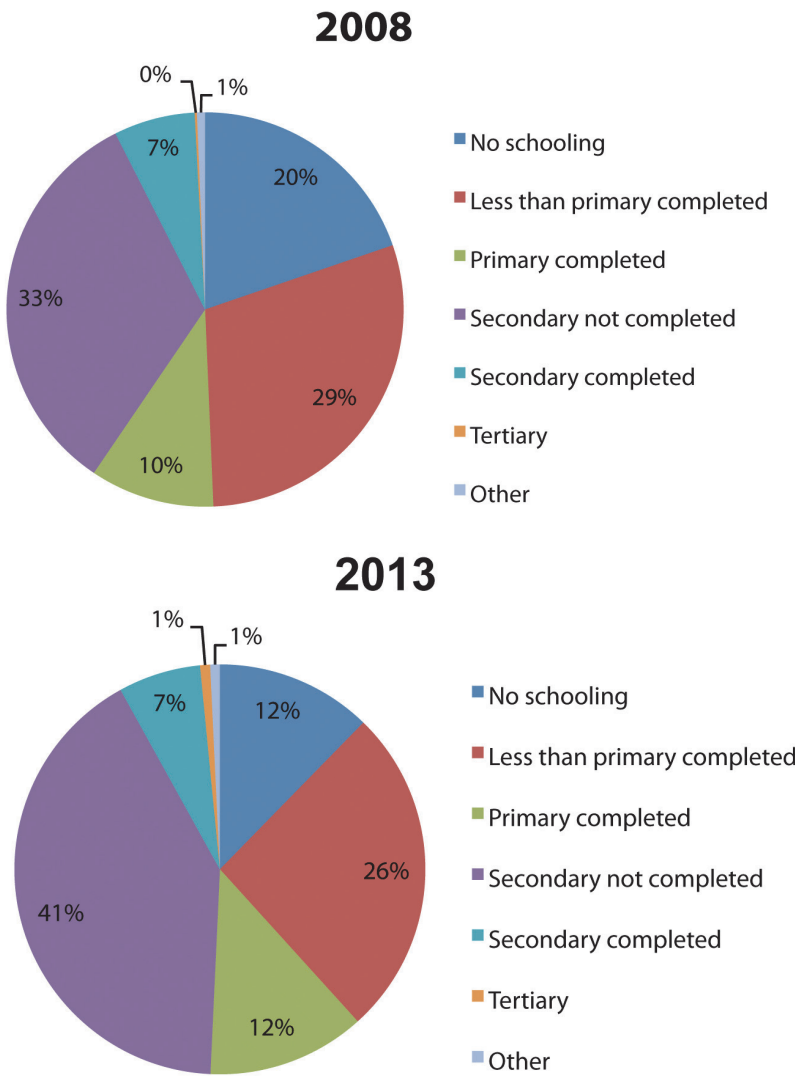

Figure 3: Education level of Informal Agriculture 2008 *vs* average for 2013 (QLFS, 2013)

The primary and secondary agricultural sectors are therefore important sources of providing trained labour to the economy, and should therefore receive the necessary attention and funding support to increase investment in training. The need to retrain and upgrade extension officers to better serve the needs and requirements of especially the large existing smallholder farmers (agricultural economics, farm management, irrigation water management, financial management) are priorities within the Provincial Department of Agriculture (DAFF,2015).

3.2 Formal education in agriculture

Formal agriculture education and training (AET) programs are offered by (11) agricultural colleges, (6) universities of technology, (1) comprehensive university (University of Mpumalanga) and (9) universities and these programs are usually nationally accredited by SAQA. Secondary AET is provided by approximately 1500 secondary schools. At tertiary level

the Agricultural Colleges offer AET in practical agricultural production within the broad categories of crops and livestock, with some of the colleges specialising in specific crops that are more prevalent in their relevant geographical areas. Elements of agricultural extension are also included in the curricula (Stevens and van Heerden, 2007), and learners can leave these institutions with certificates (NQF5) and agricultural diplomas (NQF6) awarded. The Higher Educations Qualifications Framework (HEQF) also allows ATIs to offer some NQF level 7 qualifications in partnership with universities – notably the Bachelor of Agriculture and Bachelor of Technology in Agriculture, or if they upgrade their program and facilities as required they may offer it on their own. Existing examples are the collaboration between University Stellenbosch and Cape Institute for Agricultural Training: Elsenburg with the offering of a B Agric; University KwaZulu-Natal and Cedara College of Agriculture offering a B Agric in Extension and Grootfontein Agricultural Development Institute and Free State University (UFS) for offering a joint B Agric degree. Nine of the 11 Colleges of Agriculture are accredited with the Higher Education Qualification Council (HEQC). Colleges currently resort under the provincial departments of agriculture, except for Fort Cox Agricultural College, which is currently autonomous and receives funding from the Eastern Cape Department of Agriculture and Grootfontein Agricultural College, which resorts under the National Department of Agriculture (NDA). Universities of Technology also offer agricultural education and training programs with a strong focus on a practical curriculum, though not as extensive as agricultural colleges. With the offering of BTech degrees, Universities of Technologies were increasing the theoretical components in offering agricultural science, with a primary focus on crop and livestock production.

Universities offer a very broad and diversified range of agricultural sciences, touching on pre-production, production and post-harvest technologies related to livestock and crops. They also offer curricula on a variety of associated disciplines including Agricultural Engineering; Agricultural Management; Agricultural Economics; Agricultural Extension; Soil Science; Food Security; Community Resource Management; Hydroponics; Bio-Resources; Range and Wildlife Management. The curriculum is more oriented towards teaching and learning of agricultural science than agricultural practises. In addition to the agri-programs they also offer a full range of management, business, engineering in the and administrative programs needed in the secondary sector

3.3 Informal education in agriculture

In-formal education and practical training programs are offered by a range of providers which includes NGOs, universities, Agriseta accredited trainers, private sector (SASRI, TSB, SAB), agricultural colleges and public agriculture extension services, of which many of the training programs are not accredited, but are never less very important for the agricultural education and training network. Agriseta has a total of 120 accredited providers offering a wide range of learnerships and Skills Programs. From the submitted Annual Training Returns (ATR's) approximately 50% of the total workforce within the agri-sector received some form of on-the-

job and informal training during the 2004/2005 financial year (non-accredited) (Agriseta, 2010).

Some of the agricultural colleges have developed excellent reputations for the offering of short courses to farmers, but the quality of training at these colleges need to be improved – if selected colleges want to function as “Specialised Centres of Excellence” (Agriseta, 2010). There is also a great need for increased decentralised training to take training on-site and to farms (also a need for mentorship approaches to the training of especially emerging farmers).

3.4 Repositioning of Agriculture Colleges in South Africa

After a comprehensive investigation into the status of the 11 agricultural colleges conducted by the National Department of Agriculture Forestry and Fisheries, it was found that vast differences exist between colleges with regard to support received from departments of agriculture. Some colleges are well endowed with human, physical and financial resources, while others are vastly under-resourced (financial, human and infrastructure). It also appears that some of the colleges are placed high on the agendas of some Provincial Departments of Agriculture, while others battle to be heard (DAFF, 2015). The study recommended that a set of Norms and Standards for governance of these colleges should be developed. This set of Norms and Standards for agricultural colleges were adopted in 2015 to ensure that colleges operate at the highest possible level for ensuring that it is suited for the development of a skilled and capable workforce. As part of the repositioning process of Colleges of Agriculture, the replacement of the name “College of Agriculture” to “Agriculture Training Institutes (ATI” was adopted. The term “institute” has been carefully selected to refer to an institution and /or organisation which perform at the highest possible level of excellence and professionalism (NDA, 2015). Dr Edith de Vries, Director General of the National Department of Agriculture, perceives this change of name as indicative of the transformational requirements for Colleges to serve this particular niche and clientele and to operate at the highest level of excellence possible (DAFF, 2015). ATIs are expected to develop their capacity to make significant contributions to the creation of wealth amongst rural communities. Through community development and outreach programs where teaching, research, extension and development are well integrated, ATIs are acting as *Centres for Rural Wealth Creation*. Furthermore ATIs are also expected to act as *Centres of Excellence* within their respective agro-ecological zones. It is anticipated that ATIs should become centres of practical and theoretical training in specific niches within the agricultural sector towards the agricultural industry. This broader context of ATIs allow them to become actively involved in the execution of the Extension Recovery Plan (ERP) through the provision of in-service training to extension advisors from the various PDAs.

The ATIs serve a wide range of clients as illustrated in Table 1, but chief among them is the offering of higher educational programs to students. Farmers are also important clients, while

Provincial Departments of Agriculture, extension staff, rural communities, municipalities and agricultural organisations and businesses also fall into the scope of ATIs as part of further education and training.

Table 1 : Categories of ATI clients (DAFF, 2015)

CATEGORY OF CLIENTS	DESCRIPTION	ROLE OF THE ATI
Future agricultural practitioners and scientists	Qualified learners interested in HE training for a career in agriculture	HE qualifications on NQF levels 5-7
Subsistence and household food producers	Mainly produce for own consumption; may produce small marketable surplus.	Farming and farm management skills training.
Small-scale farmers and land reform beneficiaries	Mainly produce on a small scale for own consumption; produce small marketable surplus or does not have farming knowledge.	FET qualifications on NQF levels 1-4; Farming and farm management skills training.
Commercial farmers	Produce marketable quantities of produce.	Advanced farm and farm management skill training; Training for agricultural niche markets.
Extension Officers	Extension practitioners in the public, private and NGO sectors needing upgrading or retraining.	In-service training in agricultural extension and commodities.
Rural communities District and Local Municipalities	Communities in the area in which the ATI is situated and where its training clients are located.	Practical engagement for local economic and social development; Training of personnel community members
Provincial departments of agriculture	PDAs within which the ATI is located or otherwise services.	Addressing human resource development needs in the agricultural sector in the province; Support with agricultural extension; Applied research Training of PDA personnel.
Agribusinesses, commodity groups and farmers' associations and private sector within agriculture.	Organisations engaged in some aspect of agriculture, including production, value adding, marketing, research, development and farmer training.	Tailor-made training Partnerships in technology development and training.

4. Objectives and approach

The study was done on a national basis but also involved international participants. The aim of this project was to make key actors within the various education and training organisations aware of the learning material and to disseminate the knowledge on the training and learner guides developed by the WRC for extension advisors in irrigation water management, and to identify possible constraints in the uptake of the research knowledge.

Specific objectives of the project

1. To identify key actors for the dissemination of the research knowledge within agricultural colleges, AgriSETA accredited training institutions, Technology Universities and Provincial Departments of Agriculture.
2. Dissemination and raise awareness of the research knowledge through the use of appropriate networks and bilateral interactions.
3. Assess in a collaborative manner the feedback provided and identify possible constraints in the uptake of developed learning material into current training curricula and/or programmes.
4. Report on the possible way forward for future research and uptake of training/learning guidelines.

The conceptual framework followed in the project was based on four interlinked phases (Figure 4):

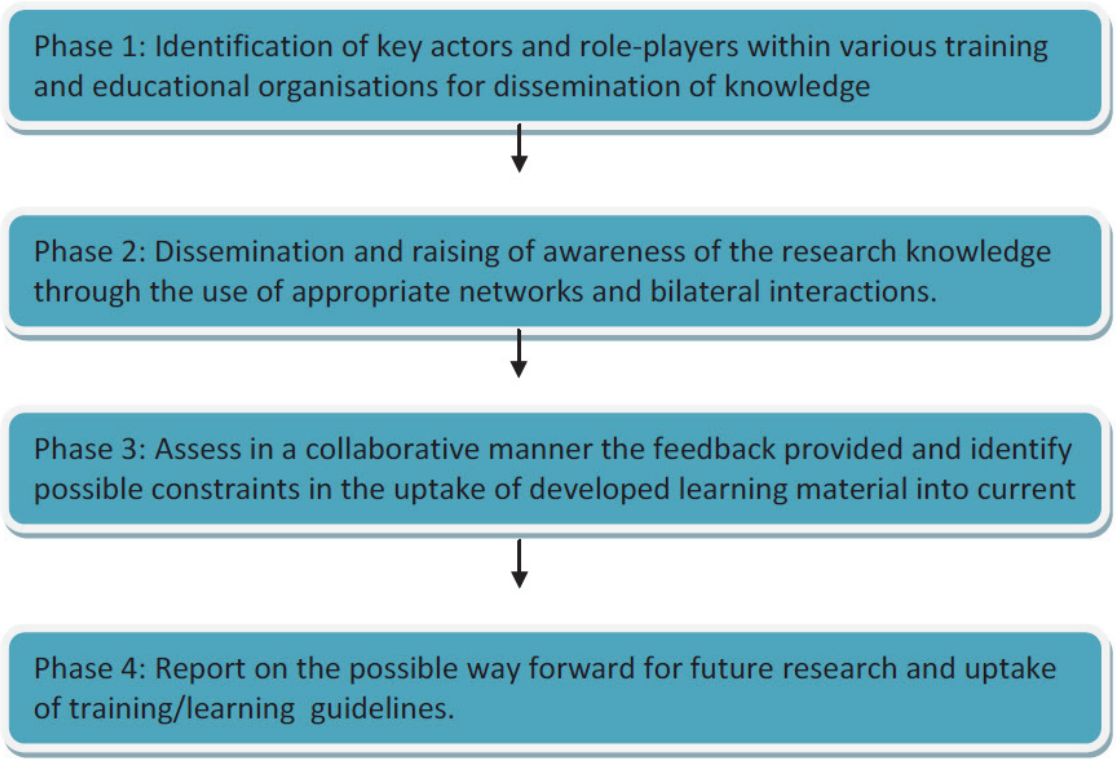

Figure 4: Conceptual framework for execution of study

The *first phase* of the study comprised of a detail planning session where target training organisations as well as key actors were identified. This was done in collaboration with the Program Manager and similar working sessions took place throughout the project period which also served as feedback as well as an evaluation tool for direction on the project after reaching milestones set. Close collaboration between WRC and researchers led to the planning of the specific approach followed for the dissemination of knowledge to the various identified target audiences and how to evaluate/assess the outcome of these discussion forums.

Phase two of the project comprised of the dissemination and creating of awareness of the research knowledge through the use of appropriate networks and bilateral interactions. The following educational and training organisations offering formal and informal training were involved in the discussion forums and workshops conducted (Table 2).

The consultation agenda used for the discussion forums and workshops held in the various provinces mainly consist of the following focus areas:

- Background to the development of the Training Material (consultation project)
- Brief overview of Training Material for Extension in Irrigation Water Management
- General discussion about the possible uptake of the learning material in existing curriculums, how policies may impede the use of the material, opportunities and constraints
- Conclusion and way forward (immediate action plan and what is required for implementation)

The third phase involved the assessing and evaluating of the feedback provided by targeted audiences on the learning modules as well as the identifying of possible constraints in the uptake of the research knowledge. This was done in a collaborative manner where stakeholders jointly engaged in the identifying of possible constraints and possible opportunities for the uptake of learning material. The various disseminating platforms used were cross-analysed and also served to help formulate the main lessons and possible messages for future development and uptake of training modules into training curriculums (Phase Four).

Other existing platforms that incorporate irrigation advisors and professionals like SARIA, Ministry of agriculture Mozambique, SASAE, SA Cotton, Nufarmer, SAB were also approached in the dissemination of the research knowledge. Articles were put on the SASAE website for the nearly 2000 members to read and take note of, while articles were also issued to Nufarmer and SABI for publication. The specific methods selected for dissemination of knowledge depend on the specific audiences identified, and how to ensure that maximum effectiveness is achieved with the specific TOR in mind.

Table 2: Stakeholders consulted and their areas of specialisation

Organisation	No of people	Area of specialisation
a. *Agricultural colleges*		
Taung Agricultural College ,Northwest Province	4	Lecturing staff crop production and irrigation (3) Head of Department (1)
Madzivhandila Centre for Agriculture,Limpopo Province	3	Extension (1) Crop science (2)
Tompi Seleka College of Agriculture, Limpopo Province	4	Crop science (3) Principal of College (1)
Tsolo Agricultural College, Eastern Cape	1	Principal of College (1)
Fort Cox College of Agriculture and Forestry, Eastern Cape	2	Acting Principal of College (1) Irrigation (1)
Owen Sithole College of Agriculture, KwaZulu-Natal	1	Principal of College (1)
Cedara College of Agriculture, KwaZulu-Natal	1	Principal of College (1)
The Cape Institute for Agricultural Training: Elsenburg	4	Principal of College (1) Extension (1) Crop science/pomology (2)
Grootfontein Agricultural Development Institute, Northern Cape	1	Principal of college (1)
b. Universities of Technology		
Cape Peninsula University of Technology, Western Cape	2	Extension science (2)
Mangosuthu University of Technology, KwaZulu-Natal	3	Extension (1) Head of Department (2)
Central University of Technology, Free State	1	HOD Department Agriculture (1)
c. Provincial Department of Agriculture		
Western Cape Department of Agriculture	21	Extension advisors (12) Researchers (crop, fruit and pomology)(7) Agricultural engineers (2)
Limpopo Department of Agriculture	6	Agric engineer (1) Crop science (1) Extension advisors (3) HOD (1)
Mpumalanga Department of Agriculture	7	Extension advisors (7)
KwaZulu-Natal Department of Agriculture and Rural Development	3	Soil science (1) Extension manager (1)
Free State Department of Agriculture	6	Extension managers (4) Extension advisors (2)
Northwest Department of Agriculture	2	Extension advisors (2)
Eastern Cape Department of Agriculture	15	Extension advisors (12) Manager Extension (3)
Gauteng Department of Agriculture and Rural Development	5	Extension advisors (5)
d. Agriseta accredited trainers and private organisations		
Mzinti training centre	4	Agricultural trainers (4)
Agriwiz	3	Crop science (2) Soil science (1)
McCain	1	Crop/Extension science (1)
TSB	4	Extension (4)
Akwandze	1	Agric Economics (1)
TSGro	2	Extension (2)
Canegrowers/SASRI	8	Extension/Sugarcane (7) Manager (1)
SA Breweries (SAB), Taung	2	Crop science /Extension (1) Extension management (1)
Dadhla Associates and Department Cooperative Governance and Traditional Affairs	4	Agricultural economics (21) Accounting (2)
Casidra, Western Cape	1	Extension (1)
e. Comprehensive University of Technology		
University of Mpumalanga	3	Irrigation (2) Crop science (1)
f. International professionals consulted		
SARIA members	22	Irrigation professionals (22)
Ministry of Agriculture and Fisheries, Mozambique	19	Head of Department (1) Extension managers (14) Researchers (crop) (4)
Total	**166**	

4.1 Overview on consulted training and education organisations

The qualitative data was collected through various discussion forums and workshops conducted with staff from nine agricultural colleges (or also known as agricultural training institutes (DAFF, 2015) and four universities of technology. A brief overview of the current status and programs offered by these training and educational organisations are presented.

4.1.1 Agricultural Colleges offering AET programs

i. Taung Agricultural College, Northwest Province

During the discussion forums held with lecturing staff at Taung Agricultural College, a better understanding was gained of the challenges this specific training organisation is facing with regard to inappropriate budgets, understaffing of lecturers and poor practical training facilities. Taung Agricultural College is offering a three year Diploma in Agriculture in Irrigation (NQF level 6) since 2013 which consists of:

- Agricultural management (Agricultural economics; agricultural marketing; agricultural financial management; basic computer management; agribusiness management and rural development)
- Plant production (Soil science; agricultural botany; horticulture; agronomy and pasture science)
- Animal production (Anatomy and physiology; pig production; small stock production; poultry production; large stock production)
- Irrigation and engineering (Fundamentals of irrigation; pumps and propulsion; hydraulics and flow system design; irrigation equipment design ;drainage systems and design; irrigation management practices; irrigation economics; soil and water conservation)

Many of the modules included in the current syllabus was designed and added after taking into account the “knowledge profile” that was constructed during the WRC consultation project in 2006/7 (Stevens and van Heerden, 2007). During the designing and finalisation of the new curriculum for Taung, the research team was on many occasions in consultation with the previous principal of Taung, Mr van Heerden.

Figure 5: Taung Agricultural College experimental farm

ii. Madzivhandila Centre for Agriculture and Tompi Seleka College of Agriculture, Limpopo Province

The two Limpopo colleges of agriculture reopened their doors for academic learning in February 2015, after they have lost their accreditation from the Council for Higher Education (CHE) in 2005. Madzivhandila Centre for Agriculture can admit 60 students, while Tompi Seleka can admit 80 students. These two colleges currently provide only skills development short courses to farmers since 2006. Urgent transformation of the syllabus offered at the two organisations is required as well as the upgrading of training facilities. Mr P Modise (Principal Tompi Seleka) and Mr K Madau (Manager Learner Support at Madzivhandila Centre for Agriculture) both agreed that the current syllabus offered in plant production (specifically with regard to the content on irrigation water management) is out-dated, and requires urgent attention.

The envisaged Farmer Entrepreneur and Incubation Centres (FEDIC) that will be established at both these agricultural colleges will also provide short courses in irrigation water management. The learning material package can be of great support in the designing of these courses as well as in the reviewing of out-dated syllabus content.

iii. Fort Cox College of Agriculture and Forestry and Tsolo Agricultural College, Eastern Cape

Fort Cox College of Agriculture and Forestry received full accreditation in 2002, and in 2010 the curriculum was reviewed based on external reviewing report to make it more in line with the industry and socio economic need of the country. Fort Cox College for Agriculture currently offers two programs namely a Diploma in Agriculture and Diploma in Forestry. The college exists of a farm of 1500ha in size, of which 60 ha is cultivated land. According to the

acting principal (Dr Letsoli) the current syllabus used for training of students in crop and irrigation water management is out-dated and the practical training offered is of a substandard level. After the discussions held during April 2015, a request was received for 100 hard copies of the training material, which was assumed, could be distributed to students as prescribed text books.

Tsolo is partially accredited for training of students namely by providing a three year Diploma in Animal Health. Currently the training offered in crop production (which includes training in food garden production) is offered as part of the skills development program (short courses) to support farmers. The learning material is envisaged to support the development and improvement of content of these short courses.

iv. Owen Sithole College of Agriculture and Cedara College of Agriculture, KwaZulu-Natal

During a workshop on the reviewing of the content of extension programs offered at South African tertiary organisations held in Pretoria, in November 2015, two sets of hard copies of the learning material were handed to the Principals of Owen Sithole College of Agriculture (Mr M Mazibuko) and Cedara College of Agriculture (Mr B Lutig) for distribution and feedback from the respective college lecturing staff. Very positive feedback was received from the Principal of Owen Sithole and further collaboration between the research team and the specific college was proposed. The farm on which Owen Sithole College is situated is approximately 670 ha and since the location of the college is in a subtropical area, much emphasis is placed on the production of subtropical fruit. Diplomas in Agriculture (Animal Production, Crop Production or Consumer Science) are offered at the college. Lecturing staff and management perceived the learning material to be extremely valuable for reviewing of current curriculum content offered in the diploma program with crop production as main stream. It will also be used for reviewing of the curriculum content in the animal and consumer science diploma programs.

At Cedara Agricultural College various qualifications are offered which include a Higher Certificate in Agriculture (2 years) and Diplomas in Agriculture (3 years) with either crop or animal as the main stream and in Home Economics as the main stream. Figure 6 illustrates the typical qualification profile offered at Cedara Agricultural College.

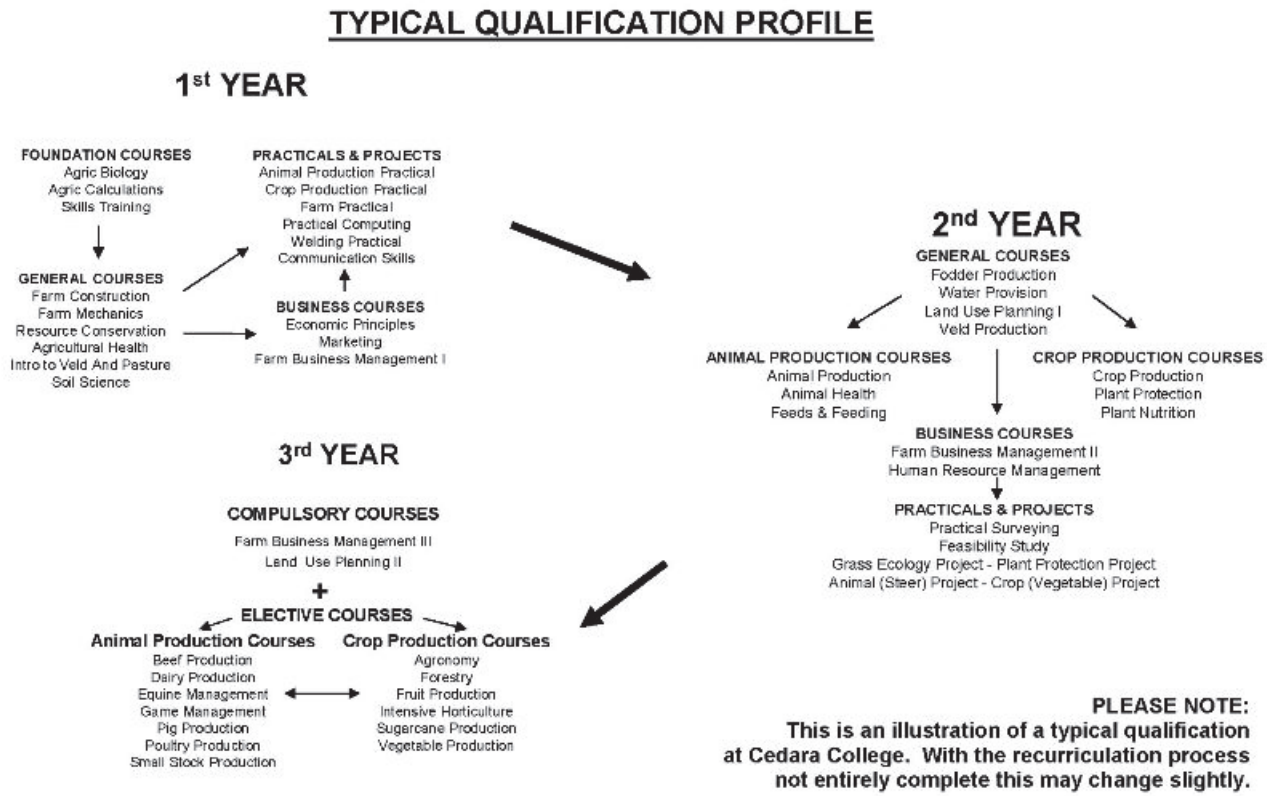

Figure 6: Typical qualification offered at Cedara Agricultural College (DAEA KZN, 2015)

The Diploma in Agriculture with crop production as main stream include courses like crop production, plant protection, land use planning, extension and farm business management (entrepreneur skills and risk management). The Diploma in Agriculture with animal production as main stream include courses like animal production (large and small stock), land use planning, extension and farm business management (entrepreneur skills and risk management). The curriculum used for training of agricultural diploma students in plant production at Cedara is relatively up to standard an advanced in comparison to the other agricultural colleges. However there are some learning areas included in the learning material package, which could enrich the current syllabus offered in crop production and agricultural engineering. Apart from the diplomas offered in Agriculture and Home Economics, Cedara College of Agriculture in collaboration with University of KwaZulu-Natal, is offering a B Agric degree in Agricultural Extension.

v. The Cape Institute for Agricultural Training: Elsenburg

In the Western Cape lecturing staff based at Elsenburg, irrigation engineers; researchers and extension staff were invited to a workshop that was held June 2015 at Elsenburg. The Cape Institute for Agricultural Training: Elsenburg offers the following training:

- *B Agric Degree Programme (three years):* The B Agric degree program is offered in association with the University of Stellenbosch. Main study fields include: agritourism,

agronomy and pastures, animal production (small stock), animal production (large stock), vegetable production, cellar management, pomology, extension, viticulture and oenology

- *Higher Certificate in Agriculture (two years)*
  Specialising in one of three program options:
  - Program A: Agronomy, Vegetable Production, Large Stock, Small Stock
  - Program B: Pomology, Viticulture
  - Program C: Large Stock, Small Stock, Monogastric Animals, Agronomy
- *Diploma in Agriculture (one year):* Modular experiential training program in respect of production, agricultural management, natural resource management and extension.
- *Diploma in Cellar Technology (one year):* Modular program aimed at training candidates as winemakers.
- Various short courses offered by the FET (Further Education and Training) Section
  - Learnerships
  - National Certificate in Plant Production NQF level 1 and / or level 4 in the following study fields: Viticulture; Vegetable Production; Fruit Production

vi. Grootfontein Agricultural Development Institute, Northern Cape

The learning material was introduced to lecturing staff of Grootfontein Agricultural Development Institute, Middelburg who is offering a number of diploma programs. During 2014 the Grootfontein College of Agriculture implemented the Competency Based Learning curriculum at first year level, and negotiations with the University of the Free State (UFS) were continued to finalise the curriculum for joint presentation of the B Agric degree. A bridging course was approved by the UFS for Grootfontein students who obtained their Diploma in Agriculture to obtain a B Agric degree after one year of study at UFS. Apart from learners from matric and Further Education and Training (FET) programs who do skills training on NQF level 2-4, farmers and the Provincial Departments of Agriculture are the other main focus groups. Farmers are from Eastern, Northern and Western Cape provinces, and the training agenda is most of the time being set by the Provincial Departments of Agriculture.

Apart from the accredited NQF6 diploma being offered, AgriSETA also granted approval to the institute for NQF level 2-4 training programs. The Diploma in Agriculture consists of approximately 60% theoretical training and 40% practical training. The three year instructional program offered at Grootfontein Agricultural Development Institute includes courses like agricultural management, crop production, information management, agricultural law, agricultural extension, and agricultural entrepreneurship. Irrigation water management forms part of the crop production courses offered at the institute.

4.1.2 Universities of Technology

Since many of the Universities of Technology are either already involved or will be involved with the offering of training in agricultural extension, it was appropriate that these educational or training organisations were also targeted. The following universities of technology have been involved in discussions and bilateral meetings: Central University of Technology (CUT), Mangosuthu University of Technology and Cape Peninsula University of Technology (CPUT).

i. Cape Peninsula University of Technology (CPUT), Western Cape

Lecturing staff responsible for the offering of courses as part of the BTech degree and National Diploma in Agriculture were involved in discussions held June 2015, and both welcomed the learning material package to be used in the practical as well as theoretical training of students. The Cape Peninsula University of Technology offers the following agricultural diplomas and degrees under the Faculty of Applied Sciences on the Wellington Campus:

- *National Diploma: Agriculture Management:* The purpose of this program is to provide industry with agricultural and extension practitioners that are able to apply technical knowledge, practical competencies and appropriate extension and scientific communication skills in operating agricultural production units effectively as part of a production and/or advisory team.

The main study fields comprise of: Plant Production; Agricultural Economics ;Vegetable Production; Crop Protection; Soil Science, Agricultural Extension; Agricultural Marketing; Agricultural Mechanization; Soil Surveys; Animal Nutrition; Oenology; Viticulture; Agricultural Production Management; Fruit Production; Cultivated Pastures; Small Stock Production The third year of this diploma program is dedicated to experiential learning. CPUT's Department of Agriculture utilises the project-based modality of the Work Integrated Learning methodology, whereby students are placed in industry at approved agricultural businesses to gain experience and prove their ability to integrate theory with practice. Learning is focused on the overall management of an agricultural business, including aspects such as:

  - the natural and business environment wherein the business is operated
  - production processes and systems
  - the labour practice implemented in the business
  - the prevailing management information system in the business

- *BTech: Agriculture*

The admission requirements for entering this study are an applicable three year national diploma in Agriculture or an equivalent qualification on NQF level 6. The course is structured to provide career-oriented education in order to prepare students for higher level employment in the agricultural sector. The purpose of this program is to provide industry with agricultural and extension practitioners that are able to apply technical knowledge, practical

competencies and appropriate extension and scientific communication skills in operating agricultural production units effectively as part of a production and/or advisory team. Main study fields for a BTech degree include: Extension Bridging; Agricultural Communication; Agricultural Extension; Research Methodology, Animal Production and Crop Production

ii. Mangosuthu University of Technology, Kwa Zulu Natal

The Department of Agriculture at Mangosuthu University of Technology offers the following diplomas in agriculture:

- *National Diploma: Agriculture and National Diploma: Agriculture (ECP)*

These programs aim to equip students with skills in running of enterprises in plant production from seedling preparation, through planting and general management to marketing. Plants studies are biased to field crops, fruit and vegetables. The study of these enterprises is complemented by studying agricultural extension which focuses on dissemination of agricultural information to farmers, agricultural economics which deals with business aspects, and soil science which is presented as a medium for plant growth.

- *National Diploma: Agriculture: Animal Production and Diploma: Agriculture: Animal Production (ECP)*

These programs aim to equip students with skills in running of enterprises in animal production. Animal studies are biased to beef production, milk production, pig production, poultry production (broilers and layers) and small stock production (goats and sheep). The study of these enterprises is complemented by studying pasture sciences.

The study duration for the National Diploma: Agriculture and National Diploma Agriculture: Animal Production programs are three years. Major study fields include: agricultural botany; agricultural economics; agricultural extension; crop production; crop protection; agricultural calculations; agricultural mechanisation, soil science, vegetable production, agricultural marketing; agricultural production management, fruit production and agricultural production techniques. The first two years is being spent full time at the university and the third being work-integrated learning at a practical agriculture environment.

For the National Diploma: Agriculture (ECP) and Diploma: Agriculture: Animal Production (ECP) the study duration for these programs are four years. The major study fields are the same as for National Diploma Agriculture, but the first year includes study fields like basic English, basic numeracy, physical science, plant biology, chemistry, agricultural numeracy, animal biology, communication and computer literacy. The first three being spent full-time at the university and the fourth being work-integrated learning at a practical agriculture environment.

iii. Central University of Technology (CUT), Free State

The Central University of Technology, Department of Agriculture, is since 2014 offering an Advanced Diploma in Agricultural Extension. This is a first diploma of this kind offered at the university and the diploma will provide learners a proper understanding and knowledge of extension and an integrated effective mix of extension skills that build on prior graduate level agricultural knowledge. The admission requirements for entering this study are an applicable three year national diploma or National Diploma in Agricultural Management.

The following diplomas and degree are offered at CUT:

- *National Diploma : Agricultural Management*

Major study fields include: agricultural management, plant production; animal production agricultural soil science; pasture science; soil classification; production and operational techniques; agricultural engineering; personnel management; agricultural law and optional instructional offerings. The third year of the diploma is dedicated to work integrated learning.

- *BTech : Agricultural Management*

Duration of program is one year after completion of National Diploma: Agricultural Management or equivalent qualification.

- *Advanced Diploma in Agricultural Extension*

Duration of program is one year after completion of National Diploma: Agricultural Management or equivalent qualification. Major fields of study: agricultural economics; behaviour change and intervention; advisory principles and approaches; leadership, group dynamics and networking in extension; project planning, implementation and evaluation.

iv. Comprehensive University of Technology (University of Mpumalanga)

The University of Mpumalanga, a comprehensive university, was opened in February 2014 and the Lowveld College of Agriculture was formally incorporated into the UMP on the 1st January 2015. The following programs are offered:

- Bachelor of Education (Foundation Phase)
- Diploma in Hospitality Management
- Bachelor of Agriculture (Agricultural Extension)
- Diploma in Information Communication Technology in Applications Development

- *Diploma in Agriculture : Plant Production (Dip Agriculture: Plant Production)*

The diploma which prepares students to work on and manage farms in the sub-tropics, focus on both basic subjects including botany, soil science and water management, and more applied subjects including the production of sub-tropical fruit such as citrus, cotton and sugar cane. A strong emphasis is placed on practical skills and the third year is dedicated as a full year of experiential learning where students are placed on farms.

- *Bachelor Degree in Agriculture Extension and Rural Development*

Currently the Bachelor Degree in Agriculture Extension and Rural Development is still at a beginning stage with the designing and structuring of intended courses. The learner guide on extension (TT 541/12) was acknowledged to be of great support in this exercise.

It is also envisaged that an Advanced Diploma in Agricultural Extension will be offered at the university due to the huge number of extension staff employed by the Department of Agriculture without appropriate agricultural extension background or appropriate training. These extension staff can only be registered as a Certified Natural Scientist (level B) with SACNASP. The University has officially applied with the Council for Higher Education for the offering of this course from 2016 onwards.

4.2 Consulted international irrigation and extension practitioners

This part of the report focuses on the discussion forums and workshops held with international irrigation professionals and extension advisors, mainly from the Southern African Development Community (SADC). First of all a brief overview of irrigation potential in SADC is provided, which outlines the importance of irrigation for food production in southern Africa. This is followed with a brief description of the consultation approaches used to collect views and perspectives from the international participants.

Southern Africa irrigation potential

About 70% of citizens of the Southern African Development Community (SADC) depend on rainfed agriculture for their livelihoods (SADC 2003). Moreover, enhanced and sustainable development of the irrigation sector is the engine of improved economic growth, socio-human development, food and nutrition security and alleviation of poverty (SADC 2014). Rainfed agriculture is directly exposed to the hazards of climate and SADC's rainfall patterns are characterised by high and unpredictable variability over the seasons, years, and decades (IPCC, 2014). It is one of the few regions in the world that will experience significantly drier conditions, more extreme and unpredictable dry spells, droughts, and floods, while sea levels will rise faster here than elsewhere. These increased temperatures and less predictable, more variable extreme events hold SADC's farmers and economy 'hostage to hydrology'. This is also true where average rainfall is abundant. These predictions of long-term climate-induced changes render the need for improved agricultural water management.

The CAADP of the African Union's (AU's) New Partnership for Africa's Development (NEPAD) recognized this unlocked potential throughout Africa by prioritizing the first of its four pillars, that of *"Sustainable Land and Water Management"*. In pillar one, African states committed to the doubling of irrigated area from the 3.5% at the time to 7% by 2015 (CAADP, 2009). SADC's Regional Indicative Strategic Development Plan (2003, revised in 2007 and 2015) re-affirms CAADP goals, including pillar one. The SADC Regional Agricultural Policy (RAP) (SADC 2014) envisages the improvement of the management of water resources for agriculture. RAP commits to assess the effective utilisation of existing irrigation infrastructure

as well as to promote new infrastructure development (SADC 2014). The Regional Strategic Action Plan IV (RSAP IV) (SADC 2015), which is based on the SADC Water Policy (2005) and Strategy (2006) aims at 'An equitable and sustainable utilization of water for social and environmental justice, regional integration and economic benefit for present and future generations'. Noting that there is about 50 million hectares (ha) of irrigable land available within the SADC Region of which only 3.4 million ha (7%) is currently irrigated, the RSAP IV emphasizes the importance of infrastructure development and water resource management for food security in the water-food nexus.

As shown in Table 3, out of SADC's total land area of about 1 billion ha, 266.8 million ha are arable land, but only 52.8 million ha are cultivated. Table 4 combines estimates of potentially irrigable land per country and actually irrigated area. Estimates of potentials have been set at 20.2 million ha at regional level. Of this total potential, 6.7 million ha is already equipped for irrigation (Table 4). This leaves 13.4 million ha of high-potential area for new irrigation development. Important differences exist between countries, while in South Africa all potential has been used. In all other countries there is still a major unused potential.

Table 3: Areas of different land use categories in SADC countries

Country	Total land area (1 000 ha)	Arable land (1 000 ha)	Cultivated area (1 000 ha)
Angola	124 670	32 000	3 300
Botswana	58 173	2 909	380
DRC	234 541	80 000	7 800
Lesotho	3 036	308	334
Madagascar	58 704	8 000	3 550
Malawi	9 428	3 600	2 440
Mauritius	204	78	106
Mozambique	79 938	36 000	4 435
Namibia	82 562	25 000	820
Seychelles	46	1	7
South Africa	122 081	18 320	15 712
Swaziland	1 736	175	190
Tanzania	88 580	40 000	5 100
Zambia	75 261	16 350	5 289
Zimbabwe	39 076	4 100	3 350
SADC	986 474	266 841	52 813

Source: FAO 2005; Aquastat database (FAO 2013)

Table 4: Irrigation potential area in SADC countries

Country	Irrigation potential (1 000 ha)	Irrigation potential equipped for irrigation (1 000 ha)	Potential area for new irrigation development (1 000 ha)	Area under non-equipped agricultural water management (1 000 ha)
Angola	3 700	85.5	3 614.5	0.4
Botswana	13	1.4	11.6	6.5
DRC	7 000	10.5	6 989.5	3.0
Lesotho	13	2,6	9.9	0.0
Madagascar	1 517	1 086.0	431.0	10.0
Malawi	162	73.5	88.4	0.0
Mauritius	33	21.2	11.8	0.0
Mozambique	3 072	104,4	2 967.6	13.7
Namibia	47	7.6	39.7	2.0
Seychelles	1	0.3	0.7	0.0
South Africa	1 500	1 500.0	0.0	170.0
Swaziland	93	49.9	43.4	4 935.1
Tanzania	2 132	184.2	1 947.8	0.3
Zambia	523	155.9	367.1	100.0
Zimbabwe	366	173.5	192.1	20.0
SADC	20 172	6 733.7	13 437.9	5 260.9

Source: Aquastat database (FAO 2013)

i. SARIA workshop

During the first round of discussion forums, a workshop was held at Roodevallei Hotel in Pretoria from 26 -27 February 2014 with Southern African Regional Irrigation Association (SARIA) members. SANCID plays a vital role in the region and is annually hosting the Southern African Regional Irrigation Association (SARIA) workshops and steering committee meetings since 2000. SANCID also played an important role in reactivating SARIA and currently a memorandum of agreement exists between the following SADC countries: South Africa; Botswana, Swaziland, Lesotho, Namibia, Malawi, Zambia, Zimbabwe, Tanzania; Madagascar; Mauritius, Mozambique, Angola and the Democratic Republic of Congo. The theme for the workshop held at Roodevallei Hotel was *"Extension for Management of Agricultural Water"* and formed part of the annual SARIA meeting held in South Africa.

The workshop was attended by 22 delegates from the various participating SADC countries and consisted of academia, government officials, irrigation researchers and research managers participants were presented with hardcopies of the main report and a full set of learning material (9 parts). The SARIA attendance list is included as Annex 3. The workshop was structured with the primary focus to create awareness about the learning material and to identify the current situation of training of extension advisors with regard to irrigation water

management in the various countries (SADC). The main topic areas addressed during the one day workshop of rich discussions included:

1. The role and impact of extension advisors in irrigation management in the various countries with specific reference to support of irrigation farmers
2. Background to the development of the learning material for irrigation advisors
3. Current status of training and education in irrigation water management within the various countries
4. Way forward and key messages

The facilitation of the workshop was steered by Dr Gerhard Backeberg and the program (Annex 2) served as the structure for the overview of the process followed during the workshop.

ii. Training of Mozambique extension staff (PRONEA SUPPORT PROJECT (PSP) / Direcção Nacional de Extensão Agrária (DNEA))

Extension and research staff from the Ministry of Agriculture and Fisheries (MAF) from Mozambique attended a two week training course in Agriculture Extension offered by CE@UP during June 2015. These participants consisted of extension and research managers employed by MAF and due to the very long period of civil war in the country, were interested about any new development in agriculture. During the training course the role of newly established National Irrigation Institute (2012) was discussed as an innovation platform where respective stakeholders namely government, academia, private sector and farmers are collaborating in efforts to .enhance irrigation development in the country. Currently only a small percentage of arable land (36m ha) is under irrigation, but government has placed huge focus on the development of irrigation and irrigation agribusinesses. This discussion lead to the scheduling of a special session where a brief overview of the learning material was presented followed by discussions. Participants were presented a hard copy of the main report which includes also a CD with the learning modules. The attendance list is included as Annex 4. This topic initiated

5. Syntheses of discussion forums and key messages

The following key messages, opportunities and challenges for the shifting the discourse within the educational and training to include irrigation water management learning material in existing curricula offered at agricultural colleges and universities of technology are reflected. Secondly the insights of international participants from SADC with regard to the current status of irrigation water management training, skills and knowledge level of extension advisors on irrigation water management and the way forward will be discussed.

5.1 Key messages

a. Current curricula and training programs (NQF level 5 and 6) offering

- Participants involved in educational training of students at agricultural colleges and universities of technology acknowledged the fact that current curriculum offering has huge shortcomings regarding basic information about irrigation water management – either totally missing or out dated. Interactions with lecturing staff emphasised the fact that programs offered at educational organisations differ markedly in quality, standard and outcomes. This point was specifically raised by participating lecturing staff at CUT, Mangosuthu University of Technology, Elsenburg CIAT, Owen Sithole College of Agricultural, Madzivhandela Centre for Agriculture, Tompi Seleka College for Agriculture, University of Mpumalanga and CPUT.
- The existence of theoretical information and practical exercises for updating of existing curricula is not to be found in one or two handbooks, and therefore no prescribed handbook can be recommended to students. The learning material on irrigation water management will therefore be of great support to help students to obtain a more holistic perspective of irrigation water management and the material can even be used to address this need. This need for the use of the learning material as possible handbooks for students was highlighted when requests from Fort Cox College of Agriculture and Forestry, Mangosuthu University of Technology and Owen Sithole College of Agricultural were received for 100 plus copies of the learning material for possible hand-outs to students. Therefore the need for the compiling of context specific handbooks for irrigation water management in South Africa should be urgently considered.
- Current educational programs offered at agricultural colleges and universities of technology often lack quality practical or skills training that are so important for the preparing of students for the agriculture industry.
- Fragmentation and poor coordination characterise the programs offered between formal and informal educational training, with poor articulation vertically but also horizontally.
- Irregular reviewing and stock taking of the appropriateness and requirements from the agricultural industry regarding agricultural educational programs. Participants in general agreed that reviewing of curricula and training programs do not take place regularly. Perhaps one of the reasons for this shortcoming is that poor formal linkages exist between AET providers and the agricultural industry, with regard to what is required for successful employment of students and what should be strategically be considered with regard to the current curricula and programs offered.

- Formal education and training at agricultural colleges (they do fall under the ambit of the Department of Agriculture) is poorly controlled by the various provincial departments of agriculture both in terms of curriculum as well as qualifications of lecturing staff.
- Informal training (short courses) is to a large extent untested in terms of quality and appropriateness.

b. Knowledge and experience level of lecturing staff at colleges

- Formal education levels of lecturers at colleges: - very often lecturers are adequately trained in theoretical aspects of irrigation water management and agriculture in general- but have limited practical experience. Therefore they find it challenging most of the time to demonstrate to students the necessary skills.
- Many junior lecturing staff appointed at AET centres without previous experience in teaching and irrigation farming – envisaged that the learning material will help with reviewing and development of curricula and also help to build the necessary self- esteem.
- At Grootfontein Agriculture Development Institute, due to a lack of Agricultural Technicians, the course in irrigation management cannot be presented.

c. Status of irrigation equipment at agricultural colleges and training centres

- The irrigation equipment at many of the AET centres like Mangosuthu University of Technology, University of Mpumalanga, Owen Sithole College of Agricultural, Taung Agricultural College. Madzivhandila Centre for Agriculture and Tompi Seleka College of Agriculture is either out dated or in a bad condition and therefore not suitable for training.
- Poor maintenance of irrigation equipment at AET centres exist due to a lack of staff interest (demotivated) and poor budgets allocations.
- Poor budget allocation for the buying of new and modern irrigation equipment necessary for demonstrating new methods of irrigation hamper effective practical training. The practical nature of AET implies that this type of training is expensive.

d. Urgent need for developing of aligned short courses

- Urgent need exists for designing and offering of structured short courses and on-the–job skills training to small scale, commercial farmers and extension advisors at agricultural colleges and universities of technology. Although the constraints to attain full potential of agricultural performance are known, in

general inappropriate response from formal education and training programs to address the required improvement prevail.

- Participants from SASRI, KZN DoA, Grootfontein Development Institute, Elsenburg CIAT, TSB and Agriwiz are excited about the potential use of the learning material in current short courses offered at these centres and companies.
- Accreditation endorsement of learning material with quality requirements of SAQA important for the offering of accredited short courses, otherwise largely untested in terms of quality.
- The development of short courses in irrigation water management important for AET centres already functioning as “Specialised Centres of Excellence”. like Elsenburg CIAT and Cedara Agricultural College Currently no short courses in irrigation water management are offered.
- Need for increased participation and collaboration of employers and industry in the designing and offering of training opportunities like learnerships and skills programs.

e. Changing extension landscape

- Current extension initiatives are not aligned with the needs of farmers on irrigation schemes. Irrigation farmers are most of the time involved in growing high value crops - and therefore requires a wide range of extension support, covering technical but also organisational, marketing and entrepreneurial skills (soft skills). Farmers must be challenged to think beyond the farm gate - and in this regard the comprehensive learning material package is ideally suited to help with the retraining and reorientation of extension advisors.
- Changing views on who should provide extension support to farmers necessitates rethinking of the role of irrigation extension advisors and their training. The shrinking ability of public extension to address the needs of irrigation farmers necessitates the evolving of the private sector alongside the government in provision of research, extension and training of students – a system mind set is required!. An example of this in practice is where TSB provides total extension support to their growers which include advice on site selection to technical guidance throughout the growing period as well as support regarding take-off and marketing. This holistic approach requires however training of extension support on more aspects than only sugarcane husbandry and irrigation water management, and therefore the learning material is excellent positioned for this requirement.
- Inadequate technical (day-to day) support to irrigation farmers by public extension staff - especially to newly settled farmers open the way for other role players like the private sector and NGOs to provide technical support and training. Much of the extension and education support being provided by

agricultural companies is linked to purchase of products, and many of the representatives of these companies require additional skills and training.

- The need for the development of a “workable knowledge” (theoretical as well as how to apply this theoretical knowledge) on irrigation water important is a prerequisite for effective extension support.
- The changing extension landscape necessitates the effective coordination between public and private agribusinesses, cooperatives and producer groups. Public-private-partnerships (PPP) are required for addressing of skills and work integrated learning requirements that occur at AETs. Excellent examples occur in the field where private and public sector joint hands with regard to the training like SASRI and KwaZulu-Natal Department of Agriculture in the training of small-scale sugarcane farmers and extension advisors from the provincial department in sugarcane husbandry. The same collaboration exists between TSB and Mpumalanga Department of Agriculture. In the Western Cape, CPUT established excellent relationships with agribusinesses like the du Toit Group and others for the placement of BTech and Diploma students for work integrated learning.

f. South Africa water scarce country

- Agricultural producers need a wide range of hard and soft technologies and approaches required to make appropriate choices tailored to their own situation and needs. Critical scientific and practical needs of farmers should be addressed by well trained and skilled extension corps.
- Water planning and adaptive initiatives for the agricultural sector is urgently required - however a favourable policy, institutional and regulatory enabling environment should be in place to ensure that the initiatives are not hampered.
- Although the learning material is important for training of extension advisors and students at AET centres, it should also be used to make youth and the general public aware of efficient water use- for example home gardening, re-use of grey water, etc.

5.2 Opportunities for uptake of learning material in curricula and training programs

The interactive discussions and workshops with academic staff, extension advisors, policymakers and farmers uncovered a number of opportunities with regard to the uptake of the learning material.

a. Potential uptake of training material in short courses and skills training(informal training)

- Short courses in skills training by Elsenburg CIAT and Grootfontein Agriculture Development Institute are currently provided on many important aspects of farming, but exclude training on irrigation water management. The discussions unveiled the possible inclusion of this as part of the short courses offered.
- Current public-private-partnerships that exist between SASRI and KZN DoAE, TSB and Mpumalanga DoA and SAB and Northwest Department of Agriculture are examples where secondment of extension staff from the respective provincial departments of agriculture took place , but which require additional skills and hands-on training in irrigation water management.
- Elsenburg (CIAT) through its cooperation with Wageningen University is currently involved in a program called: *Extension: Big Five*. This program is currently presented to front line extension advisors from the three Cape provinces (Western, Northern and Eastern). The objective of the programme is to equip extension officials with additional knowledge and skills which will assist them to perform their role in agricultural and rural development more efficiently and effectively. The program consists of the following modules:
    - RHINO: The setting in which we act
    - ELEPHANT: Me & the others
    - BUFFALO: The group & me
    - LION: Economic viability of alternatives
    - LEOPARD: Getting things done

  The possible inclusion of a number of modules from the learning material in this Big Five program will be explored by CIAT staff.
- At Elsenburg CIAT, participants are of opinion that the learning material can also be considered for using in the *"Smart Agriculture Project-Agroclimatology"* implemented in the Western Cape.
- At CPUT the possibility of including specific modules from the learning material in their current Work Integrated Learning program which diploma students follow during their 3rd year of training will be explored.

- CPUT is also involved in the establishing of an Agri-Hub outside Wellington, where practical work and research in crop production will take place. The possible inclusion of the learning material into practical training programs envisaged will be considered.
- In the main report (TT 539/12 (Vol 1)) the poor status of on the job training to extension practitioners was highlighted. The opportunity of using the training material in short courses aligned for the up skilling of extension advisors was echoed by many. In essence, a short course of this kind may or may not be awarded credits or CPD points, depending on the purpose of the program.
- The general feeling is that as far as possible only accredited short courses should be offered and therefore training organisations that offer these short courses, should comply with the requirements for accreditation to ensure quality assurance.
- The format of this material is flexible enough to be used for the development of learnership programs and short courses. This was also the view expressed by consultants (Agriseta accredited trainers) and officials from the Department of Cooperative Governance and Traditional Affairs (DCoGTA). DCoGTA is responsible for the housing of the Community Works Programme (CWP), a government programme aimed at tackling poverty and unemployment. On invitation by the Steering Committee of DCoGTA and implementing consultants (Dadhla Foundation) the learning material was introduced to members of the steering committee. DCoGTA is responsible for the training of approximately 300 small scale farmers per year, mainly involved in home food gardening at various defined local sites across the country.

b. Use of material in fostering awareness about water quality

- South Africa is facing serious challenges regarding the management of water quality and combating of water pollution. Great appreciation for the inclusion of modules on water quality and how to measure it was expressed by participants in nearly all discussions.
- A shortcoming with regard to this specific module identified is however the limited inclusion of pictures, case studies and diagrams to illustrate the extent of the problem in a South African context.

c. New entrants to irrigation farming (land reform and expansion of irrigation) (Farmer Entrepreneur and Incubation Centres)(FEDIC)

- Farmer training is critical for the viability and sustainability of agricultural projects. Three methods to facilitate skills transfer to new entrants and land reform beneficiaries are training through agricultural colleges, mentorship and management programs. The National Department of Agriculture (NDA)

identified FEDICs as the main model proposed for comprehensive farmer support programs. These training centres will be set up at agricultural colleges (Tompi Seleka and Madzivhandila already earmarked) and on commercial farms for on-farm training. General opinion that learning material modules can easily be tailor made for this need.

- Collaboration and possible partnerships between Provincial Departments of Agriculture, farmer organisations (like AgriSA, TAU, NAFU) and private agribusiness sector will be of utmost importance to ensure that these endeavours are fruitful and addressing the real needs of entrepreneurs.

d. Use of learning material in skills and hands on training

- Participants viewed the biggest advantage of the learning material to be the hands on or skills development approach that was followed with the development of the material. This will indeed help trainers/lecturing staff with the offering of practical /skills training. This type of training was highlighted to be very important within the context of an agricultural sector where there are regular changes (new products, new irrigation equipment becoming more sophisticated and new irrigation farming methods). This however requires training that can address these challenges with practical demonstrations and appropriate context specific learning content and skilled trainers.
- The skills and knowledge profile of newly established land reform beneficiaries on irrigation schemes reveal a critical demand for farm management and business management skills. Currently only a few FET colleges are offering agricultural related programs, and the potential use of the learning material in the designing and implementing of the training programs is prevailing.

e. Format of training material

- Participants expressed their appreciation for the fact that the training material was developed in a modular format, which makes it possible that a comprehensive learning package like this can be tailor made and structured for offering of short courses, learnership programs and educational training at a specific target level.
- The inclusion of practical exercises and case studies was highlighted. The practical exercises will serve as important parameters to test whether learners indeed understand the specific module and gained enough capacity and learning to apprehend this knowledge in a working environment.
- Requests for inclusion of more case studies especially regarding the following learning areas: irrigation water management, land use planning and irrigation economics were raised.

- Appreciation was expressed for the visual approach followed to demonstrate rather complex concepts and principles in the learning material

f. Workable knowledge

- Many of the participants viewed the "knowledge profile" as being perhaps too idealistic. After a thorough explanation of the rationale for the development of a "knowledge profile", participants understood better why all these learning areas should be covered. *The aim with the development of the learning material was to ensure that extension advisors should have a workable knowledge on each of these learning areas to help them with their communication after they have "trouble shoot" some problem on the farm.to subject matter specialists like agricultural economists, irrigation engineers, soil scientist, etc.*
- It was highlighted that extension advisors should at least select one of the technical fields to become an expert, and together with a good understanding of extension principles they will be able to consult with farmers effectively. Farmers expect the extension advisor to be at the forefront on at least some of these learning areas.

g. Professional registration of extension advisors with (SACNASP)

- Since 2013 all extension advisors need to be registered under the Natural Scientific Profession Act (Act No 27 of 2003). Once registered as a professional scientist with the South African Council for Scientific Professions (SACNASP), like applicable for any other professional career, it will be required from the applicant to earn a certain total Continuous Professional Development (CPD) points over a certain time span (5 years).
- The learning material is ideally suited for training that can be offered to help extension advisors earn the necessary CPD points in adherence with SACNASP regulations through accredited CPD courses.

h. NQF level descriptor

- The fact that the training material was developed at NQF 5 level descriptor during 2012 (since 2015 the level descriptors were adjusted by one level descriptor to NQF 6 level by SAQA) provides the opportunity to offer this material at a lower levels like NQF 3, 4 or 5 with the necessary adaptations as being required for the specific training situation.
- A question on what level descriptor the modules on irrigation engineering was developed arose during discussions in the Western Cape. It was explained that the two modules on Evaluation and Maintenance of Irrigation Systems which were included in Part 5: Irrigation Engineering were approached from a

view of what an irrigation manager or farmer will require for maintaining and evaluating of the irrigation system (s) on the farm. It was purposefully compiled to address the basics of maintaining and evaluating irrigation systems and to avoid duplication of what already exist in the comprehensive irrigation manuals presented by the Agricultural Research Council (ARC).

i. Strengthening agricultural colleges institutional capacity

- Instead of re-designing or development of new curricula at AET centres (agricultural colleges specifically), the general feeling from participants was to rather update existing curricula with information taken from the training material.
- Taung Agricultural College had the privilege to make huge adaptations to their curricula in 2013/14, and is since then offering a very comprehensive course in irrigation water management .Participants from Fort Cox College of Agriculture and Forestry, Tsolo Development Centre, Madzivhandila Centre for Agriculture, Tompi Seleka Agricultural College, Owen Sithole Agricultural College, Mangosuthu University of Technology all indicated their longing to update current curricula as soon as possible, preferably before the next academic year starts.
- Very positive from all the discussion forums was the general willingness and understanding voiced by participants that current curricula offered at the majority of AET centres should urgently be reviewed and the necessary changes should be made to address the shortcomings in training of farmers and extension advisors.

5.3 Challenges for uptake of learning material in current curricula and training programs

a. Evaluate current curricula offered at AETs and universities of technology and revise where required

- The development of new NQF aligned curriculums leading to a whole qualification is not simple, and takes apart from a lot of effort also quite time before it is finally accepted and implemented due to the specific process to be followed. Therefore the general recommendation by the majority participants involved in lecturing is to evaluate the existing curricula offered at colleges and where required revise it by using and adding modules or aspects of the learning material modules where applicable. This can be done throughout the academic year when required.

b. Designing and offering of accredited short courses

A *credit-bearing short course* (unit standard based)is a type of short learning program for which credits, in relation to the course's contribution to a particular program, unit standard and/or (part) qualification, is awarded. A credit-bearing short course contains less than 120 credits. An example is a skills programs leading to the achievement of credits in relation to a qualification.

A *non-credit-bearing short course* is a type of short learning program for which no credits are awarded in relation to unit standards or (part) qualifications depending on the purpose and/or assessment of the program. An example is program where less than one credit can be awarded. The challenge will be to develop short courses in irrigation water management based on the learning material for specific target learner groups with specific needs.

- Participants emphasised the fact that agricultural colleges are ideally geographically spread to offer a great deal of more short courses and specifically offering more unit standard based (accredited) short courses, which can be used for recognition of prior learning (RPL) for career or further studying opportunities.

c. Department Agriculture attitude towards the extension service

- Concern was expressed that extension services and farmer support rendered in the country is not addressing the needs of the broader farming community. In the case of new entrants to farming, extension services fail to address the needs for sustainable settlement and development notwithstanding the fact that the provincial departments have been restructured to deliver better services especially to land reform beneficiaries.

  The Agricultural Policy Action Plan (2014) clearly states:
  - ***Support services***
  - There is a clear gap in terms of the effectiveness of the support programmes and the impact these programmes have on the sector.
  - ***Skills development***
  - The absence of the correct and required skills, compromises the productivity and effectiveness of government and industry.

  BUT participants are questioning whether the Department really intends to make a difference in addressing the needs, since in many of the provincial departments of agriculture aside for the Farmer Support Services role clearly spelled out, extension advisors are not doing what they are trained for namely

to support farmers with decision making - instead they rather address political milestones set.

d. Position of agricultural colleges (AETs) in South Africa

- Although AETs serve as critical and essential providers of education and training services to the agricultural sector, numerous problems and constraints are being experienced at a number of AETs, which results in the outputs not fully meeting the demands and expectations of the industry. Due to this uncertainty and a debate that has been going on for the last 10 plus years, the standards and services offered at these AETs have deteriorated. Within the context of the HET and FET landscapes, numerous arguments for and against the transfer of agricultural colleges to the Department of Education have been made. The lack of decision and direction on above have resulted in limited financial investments in the AETs over the last decade, and left these centres with deteriorating infrastructure and diminishing morale amongst lecturing staff. Unless clear and distinctive decisions in this regard (not like the “official announcement” in 2004 by the Minister of Higher Education and Training that agricultural colleges will be transferred to the Department of Education with no implementation plan yet) are taken and implemented, AETs will and cannot fulfil the expected role they are supposed to play.

e. Role of public FET colleges in offering irrigation management programs

- Given the strong focus of FET colleges on providing industry led education and training programs (preferably in partnership with local business via collaborative training models where learners received practical training and exposure to companies), the focus was initially only on technical training. With the change in the education system a number of FET colleges changed their strategic vision and allowed a shift towards the so called more general business studies. With the introducing of the Re Capitalisation Program by the Department of Education in 2006 for the upgrading and addressing of needs at colleges, new curriculum guidelines were developed which also addressed relevant aspects important for agriculture:
    - General management studies, including aspects of human development
    - Business management and entrepreneurship studies (which includes marketing and financial management)
    - Engineering related studies
    - Variety of vocational oriented programs

The challenge will be to investigate the possibility if and how big a demand exist for the introduction of tailor made programs in irrigation water management at FETs where agricultural programs are offered. According to a report by Agriseta (2010) there are 21 colleges that are interested to offer agricultural programs:

- 6 colleges in KwaZulu-Natal province
- 2 colleges in each of Eastern Cape, Free State, Northwest and Mpumalanga provinces
- 3 colleges in each of Limpopo and Western Cape provinces
- 1 College in the Northern Cape province

f. Time required for offering training material as an accredited short course

- Time required for offering the comprehensive set of training material as part of accredited skills program will depend on the skills level of learners or clients attending the specific course and the number of credits required to be awarded from the course.
- The advantage of the format of the training material is that it allows any facilitator of such a course to adapt it as being required by the specific terms of reference for the training.

g. Appropriate skilled trainers and training sites required

- One of the biggest challenges in offering short courses at colleges and accredited service providers will be to select and find trainers with the necessary knowledge and experience in irrigation water management. Important will be the ability of the trainer to illustrate to learners how to apply the principles and information contained in the training material on the farm. The majority of accredited provider registered at Agriseta are geared towards farming enterprises and focus mainly on the lower NQF levels (1-4). Many of these accredited training providers however lack the necessary ability and capacity to operate within NQF, and it should therefore be ensured that they receive the support required.
- Secondly to find appropriate training sites with the necessary infrastructure and irrigation equipment for demonstration and practical exercises is of paramount. Where AET centres like agricultural colleges cannot provide these training facilities, PPP initiatives like the existing collaboration between TSB and DoA Mpumalanga, Taung and SAB, CPUT and private agribusiness should be considered.

h. Distribution of irrigation water management guidelines and information

- Discussions with various participants re-emphasised and highlighted again the huge need for this type of information to be distributed to all potential users, either to be used for training of students or to help and support farmers at farm level.
- The challenge in this regard will be how to distribute this information apart from in the existing training material format, perhaps in a book format or as guidelines to help farmers and extension advisors in the practising of their duties. Despite the variation in type and size of clientele, it is important that pathways are also developed where individuals can search for their own specific information needs.

i. Addressing of identified shortcomings in existing learning material

- Participants (extension advisors in the Overberg and lecturing staff from Elsenburg) in the Western Cape strongly voiced a need for the inclusion of guidelines on irrigation water management for deciduous fruit and viticulture production.
- Secondly they also expressed a need for the development of simple factsheets on important learning areas included in the knowledge profile, namely irrigation water management, soil classification and use, irrigation economics, etc. that can be used by extension advisors.
- The inclusion of more context specific cases studies will also enrich the learning material in general.

j. Up skilling of extension advisors

- A general feeling exists that the up skilling of extension advisors, especially those that are situated on irrigation schemes in the country is urgently required – taken into account South Africa's irrigation water challenges, water pollution, National Development Plan (NDP) and the role that extension should fulfil within it.
- Extension advisors can only fulfil their role within NDP *if* they are skilled and well trained. Currently many of the agricultural colleges are shifting their focus from training and educating extension practitioners to training of farmers like at Tompi Seleka College of Agriculture, Madzivhandela Centre for Agricultural and Tsolo Agriculture College. Agricultural colleges however will always play an important role in the offering of short courses - also to extension advisors *if* they have skilled and well trained lecturing staff to present it.
- Innovative and new thinking is required for the training and development of extension advisors. Since the aim with the development of the training

material was to support the skilling and training of extension advisors in irrigation water management - participants raised their concern about the urgency of implementation of such a re-training program. In this regard possible partnerships between AET centres and the private sector should be explored (for instance SABI and private irrigation companies like Netafim, Agriplas) to help with the designing and offering of training programs in the various provinces.

5.4 Mapping of international perspectives on the value of the learning material and way forward

The SADC participants highlighted the following opinions during the SARIA workshop and discussions with Mozambique extension staff:

a. Current status of training in irrigation water management in SADC countries

The status of irrigation water management training varies in the different countries, with some function within an enabling environment where government is supporting the initiatives while others do not enjoy the privilege:

- Too much theoretical training – nearly no practical training
- Very little focus on small scale irrigation farming (for instance in Swaziland where the focus is mainly on commercial sugarcane growing)
- View training organisations and centres offering training in irrigation water management (with exception of Zimbabwe, Democratic Republic of Congo, Tanzania). Mainly irrigation engineering courses presented in formal training programs.
- Use of out-dated information in training programs
- In-service training offered to extension advisors in Zimbabwe, Tanzania, and Malawi
- Policy environment in many countries not conducive for supporting of training – therefore limited financial and human resources allocated for this purpose

b. Skills and knowledge level of extension advisors on irrigation water management

The following opinions were provided regarding the competency level of extension advisors in the various countries:

- Current knowledge and skills level of extension advisors inadequate
- Extension advisors not appropriately trained for the challenges of supporting irrigation farmers
- Upgrading of skills urgently required for sustainable irrigation development

- In many of the SADC countries the budget allocation for extension advisors to fulfil their responsibilities is inadequate
- With many extension advisors there is a "resistance" to get involved with irrigation development –"dirty job"
- Lack of appropriate training results in low motivation and aspiration amongst many extension advisors
- Mentorship required for helping new extension advisors
- Lack of a succession plan within many of the Departments and extension organisations - many of the current extension staff close to the age of retirement

c. Way forward

The following aspects were raised in how to move forward and use the learning material to equip extension advisors with the necessary competency:

- Urgent attention to retraining and in service training of extension advisors proposed
- Partnership across countries within the SARIA family regarding the offering of training and up skilling of extension advisors
- SARIA can perhaps also support the necessary capacity building of extension advisors.
- What can be done to make the material perhaps more related to the specific challenges of the SARIA regions?
- Need for collaboration between various organisations involved in irrigation water management like SADC - but without a predetermined agenda. Investigate the possible opportunity of SADC secretariat "buying in" on the use of the training material.
- Important to assess the current skills and qualifications of extension advisors in the various countries.
- Investigate the possibility of bilateral agreements between countries on technical assistance – especially where training capacity is identified to be a shortcoming in a specific country.
- SARIA can perhaps consider offering of short courses in irrigation water management in future
- Drainage is not covered in the training material – but important aspect of irrigation management within the SARIA region
- Investigate the possibility of introducing farmer-extension training camps

6. Concluding thoughts and moving forward

Extension is a process of capacity building through engagement of individuals, groups and communities so that farmers are more able to deal with various issues affecting them and opportunities open to them. Extension therefore comprises of several activities that may provide: a framework for learning, a specific learning event; a process for developing or modifying specific management practices or technologies; individual mentoring and an on-going access to needed knowledge and information. Capacity building is not a once off event but must be rather seen as a ladder where information access, facilitation and empowerment, technological development, mentorship role of consultants/extension advisors and programmed learning are important pillars for increasing of capacity. Extension investments are therefore critical in South Africa to bring about change on the ground and a professional understanding about its rigour and processes is required by all involved. Educational or training of competent extension advisors is therefore imperative for the successful settlement of new farmers.

The reflections and insight of a strong set of knowledgeable individuals involved in training and extension provide a nuanced image of challenges and shortcomings that are critical to address training and education in irrigation water management. It helped to better understand the underlying challenges at training organisations for the uptake of the learning material. In summary there are a number of thoughts for moving forward:

a. *Quality of training in irrigation water management*

   A positive interest and need exists with all stakeholders to upscale the quality of training to extension advisors, farmers and academic staff/lecturers responsible for training through mainly the offering of accredited short courses. These courses can be offered through private training organisations, universities or agricultural colleges. An important condition will be that apart from theory being offered, attention should also be given to hands on skills during these courses. The training product should therefore be designed to address specific competency needs of clients.

b. Policy enabling environment

   The necessary conducive strategies and policies already exist for the role that extension advisors should play in enhancing sustainable irrigation agricultural development, such as the Farmer Support Programs that are implemented in all the Provincial Departments of Agriculture. However the lack of the necessary political will to implement these strategies in a way where extension advisors are released to address the real needs of farmers and do what is required of extension, undermine smallholder farmer advancement.

c. *Strengthening agricultural colleges organisational capacity*

An urgent need exists for reviewing of content on current curricula offered at Agricultural Colleges and Universities of Technology to align with industry needs. Instead of developing new curricula at colleges and universities of technology, the general feeling by participants were that updating of existing curricula with information from the learning material will be in the short term the best option. At Grootfontein, Elsenburg, CUT and Mangosuthu – serious staff shortages necessitate the employment of young, inexperienced staff which requires additional mentoring and support. This learning material can be of great support to help these young scientists and lecturers with the updating and revision of existing curricula. Overall much agricultural education and training focuses largely on primary production rather than on farming as a business- a crucial need for general economic and business skills which are clearly addressed in the learning material content.

Very positive findings from the discussions were the general attitude and understanding expressed by participants that current curricula offered at many colleges and universities of technology are out-dated and should be reviewed. The general opinion expressed in the majority of discussion forums and meetings held was that WRC should play a more important *intervening or brokering role* in addressing the shortcomings and misalignment of formal education by agricultural colleges and universities.

d. *Explore possibilities for establishment of Irrigation Water School or Centre for Irrigation Water Management*

Participants in the discussion forum at Elsenburg, Western Cape suggested the further exploring for the establishment of an Irrigation Water School or Centre for Irrigation Water Management at Elsenburg in collaboration with the private irrigation sector. The private sector can help with the funding of such a project and also be involved in the training and research envisaged for such a centre.

e. *Policies and implementation of decisions that support the proper functioning of AETs*

Although the necessary policies and strategies with regard to the repositioning of AETs have been accepted (AET Strategy (2005); Norms and Standards for the Agricultural Training Institutes of South Africa (2015)), no concrete actions to implement these decisions has taken place yet. Unless the current position of AETs is not soon clarified the further degradation of infrastructure (also existing irrigation infrastructure) and demoralising of lecturing staff will continue. Clear and distinctive decisions and implementation of an action plan are required to enable AETs to play their role in providing training and short courses to the agricultural sector.

Currently agricultural colleges are still the mandate of the provincial departments of agriculture in the various provinces, and therefore the quality of training offered in the various provinces differs based on the budget allocated for this purpose. Taung Agricultural College for instance received quite a budget to address some shortcomings identified in the past, while the general infrastructure at Tompi Seleka, Tsolo Development Centre and Madzivhandila Centre for Agriculture in comparison is of much a lower standard.

f. *Explore irrigation communication networks*

A need exists for exploring more linkages for the communication of this research knowledge/product to provincial departments, cooperatives, private sector and training organisations involved in capacity development of irrigation farmers and extension advisors.

The establishing of Irrigation Innovation Networks between private, public and commodity based organisations should be investigated. Looking at the last 20 years plus, the biggest challenge will be the capacity to work across disciplines and sectors. The current drought in South Africa will require diverse collaboration among organisations with diverse missions. Time for duplication and non-collaborative approach in addressing of the problem is now longer an alternative. Excellent examples were discussed where private and public sector addresses the challenges of training and skills development in irrigation management.

g. *Status of irrigation equipment*

The condition of irrigation equipment at AET centres used for practical training deteriorated over time and is not up to standard for training of students. The practical training facilities at University of Mpumalanga, Mangosuthu University of Technology, and colleges like Owen Sithole (personal communication with farm manager) are not suited for the offering of quality training and will require additional budgets for up-scaling and maintenance of it. The allocation of additional budgets will depend on the position of AETs in the near future (as explained in point e above) and how important the various provincial departments regard this aspect of training offered at colleges for the on-the-job training of extension advisors and to farmers.

h. Farmer Entrepreneur and Incubation Centres (FEDIC)

Although the Department of Agriculture, Forestry and Fisheries identified FEDICs as critical for the development of capacity of farmers, not one of these incubation centres is currently in operation at agricultural colleges like planned. The incubator program is however costly and therefore require the necessary resources. Currently with the support of Industrial Development Corporation (IDC) a couple of agribusiness incubation centres like Timbali exists in South Africa, but very little participation from the respective Provincial Department of Agriculture in the activities of this incubation program occur.

Discussions with the Mozambique Extension group emphasised the importance of incubation centres for the development of farmer capacity in their country, and therefore the Ministry of Agriculture in Mozambique has identified this model as of paramount importance for the development of irrigation farmers in Mozambique.

i. *Professional registration of extension advisors*

Professional registration of extension advisors with SACNASP open doors for the offering of credit bearing short courses and training events as part of the continuous professional development required to maintain registration. This will help fostering on-going involvement in learning as well as supporting the national institutional arrangement for recognition and accreditation of learning.

j. Extension Suite on Line

Extension Suite on Line is an internet based application developed by Manstrat Agricultural Intelligence Solutions in an effort to provide an important linkage and information transfer mechanism between agricultural research and extension services. The system facilitates and enhances the transfer of information between these parties by collecting, collating, interpreting and transforming scientific agricultural data into useful and user friendly formats for use by extension practitioners and farmers. The possibility of including some of the material as part of this service rendered to extension practitioners were discussed with Manstrat executive and detail planning or the incorporation will soon take place.

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Annex 1: Overview of learning material

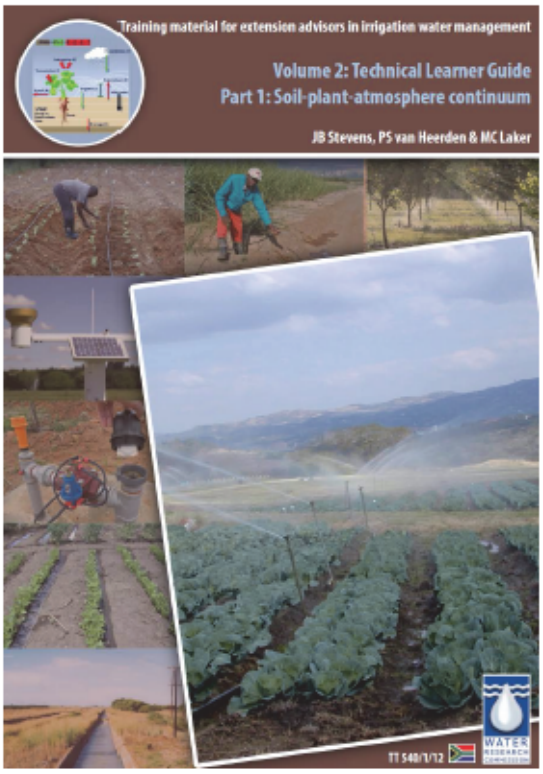
The learning material consists of 93 learning modules divided into technical and extension related volumes. The learning package starts with a brief overview of the soil-plant-atmosphere continuum, which also forms the reference framework for deliberations and learning in the other seven technical learning areas.

Volume 2: Technical Learner Guide

Part 1: SPAC

The soil-plant-atmosphere relationship recognizes that all components of the irrigation field (soil, plant and atmosphere) should be taken collectively into account when decisions are made regarding irrigation water management.

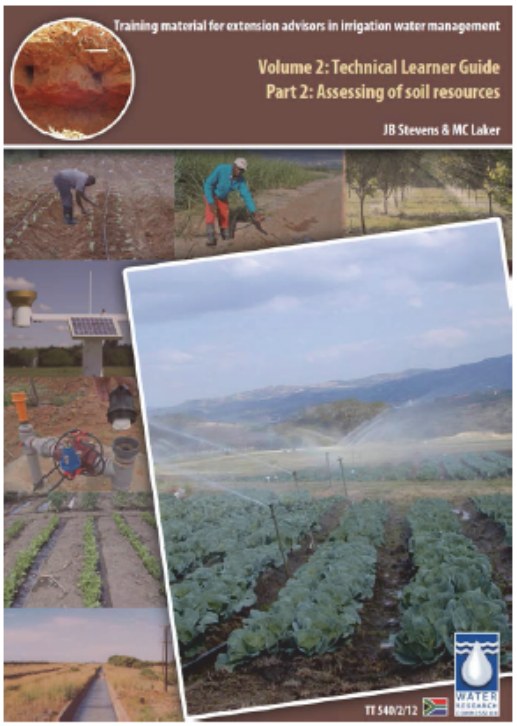
This part serves as an introduction to the concepts like dynamic field balance of water and energy that is required for the flow of water and helps the learner to understand the whole picture



Volume 2: Technical Learner Guide

Part 2: Assessing of soil resources

- Objective to provide learners with a **comprehensive understanding (in depth)** of the soil factors required for land suitability evaluation and land use planning for irrigated agriculture.
- Comprises of 13 learning modules and specific attention in the development of the learning material was given to soil requirements (ideal conditions) and tolerances of crops grown under irrigation - with emphasis on the different crops.



Content: Assessing of soil resources

Module 1: Introduction to soil

Module 2: Soil formation

Module 3: Soil texture (particle size distribution)

Module 4: Soil organic matter and soil organisms

Module 5: Soil structure

Module 6: Additional soil physical properties

Module 7: Soil compaction

Module 8: Soil crusting (surface sealing)

Module 9: Salt affected soils

Module 10: Soil water dynamics

Module 11: Soil water statics

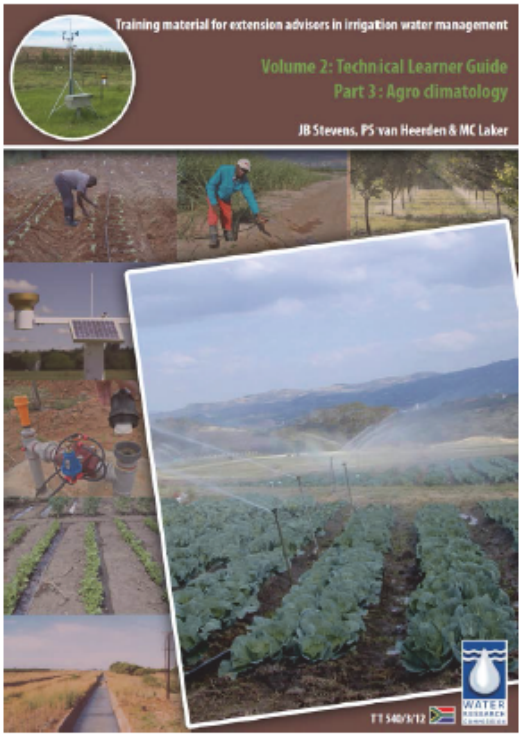
Module 12: Soil fertility in irrigated agriculture

Module 13: Soil surveys for irrigated agriculture

Volume 2: Technical Learner Guide

Part 3: Agroclimatology

- Consists of 10 modules and the aim is to provide learners with a general overview (NQF level 5) of the agro-climatic factors that need to be taken into consideration for effective irrigation management.
- This will enable them to communicate effectively with subject matter specialists and farmers in this regard.



Content:Agroclimatology

Module 1: Introduction to climate and weather
Module 2: Solar radiation
Module 3: Temperature
Module 4: Heat units, chill units and day length (photoperiod)
Module 5: Frost
Module 6: Rainfall
Module 7: Evaporation, transpiration and evapotranspiration
Module 8: Vapour pressure deficit and relative humidity
Module 9: Hail, snow mist and dew
Module 10: Wind

Volume 2: Technical Learner Guide

Part 4: Irrigation water management

- Aim to acquaint learners with a **comprehensive understanding** of irrigation water management principles,
- Introduce them to various irrigation systems that can be selected,
- An understanding of the layout and operation of an irrigation system and how to set benchmarks for efficient irrigation water mgt on the farm.
- Comprises of nine learning modules.

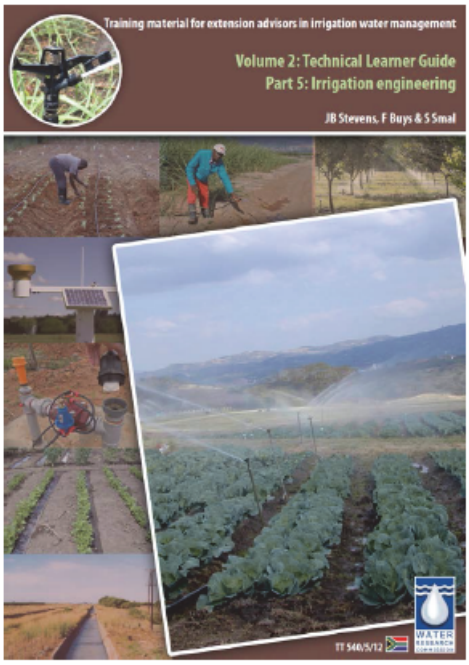
Content: Irrigation water management

Module 1: Introduction to irrigation management
Module 2: Assessing of water resources
Module 3: Assessing water quality
Module 4: Planning for irrigation development
Module 5: Introduction to different irrigation systems
Module 6: Layout of irrigation system
Module 7: Irrigation scheduling
Module 8: Fertigation
Module 9: Irrigation benchmarking

Volume 2: Technical Learner Guide

Part 5: Irrigation engineering

- Objective to provide learners with an overview of irrigation engineering aspects required for effective management like evaluation and maintenance of irrigation systems.
- Three modules regarding maintenance and evaluation of irrigation system were identified for inclusion in this learning material.
- The knowledge and skills will enable the extension agent to communicate effectively with specialists like irrigation engineers after trouble shooting on the farm and to apprehend the ARC Irrigation Manual more effectively.



Contents

Module 1: Maintenance of pumps, pipes, valves and filter systems for efficient irrigation

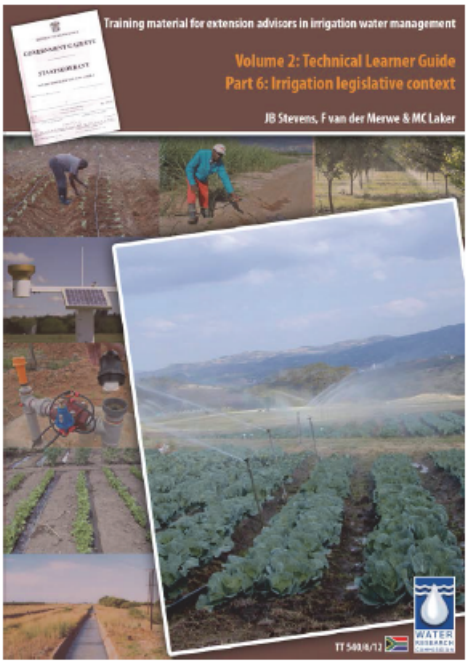
Module 2: Maintenance of irrigation systems

Module 3: Evaluation of irrigation systems

Volume 2: Technical Learner Guide

Part 6: Irrigation legislative context

- Objective to providebasic knowledge and understanding required to apprehend the legal environment of an irrigation farmer.
- Four modules relating the agricultural policy of South Africa, National Water Act (No36, 1998), National Water Resource Strategy (2004) and Irrigation Strategy (2007) were included



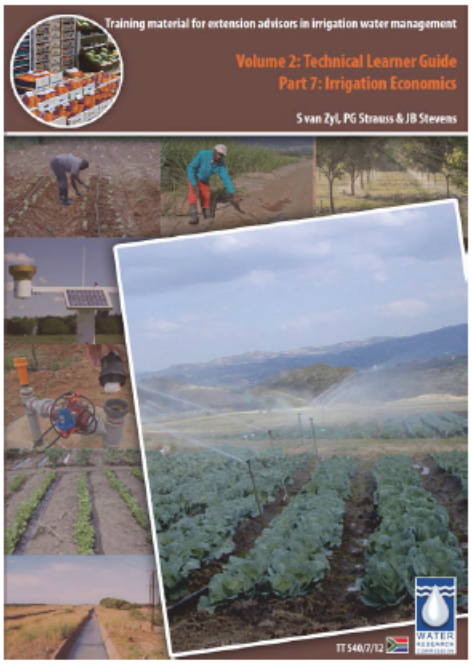
Irrigation legislative context

Module 1: Agricultural Policy and legislation
Module 2: National Water Policy and Act
Module 3: National Water Resource Strategy
Module 4: National Irrigation Strategy

Volume 2: Technical Learner Guide

Part 7: Irrigation economics

- Learning material (12 modules) aims at providing a basic understanding of farm management with the various tools that can help the farmer to achieve his objectives.
- These tools and methods are divided into six sections which enclose production and resource planning, financial management, marketing, human resource management and risk management.
- All of these sections are then incorporated in the business plan which forms the road map for the farm, enabling the farmer to achieve his goals and objectives.



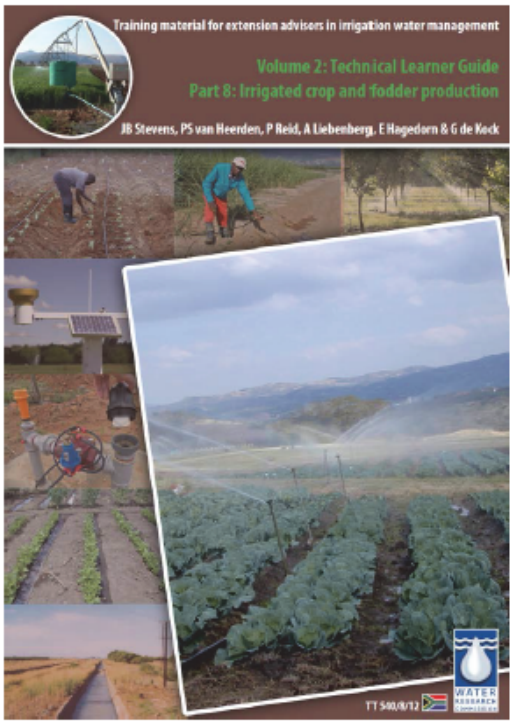
Irrigation economics

Module 1: Introduction to farm management
Module 2: The farm business and its enterprises
Module 3: Farm management and information system
Module 4: Production economic concepts and principles
Module 5: Farm Budgets
Module 6: Financial management
Module 7: Financing principles
Module 8: Marketing
Module 9: Value adding
Module 10: Risk management
Module 11: Human resource management
Module 12: The business plan

Volume 2: Technical Learner Guide

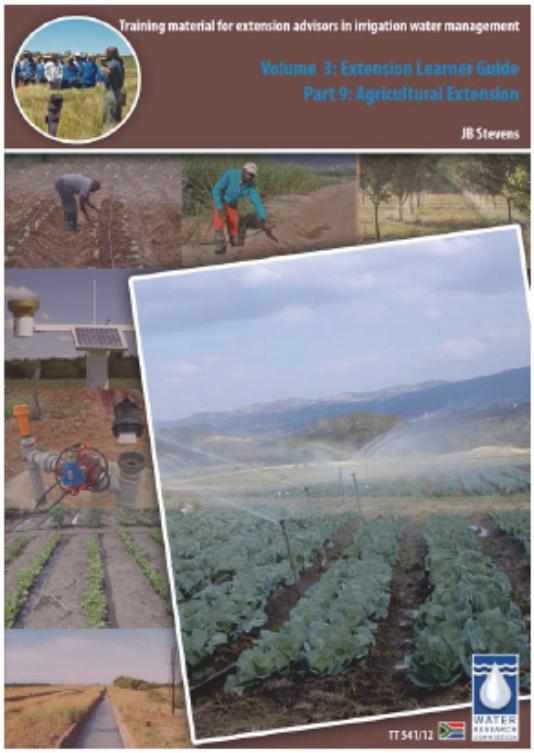
Part 8: Irrigated crop and fodder production

- This learning material aims at providing an overview of sustainable cropping systems, basic understanding of the water uptake by plants, vegetative and reproductive growth of plants followed by a comprehensive overview of production practices with specific emphasis on the crop irrigation requirements of various crop types.
- This material comprises of 30 learning modules.



Volume 3: Extension Learner Guide

- *Module 1: Principles of agricultural extension*
- *Module 2: The extensionists or extension agent*
- *Module 3: Communication as the basis for extension*
- *Module 4:Extension approaches*
- *Module 5: Community development and mentorship*
- *Module 6: Mobilising of farmer groups*
- *Module 7: Leadership and facilitation*
- *Module 8: Situation analysis*
- *Module 9: Project development and management for extensionists*
- *Module 10: How to prepare a holistic farm plan for irrigation*
- *Module 11: Land suitability evaluation for irrigation agriculture*



Annex 2: SARIA Workshop Programme

Wednesday 26 February 2014		
Session 1	**Chairperson: Dr Sebolelo Molete (Chairperson SARIA)**	
8.00 8.30	Official opening	Dr Sebolelo Molete
8.30-9.00	SARIA Strategy	Dr Sylvester Mpandeli
9.00 -9.30	A brief history on SARIA workshops	Mr Felix Reinders ICID VPH
9.30-10.00	Setting the tone for the 2014 workshop	Dr Gerhard Backeberg ICID VP
10.30-13.00	The role of extension advisors in irrigation management	Joe Stevens
	Group discussion on the role of extension advisors in the various countries	Dr Gerhard Backeberg/Joe Stevens
13.00-14.00	Lunch	
Session 2	**Chairperson Dr Gerhard Backeberg (WRC)**	
14.00-16.00	Participatory development of training material for irrigation extension advisors	Joe Stevens, Project leader
Session 3	**Chairperson Dr Gerhard Backeberg (WRC)**	
16.30-17.00	Participatory development of training material for irrigation extension advisors	Joe Stevens, Project leader
	Group discussions on the availability and appropriateness of training/education material for extension advisors	
Session 4	**Chairperson Dr Gerhard Backeberg (WRC)**	
17.30-18.00	Way forward: key messages from stakeholder dialogue	Joe Stevens/Dr Gerhard Backeberg

Annex 3: Attendance register of SARIA workshop

Name	Organisation	Country
Dr Sebolelo Molete	SARIA Chair, University of Lesotho	Lesotho
Dr Conrad Zawe	SARIA Vice Chair, Department of Irrigation	Zimbabwe
Mrs Soneni Nyamangara	Department of Irrigation	Zimbabwe
Dr GR Backeberg	ICID VP, WRC	South Africa
Dr Joachim Makoi	Min of Agriculture, Food Security and Cooperatives	Tanzania
Mr Ventuundja Kazapua	Namibian National Farmers Union	Namibia
Mr Winston Sataya	Ministry of Water Development and Irrigation (MWDI)	Malawi
Ms Olivia Fajolina Rafalimanana	Ministry of Agriculture /DGR	Madagascar
Mr Cinsani Tfwala	Ministry of Agriculture	Swaziland
Ms Nomsa Masemola	DAFF	South Africa
Mr C Sitali	Department of Agriculture	
Ms Maria Dombaxe	Ministry of Fisheries	Angola
Dr Emery Kasango	University of Lubumbasji	DRC
Ms Anne Clift Hill	Botswana College of Agriculture	Botswana
Ms Afonso Felisberto	Eduardo Mondiane University	Mozambique
Mr Jan Potgieter	Department of Agriculture	South Africa
Mr Andrew Songiso	Ministry of Agriculture	Zambia
Ms Nomvuzo Mjadu	DAFF	South Africa
Ms Mary Jean Gabriel	DAFF	South Africa
Dr Sylvester Mpandeli	WRC	South Africa
Mr Felix Reinders	ARC Institute for Agric Eng; ICID PVP	South Africa
Dr Andrew Sanewe	WRC, Private consultant	South Africa

Annex 4: Attendance register of training of Mozambique extension staff

Name	Position
Inácio T. Nhancale	Head/Technical dep. at central DNEA
Sérgio Estévão Mugadui Mabasso	Extension officer at central DNEA
José Manuel José Dança	Extension officer at central DNEA
Carla da Estrela Mahumana	Extension officer at central DNEA
Sérgio Valentim	Head of Extension Services (HES), Maputo peri-urban areas
Elias Arão Mula	HES, Maputo province
Domingos Lourino Celestino Chemane	HES, Gaza province
Crimildo Joaquim	HES, Inhambane province
Armando Dique Camisa	HES, Sofala province
José Manuel Serico Silvestre	HES, Manica province
Fernando Assane	HES, Tete province
José Amándio Lopes	HES, Zambézia province
Ernesto Joel Pacule	HES, Nampula province
Daniel Agostinho	HES Cabo-Delgado province
Afonso Sebastião	HES, Niassa province
Joaquim dos Santos Manhoca	Research Officer, Mozambique's Agrarian Research Institute (IIAM), Central region, based in Manica province
Alberto Antonio Manhiça	Research Officer, IIAM, South region
Guilhermino Boina	Research Officer, IIAM, Northwest region, based in Niassa province
Lígia Rhoda Mateus Dzimba	Research officer, Northeast region, based in Nampula province