



INITIATIVE ON  
NEXUS Gains



# Report on Integrating WEF Nexus into Teaching and Learning and on the Outcome of the Short Training Programme

Susan Tsvuura, Aidan Senzanje, Maxwell Mudhara and Tafadzwa Mabhaudhi



UNIVERSITY OF  
KWAZULU-NATAL<sup>TM</sup>  
INYUVESI  
YAKWAZULU-NATALI

**CTAFS**  
Centre for Transformative  
Agricultural and Food Systems

**IWM**  
International Water  
Management Institute



NEXUS Gains

**Report on Integrating WEF Nexus into  
Teaching and Learning and on the Outcome  
of the Short Training Programme**

Susan Tsvuura, University of KwaZulu-Natal

Aidan Senzanje, University of KwaZulu-Natal

Maxwell Mudhara, University of KwaZulu-Natal

Tafadzwa Mabhaudhi, International Water Management Institute (IWMI)

December 2022

Citation: Tsvuura, S.; Senzanje, A.; Mudhara, M.; Mabhaudhi, T. 2022. *Report on integrating WEF Nexus into teaching and learning and on the outcome of the short training programme*. Pretoria, South Africa: International Water Management Institute (IWMI). CGIAR Initiative on NEXUS Gains. 33p.

### **Acknowledgements**

This work was carried out under the CGIAR Initiative on NEXUS Gains, which is grateful for the support of CGIAR Trust Fund contributors ([www.cgiar.org/funders](http://www.cgiar.org/funders)).

Disclaimer: This publication has been prepared as an output of the CGIAR Initiative on NEXUS Gains and has not been independently peer reviewed. Responsibility for editing, proofreading, and layout, opinions expressed and any possible errors lies with the authors and not the institutions involved.

The CGIAR Initiative on NEXUS Gains aims to realize multiple benefits across water, energy, food and ecosystems in selected transboundary river basins, by leading global nexus thinking and providing tools, guidelines, training and facilitation for analysis and research for development.

[on.cgiar.org/NEXUSGains](http://on.cgiar.org/NEXUSGains)

Cover photo: Cindy Chamane

# Contents

Abbreviations and Acronyms.....	5
Executive Summary.....	6
Introduction .....	7
Background .....	7
Purpose of this report.....	7
Literature Review.....	8
The Water-Energy-Food (WEF) Nexus .....	8
The Water-Energy-Food (WEF) Nexus Dimensions and its Uptake as a Practice .....	8
Curriculum Development, Curriculum Review and Curriculum Reform Processes.....	9
Embedding Water-Energy-Food (WEF) Nexus into Tertiary Institutions Curriculum .....	11
Survey on Water-Energy-Food (WEF) Nexus Curriculum Analysis at Selected Tertiary Institutions in South Africa.....	12
Methodology.....	12
Findings .....	12
Respondent details .....	12
General information on participating institution .....	12
Knowledge of WEF Nexus .....	13
WEF Nexus Teaching and Learning .....	13
Potential for WEF Nexus Expansion/Integration .....	15
Training of university academics .....	16
Report on the Implementation of WEF Nexus Short Courses Training .....	17
The WEF Nexus Winter School and MasterClass .....	17
Course Contents.....	18
WEF Nexus Master Class.....	18
WEF Nexus Winter School.....	21
Introductory WEF Nexus short course .....	25
Conclusion.....	27
References .....	28
Annex 1: Survey on Water-Energy-Food (WEF) Nexus Curriculum Analysis at Selected Tertiary Institutions (Universities, Technical Colleges) in South Africa.....	29

## List of Tables

Table 1: Target clients or trainees for WEF Nexus expansion or integration .....	16
Table 2: WEF Nexus Master Class .....	19
Table 3: Proposed topic, format and lead facilitators for the WEF Nexus Winter School.....	22
Table 4: Introductory WEF Nexus Short Course .....	25

## List of Figures

Figure 1: Distribution of respondents across the country's provinces .....	13
Figure 2: How WEF Nexus is embedded in the curriculum.....	14
Figure 3: Aspects of WEF Nexus covered in the curriculum .....	14

# Abbreviations and Acronyms

GWP-SA	Global Water Partnership Southern Africa
iWEF	integrative Analytical WEF Nexus Model
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
M&E	Monitoring and Evaluation
RUNRES	Rural and Urban Nexus for Resilient Cities
SDG	Sustainable Development Goals
SHEFS	Sustainable and Healthy Food Systems
UKZN	University of KwaZulu-Natal
WACOZA	Water and Cooperation within the Zambezi River Basin
WEF	Water-Energy-Food
WRC	Water Research Council

# Executive Summary

This is a report on the survey of WEF Nexus teaching in selected higher education and tertiary institutions in South Africa, outcomes of the WEF Nexus short training programmes, and the development of WEF Nexus teaching material.

The report presents the survey results on WEF Nexus teaching in South African higher and tertiary education institutions. The main findings of the survey are that; there is general knowledge of the WEF Nexus in the country, some of the institutions have been involved in WEF Nexus 'training' for a while now, WEF Nexus activities are found mainly in water-related departments at most institutions, WEF Nexus related work is mainly embedded in MSc and PhD research programmes, the WEF Nexus covered are wide but focused mainly on concepts, frameworks and application of models and tools. Most believed WEF Nexus should be focused on postgraduate students, and their institutions would welcome WEF Nexus-related teaching and learning.

The deliverable also reports two WEF Nexus short course training undertaken in 2021 and 2022, initially virtually (due to Covid-19 restrictions) and then in person in 2022. The short courses were very well received, attracting more than 80 participants worldwide for the virtual versions and some 50 students for the in-person training. Details of the course contents of the training are presented in the report.



# Introduction

## Background

Rapid population and economic growth accelerated urbanisation, and changing lifestyles have led to the rising global demand for water, food, and energy. Meeting Sustainable Development Goals (SDG) 2 (zero hunger), SDG 6 (clean water and sanitation), and SDG 7 (Clean and affordable energy) will require greater efficiencies in agricultural production systems globally (using water and energy). During the late 2000s and early 2010s, the WEF Nexus emerged as an integral approach to managing the three resource sectors of water, energy, and food. In theory, the WEF Nexus means that water security, energy security and food security are ultimately linked, and resource use and availability rely heavily on each other (Pardoe *et al.*, 2018). Hence, the goal of the WEF Nexus is to approach resource management more holistically by utilising a multi- or poly-centric philosophy. The WEF Nexus provides the opportunity to move beyond the current sectoral approach to policymaking to highlight the interlinkages between the sectors and the need to implement system thinking towards achieving the SDGs. The WEF Nexus presents an opportunity for policymakers, researchers, and development agencies to integrate the sectors to optimise the use of the resource base, maximise synergies and minimise trade-offs and conflicts.

Developing countries, particularly those experiencing significant trade-offs between water, energy, and food, such as South Africa, will benefit significantly from the integrated resource management approach that the WEF Nexus provides. South Africa is currently facing many challenges concerning water, energy, and food security, making it imperative that future development is anchored in WEF Nexus approaches. Thus, the operationalisation of the WEF Nexus at various spatial and temporal scales within South Africa can address the challenges related to water, energy, and food resource insecurities (Mabhaudhi *et al.*, 2016a; Nhamo *et al.*, 2018).

Universities in South Africa have taken up the WEF Nexus approach as an integral part of research and are involved in projects to maximise synergies between WEF sectors. Most of the existing projects have a focus on conceptual and discourse-level WEF Nexus applications. The University of Cape Town has a WRC-funded project focusing on generating evidence for the WEF Nexus at a local scale. It focuses on catchment and household-level analyses. The University of Stellenbosch has been developing WEF Nexus proposals focusing on the Western Cape and Cape Town, particularly a city WEF Nexus study. The University of KwaZulu-Natal (UKZN) has completed a WEF Nexus assessment study for South Africa and is currently undertaking a new WRC-funded project and looking at WEF Nexus research in food systems through the Sustainable and Healthy Food Systems (SHEFS) programme. UKZN also has a project called Rural and Urban Nexus for Resilient Cities (RUNRES), which focuses on applying nexus approaches to promote the transition to a circular approach. The UKZN-led projects concentrate on the WEF Nexus analytical models and the operationalisation of the WEF Nexus.

## Purpose of this report

It has been highlighted that the discussion on the WEF Nexus needed to be broadened to include the participation of other sectors, not water-centric, driven by water experts. It was noted that it has not yet been institutionalised in the curriculum. The objective of the report is to describe the outcome of

the survey conducted on a curriculum analysis of WEF Nexus teaching and learning at selected tertiary institutions (technical colleges and universities) in South Africa. The study looked at the who, what and how much of the WEF Nexus material is covered in the certificate, diploma, and degree programmes. The deliverable also reports on the outcome of two training programmes (WEF Nexus winter school, conducted in person, and WEF Nexus Master Class, conducted virtually) to demonstrate the operationalisation of WEF Nexus curricula.

## Literature Review

### The Water-Energy-Food (WEF) Nexus

The argument for the WEF Nexus has, by now, been adequately articulated, given the background that by 2030 the global population will need at least 40% more water, 35% more food and 50% more energy. By 2050, a 70% increase in global food demand is predicted. Meeting the demand for food in sufficient quantities and acceptable nutritious quality underlines the importance of greater global efficiencies in agricultural production systems (using water and energy). By 2025, 40% of the global population will be prone to severe physical and economic water stress. It is against this background that the WEF Nexus came to the fore as a viable decision support tool that, among other things, indicates the performance of resource utilisation and planning, establishes a quantitative relationship among interlinked resources, and indicates priority areas for intervention, aimed at establishing a balanced resource use and planning, and inclusive economic growth for sustainable development (Nhamo et al., 2020). Thus, the method catalyses climate change adaptation and resilience-building by improving human well-being and attaining Sustainable Development Goals (SDGs), particularly SDGs 2, 6, and 7 (Mabhaudhi et al., 2019).

The WEF Nexus has gained undivided attention in the agenda of research, policy dialogue and development (Bazilian et al., 2011; Eftelioglu et al., 2017). This has seen the WEF Nexus being mainstreamed into thematic areas, strategies and policies by local, regional, and international institutions, governments, and organisations (SADC, 2016; GWP-SA, 2019a; GWP-SA, 2019b). The nature and significance of interconnections between the WEF resources are context-specific, hence the need to explore and understand the interdependence of water, energy and food security and the natural resources that underpin their security (Liu et al., 2017; Salam et al., 2017). Despite the hype of the WEF Nexus agenda, several authors concur that the actual translation of the theory into practice is lagging hence the need to investigate the limited uptake of the promising approach (Byers, 2015; Daher and Mohtar, 2015; Liu et al., 2017; Galaitsi et al., 2018; McGrane et al., 2019; Nhamo et al., 2020a; Naidoo et al., 2021).

### The Water-Energy-Food (WEF) Nexus Dimensions and its Uptake as a Practice

Being a relatively new concept (since about 2011), the WEF Nexus comes across with many definitions and conceptualisations as it is understood differently by different users and its diverse utility. For example, the WEF Nexus has been called a conceptual framework, a concept, a discourse, an analytical tool, an innovation and, more recently, a practice. Worldwide the WEF Nexus has been applied to a wide range of cases, both in space and time. Despite its popularity, as evidenced by the exponential growth in research publications to do with the WEF Nexus (see Deliverables 1 and 3), its wider uptake and application have remained relatively low, both in South Africa and across the

world. It has generally been applied only on a case study basis, and tools and models developed have also shown very limited application across space and time scales (Taguta et al., 2022). There is no evidence of wholesale mainstreaming of the WEF Nexus as a planning tool for natural resources management. As discussed in Deliverable 5 of this research, the question that arises then is, why is there no wholesale uptake and application of the WEF Nexus, especially in government departments mandated with natural resources management?

In formulating this research, pertinent questions were asked, and some of these include:

- How best can the WEF Nexus be applied in the context of South Africa's problems?
- How can the WEF Nexus move from theory to analysis to practice in South Africa?
- How can the WEF Nexus be packaged and applied to realise SDGs 2, 6 and 7 in South Africa?
- Are there any tertiary institutions teaching the WEF Nexus in South Africa, as was the case with the Integrated Water Resources Management (IWRM) concept and practice?

The last question in the list above is particularly pertinent: Are any higher education and tertiary institutions in South Africa involved in teaching and learning the WEF Nexus? To answer this question, a curriculum review needs to assess what is on the ground, what gaps exist, how these gaps can be filled, and by who, how and when.

## **Curriculum Development, Curriculum Review and Curriculum Reform Processes**

Simply put, the curriculum comprises a course of study to be taken by students at a learning institution. Curriculum development, curriculum review and curriculum reform are three related but different processes. Curriculum development, by and large, implies the development of a (new) curriculum or programme of teaching and learning from 'scratch' answering the questions "what will be taught, who will be taught, and how it will be taught". On the other hand, curriculum review generally means a curriculum exists and is now being re-looked to improve it to serve a particular purpose: to enhance student learning, engagement, experience and outcomes (Drummond et al., 1999). Related to the two is curriculum reform, which is a process of making changes to the curriculum to make teaching and learning more meaningful and effective.

There are several ways of undertaking curriculum development, curriculum review and curriculum reform, but all have some commonalities regarding the steps to follow. The review's main purpose is to determine the depth of detail required for the individual steps. For example, one might be involved in a cursory review of certain aspects of a curriculum that will culminate in less than a 10% change to the curriculum. This can be compared to a detailed review of all aspects of a curriculum resulting in substantial changes to that curriculum. Below are the general steps followed in curriculum review, and these are not hard and fast but a guide. They comprise the key steps of planning, content and methods development, implementation, and evaluation.

**STEP 1: *Need for Curriculum Review*:** What is the need for curriculum review?

**STEP 2: *Form Curriculum Review Committee*:** Determine who will be involved in the curriculum process.

**STEP 3: *Terms of Reference (ToR)*:** Outline the ToR of the Curriculum Review Committee and the timeline for the review.

**STEP 4: *Undertake Curriculum Review*:** Attend to the following issues:

- What is the current curriculum?
- Who are the key stakeholders?
- Who are the target learners?
- What are the target outcomes of the learning?
- What are the teaching methods?
- What are the assessment methods?
- What are the gaps or required changes in the current curriculum?

**STEP 5: *Develop New/Revised Curriculum*:** Based on STEP 4, develop a revised or new curriculum to meet the needs of learners and expected learning outcomes.

**STEP 6a: *Recruit and/or Capacitate Teachers/Instructors*:** If needed, capacitate or recruit teachers or instructors required to teach the new or revised curriculum.

**STEP 6b: *Upgrade/Update Teaching Facilities/Resources*:** If needed, update or develop required resources, e.g., laboratories, libraries, etc.

**STEP 7: *Pilot New/Revised Curriculum*:** Pilot teach the new or revised curriculum and adjust it as needed.

**STEP 8: *Implement New/Revised Curriculum*:** Implement the new or revised curriculum with capacitated teachers and upgraded facilities.

**STEP 9: *Monitor and Evaluate Implementation of New/Revised Curriculum*:** Monitor and evaluate the new or revised curriculum implementation.

**STEP 10: *Go to STEP 1*:** After an appropriate period and depending on developments, go to STEP 1.

As previously stated, the above steps are generic and can be modified depending on the need for curriculum reform. Concerning the current WEF Nexus teaching and learning in the context of South Africa, the above steps apply. This Deliverable touches on Steps 1 to 4 above, as reported in Section 3.

## **Embedding Water-Energy-Food (WEF) Nexus into Tertiary Institutions Curriculum**

In line with the above discussion, and as part of enhancing the uptake and practice of WEF Nexus as a natural resource planning and management approach in South Africa, it is expected that WEF Nexus material will and should be included in the teaching and learning in institutions of higher and tertiary learning. This can also be considered as part of deep-scaling the WF nexus in South Africa. A parallel equivalent is the IWRM concept which has been part of higher and tertiary education in South Africa and the world to such an extent that it is now part and parcel of daily operations in most departments dealing with water issues. The WEF Nexus is better because it is not water-centric but gives equal weight to the three resources of water, energy and food, ensuring synergistic management of these.

How can this be practically undertaken in South Africa, and over what timeline? Concerning how it can be done, a survey of the WEF Nexus curriculum in South Africa was undertaken and is reported in Section 3 of this report. In terms of the timeline, this will be after the end of this research project because it is acknowledged that curriculum review and change in South Africa take an inordinate amount of time, running up to 5 years from start to finish.

# Survey on Water-Energy-Food (WEF) Nexus Curriculum Analysis at Selected Tertiary Institutions in South Africa

This section presents the results of a survey undertaken to analyse the teaching of WEF Nexus-related material at some South African tertiary institutions.

## Methodology

A questionnaire survey was administered to 28 institutions of higher learning in South Africa. The questionnaire was administered online using Google Forms. The UKZN Humanities and Social Sciences Research Ethics Committee ethically reviewed and approved the survey as part of a more extensive WEF study (approval number HSS/1971/017D). Data were downloaded to Excel software. The analysis of the results, including graphs and frequencies, was done on Google Forms. Ten completed questionnaires, representing a 36% return, were received and included in the analysis.

## Findings

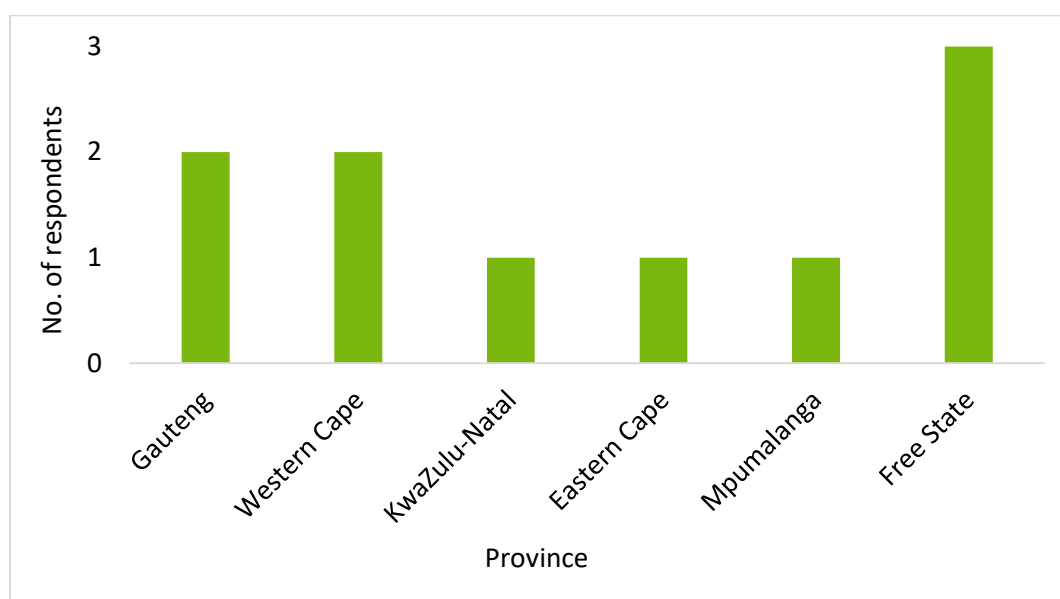
### *Respondent details*

The respondents represented a cross-section of disciplines found in academic and research institutions, i.e., senior lecturers, professors, research chairs, and research directors of learning institutions. The respondents related to varying departments, most of which had an agriculture focus, environmental management centres, water, and sanitation, built environment, and bioresources engineering. Eight respondents had been involved in reviewing and developing new curricula at the undergraduate or postgraduate level. The remaining two were unrelated to curriculum development issues in the university system.

### *General information on participating institution*

Figure 1 shows the location of the institutions involved in the survey, spanning six of the country's nine provinces. All the institutions included in the study offer undergraduate, Master and PhD degree programmes, whilst nine offer Diploma programmes, and only five provide Certificate courses.

**Figure 1: Distribution of respondents across the country's provinces**



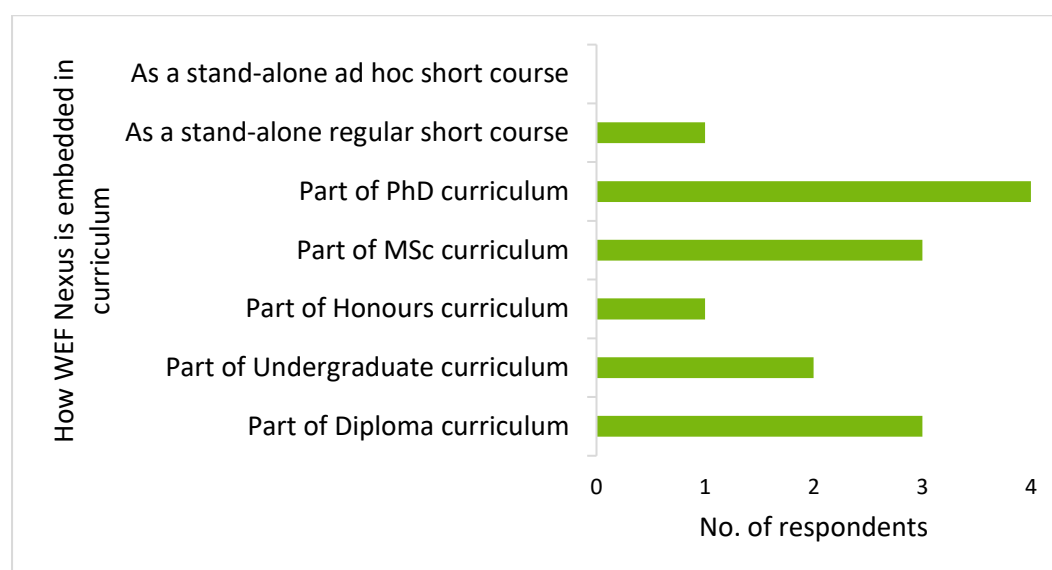
### ***Knowledge of WEF Nexus***

All respondents indicated that some members of their institutions were aware of WEF Nexus. Nine out of the ten respondents had been involved in WEF Nexus research. Nine of the ten respondents also indicated that their institutions were involved in the incorporation of Integrated Water Resources Management (IWRM) into teaching and research.

### ***WEF Nexus Teaching and Learning***

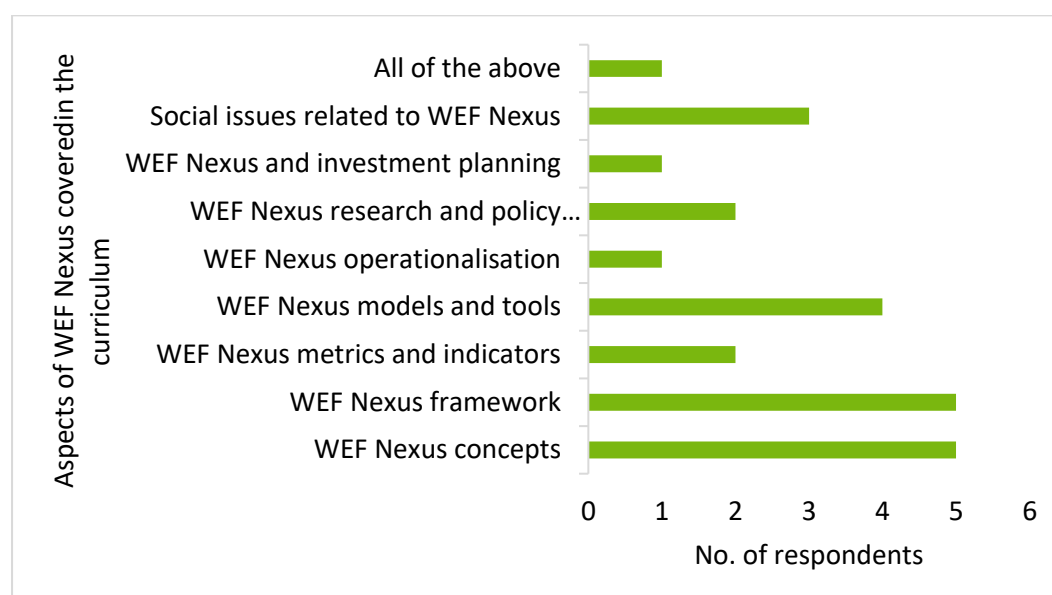
All respondents had been involved in aspects of WEF Nexus teaching and research for a period ranging from three to 20 years. This would suggest that there is a view that WEF teaching and research was initiated earlier than the last ten years when it was popularised. Departments or centres involved in WEF Nexus teaching and learning in the various institutions were Environmental Management, Development Studies, Water Resources Management, Water and Sanitation Research, Engineering and Built Environment, Applied Sciences, South African Renewable Technology Centre, Earth Sciences, Bioresources Engineering, Transformative Agriculture and Food Systems, and Water Resources Research. WEF Nexus training is being conducted primarily at the postgraduate level in all institutions. Three institutions offer undergraduate-level degrees, four at the diploma level, and two indicated that WEF Nexus training is conducted at the certificate level. Figure 2 shows that WEF Nexus is primarily embedded in the curriculum at the postgraduate level and less so at undergraduate, diploma and short courses.

**Figure 2: How WEF Nexus is embedded in the curriculum**



Findings also showed that most institutions focus on their curriculum's WEF Nexus concepts, frameworks, models, and tools (Figure 3).

**Figure 3: Aspects of WEF Nexus covered in the curriculum**



Findings showed that only two institutions had specific modules for WEF Nexus: An overview of the WEF Nexus concepts, WEF Nexus Master Class and WEF Nexus Winter School. Two respondents indicated that they did not have stand-alone, precisely termed WEF Nexus, but they have modules with aspects of WEF Nexus in the curriculum. Other institutions offer modules such as Water Resources Assessment, Water Resources Management, Environmental Science, and Sustainable Development: Policy and Practice. One respondent indicated that while their institution offered no WEF Nexus-related modules, they only conducted research. Most respondents indicated that WEF Nexus is assessed through postgraduate dissertations and theses. At the same time, four



respondents mentioned assessing WEF Nexus as case studies, practical reports, or formal tests and examinations.

All respondents believe there are gaps in the teaching and learning of WEF Nexus. Seven respondents indicated that WEF Nexus has always been part of their curriculum, but they do not refer to it as WEF Nexus. In this regard, they teach aspects of water, energy, and food separately, focusing primarily on water and food. They expressed that the link across the three elements of WEF Nexus is still missing in the curriculum, and there is no clarity on how the connection can be created. One respondent mentioned that although training on water was conducted across all faculties at their institution, it is taught only in the Faculty of Agriculture, and Energy is in the Faculty of Engineering. The gap lies in how best to incorporate WEF because curriculum development is costly and takes time. Other respondents indicated that there is very little content on WEF Nexus covered in undergraduate agricultural courses because there is inadequate space and time in the modules to have depth. One respondent indicated that their institution did not cover operationalisation, systems dynamics modelling and social aspects of WEF Nexus.

Findings showed that advocacy for incorporating aspects of WEF into the curriculum is needed to improve WEF Nexus teaching and learning. Respondents suggested various ways that can be applied to strengthen WEF Nexus teaching and learning. Summer schools and short courses were recommended for imparting WEF knowledge to students, conducting more research that can translate to teaching in the class, and including more WEF Nexus content in undergraduate courses, particularly in the third or fourth-year undergraduate teaching and at the MSc by research. They also indicated the need to show the relevance of WEF to different contexts and applications and embed the learning more strongly in climate change courses instead of just meeting SDG targets.

### ***Potential for WEF Nexus Expansion/Integration***

Findings showed that WEF Nexus awareness is generally required at various learning institutions across departments and research centres because few people are working on it. Without understanding, implementation will not gain traction. The reason is that academic teaching modules are reviewed every five years and end up missing out on topical issues within the five-year horizon. Awareness will also improve the understanding of the relevance of WEF to IWRM in a different context. Three respondents also mentioned that awareness of the WEF Nexus approach is crucial because it accelerates transdisciplinary research to provide sustainable solutions to complex problems that a single discipline cannot address. In addition, all three aspects of WEF Nexus represent a critical challenge in South Africa and many other countries and deserve urgent attention on strategies to deal with the challenge.

Most respondents recommended Agriculture and Environmental studies as the disciplines they recommended for housing WEF Nexus teaching. Although one respondent indicated Health studies, and two others suggested Architecture, Engineering and Construction or Applied Sciences as the recommended disciplines to incorporate WEF Nexus in their curricula. Most responses for the departments that should be targeted for WEF Nexus expansion or integration pointed to Agriculture and Environmental studies. A few respondents indicated Health Studies, Engineering, and centres for Water Studies. Table 1 shows that most respondents view postgraduate studies as the targeted trainees for WEF Nexus expansion or integration.

**Table 1: Target clients or trainees for WEF Nexus expansion or integration**

Academic level	No. of respondents
Certificates	3
Diplomas	6
Undergraduates	6
Postgraduates	10

### *Training of university academics*

Most respondents think there is a need for capacity building of WEF Nexus at their institutions because of poor awareness and knowledge among academics. Areas where capacity building is required, include the relevance of the WEF Nexus to different contexts, operationalisation of the approach, system dynamics modelling, WEF Nexus and investment planning, and WEF Nexus and the practicalities of SDGs. One respondent indicated they require collaboration with institutions with more expertise and resources. Interestingly, one respondent indicated that awareness across institutions is more crucial before capacity building because universities need to understand what is new in WEF Nexus and what is already being taught for buy-in. Since the implementation of WEF Nexus involves an increase in workload, there is a need for discussions on whether to employ new people to implement it or to offer training programmes to some of the junior staff to grow champions of WEF Nexus within the institutions.

Most respondents suggested that students will receive WEF Nexus courses at their institution well because it is a new approach that cuts across different aspects of ideas. Students are generally interested in learning topical issues. However, two respondents indicated that they do not believe WEF Nexus courses will be well received because students will only take up WEF Nexus courses if they see employment opportunities resulting from being skilled in them. Undergraduate students generally enrol for programmes which they believe are linked to direct and immediate access to employment opportunities. Currently, WEF Nexus issues are still new, and there is no clarity on how it fits into the employment system. Another respondent indicated that university management and the lecturers/trainers must be convinced first, based on relevance, affordability, and availability of time and space, before such knowledge can trickle down to students.

# Report on the Implementation of WEF Nexus Short Courses Training

This section covers material on WEF Nexus short courses training held both virtually and in person in 2021 and 2022.

## The WEF Nexus Winter School and MasterClass

The origins of the Water-Energy-Food (WEF) Nexus Winter School and MasterClass trace back to a workshop held in Pietermaritzburg in March 2020. Initially conceived as an in-person event, the COVID-19 lockdowns in 2021 scuttled plans for the first Winter School. Adapting, we decided to host an online WEF Nexus Masterclass in place of the Winter School. The Masterclass would be a success, with more than 80 participants from across the globe participating in the three-day online training.



The MasterClass has now been maintained as part of the WEF Nexus capacity development programme. It provides an introductory and foundational course to understanding WEF Nexus concepts and tools.

Due to the MasterClass' success, it was decided to maintain two formats – an online MasterClass and an in-person Winter School. Attendance of the Master Class is a prerequisite for participation in Winter School. In 2022, the Master Class was conducted from 13-15 June and has continued to be popular, attracting a global audience across Africa, Europe and the USA.

This WEF Nexus Masterclass and Winter School is a partnership between UKZN, the Water Research Commission, IHE-Delft, Global Water Partnership Southern Africa (GWPSA) and the Nexus Gains Initiative of the OneCGIAR. The partners have committed to supporting the two events for at least another five years.



## Course Contents

### *WEF Nexus Master Class*

The WEF Nexus Winter Masterclass will introduce state-of-the-art nexus research, presenting completed and currently ongoing cutting-edge approaches from various WEF Nexus projects in the SADC region and from abroad (Table 2). Very little conceptual and theoretical background to the WEF Nexus will be presented (this is provided as background material, and participants are expected to have some background in the WEF Nexus). Rather, the emphasis is to impart practical skills that can be applied to complete WEF Nexus assessments and to support the development of appropriate policy and management responses. They will draw specifically on outputs from the WEFTools project (<https://wef-tools.un-ihe.org/project>).

**Table 2: WEF Nexus Master Class**

*Online session: June 13-15, 2022, from 10 am-1 pm each day*

Day		Topic	Content/Objective	Proposed Format	Lead Facilitator	Approx. timing	Material
0	0:1	Preparatory materials  Introduction to nexus thinking and analysis	Overview of WEF Nexus concepts.  Introduction to systems thinking and analysis.	<i>Preparatory material</i>  WEF Nexus background materials:  -overview and concepts  -nexus thinking and system analysis  -nexus indicators  -Hoff Framework  - conceptual mapping  -causal loop diagrams  -systems dynamics modelling	University of KwaZulu-Natal  IHE Delft  Penn State WRC  GWP-SA  IWMI		PPT slides/Short videos  Existing WEF videos (online material)  Links to online material.  Recent papers
1	1:1	Introduction to nexus thinking:  <i>Lecture; Q&amp;A</i>	Introduction to the course. <ul style="list-style-type: none"> <li>Welcome</li> <li>Purpose</li> <li>Structure and Approach</li> </ul>	Introduction and experiences from participants and facilitation team.	UKZN/IHE	30 mins	Material shared in 0:1
	1:2	Introduction to indicators. Overview of WEF Nexus index and iWEF tool  <i>Lecture; Group work</i>	Introduce indicators and the link to achieving SDGs, sustainable food systems and a circular economy	Lecture followed by group exercise and discussion.	JWET/UKZN	1.5	
	1:3	Introduction to indicators:  <i>Feedback and discussion on the group work</i>		Group discussions with feedback	JWET/UKZN	1	
	2:1	Introduction to mapping WEF Nexus relationships and feedback:  <i>Lecture; Q&amp;A</i>	Introduce participants to the Hoff framework, conceptual mapping, causal loop diagrams, and SDM method and application.	Lecture followed by group work and discussion.	IHE Delft; UKZN	60 mins	Material shared in 0:1
	2:	Introduction to mapping		Guided class	IHE Delft;	1.5	Material

2	2	<p>WEF Nexus relationships and feedback:</p> <p><i>Group work</i></p>		<p>exercise. Fill in the revised Hoff framework<sup>2</sup> to describe a WEF Nexus case study. Template and literature provided</p>	UKZN		shared in 0:2
	2:3	<p>Introduction to mapping WEF Nexus relationships and feedback:</p> <p><i>Feedback and discussion on the group work</i></p>		Group discussions with feedback	IHE Delft; UKZN	1	
3	3:1	<p>WEF Nexus discourse in southern Africa and financing WEF Nexus investments</p> <p><i>Lecture; Q&amp;A</i></p>	To learn how the WEF Nexus can be used to inform investment planning	Lectures followed by group work and discussion	GWP-SA	30 mins	Knowledge from experienced policymakers. Videos.
	3:2	<p>WEF Nexus discourse in southern Africa and financing WEF Nexus investments</p> <p><i>Group work</i></p>		Group work	GWP-SA	1	
	3:3	<p>WEF Nexus discourse in southern Africa and financing WEF Nexus investments</p> <p><i>Feedback and discussion on the group work</i></p>		Group discussions with feedback	GWP-SA	30 mins	
	3:4	Wrap-Up and closure			JWET; IHE Delft; UKZN; GWP-SA; WRC; Penn State	30 mins	

### **WEF Nexus Winter School**

The WEF Nexus Winter School will introduce state-of-the-art nexus research, presenting completed and currently ongoing cutting-edge research from various WEF Nexus projects in the region and abroad (Table 3). The Winter School will be novel and innovative and draw specifically on outputs<sup>1</sup> from the WEFTools project (<https://wef-tools.un-ihe.org/project>). Although some conceptual and theoretical background to the WEF Nexus will be provided, the emphasis is to provide participants with practical skills that can be applied to complete WEF Nexus assessments and to support the development of appropriate policy and management responses.

#### **At the end of the course, participants will be able to:**

- Critique/discuss the WEF Nexus approach (strengths, weaknesses, opportunities, and threats)
- Explain the link to global challenges such as Climate and Socio-Economic Changes and SDGs achievement
- Identify indicators that are applicable for tracking WEF security and SDGs achievement
- Analyse the WEF interactions for different situations using WEF Nexus frameworks
- Apply specific tools to support WEF Nexus planning and management and enhance WEF Nexus operationalisation
- Develop policy recommendations for WEF Nexus implementation and assess opportunities and bottlenecks.

The School will follow a mix of presentations and individual and interdisciplinary group work. Participants must supply their own laptop.

**Table 3: Proposed topic, format and lead facilitators for the WEF Nexus Winter School**

	Topic	Content/Objective	Proposed Format	Lead Facilitator	Approx. timing	Material
0:1	Introduction to nexus thinking	To provide background and introduction to the concept of nexus thinking and how it has emerged, as well as various other nexus that exist. Introduction to systems analysis, thinking and representation	Preparatory material	UKZN	4-6 hrs, depending on detail.	PPT slides/Short videos
	Introduction to WEF Nexus frameworks, tools, and indicators	To provide background about current theory and practice related to WEF Nexus frameworks, tools and indicators and linking them to achieving SDGs, sustainable food systems and a circular economy.	<p>WEF Nexus background materials:</p> <ul style="list-style-type: none"> <li>■ overview and concepts</li> <li>■ nexus thinking and system analysis</li> <li>■ nexus indicators</li> <li>■ Hoff Framework*</li> <li>■ conceptual mapping</li> <li>■ causal loop diagrams</li> <li>■ systems dynamics modelling</li> </ul>	<p>IHE Delft</p> <p>Penn State</p> <p>WRC</p> <p>GWP</p>		<p>Existing WEF videos (online material)</p> <p>Papers/books</p> <p>Links to online material.</p>
0:2	Homework Exercise	Participants fill in the revised Hoff framework <sup>2</sup> to describe a WEF Nexus case study.	<ul style="list-style-type: none"> <li>■ Hoff Framework table</li> </ul>	<p>IHE Delft</p> <p>University of KwaZulu-Natal</p>		Hoff et al., 2019 <sup>2</sup> paper
	<p>*The homework has to be sent to XXX by July 24th.</p> <p>*The relevant material collected to fill in the Hoff framework needs to be brought for Day 2 class</p> <p>Exercise: develop a framework for their own country</p>					



	Topic	Content/Objective	Proposed Format	Lead Facilitator	Approx. timing	Material
	following the analytical framework suggested by Hoff et al., 2019 <sup>2</sup>					
	Individual exercise					
1:1	Identify indicators that are applicable for tracking WEF security and SDGs achievement  <i>Recap lecture; Q&amp;A; Group work and discussion</i>	Participants explore and analyse the WEF Nexus Index for their own country.	Recap lecture, group exercises and discussions.  Group exercise and group discussions.	IHE-Delft, JWET, UKZN	Half day	Lectures. Study notes and exercise guidelines. Worked examples.  WEF Nexus index exercise
1:2	<i>Group work</i>	Participants explore the iWEF tool	Group exercise. Explore the iWEF tool  Compare and contrast global vs local level tools and appropriate indicators.	IHE-Delft, JWET, UKZN	Half day	Study notes and exercise guidelines.  iWEF tool structured exercise
2:1	Develop a WEF Nexus conceptual map/s  <i>Recap lecture; Q&amp;A; individual exercise and discussion</i>	Participants apply a high-level nexus mapping with the case study assessed in the Hoff Framework filled in as homework.	Recap lecture and practical exercise.  Individual exercise.  Develop conceptual map/s of the case study described by using the Hoff framework developed as homework before the Masterclass  Present back to plenary and feedback session	IHE-Delft & University of KwaZulu-Natal	All day	Lectures. Study notes and exercise guidelines. Worked examples.
2:2	Excursion	Shares logistics and				

	Topic	Content/Objective	Proposed Format	Lead Facilitator	Approx. timing	Material
	preparation	field notes. Tips and pointers.				
3	Day 3 Observing the WEF Nexus in practice.	To expose participants to real-life WEF interlinkages and how the WEF Nexus can be applied to informing solutions to real-life challenges	Excursion to show and explore WEF Nexus relationships in a real-life setting. Participants to use this to further apply knowledge gained in the course to date.	Water Research Commission & Department of Water & Sanitation	Full Day	Field trip description. Study sheet and exercise guidelines.
4:1	Day 4 Session 1  Introduction to WEF Nexus Serious Game  <i>Lecture; Q&amp;A</i>	Introduce the development of WEF Nexus serious games and the case studies applied to them. Briefly demonstrate the game essentials.	Lecture and short game demonstration.	IHE Delft	Half Day	Lecture, online demo
4:2	Day 4 Session 2  Serious game playing  <i>Group work and discussion</i>	In small groups, choose a playable nexus case study, and play the serious game using structured questions to answer about the nexus.	Practical group-based gaming session  Present back to plenary and feedback session	IHE Delft	Half Day	Structured gaming session
5:1	Day 5 Session 1  WEF Nexus discourse in southern Africa and Governance framework	To learn how the WEF Nexus can be used to facilitate multi-partner and multi-level discourse	Group work and feedback  Lectures	Global Water Partnership – Southern Africa	Half day	Shared knowledge from experienced policymakers. Videos.
5:2	Day 5 Session 2	Wrap-Up and closure			1 hour	

\*Hoff's Analytical Framework: <https://www.frontiersin.org/articles/10.3389/fenvs.2019.00048/full>

This is a high-level framework. The text below is verbatim from the paper. Consider some modifications to fit WEF Tools approach better.

i) Nexus framing: this category creates a common, context-specific understanding of the key issues from a nexus perspective, explores the interlinkages between the different sectors and resources, and includes synergies and trade-offs which could be relevant for the case study;

- ii) Nexus opportunities: this category identifies how a nexus approach could add value in the respective context, e.g., by improving (cross-)resource productivity, reducing resource and environmental degradation, increasing climate resilience, and reducing human insecurities/poverty/unemployment;
- iii) Technical and economic nexus solutions: this category assesses and, if possible, quantifies potential benefits from the implementation of nexus approaches or "nexus savings" in the respective case study, e.g., through multi-functional production systems, municipalities or landscapes, and cross-resources and cross-sector recycling;
- iv) Stakeholders involved: this category specifies the different types and levels of stakeholders involved in the case study, e.g., from the public and private sector and civil society, their respective roles, and what is required to make it successful;
- v) Framework conditions: This category addresses relevant conditions and context factors, including type (technical solutions, policy solutions, mix of measures), scale and level (e.g., farm-level, community-level, national level etc.) and the actual implementation of a nexus approach. It also aims to answer questions such as: how can the nexus approach be institutionalised, i.e., how can the experience from practical implementation be taken into account in policy and decision making, e.g., by improved cooperation between sectors and institutions? Have any new bridging mechanisms or nexus institutions been established yet, including integrated SDG and/or NDC implementation? Does this contribute to improving policy coherence, and if so, how? Do integrated approaches contribute to innovation (e.g., via entrepreneurs and incubators, also considering relevant framework conditions outside the nexus)?
- vi) Monitoring, evaluation and next steps: This category defines indicators and required data for monitoring and evaluation (M&E) of implementing the nexus approach. It builds on the understanding that nexus implementation is a process with dynamic objectives, the composition of stakeholders and processes and therefore requires a self-reflexive mechanism (institutional learning mechanism and multi-loop learning) to further evolve. This section also provides an outlook on the potential of each case study for replication and upscaling.

### **Introductory WEF Nexus short course**

This WEF Nexus short course was proposed under the WACOZA project as a possible introductory course suited to various WEF Nexus stakeholders. Naturally, some aspects are covered in the two short courses discussed above, but this one could be a much shorter and more compact one to introduce interested parties to the WEF Nexus.

**Table 4: Introductory WEF Nexus Short Course**

1	COURSE TITLE
	<ul style="list-style-type: none"> <li>Water Energy Food Nexus as a Sustainable Resource Management Tool – Local Scale Applications</li> </ul>
2	COURSE OBJECTIVE
	<ul style="list-style-type: none"> <li>To equip trainees with the requisite understanding and skills to apply the WEF Nexus approach for natural resources management to ensure resource securities for the target population</li> </ul>
3	LEARNING OUTCOMES
	<p>At the end of the short course, the trainees will be able to:</p> <ul style="list-style-type: none"> <li>Define the WEF Nexus and its relevant variants</li> <li>Understand the scope of application of the WEF Nexus from technical to policy aspects.</li> <li>Define the spatial scale of applying the WEF Nexus</li> <li>Define the temporal scale of application of the WEF Nexus</li> <li>Define and identify the data requirements for use in the WEF Nexus</li> </ul>

	<ul style="list-style-type: none"> <li>Identify and select the appropriate WEF Nexus models/software and applicable techniques</li> <li>Apply the WEF Nexus to specific local scales</li> </ul>
4	<b>TARGET TRAINEES</b>
	<ul style="list-style-type: none"> <li>Researchers, technical officers, project implementers, policy people</li> </ul>
5	<b>COURSE DURATION</b>
	<ul style="list-style-type: none"> <li>4 days</li> </ul>
6	<b>COURSE DETAILS</b>
	<p>Day 1</p> <ul style="list-style-type: none"> <li>Introduction to the WEF Nexus concept – the W.W.W.H.W. of the WEF Nexus</li> <li>WEF Nexus variants</li> <li>WEF Nexus scope of application with relevant examples from around the world</li> <li>Spatial scale issues when applying the WEF Nexus</li> <li>Temporal scale issues in applying the WEF Nexus</li> </ul> <p>Day 2</p> <ul style="list-style-type: none"> <li>WEF Nexus indicators and their applicability and usability</li> <li>Data issues for the WEF Nexus</li> <li>Data sources and actual sourcing for the WEF Nexus</li> <li>Data quality and data cleaning for the WEF Nexus</li> <li>WEF Nexus models/source and other WEF Nexus methodologies</li> </ul> <p>Day 3</p> <ul style="list-style-type: none"> <li>Group practical – WEF Nexus problem definition and set-up</li> <li>Group practical – WEF Nexus practical problem solving</li> </ul> <p>Day 4</p> <ul style="list-style-type: none"> <li>Group practical – WEF Nexus assignment presentation and feedback to groups</li> </ul>
7	<b>TEACHING &amp; LEARNING METHODS</b>
	<ul style="list-style-type: none"> <li>Interactive lectures from WEF Nexus experts</li> <li>Individual trainee tasks with feedback, e.g., problem definition, problem scoping, model selection</li> <li>Interactive practicals with WEF Nexus experts and the trainees</li> <li>Individual trainee hands-on practical tasks on specific aspects, e.g., data sourcing, data cleaning, data input into WEF Nexus models</li> <li>Group hands-on tasks on natural resources management by applying the WEF Nexus approach for specifically defined problem cases – from the beginning to the end</li> <li>Group feedback with critiquing and assessment to the class</li> </ul>
8	<b>LEARNING ASSESSMENT</b>
	<p>Learning outcomes will be assessed through the:</p> <ul style="list-style-type: none"> <li>Summative assessment of the theoretical aspects of the WEF Nexus</li> <li>Assessment of the practical project on the application of the WEF Nexus</li> </ul>
9	<b>REFERENCE MATERIALS</b>
	<p>1) FAO (2014): The Water-Energy-Food Nexus. A New Approach in Support of Food Security and Sustainable Agriculture.</p>

## Conclusion

The main focus of this study was on WEF Nexus curriculum-related issues, in general and specifically in South Africa. At this research stage, it is acknowledged that the WEF Nexus approach is well-established. However, the uptake and practice of the WEF Nexus as a natural resources management approach is still lagging in South Africa and the world in general. One of the proposed approaches to enhance the deep-scaling of the WEF Nexus to improve its uptake and practice is to embed it into the curriculum at higher and tertiary learning institutions. Curriculum development, curriculum review and curriculum reform are related processes which must be undertaken if any curriculum is to be changed. The process goes through several steps, some of which involve undertaking a needs assessment, establishing a review team and undertaking the review process, not forgetting the critical steps involved.

A survey was undertaken of the WEF Nexus curriculum in South Africa's higher and tertiary institutions to answer questions on the who, what and how much of the WEF Nexus material is covered in the certificate, diploma, and degree programmes. In conclusion, the key findings of the survey were that; most of the surveyed institutions had some knowledge of the WEF Nexus, some had been involved in WEF Nexus research for several years now, the WEF Nexus efforts were housed mainly in water-related departments and programmes such as environmental sciences, water resources management, water and sanitation research, engineering and built environment, applied sciences, earth sciences, and bioresources engineering. WEF Nexus research is embedded predominantly in MSc and PhD research programmes, a wide range of WEF Nexus aspects are covered, but the dominant ones are concepts, frameworks and the application of models and tools. Most institutions believe that the target should be postgraduate and undergraduate students to a certain extent. The surveyed institutions indicated embedding WEF Nexus teaching and training at their institutions would be welcome.

Regarding the short course on the WEF Nexus, two were run in 2021 (virtual only) and 2022 (virtual and in-person). The short courses were well received and will be run regularly in the future, with the virtual MasterClass being a prerequisite and feeding into the in-person Winter School. The intention was always to have the short course as hands-on as possible, which was achieved largely because of the case study approach. The Winter School participants had to bring their own case studies, making the training very relevant. Some of the material covered in the Master Class included; an introduction to nexus thinking, an overview of the WEF Nexus index and iWEF tool, an introduction to indicators, an introduction to mapping WEF Nexus relationships and feedback, and WEF Nexus discourse in southern Africa and financing WEF Nexus investments. For the Winter School, most activities involved hands-on exercises for what was covered in the MasterClass but also included; observing the WEF Nexus in practice, introduction to the WEF Nexus Serious Game, WEF Nexus discourse in southern Africa and Governance framework.

# References

- Bazilian, M., Rogner, H., Howells, M., Hermann, S., Arent, D., Gielen, D., et al. (2011). Considering the energy, water and food nexus: Towards an integrated modelling approach. *Energy Policy* 39 (12): 7896-7906. doi:10.1016/j.enpol.2011.09.039
- Byers, E. A. (2015). Tools for tackling the water-energy-food nexus. *Change and Adaptation in Socio-Ecological Systems* 2 (1). doi:10.1515/cass-2015-0019
- Daher, B. T., and Mohtar, R. H. (2015). Water–energy–food (WEF) Nexus Tool 2.0: guiding integrative resource planning and decision-making. *Water International* 40 (5-6): 748-771. doi:10.1080/02508060.2015.1074148
- Drummond, I., Alderson, K., Nixon, I. and Wiltshire, J. (1999) Managing curriculum change in Higher Education: realising good practice in key skills development.
- Eftelioglu, E., Jiang, Z., Tang, X., and Shekhar, S. (2017). "The Nexus of Food, Energy, and Water Resources: Visions and Challenges in Spatial Computing," in *Advances in Geocomputation. Advances in Geographic Information Science*, ed. Griffith, D. A., Chun, Y. Dean., Denis J (Cham: Springer International Publishing), 5-20. doi.org/10.1007/978-3-319-22786-3\_2
- Galaitis, S., Veysey, J., and Huber-Lee, A. (2018). Where is the added value? A review of the water-energy-food nexus literature. Somerville: Stockholm Environment Institute.
- Liu, J., Yang, H., Cudennec, C., Gain, A. K., Hoff, H., Lawford, R., et al. (2017). Challenges in operationalising the water–energy–food nexus. *Hydrological Sciences Journal* 62 (11): 1714-1720. doi:10.1080/02626667.2017.1353695
- Mabhaudhi, T., Nhamo, L., Mpandeli, S., Nhemachena, C., Senzanje, A., Sobratee, N., et al. (2019). The water–energy–food nexus as a tool to transform rural livelihoods and well-being in Southern Africa. *International Journal of Environmental Research and Public Health* 16 (16). doi:10.3390/ijerph16162970
- McGrane, S. J., Acuto, M., Artioli, F., Chen, P-Y., Comber, R., Cottee, J., et al. (2019). Scaling the nexus: Towards integrated frameworks for analysing water, energy and food. *The Geographical Journal* 185 (4): 419-431. doi:10.1111/geoj.12256
- Naidoo, D., Nhamo, L., Mpandeli, S., Sobratee, N., Senzanje, A., Liphadzi, S., et al. (2021). Operationalising the water-energy-food nexus through the theory of change. *Renewable and Sustainable Energy Reviews* 149. doi:10.1016/j.rser.2021.111416
- Nhamo L., Ndlela B., Nhemachena C., Mabhaudhi T., Mpandeli S., and Matchaya G. (2018). The Water-Energy-Food Nexus: Climate Risks and Opportunities in Southern Africa. *Water* **10**, 18.
- Nhamo, L., Mabhaudhi, T., Mpandeli, S., Dickens, C., Nhemachena, C., Senzanje, A., et al. (2020). An integrative analytical model for the water-energy-food nexus: South Africa case study. *Environmental Science and Policy* 109 15-24. doi:10.1016/j.envsci.2020.04.010
- Pardoe J., D. Conway E. Namaganda K. Vincent A.J. Dougill and Kashaigili J.J. (2018). Climate change and the water–energy–food nexus: insights from policy and practice in Tanzania. *Clim. Policy* 18(7): 863–877
- Salam, A. P., Shrestha, S., Pandey, V. P., and Anal, A. K. (2017). *Water-Energy-Food Nexus: Principles and Practices*. Hoboken: American Geophysical Union. doi:10.1002/9781119243175
- Taguta, C., Senzanje, A., Kiala, Z., Malota, M., Mabhaudhi, T. (2022). Water-Energy-Food Nexus Tools in Theory and Practice: A Systematic Review. *Front. Water*, 25 March 2022. Sec. Water and Human Systems. <https://doi.org/10.3389/frwa.2022.837316>

# Annex 1: Survey on Water-Energy-Food (WEF) Nexus Curriculum Analysis at Selected Tertiary Institutions (Universities, Technical Colleges) in South Africa

## Section 1

**Background:** The Water-Energy-Food (WEF) nexus is a new and sustainable approach for advancing food and nutrition security and achieving SDGs 2 (Zero hunger), 6 (Clean water and sanitation) and 7 (Clean and affordable energy).

**Objective:** The objective of this survey is to conduct a curriculum analysis on WEF Nexus teaching and learning at selected tertiary institutions (technical colleges and universities) in South Africa, in terms of who, what and how much of the WEF Nexus material is covered in certificate, diploma, and degree programmes.

**Confidentiality:** The information captured in this questionnaire is strictly confidential and will be used for research purposes only.

**Participation:** Participation in this study is voluntary and participants are free to withdraw from the study at any time without any negative or undesirable consequences to themselves.

**Ethical clearance:** The study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number HSS/1971/017D).

**No Remuneration:** Due to the nature of the study, the researcher is not promising any benefits for participation in the research.

**Research Funding & Leadership:** The research is funded by the Water Research Commission of South Africa and Nexus Gains Initiative under the leadership of Prof T Mabhaudhi (Mabhaudhi@ukzn.ac.za), Dr A Senzanje (SenzanjeA@ukzn.ac.za), and Prof M Mudhara (Mudhara@ukzn.ac.za) to whom any queries can be directed.

**Duration:** The online survey will take approximately 5 minutes to complete.

## Section 2

### Respondent details

2.1 What is your position in the university or college system?

---

2.2 Which department do you work in?

---

2.3 Are you linked or related to curriculum development issues in the university or college system? If so, please explain.

## Section 3

### General Institution Information

3.1 Name of the Institution

3.2 Location of the institution (please tick)

Gauteng

Western Cape

KwaZulu-Natal

Eastern Cape

Mpumalanga

Free State

Northern Cape

North West

Limpopo

3.3 Programmes offered at the institution (please tick ALL that apply)

Certificates

Diplomas

Undergraduate

Masters

PhD

## Section 4

### Knowledge of WEF Nexus

4.1 Are you or members of your institution aware of WEF Nexus?

Yes



No

I do not know

4.2 Are you or members of your institution involved in WEF Nexus research?

Yes

No

I do not know

4.3 Is your institution involved in Integrated Water Resources Management (IWRM) teaching and research

Yes

No

I do not know

## Section 5

### WEF Nexus Teaching and Learning

This section can only be answered if the institution is involved in WEF Nexus (otherwise please proceed to Section 6)

5.1 How long have members of your institution been involved in WEF Nexus training? (years)

.....

5.2 Which departments/programmes/centres are hosting the WEF Nexus teaching and learning?

.....

.....

5.3 Who are the target clients or trainees for WEF Nexus? (Please tick ALL that apply)

Certificate level

Diploma level

Undergraduate level

Postgraduate level

5.4 How is the WEF Nexus embedded in the curriculum at your institution? (Tick ALL that applies)

Part of Diploma curriculum

Part of Undergraduate curriculum

Part of MSc curriculum

Part of PhD curriculum

As a stand-alone regular short course

As a stand-alone ad hoc short course

5.5 What aspects of WEF Nexus are covered in the curriculum? (Tick ALL that applies)

WEF Nexus concepts

WEF Nexus framework

WEF Nexus metrics and indicators

WEF Nexus models and tools

WEF Nexus operationalisation

WEF Nexus research and policy dialogue

WEF Nexus and investment planning

Social issues related to WEF Nexus

All of the above

5.6 List the WEF Nexus courses that are in the curriculum

---

---

5.7 Explain how the WEF Nexus curriculum is assessed (Tick ALL that applies).

Formal tests and examination

Case studies and practical reports

Postgraduate dissertations and theses

Other

5.8 Indicate any gaps that you see in WEF Nexus teaching and learning?

---

---

5.9 Indicate any improvements that you think are required/expected in WEF Nexus teaching and learning?

---

---

## Section 6

### Potential for WEF Nexus expansion/integration

6.1 Indicate if you think there is need for awareness sessions on WEF Nexus at your institution. If your answer is yes, please explain why

---

---

6.2 Indicate the discipline/programme/department that you would recommend incorporating WEF Nexus in their teaching/curricula. If any.

---

---

6.3 Which departments/programmes/centres should be targeted for WEF Nexus expansion/integration? If any.

---

---

6.4 Who should be the target clients or trainees for WEF Nexus expansion/integration? (Please tick ALL that applies)

Certificates

Diplomas

Undergraduates

Postgraduates

Other

6.5 Will capacity building be required? If yes, please explain what capacity building is required and who should be targeted.

---

---

6.6 Do you think WEF Nexus courses will be well received by students at your institution? Please give reasons for your answer.

---

---



INITIATIVE ON  
NEXUS Gains

CGIAR is a global research partnership for a food-secure future. CGIAR science is dedicated to transforming food, land and water systems in a climate crisis. Its research is carried out by 13 CGIAR Centers/Alliances in close collaboration with hundreds of partners, including national and regional research institutes, civil society organizations, academia, development organizations and the private sector. [www.cgiar.org](http://www.cgiar.org)

We would like to thank all funders who support this research through their contributions to the CGIAR Trust Fund:  
<https://www.cgiar.org/funders>

To learn more about this Initiative, please visit:  
[www.cgiar.org/initiative/28-nexus-gains-realizing-multiple-benefits-across-water-energy-food-forest-biodiversity-systems](http://www.cgiar.org/initiative/28-nexus-gains-realizing-multiple-benefits-across-water-energy-food-forest-biodiversity-systems)

To learn more about other Initiatives in the CGIAR Research Portfolio, please visit [www.cgiar.org/cgiar-portfolio](http://www.cgiar.org/cgiar-portfolio)



@CGIAR



CGIAR



CGIAR



CGIAR



UNIVERSITY OF  
KWAZULU-NATAL<sup>™</sup>  
INYUVESI  
YAKWAZULU-NATALI

CTAFS  
Centre for Transformative  
Agricultural and Food Systems

IWMI  
International Water  
Management Institute