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Outcome Evaluation of Research for Development Work Conducted in Ghana and Sri Lanka under the Resource, Recovery and Reuse (RRR) Subprogram of the CGIAR Research Program on Water, Land and Ecosystems (WLE)

Final report

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Submitted to the CGIAR Research Program on Water, Land and Ecosystems (WLE)

IN PARTNERSHIP WITH:

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Acronyms

A4NH	CGIAR Research Program on Agriculture for Nutrition and Health
AAS	CGIAR Research Program on Aquatic Agricultural Systems
AfDB	African Development Bank
AQUASTAT	FAO's global water information system
BMGF	Bill and Melinda Gates Foundation
BMZ	<i>Bundesministerium Für Wirtschaftliche Zusammenarbeit</i> (German Federal Ministry for Economic Development Cooperation)
CapVal	Creating and Capturing Value: Supporting Enterprises for Urban Liquid and Solid Wastes Recycling for Food, Energy and Clean Environment, Ghana
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CEA	Central Environment Authority, Sri Lanka
CEWAS	International Centre for Water Management Services, Switzerland
CGIAR-IEA	CGIAR Independent Evaluation Arrangement
CIM	Centre for International Migration and Development, Germany
CoA	Cluster of Activities
CRI	Coconut Research Institute, Sri Lanka
CRP	CGIAR Research Program
DEWATS	Decentralized Wastewater Treatment System
DFID	Department for International Development, United Kingdom
DGM	Deputy General Manager
EAWEG	Swiss Federal Institute of Aquatic Science and Technology, Switzerland
EPA	Environmental Protection Agency, USA
FAO	United Nations Food and Agriculture Organization
FSM	Fecal Sludge Management
GCC	Grand Challenge Canada
IBSRAM	International Board for Soil Research and Management
ICID	International Commission on Irrigation and Drainage
ICRAF	World Agroforestry Centre
IFAD	International Fund for Agricultural Development
IP	Intellectual Property
IPG	International Public Good
IWA	International Water Association
IWMI	International Water Management Institute
JVL	Jekora Ventures Ltd.
KNUST	Kwame Nkrumah University of Science and Technology, Ghana
LKR	Sri Lankan Rupee
LWS	Land and Water Solutions (WLE Flagship)
MCPWS	Ministry of City Planning and Water Supply, Sri Lanka
MLGRD	Ministry of Local Government and Rural Development, Ghana
MOFA	Ministry of Food and Agriculture, Ghana
MOOC	Massive Open Online Courses
MoU	Memorandum of Understanding
MSW	Municipal Solid Waste

NWSDB	National Water Supply and Drainage Board, Sri Lanka
PILASARU	Integrated solid waste management program, Sri Lanka
PPP	Public Private Partnership
R4D	Research-for-Development
RDL	Restoring Degraded Landscapes (WLE Flagship)
RRI	Rubber Research Institute, Sri Lanka
RRR	Resource Recovery and Reuse
RUAF	Global Partnership on Sustainable Urban Agriculture and Food Systems
RUB	Ruhr University Bochum
RUL	Sustaining Rural Urban Linkages (WLE Flagship)
SANDEC	Department Sanitation Water and Solid Waste for Development, Eaweg, Switzerland
SACOSAN	South Asian Conference on Sanitation
SDC	Swiss Agency for Development and Cooperation
SDG	Sustainable Development Goal
SRP	Strategic Research Portfolio
SSWM	Sustainable Sanitation and Water Management Toolbox
TMA	Tema Metropolitan Assembly (Ghana)
ToC	Theory of Change
ToR	Terms of Reference
TREND	Training Research and Networking for Development, Ghana
UNEP	United Nations Environment Program
UNICEF	United Nations Children's Fund
UNU- INWEH	United Nations University Institute for Water, Environment and Health
UNWDPC	UN-Water Decade Programme on Capacity Development
USAID	United States Agency for International Development
USD	United States Dollar
US-EPA	United States Environmental Protection Agency
WaFo	Scaling Out the Recovery of Nutrients and Organic Matter from Faecal Sludge for Food Production in Ghana: From Waste to Food project, Ghana
WASH	Water, Sanitation and Hygiene
WaSSIP	Water Supply and Sanitation Improvement Project, Sri Lanka
WATSAN	Water and Sanitation
WB	World Bank
WEDEC	Water Engineering and Development Centre, Loughborough University, UK
WHO	World Health Organization
WLE	CGIAR Research Program on Water, Land and Ecosystems
WSS	Water Supply and Sanitation
WWR	Waste Water Reuse
YKMA	Yilo Krobo Municipal Assembly (Ghana)

Preface

The CGIAR Research Program on Water Land and Ecosystems (WLE) commissioned this study of the lessons learned from implementing the research program on Resource Recovery and Reuse (RRR). The “resource” in this case is the growing volumes of waste produced in cities in developing countries. We are grateful to all the RRR scientists and their partners who willingly gave their time to answer our numerous questions and help us to understand the underlying research for development processes. We especially acknowledge the efforts of the senior researchers, Pay Drechsel, Miriam Otoo, and Olufunke Cofie, to help us understand the program. We are also grateful to Sudarshana Fernando and Eric Nartley who helped us meet a variety of partners in Sri Lanka and Ghana respectively.

We received valuable initial feedback from Izabella Koziell, Pay Drechsel, Emma Greatrix, Keith Child, and Miriam Otoo when we presented preliminary conclusions and recommendations on 13th March 2019. Keith also carried out a detailed review of an earlier draft and made significant suggestions for improving the structure of the report.

In May 2019, we received detailed comments from the WLE RUL team on the draft final report. We have considered all of these comments carefully, made corrections where there were errors, accepted some suggested changes, and clarified points in response to comments.

We would like to note that our evaluation is a very positive one. The team should be proud of what it has accomplished, especially given the modest financial resources available. There are lessons for WLE and other Flagships emerging from our evaluation. We have also made some recommendations that we believe would further strengthen the program in the future.

Needless to say, we remain solely responsible for the contents of this report.

Hilmy Sally

Douglas Merrey

14 June 2019

Abstract

This is the main report of an external evaluation of the Resource Recovery and Reuse Flagship of the Water Land and Ecosystems (WLE) CGIAR Research Program. WLE commissioned the study. A separate extended Executive Summary has also been prepared. The Evaluators interviewed researchers and partners in two countries, Ghana and Sri Lanka, and in Ghana visited two sites. They also interviewed key international partners and analyzed a wide range of documents, reports and publications. The evaluation was focused on understanding how and in what ways the research and other activities carried out by IWMI and supported by WLE contributed to the outcomes. In essence, the purpose was to understand the specific impact pathways from research to outputs and outcomes.

The “value added” of this evaluation has at least three dimensions. First, it independently validates specific outputs and outcomes of the RRR subprogram. Second, it offers evidence on what contributions WLE has made to achieve the outputs and outcomes and how they were achieved. Third, based on the evaluation findings it offers a number of specific conclusions tied to the questions posed in the Terms of Reference. It also presents five recommendations and five additional “suggestions”.

The evaluation is very positive overall. This is a very successful pioneering research-for-development program which offers lessons for other CRPs and WLE Flagships.

This Report presents the conclusions and recommendations and a detailed discussion of the specific findings that form the basis for the conclusions and recommendations. The separate Executive Summary focuses on presenting the conclusions and recommendations.

1. Purpose and Scope of the Study

1.1. Purpose and Scope of the Study

With the support of the Water Land and Ecosystems (WLE) Program, the International Water Management Institute (IWMI) and its partners have been implementing research activities aimed at developing new value propositions and business models for recovering and reusing urban solid and liquid waste, mainly though not exclusively for agriculture. The work has its roots in IWMI's work on wastewater reuse in the 1990s but has been supported by WLE since 2011. The research has been transdisciplinary, combining technical with institutional, policy and business studies. IWMI has been especially active in Ghana but has worked in other countries as well. In addition, IWMI has been engaging with international agencies to influence various United Nations guidelines and manuals related to recycling urban waste.

The Invitation for Expressions of Interest (IWMI 2018) provided a detailed explanation of the proposed evaluation, including the purpose, draft evaluation questions and suggestions on the approach to be followed. These Terms of Reference (ToR) were further clarified in a scoping meeting via Skype with the key WLE people on 22 January 2019 (Child 2019).

This is a unique type of evaluation in that it is not aimed at verifying the outputs and outcomes claimed by IWMI and WLE (though we did validate them). Rather, it is focused on understanding how and in what ways the research and other activities carried out by IWMI and supported in various ways by WLE contributed to the outcomes. In essence, the purpose is to understand the specific impact pathways from research to outputs and outcomes. In the course of answering this question, we sought to document and verify what specific roles WLE played: would the same outcomes have been achieved without WLE? This is not a trivial or simple question. WLE provides many kinds of support, including offering relatively flexible though modest funding, production of a wide range of WLE-branded knowledge products, support for developing proposals and theories of change, and monitoring and reporting to donors and other stakeholders.

We believe the “value added” of this evaluation has at least three dimensions. First, it independently validates specific outputs and outcomes of the RRR subprogram. Second, it offers evidence on what contributions WLE has made to achieving the outputs and outcomes and how they were achieved. Third, based on the evaluation findings, the study makes recommendations on how IWMI and WLE (and indeed other CGIAR Research Programs) could become more effective in supporting agricultural and natural resources management research for developing processes.

The ToR articulates three major draft evaluation questions. Each one is followed by two to three sub-questions. The three major questions posed are:

1. How and in what ways did WLE's RRR subprogram support the contribution of intended outcomes?
2. Are [the] outcomes likely to be sustainable over the long term?
3. What lessons can be learned from this body of work to enhance the effective design, management and assessment of WLE research-for-development programs in the future?

The sub-questions for each major evaluation question are included in Annex 2, where we have also listed a set of questions intended to guide our inquiries. We found the wording of the first major question somewhat unclear (“support the contribution ...”), but the sub-questions, as well as the Scoping Meeting, helped clarify what is expected. We have therefore tried to understand the specific contributions of the wide range of WLE knowledge products and activities as well as budget allocations to achieving the outcomes and whether there were any negative or unexpected outcomes as a result of WLE's support.

1.2. Structure of the report

This document is the *final report* of our evaluation. Section 2 presents our main conclusions and recommendations for how WLE can strengthen its support to its partners to enhance the effectiveness of its research-for-development program. The remainder of the report presents the evidence and observations that support our conclusions. Section 3 provides some background on the program, while Section 4 explains our overall conceptual framework and methodological approach. Section 5 analyzes the WLE and RRR evolving Theory of Change; and Section 6 presents our main findings with respect to the pathways through which WLE achieved the outcomes and impacts.

2. Conclusions and Recommendations

2.1. Conclusions

Overall, we have arrived at very positive conclusions. WLE's RRR (and now RUL [Rural-Urban Linkages]) Flagship is innovative, well-managed, and is achieving significant outcomes that have the potential to lead to major long-term impacts. The ToR poses three major questions for the study, supplemented by two to three sub-questions for each major question. We have organized our major conclusions around these questions. For most of our conclusions, we have indicated our degree of confidence: "high", "moderate" or "uncertain".

2.1.1. How and in what ways did WLE's RRR subprogram support the contribution of intended outcomes?

1. Did RRR knowledge products and engagement activities make a sufficient and appropriate contribution to observed outcomes? What alternative explanations exist for the achievement of these outcomes?

"Knowledge products and engagement activities" is a far-reaching term. We are highly confident that RRR knowledge products and knowledge sharing did contribute to some extent in the two countries, and significantly at the international level (*Sections 6.1, 6.2*). We are uncertain whether the same results would have been achieved in the two countries without these knowledge products, but it is plausible they would have been in Ghana (though more slowly) but probably not in Sri Lanka. We are moderately certain they were necessary for successful international engagement as they are the basis for IWMI's credibility at that level (*Section 6.3*). We are highly confident that the focused engagement process through multiple channels both in the two countries and at the international level has contributed significantly to achieving the observed outcomes (*Sections 6.1, 6.2, 6.3*). Based on our personal experiences in other research for development programs, we are highly confident that this engagement process was critical to success and could not have been achieved in the absence of effective engagement.

2. Did WLE help influence/contribute to partners designing and promoting research work that consider gender or the needs of marginalized groups?

The researchers we consulted agreed that to date, very little attention has been paid to gender or the needs of marginalized groups (*Section 6.2.9*). This most likely reflects a decision about research personnel priorities given limited resources. An important exception is the Business Model Catalog (Otoo and Drechsel 2018), where every business model has been analyzed from a gender perspective. Another example is the production of charcoal briquettes in Ghana for which a major market is women fish smokers. We accept that the work has been "gender-sensitive," i.e. it is likely the impacts of the work benefits women as well as men. In principle, there ought to be considerable opportunities for promoting women- and youth-owned small and medium businesses, but we are not aware of any such targeted effort. We were provided with a summary of a new project supported by *Bundesministerium Für Wirtschaftliche Zusammenarbeit*, the German Federal Ministry for Economic Development Cooperation (BMZ), "Gender-responsive innovations for soil rehabilitation, alternative fuel and agriculture for resilient refugee and host community settlements in East Africa". See *Recommendation 1*.

3. Were there any negative or unexpected outcomes from this body of work?

We are not aware of, and do not believe there have been, any negative or major unexpected outcomes from this body of work. However, as the production of Fortifer™ and other waste-based products is ramped up, there is a potential for growing competition for the raw materials used in manufacturing the products. In Sri Lanka we were made aware of a possible unexpected positive outcome: a nascent

[pelletizing machine fabrication](#) (Section 4.2.7). We suggest that WLE-RRR should continue monitoring developments in this regard, especially with a view to assessing growth potential and improving production of co-composted products in terms of both quantity and quality.

4. Other observations regarding this question

In Ghana, the RRR program contributed significantly to increasing the interest in recycling of urban waste into commercial products (high confidence; Section 6.2). The influence the RRR/ RUL program has had on international public goods would not have been possible without the on-the-ground experience in Ghana (high confidence; Section 6.2). The influence on Sri Lanka’s septage policy was possible only because WLE-IWMI had demonstrated the concept in Ghana (high confidence; Section 6.1.2) and its approach had been endorsed by international agencies (uncertain).

The RRR/ RUL program leaders emphasized WLE’s added value. By accommodating the RRR program in phase 1 of WLE, the program enabled IWMI to build on its previous emphasis on wastewater management to include solid waste management and to do something far more innovative: to analyze economic and business-oriented approaches to RRR to accompany its portfolio of technical, policy and institutional options. This necessitated hiring staff with backgrounds in business and the private sector, to complete the existing disciplines in engineering, health and natural resources and thereby create a much larger inter-disciplinary team (Section 3.1). WLE phase 1 enabled IWMI to hire several post-docs and professionals from different disciplines, both research and non-research (e.g., a business audit specialist). WLE has provided the resources to allow IWMI and RRR to achieve results and outcomes beyond the confines of a classic research project that would otherwise have stopped with agreed outputs, publications and IPGs. In a sense, WLE took up the slack in the absence of (or very limited availability of) core/ unrestricted funds coming from IWMI for facilitating the impact pathway. In summary, researchers say that WLE added value in the following ways (*see also Section 6.2.6*):

- Providing a new programmatic scope with four defined impact pathways;
- Providing funding, mainly staff time for (a) the production and dissemination of synthesis publications and (b) networking and partnerships in support of Research-for-Development (R4D) outcomes;
- Allowing RRR to be innovative (e.g. developing and promoting business models for RRR);
- Providing the flexibility to respond to opportunities and expressions of partner interest and demand such as the revision of the Sri Lanka sanitation policy, participate in task forces/committees, attend workshops and seminars; and
- Helping RRR-IWMI to sustain its reputation without loss of momentum, as it broadened its focus from wastewater to include solid waste management and energy recovery, allowing a rebranding in line with its revamped focus, such as through its own Resource Recovery and Reuse publication series¹.

We do not dispute this positive assessment of the Flagship’s added value; indeed, we endorse it. Nevertheless, in our opening chapter (Section 1.1), we posed the question, “would the same outcomes have been achieved without WLE?” We suggested that this is not a trivial question. We are highly confident that WLE has significantly supported the achievement of important outcomes, and without that support, they are unlikely to have been achieved (Sections 6.1, 6.2, 6.3, 6.4) Whether alternative institutional arrangements could have made the same contribution is beyond the scope of this report.

¹ This is the only Flagship-specific publication series in WLE.

2.1.2. Are [the] outcomes likely to be sustainable over the long term?

1. How enduring is the influence of the RRR subprogram (through its partners) at the national and sub-national levels?

In Ghana as well as in Sri Lanka, the basic RRR concept of treating waste material as a resource and identifying ways to process it into useful products seems likely to be enduring (high confidence for Ghana, moderate confidence for Sri Lanka; *Sections 6.1, 6.2*). The research team is aware that solutions (including business models) have to be evidence-based, inherently robust and sustainable and not simply based on anecdotal observation. In Ghana, the PPP approach to processing waste products into commercially profitable products is likely to endure, even if over time other kinds of PPPs emerge (moderate confidence; *Section 6.2*).

In Sri Lanka, we are uncertain whether the concept of converting waste material into fortified co-compost will be sustainable, as there seems to be little incentive for officials to take this extra step beyond producing common compost that is sold at a heavy discount (*Sections 6.1.2; 6.1.3; 6.1.4*). While recognizing the large investments in the green economy made by the Sri Lankan government (e.g. via its integrated solid waste management [PILISARU] program) and also lauding the efforts of WLE scientists to promote uptake of RRR innovations, we are not certain, at this early stage, whether successful Public Private Partnership (PPP) co-compost production business models will emerge in the near future, given the political context. However, it is possible that contractual arrangements between municipalities and private plantation farms could develop and create demand for quality co-composted products (uncertain confidence).

Although not asked by the question posed, we also conclude the influence of RRR at the international level is likely to endure for some time (high confidence; *Section 6.3*). If WLE/ IWMI maintains its innovative research and engagement, it should be able to *continue influencing* future iterations of the databases, manuals and other documents produced by the international partners (moderate confidence; *Section 6.3*).

2. Did the RRR subprogram work with partners (research and development) who were appropriate to achieve its desired outcomes?

Based on our interviews with both IWMI researchers and many partners, we conclude that RRR did (and does) indeed collaborate with appropriate partners at national and international levels who have helped (and are helping) it to achieve the program's outcomes (high confidence; *Sections 6.1, 6.2, 6.3, 6.4*). This does not mean there might have been other partners it could have worked with, but we are not aware of any specific examples from outside WLE. However, within WLE, we have concluded that there are missed opportunities for inter-Flagship collaboration (*Point 6 of Section 6.2.6 and Section 2.2 below*). The RRR team in both Ghana and Sri Lanka are apparently carrying out research on impact of various versions of Fortifer™ and fortified co-compost that could be done in collaboration with the Land and Water Solutions (LWS) and Restoring Degraded Landscapes (RDL) Flagships. This work could be a component of those Flagships' work on soil fertility and land and water management. The summary of the BMZ proposal, "Gender-responsive innovations for soil rehabilitation, alternative fuel and agriculture for resilient refugee and host community settlements in East Africa", referred to above, indicates that this research will involve collaboration with RDL. This is a positive development; we conclude that even more could be done. See further observations below, *Section 2.2*, and *Recommendation 2*.

3. Other observations regarding this question

In Ghana, it is premature to come to a conclusion regarding the sustainability of the PPPs being established. The program is at an early stage of a proof of concept level for the commercial pilots. The major operating PPP is not yet breaking even and faces significant challenges (high confidence;

Section 6.3). Further, there is at least one competing firm making compost from fecal sludge in Accra: the Accra Compost and Recycling plant which manufactures about 40-50 bags of pelletized organic fertilizer daily (Ofori-Amanfo et al. 2018). We do not have much information on this company and its products. In comments on the draft final report, we were informed that “the IWMI Ghana team engages with the Accra Compost plant and similar compost producers in the country”; and that this plant is heavily subsidized. This reinforces our point that the Tema plant faces serious competitive challenges.

In Sri Lanka, the adoption of RRR principles and of associated good practice for the processing of co-composted products is at an early stage. IWMI-RRR is, however, already partnering with universities, the national commodity research institutes like the Coconut Research Institute (CRI) and the Rubber Research Institute (RRI), local authorities, plantation companies and associations of plantation professionals. The CRI and RRI contribute to the development of standards and guidelines for organic fertilizer standards for sustainable agricultural soil management. Local authorities are involved in co-compost production and pelletizing while the plantation companies are expected to participate in field experiments with RRR products. A combination of circumstances including technical glitches involving installation of machinery and equipment, lack of funding, plus recent political and institutional upheavals have resulted in limited production of fecal sludge enriched co-compost to date but also inadequate control of quality. Meeting the demand from large-scale plantation sectors in the future will be a challenge (high confidence; *Section 6.1*).

2.1.3. What lessons can be learned from this body of work to enhance the effective design, management and assessment of WLE research-for-development programs in the future?

In considering the two sub-questions, we understand that “mechanisms” refers to implementation strategies (sub-question 1) while facilitating or constraining “factors” refer to the conditions under which the program operated, for example, the policy environment (sub-question two)².

1. What mechanisms from RRR’s programmatic approach proved to be particularly effective? What can we learn from these mechanisms for WLE’s engagement with CGIAR centers and its other flagships?

We are highly confident the following mechanisms effectively facilitated the implementation of the RRR work: 1) excellent leadership at subprogram and country levels; 2) long-term highly focused research program; 3) provision of flexible funding support from WLE W1/W2 to complement bilateral projects (both for publications and for meeting unanticipated needs); 4) development of strong partnerships (individual and institutional) that have continued over time in Ghana and internationally, and in Ghana have often become champions or facilitators to help the implementation of the research results; 5) the quality and novelty of research products both generated new ideas (business models) and made IWMI credible in the eyes of both national and international partners; and 6) building local professional capacities, for example by support for students and interns, some of whom either joined IWMI later or went on to important positions in national and international agencies (*Sections 6.1, 6.2, 6.3, 6.4*). Most of these mechanisms are undoubtedly followed to various degrees by other CGIAR Research Programs (CRPs) and other WLE Flagships, but we are highly confident that pursuing a long-term research for development program driven by a vision of what can be accomplished is all too rare.

There is a lesson for WLE and other CRPs in the future: focus more resources on fewer “best bet” options where there is an opportunity to build on good quality past research to achieve real, significant

² Personal communication from the WLE Evaluation Manager, Keith Child.

outcomes (see Section 2.4). Compared to phase 1, the Flagships of WLE phase 2 demonstrate more focus, but we believe that more can be done along this line. *See Recommendation 3.*

2. What factors facilitated or constrained the implementation of work under the RRR subprogram?

In Ghana, several factors facilitated the implementation of the work under the RRR program. These included broadly supportive policies toward use of PPPs in managing urban waste and as a result of IWMI's intervention, support for organic fertilizer to be eligible for the fertilizer subsidy; a strong private sector partner; and interest and commitment of key partners in the government (high confidence; *Section 6.2*). Constraining factors included the low level of capacity (institutional and financial) of municipalities; lack of effective incentives for local officials to implement novel ideas; complex and opaque land rights making identification of appropriate sites for recycling plants a challenge; lack of an effective organic fertilizer value chain on the demand side; and inability so far to produce Fortifer™ at a large volume to meet demand (high confidence; *Section 6.2.8*).

In Sri Lanka, facilitating factors include IWMI's long-term presence and reputation in the country and the presence of donor funding to support implementation programs (high confidence; *Sections 6.1.2; 6.1.3; 6.1.4*). Some constraining factors in Sri Lanka are somewhat similar to those in Ghana: the institutional capacity of municipalities is weak, and there are no effective incentives for local officials to implement novel ideas. Another constraining factor is the lack of a PPP policy (indeed we detected resistance to the idea at least for joint ventures in organic fertilizer production). Municipalities are not effective at producing a quality fertilizer product and marketing it, which in turn makes effective waste management a financial challenge (high confidence; *Sections 6.1.3; 6.1.4*). Like Ghana, there is no effective marketing value chain on the demand side, and no capacity, as yet, to produce quality fortified fertilizer at a sufficient volume to attract the interest of potential large-scale customers. These factors coupled with those already described in Part 3 of section 2.1.2 above have unfortunately hampered the ability of WLE-RRR to actively promote fecal sludge-based fortified fertilizer (high confidence; *Sections 6.1, 6.2*).

At the WLE level, we are also highly confident the following acted as constraints to implementation: 1) year-to-year and even within-year financial uncertainty, making long-term planning difficult; and 2) lack of long-term donor support. Another possible constraint is that IWMI is not recognized as an institution with sanitation expertise (it works only at one end of the chain) (moderate confidence), though it has carved a unique niche for itself within the sanitation value chain. *See Recommendation 4.*

3. What insights can be gained from the use of the theory of change framework, as used by CGIAR centers and WLE?

At the Program level, WLE has a robust Theory of Change (ToC), especially in Phase 2. The ToCs have helped conceptualize plausible impact pathways to achieving outcomes that are useful at the program and sub-program level and for preparing winning proposals (high confidence; *Section 5*). However, at the project level, we found that there is no formal, conscious ToC – it is “intuitive”. In Ghana, the senior scientists emphasized being pragmatic and opportunistic. They do have a plausible implicit unstated “theory” of how the results of their work could lead to its widespread uptake and use, as summarized in *Section 6.2.5*. However, most researchers do not consider impact pathways to be useful management tools (high confidence; *Section 6.2.5*). Researchers on their own would have great difficulty carrying out an in-depth analysis of the underlying assumptions, multiple potential

pathways, hidden vested interests and perceptions that would enable them to build and use effective impact pathways (high confidence³). See *Recommendation 5*.

2.2. Other concluding remarks

Observations from WLE external evaluation. We reviewed the 2016 external evaluation of WLE (CGIAR-IEA 2016) to compare its statements on the RRR/ RUL program to our own assessment. Overall, our assessment is consistent with and therefore largely confirms the conclusions of that evaluation.

The 2016 evaluation rated the novelty and quality of the program and its output as being very high. The focus on economic analysis and business models was regarded as innovative and at “an international standard in global wastewater research and development” (CGIAR-IEA 2016: 54-55) and has had positive outcomes. It confirmed WLE’s contributions to international databases and other products. It noted that this Flagship has attempted to carry out a detailed analysis as a basis for its ToC. On the other hand, the evaluation also observed that it was not clear that the ToCs at Program and Flagship levels were being used to make management decisions, for example on the allocation of resources. It suggested that the Program’s ToCs remain somewhat linear and over-simplified, does not pay sufficient attention to the multiple factors that can affect attempts to bring about change, that there may well be different impact pathways in any given context, and impact pathways can change as windows of opportunity open or close.

WLE has brought RRR into the CGIAR discourse. The summarized version of the CGIAR Annual Performance Report (CGIAR 2018a) has the subtitle “Transforming the Global Food System”. Nevertheless, to our knowledge, the CGIAR system has yet to come to terms with its role in the larger rural-urban food, energy and water system. WLE’s Phase 1 RRR Strategic Program is a pioneer in this regard and its expansion in phase 2 to Sustaining Rural-Urban Linkages is also at the leading edge. We understand, but cannot verify the details, that there has always been some reluctance at the CGIAR system level to including this work: it does not fit “traditional” agricultural research. Some scientists in Ghana suggested that WLE has brought the RRR discourse into the CGIAR, and that as a result, it is less controversial now. Evidence for this is contained in the full CGIAR Annual Performance Report (CGIAR 2018b:21): a half-page box on the inputs to the Sri Lanka sanitation policy⁴.

Inter-flagship cooperation. An analysis of the authorship and content of the different outlets used by WLE to communicate research results reveals little evidence of inter-flagship collaboration. For example:

- Of the eight publications listed in the WLE Research for Development (R4D) Learning Series, only one (#7) had a co-author representing RRR.
- Of the seven WLE Insights and Solutions Briefs produced so far, two (#2 and #4) refer to RRR/RUL research.
- On the other hand, perhaps understandably, RRR/RUL researchers dominate the dedicated RRR research series. Thirteen RRR Research Reports have been published so far. IWMI RRR researchers account for 80% of their co-authorship with WLE partners and other flagships providing just 6% of co-authors. Co-authors representing universities, UN agencies and donors make up the remaining 14%. This observation is illustrated in Figure 1.

³ This came across in interviews but is also an observation of the external evaluation (CGIAR-IEA 2016). See Section 6.1.4.

⁴ We understand that in IWMI’s new strategy, the rural-urban linkages program will lose its visibility. We wonder what the implications may be for the future of the RUL work.

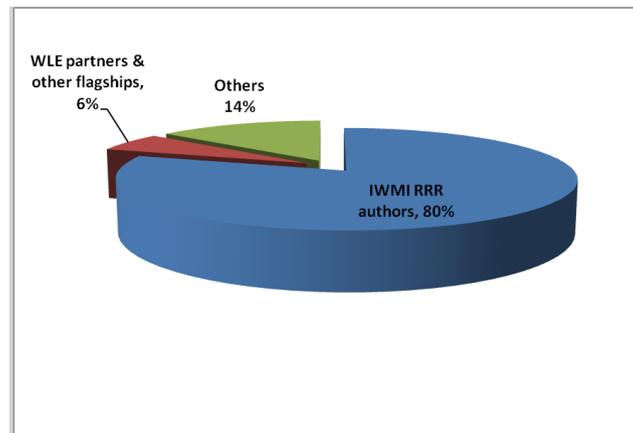


Figure 1: Co-authorship analysis of the RRR Research Report series (N=13)

2.3. Recommendations

We have no recommendations that would involve major changes in the RRR program. We have concluded that it is on track and is clearly making major contributions at national and international levels to finding ways to recycle the growing stock of urban waste material into useful commercial products (high confidence). We also believe that the approach to managing the RRR program is especially effective – indeed the quality of program management is perhaps the most critical reason for its relative success. However, we do make the following five recommendations for consideration by the WLE management.

2.3.1. Recommendation #1 on gender and youth

The main focus of the program hitherto has been on the business and financial aspects of RRR in addition to its health and environmental impacts. The researchers admit that the program has not had a strong gender focus. This applies to youth as well. We think this area needs serious attention. For example, there must be opportunities for women- and youth-owned small and medium businesses in creating value from waste. Further, there are risks of displacing women from their current (likely invisible) roles in processing urban waste material.

We recommend that the RRR program identify a social analyst with strong gender analysis credentials who understands both the entire value chain in which the program operates, as well as the potential for women- and youth-owned small to medium-sized businesses. This person should be able to assist WLE to develop and integrate a stronger gender focus in the main thrust of the program, and to develop a proposal for funding that would enable the program to implement work on gender.

2.3.2. Recommendation #2 on optimizing inter-Flagship synergies

The WLE Flagships are each designed to address critically important global challenges, for example how to manage water to sustainably increase agricultural production in the face of growing water scarcity (LWS); how to reverse the threat of worsening soil degradation and keeping soils healthy and fertile while also intensifying production (RDL); and how to improve rural-urban food and waste management systems to maximize the availability of affordable, healthy, nutritious food while also recovering and reusing urban waste (RUL). The question we are raising is whether WLE could achieve more if it made a greater effort to build on synergies among its Flagships. We recognize there is some collaboration between RDL and RUL, but it is a relatively minor component of the overall program.

In our view, there may be significant innovative “out of the box” research opportunities that could be addressed through more inter-flagship collaboration. For example, increasing soil degradation is a serious challenge, especially in Africa; and the rapid growth in cities is producing large amounts of

waste material that needs to be recycled to avoid pollution and public health risks. It seems possible that recycling this waste into fortified compost could be an excellent product to reverse land degradation and progress toward a “green economy”.

We therefore recommend that WLE Management consider facilitating a joint workshop with scientists from LWS, RDL and RUL to develop a joint research program for which separate funding could be sought. This would essentially examine how to maximize the agricultural benefits of the use of co-composted urban waste material to promote sustainable intensification while supporting cities’ management of waste material and promoting the emergence of a green economy.

2.3.3. Recommendation #3 on focusing of Flagships on a limited number of best-bet innovations

When the first phase of CRPs was initiated, CGIAR Centers were encouraged to “map” existing projects to the most appropriate CRPs. In many cases, this led to Flagships that included a wide range of research activities, and broad dispersal of limited Windows 1-2 funds. One result is that it is difficult to demonstrate the achievement of major outcomes because of insufficient long-term, flexible support.

The RRR program escaped this fate: it was developed out of the work being done by one Center (IWMI). Because there was virtually no other CGIAR work on the topic, few if any projects were “mapped” to RRR by other Centers. This focused research-for-development program was driven by a clear vision that recovery and reuse of urban waste could be made commercially viable, and would, if implemented at scale, both reduce the deleterious impacts of waste disposal and contribute to reversing soil degradation through the use of organic waste – a classic “circular” or “green” economy solution. WLE has already demonstrated important outcomes nationally and internationally as a result of this work, and as the lessons learned are scaled out, there is a plausible case that the work will result in very significant long-term impacts.

We recommend that WLE’s management consider adopting a set of criteria to rank the various activities underway in LWS, RDL and VCR as to their potential to achieve significant innovative science-based outcomes with a potential for major impacts (perhaps based on the five CGIAR “Grand Challenges”), and focus most of its human and financial resources on implementing these activities. This would require difficult decisions in terms of stopping Windows 1-2 support for some activities. We recommend WLE continue investing in a limited number of promising new areas but very selectively. If implementing this proposal is politically impossible in phase 2, it should be considered by both WLE Management and the CGIAR in designing phase 3 programs.

2.3.4. Recommendation #4 on WLE/ IWMI positioning in the sanitation sector

WLE/ IWMI work at one end of the sanitation value chain; IWMI is not seen as an expert in the larger sanitation sector. There are many initiatives underway in addition to WLE’s – in some cases they may offer viable alternatives to WLE’s solutions. On the other hand, WLE has some important strengths (e.g. the link to agriculture) and innovative ideas (e.g. the business model approach) of its own to bring to the table. WLE has a demonstrated capacity to integrate sectors such as sanitation, agriculture and ecosystem services that can lead to innovative solutions. Therefore, although there is a potential for growing competition, there are also opportunities for new partnerships. The program has published an important guideline on analyzing the enabling environment, financing sources, and potential for cost recovery in financing resource recovery and reuse (Lazurko et al. 2018). However, by itself, this does not address the question of the major risks, potential competition and partners, and what is WLE’s future niche.

We recommend two things. First, IWMI/ WLE should carry out a formal, in-depth assessment of the sanitation sector in the context of waste recycling and the green economy using external expertise. The review will identify the major risks and potential competition, who the major actors

are, what directions the sector is taking, and what could be the future niche of WLE/ IWMI. This would provide a basis for planning the next decade of work. Second, depending on the results of that assessment, we recommend that WLE's RRR program consider establishing strong long-term partnerships with institutions having complementary strengths in the sanitation sector (and its contribution to achieving a green economy).

2.3.5. Recommendation #5 on use of ToCs and impact pathways

Valid Theories of Change (ToCs) must be based on a nuanced detailed knowledge of the universe within which the program is operating, combined with basic behavioral and social science understanding. With the external evaluators of WLE (CGIAR-IEA 2016), we believe it is unrealistic to expect researchers to internalize and use ToCs without professional assistance to facilitate the development of plausible impact pathways, involving all the main partners. Just creating a figure for the purpose of a proposal is not sufficient.

We recommend that WLE take further steps to strengthen its impact pathways at sub-program and project levels and make more effective use of them. These steps could include: 1) providing effective training to researchers in the concept of ToCs and the use of impact pathways in designing and managing programs and projects; 2) use professional facilitators in a workshop or brainstorming context to develop programmatic impact pathways and impact pathways for major projects, and 3) include the major partners in the process of developing the impact pathway and overall program/project at the beginning of the program and/ or project.

2.4. Other suggestions based on the study

In this section we make a few *suggestions* for consideration by WLE management.

1. We commend the research team on achieving excellent outputs and outcomes while dealing well with on-ground technical, policy, institutional and political realities that sometimes constrain implementation and uptake of their research results. However, we *suggest* that WLE invest more in gaining a deep understanding of the contextual realities as a basis for more realistic planning of research for development programs.
2. We *suggest* WLE continue to support opportunities/ initiatives for international engagement (with implementation, development cooperation and international financing agencies; academic and UN institutions) to consolidate and enhance IWMI-WLE-RRR visibility and influence by bringing its research findings and outputs to the attention of global audiences and benefiting from extensive media exposure.
3. We endorse RRR endeavors to reach out to business schools to expand awareness-raising about the potential for adopting business approaches to address issues related to RRR and RUL and promote uptake of RRR curricula, in addition to ongoing initiatives focused on universities offering sanitation, wastewater and engineering type courses. We *suggest* other Flagships consider following this approach to engagement. We also *suggest* that WLE evaluate its success after three to four years.
4. We *suggest* that IWMI-WLE consider continuing its support to FAO's global water information system (AQUASTAT), with a view to consolidating the investments and efforts already deployed to harmonize and validate data collection for the wastewater segment of AQUASTAT.
5. We *suggest* that WLE take on board two characteristics of the Ghana RRR program that were fundamental to the success there. First, having a long-term vision of what they wanted to achieve was critically important (driven by a leader who has continued for the entire period). Second, they invested early in capacity development, especially for postgraduate students, that made very important contributions over time and continue to be important professionals in the field.

3. Overview of the RRR Program

3.1 From WWR to RRR

IWMI’s Resource Recovery and Reuse (RRR) research program was built on the foundation provided by its program on Waste Water Reuse (WWR) that had begun in the 1990s. Whereas much of the ongoing work by others at the time focused on health, sanitation and engineering aspects, IWMI carved out a niche for itself using agriculture as its entry point. In the 2000s, the emphasis gradually shifted from safe use and disposal to reuse and recovery. The RRR program also brought in another dimension to reuse and recovery – the potential for recovery of water, nutrients and energy from domestic and agricultural waste. Recognition of the business opportunities arising from such resource recovery saw the inclusion of economic and business model analyses into the RRR research portfolio.

When the CGIAR launched its new CGIAR Research Programs (CRPs), work on recycling urban waste into agricultural inputs was not a recognized thrust of the system – despite the fact that some Centers, in addition to IWMI, were working on this topic. In phase 1 of the Water Land and Ecosystems (WLE) program, RRR was included as one of the five “Strategic Research Portfolios (SRP)”. The section of the proposal describing this new program was introduced by the phrase, “*Our vision: waste is a resource, and a business opportunity*” (WLE 2011: 113ff).

The proposal presented a strong argument as to why this thrust is potentially an important area of research for the CGIAR and set out a broad strategy to achieve demonstrable results within ten years. The argument put forth was that the technical knowledge required to address the problem exists, but urgently needed more research on “developing viable waste recovery business models”, learning how to minimize health risks and enhance ecosystem services, developing new methods to create marketable products from urban waste, identifying how to support public-private enterprises, and building local capacities. Other institutions were continuing work on technological solutions, for which they had a strong comparative advantage over IWMI. The RRR program was designed to fill these non-technological gaps.

Indeed, WLE afforded IWMI an opening to do something far more innovative than wastewater reuse, around which it had built a solid reputation over the previous decade: that is, to analyze economic and business-oriented approaches to RRR to complement its portfolio of technical, policy and institutional options. WLE also enabled the hiring of staff with backgrounds in business and the private sector, both research and non-research, to complement the existing disciplines in engineering, health and natural resources. Table 1 below shows the trans-disciplinary composition of the RRR-RUL research team.

Table 1: Staff composition of RRR-RUL research team

Name and location	Position	Expertise
CURRENT TEAM MEMBERS		
Pay Drechsel, IWMI-HQ	Leader, IWMI Strategic Program and WLE-CGIAR Flagship on Rural-Urban Linkages (RUL)	Soil Science, Natural Resources Management, Wastewater use, Urban Agriculture
Miriam Otoo, IWMI-HQ	Research Group Leader – Resource Recovery and Reuse (RRR)	Agricultural Economics, Microeconomics of Business Development
Javier Mateo-Sagasta, IWMI-HQ	Agricultural and Environmental Engineer and Research Group Leader – Water, Health and Nutrition (WHN)	Control of water pollution, safe water reuse, agricultural water management, watershed planning

Name and location	Position	Expertise
Sudarshana Fernando, IWMI-HQ	Researcher - Resource Recovery and Reuse Expert	Solid waste management and regulation, composting and environmental impact assessment
Priyane Amerasinghe, IWMI-HQ	Senior Researcher – Human and Environmental Health	Human and environmental health, urban agriculture
Andreas Ulrich, IWMI-HQ	Researcher – Waste and Sanitation Management	Senior advisor on fecal sludge and wastewater management
Avinandan Taron, IWMI-HQ	Researcher - Investment and Institutional Analyst for RRR Business Development	Environmental and resource economics, Impact evaluation of interventions
Anurag Chaturvedi, IWMI-HQ & India	Researcher - Business Model Analysis & Enterprise Development	Chartered accountancy; business management
Nilanthi Jayathilake, IWMI-HQ	Research Officer – Septage Management & Reuse	Water & Wastewater Management and solid waste management
Felix Grau, IWMI-HQ	Visiting scientist & PhD Fellow	Agricultural and soil science
Olufunke Cofie, IWMI-Ghana	Head, IWMI West Africa Office	Soil science, Natural resources management
Josiane Nikiema, IWMI-Ghana	Senior Researcher – Environmental Sciences	Environmental science and technology
Solomie Gebrezgabher, IWMI-Ghana	Researcher - Economics	Business economics and investment analysis
Eric Nartey, IWMI-Ghana	Research Officer	Recycling and Reuse
Philip Amoah, IWMI-Ghana	Researcher	Environmental and human health, microbiological water quality and food safety issues.
Mary Njenga, ICRAF, Nairobi	Bioenergy Research Scientist	Biomass energy production & use and their connections to climate change, livelihoods and rural-urban linkages.

EXPERTISE OF RECENT DEPARTURES AND FORMER TEAM MEMBERS DURING WLE PHASE 1

Krishna Rao	Business analysis and enterprise development for small-scale energy & infrastructure
Munir A. Hanjra	Economics of water and food security, climate change and water sector adaptations
Johannes Paul	Water supply, water quality, waste water treatment, solid waste and bio-waste management, informal sector integration
Sena Amewu	Business model analysis, resource economics, microeconomic analysis of agricultural water management
Robert Impraim	Recycling of organic wastes into fertilizers, analyses of soil, plant and compost
John Ryan	Entrepreneurship and business development
Jasper Buijs	Business model development
Surendra Pradhan	Crop trials, public health
Lesley Hope	Agricultural economics
George Danso	Agricultural economics

It will be observed from Table 1 that the staff contingent of the RRR “Cluster of Activities” (CoA) of WLE’s phase 2 Rural-Urban Linkages (RUL) flagship program is made up almost exclusively of IWMI researchers, the only non-IWMI support coming from Mary Njenga at ICRAF.

The Rural-Urban Linkages (RUL) flagship program currently being implemented under WLE Phase 2 has enabled a broadening of the scope of RRR (the business model aspects of which remain as a major Cluster of Activities within RUL) to include urban and peri-urban food systems and food security as well as integrated rural-urban resource management. The interlinkages between these components make them all part of a circular economy.

The WWR→RRR→RUL evolution could also be viewed in terms of logical movement along an innovation continuum, spanning applied research and technology development to helping start-up businesses and bring new products to market. Whether these investments will also result in adding jobs and higher revenues to the economy is to be seen.

3.2. RRR program impact pathways

At the Scoping Meeting, four broad impact pathways were identified with specific examples for each one.

Impact Pathway 1: “Classic research for development” leading to two policy outcomes:

- In Sri Lanka, inclusion of septage management as a component of the 2017 Sri Lanka Sanitation Policy.
- In Ghana, influence on the fertilizer subsidy program to include waste-derived products.

Impact Pathway 2: “Facilitation/multi-actor direct engagement”:

This refers to several public-private-partnerships (PPPs) in Ghana for recycling urban waste into commercial products. IWMI prefers these be referred to as “outputs” because IWMI was contracted by donors to facilitate the creation and launch of these PPPs – they were project deliverables. They include the following: one PPP with a municipality in the Greater Accra Region to produce Fortifer™ fertilizer (this plant is operational); a PPP with a smaller municipality (also in the Greater Accra Region) to produce charcoal briquettes (this plant has not yet been constructed); and a PPP with Kumasi Municipal Assembly for raising fish in sewerage basins.

Impact Pathway 3: “International Engagement”:

The focus here is to understand the important influences that IWMI with WLE support has had on, and contributed material based on its research to, several United Nations and United States Agency for International Development (USAID) documents: what was the process by which these occurred?

Impact Pathway 4: “Capacity Enhancement”:

This refers mainly to the business school curricula the RRR subprogram has developed with partners. Assessing this part of the program goes beyond the current TOR. However, we have examined their status. Therefore, we look at capacity enhancement from two different angles: 1) we first examine the development and delivery of curricula based on the RRR business models; 2) we then look at capacity building both within the RRR research program and in the context of its outreach and partnership activities.

4. Conceptual Framework and Methodology

4.1. Conceptual framework: Theory of change

Growing dissatisfaction with the use of logical frameworks, especially in complex research-for-development projects, has led to the use of “theories of change” and explicit pathways to achieving planned impacts in proposals submitted for funding. These build on a growing body of research aimed at better understanding how research can contribute to achieving outcomes such as changes in knowledge, attitudes and behavior and ultimately significant social, economic and environmental impacts. Logical frameworks tended to grossly oversimplify research for development processes by implying they are linear and almost causal (i.e. doing A leads to outcome B). A Theory of Change (ToC) is intended to capture in a more nuanced manner the multiple influences and factors that affect the pathways from research to achieving outcomes and ultimately impacts. Like all CGIAR Research Programs (CRPs), WLE articulated a broad generic Theory of Change (ToC) and proposed impact pathways in both its phase 1 (WLE 2011) and phase 2 (WLE 2016) proposals.

Several other CRPs have published papers on their ToCs, experiences and lessons learned and even training manuals for their use. Alvarez et al. (2014) summarizes key lessons learned on using ToCs by the CRP on Climate Change, Agriculture and Food Security (CAAFS), while Alvarez and Schuetz (2014) provide a detailed training manual to help scientists learn how to use impact pathways. Thornton et al. (2017) provide a more analytical discussion of the use of ToCs by CCAFS: they assert that while it is premature to evaluate the effectiveness of the use of ToCs to guide research-for-development, important lessons have been learned. These lessons include the need for flexibility in implementation to enable adjustments as new information emerges. Unlike engineering projects, in research projects we do not know the end result. Therefore, adjustments in time and implementation strategy are often needed – but these may require staff and financial resources not budgeted. Another challenge is achieving the right balance between doing great science and achieving desired outcomes. A greater challenge still lies in generating an evidence base to rigorously address whether and how ToC-based approaches lead to more efficient and effective gains compared to traditional applied research.⁵

Apgar et al. (2017) explain lessons learned by the CRP on Aquatic Agricultural Systems (AAS) from using participatory action research and a ToC to facilitate transformative changes in complex agricultural systems. They used periodic critical reflection to revisit underlying assumptions as to how change occurs. Mayne and Johnson (2015) discuss examples of the use of different ToCs by the CRP on Agriculture for Nutrition and Health (A4NH). To our knowledge, the present study is the first attempt by WLE to assess its use of ToCs and impact pathways in the implementation of its research for development program.

Our approach is informed largely by two strands of change theories. The first, also drawing on CGIAR experience, describes and tests a “complexity-aware” model of change (Douthwaite and Hofwecker 2017). In essence, this model emphasizes the multiple “causal loops” that can reinforce the change process, in contrast with the more linear models commonly used. Although the WLE figures illustrating its impact pathways appear linear, it is clear from the text (“nonlinear, dynamic and recursive ...”) that WLE recognizes the complexity of innovation systems.

Because attribution of outcomes to specific research or other activities is always a challenge, we have also followed an approach called “contribution analysis” (Mayne 2008, 2012). In complex innovation systems, contribution analysis is an approach that can help confirm that a specific set of products and interventions (for example research outputs, policy dialogues) can credibly be considered a contributory cause of the outcome. A useful element of this approach is the concept of “nested” impact pathways applicable to complex research for development programs: within the larger overall

⁵ Thornton et al. also provide a list of other CCAFS publications related to its use of ToCs.

framework impact pathway, one finds smaller impact pathways targeting specific groups that must make a change in order to achieve the larger goal.

Our approach has primarily drawn on the “contribution analysis” approach, i.e. looking for evidence that would form a basis to make credible statements about the impact pathway and the roles and contributions of IWMI researchers, WLE, and other partners. The guiding questions in Annex 2 were designed to elicit the data we need to draw reasonable conclusions.

We recognize that the robustness of our conclusions relies on the strength of the evidence we gathered. This is a function of the reliability of the data, and triangulation. In general, documentary data are considered more reliable than a verbal statement by one person (depending on the type of document); the reliability of interview data increases when supported by other people and can also depend on how knowledgeable the person is. Where possible we cross-checked verbal and documentary data. This is not a standard evaluation of outcomes and impacts; rather, it is an analysis of the research-for-development processes – the impact pathways – and what lessons can be drawn to inform future activities. Therefore, we concluded that attempting to score the reliability of data sources would not be productive. Annex 4 is a brief note on the reliability of the evidence used. In our conclusions (Section 2.1) we rank most statements as being of “high”, “moderate” or “uncertain” confidence.

4.2. Methodology of the Study

We carried out the study in three phases:

- 1) Preparation and document review;
- 2) Site visits and stakeholder consultations;
- 3) Analysis and reporting.

4.2.1. Preparation and document review

A series of email exchanges with WLE management and a productive Scoping Meeting led to agreement on the approach, tools, methods, schedule, deliverables and budget. The evaluation team reviewed and analyzed available program-relevant documentation such as proposals, agreements, results frameworks, annual work plans and reports, publications, review/ evaluation reports, manuals, guidelines, web-based information and newsletters. An initial list of key people to be contacted was established (see Annex 3 for complete list of people interviewed). A list of guiding questions to structure the interviews was developed (see Annex 2). These were further adapted to suit the specific topic or person being interviewed with a view to testing the WLE ToC and identifying additional unanticipated influences or factors. Document review continued throughout the study period.

4.2.2. Site visits and consultations with stakeholders

The ToR required the evaluation team to undertake travel to project sites in Ghana and Sri Lanka. The choice of RRR sites to visit and stakeholders to consult (both face-to-face and remotely) was finalized in consultation with the IWMI RRR group. IWMI assisted in securing introductions to and appointments with stakeholders, including key staff/ coordinators/ managers, partners, beneficiaries and donors.

The consultations took different forms: face-to-face interviews or remote dialogue (via email and Skype communications). These interactions enabled us to confirm and validate that the claimed outcomes and impacts did in fact occur. Douglas Merrey visited Ghana to carry out interviews there while Hilmy Sally conducted interviews with national stakeholders in Sri Lanka and consultations with WLE staff based at IWMI. Douglas and Hilmy engaged further with IWMI Headquarters-based managers and research leaders. Hilmy interviewed key international partners.

4.2.3. Analysis and reporting

Data analysis and preparation of a draft report were largely carried out while both Douglas and Hilmy were in Sri Lanka. The draft findings were presented orally to the WLE team at IWMI in Sri Lanka, resulting in some important feedback. A Draft Final Report was shared with key stakeholders through the evaluation manager, Keith Child. This generated a long list of comments, corrections and suggestions. We used these to make final revisions and corrections to produce this final report.

5. Analysis of WLE and RRR Evolving Theory of Change

Like all CGIAR Research Programs (CRPs), WLE articulated a broad generic Theory of Change (ToC) and proposed impact pathways in its phase 1 proposal (WLE 2011: 56ff). The proposal describes separate but still quite generic impact pathways for each of the five “strategic research portfolios”, including for the Resource Recovery and Reuse (RRR) Strategic Portfolio (pp. 118-122).

The phase 2 proposal includes a revised and more robust ToC for the overall program and, as in phase 1, separate versions for each “Flagship” (WLE 2016). In phase 2, the RRR subprogram has been subsumed under a new Flagship, “Sustaining Rural-Urban Linkages” (RUL). The proposal states that RUL will build on the RRR business models developed in phase 1 “to optimize their implementation, maximize urban food security, identify new business opportunities for young women and men, and minimize the footprint of urbanization on natural resources and ecosystem services.” (WLE 2016: 96). The proposal presents a ToC illustrated by an impact pathway that is more elaborate than presented in phase 1 (pp. 100-101).

WLE’s ToCs adopt the standard distinction between “outputs”, “outcomes”, and “impacts”. Outputs are products or deliverables: research papers, workshops, training courses. “Outcomes” are changes in either *capacities* (e.g. knowledge, skills, attitudes) or *behavior*, for example a change in policy, investment priorities, or implementation strategies. Improved capacities may also enable changed behavior. “Impacts” are the ultimate changes which the outputs and outcomes are aimed at achieving: reduced poverty, cleaner cities, and the like. Researchers have control over the outputs they produce, but normally cannot directly control or cause outcomes (e.g. behavior change); at best they may contribute along with other factors. Impacts are even further removed from the researchers’ control: if they occur, it may be some years after the research was completed, and there are multiple additional influences. It is exceedingly rare in agricultural and natural resources research to see specific outputs “cause” specific outcomes and impacts.

The phase 1 version was the salient ToC for most though not all of the period under review. WLE (2011:58) emphasizes that achieving impacts is “nonlinear, dynamic and recursive and is driven by continuous engagement with the people, organizations and institutions that make decisions”. Recognizing that many drivers of change cannot be directly influenced by the researchers, the ToC places a very strong emphasis on partnerships. The proposal contains a table with 11 “levers of change”, each with associated uptake strategies (p.60). All of them are relevant to RRR’s approach to move from research to implementation.

The phase 1 proposal has a detailed discussion of the specific ToC and impact pathway for the RRR subprogram (WLE 2011: 118ff.). The Flagship Leader provided an updated RRR impact pathway that shows where Windows 1-2 funds are used and illustrates the path toward scaling and achieving specific outcomes: “‘Next user’ investments in our solutions, recommendations and curricular and RRR implementation e.g. via PPPs” (Figure 2). We find that this and other impact pathways are useful to visualize and present in broad terms how the work being done fits into a larger context and contributes to scaling out and up. However, they are too simple and linear to capture the actual complex and non-linear processes of change in the progression from research to actual outcomes. Further, it is notable that the term “policy” does not occur in the impact pathway, even though facilitating policy change has been an important step on the research to development pathway in both Ghana and Sri Lanka.

We have attempted to find out from researchers the extent to which they consciously made use of ToC concepts or the specific impact pathways contained in the WLE proposals, and to compare the actual research to development processes to these impact pathways to understand their salience. Our findings with regard to the Ghana and Sri Lanka activities are discussed below (Sections 6.1 and 6.2). Overall, we found that researchers in Ghana and Sri Lanka were broadly aware of the ToCs and impact

pathways contained in the WLE proposals. However, even senior researchers did not necessarily have a detailed understanding of them or make conscious use of them in managing their programs. Indeed, in Ghana, we found no evidence that researchers have an articulated ToC; rather, it is “intuitive” as one senior researcher said. Further, there is no evidence they have used impact pathways as a management tool. Nevertheless, impact pathways did help researchers to be aware of the importance of consciously assessing how their work could best lead to the planned outcomes and influenced how they wrote proposals to donors. This point is elaborated further below. Researchers generally recognize that using impact pathways is an iterative process, generating learning and leading to new research questions.

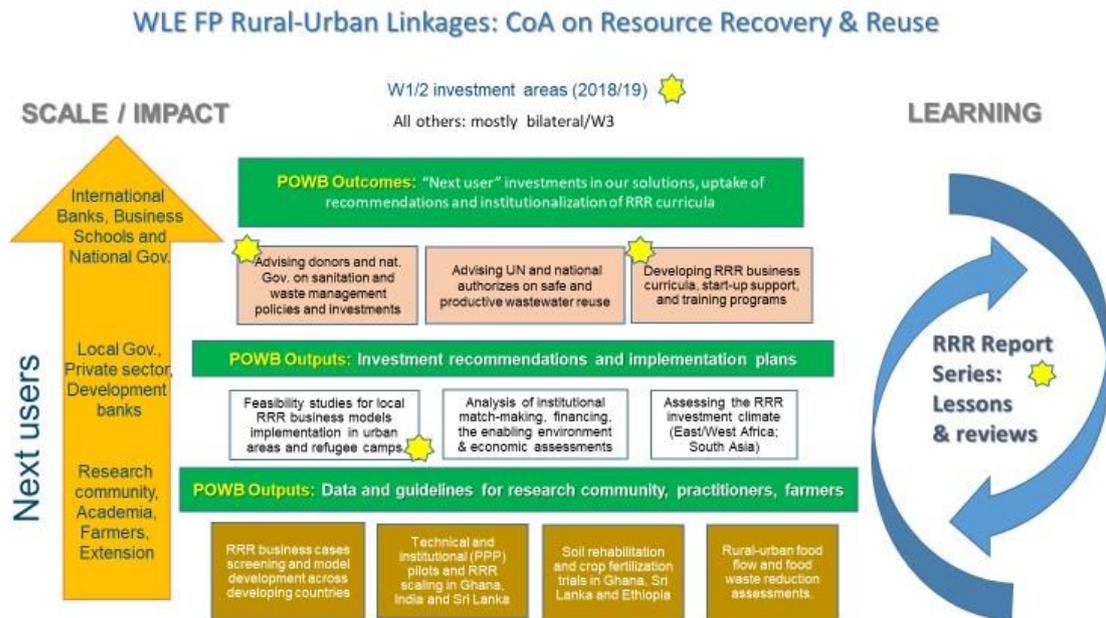


Figure 2: RRR impact pathway

Source: Powerpoint™ provided by the Flagship Leader.

6. Major Findings of the Study

6.1. Impact pathway 1: Policy outcomes in Ghana and Sri Lanka

6.1.1. Including organics in the Ghana fertilizer strategy

The Government of Ghana has been implementing a fertilizer subsidy program since 2008. It is designed to reduce the high costs of fertilizer for farmers by offering a 50% subsidy. According to the former Director of Crop Services in the Ministry of Food and Agriculture (MOFA), its mode of implementation has been changed over time based on lessons learned. Currently, the government sets a quota and calls for applications from companies. Successful companies receive a quota: the government pays the company 50% of what it sells up to that quota. From 2018, they use a bar code system for this monitoring. The subsidy has always applied only to inorganic fertilizers; there was no subsidy available for organic fertilizers, apparently because there was no production at a sufficient volume.

IWMI had already obtained a Trademark Certification for Fortifer from the Registrar General's Department in 2013.⁶ Fortifer is not patented, but the use of the name is protected by this certificate. During the implementation of the pilot PPP program (see section 6.2), it became clear that creating sufficient demand for fertilizer made from fecal sludge ("Fortifer"TM) would be possible only if it came under the subsidy program. We understand the researchers had not anticipated this – it was an unanticipated step in the program. The program did anticipate the need to have the government certify FortiferTM as organic to qualify for the fertilizer subsidy program – but certification was found to be a prerequisite to influencing the fertilizer subsidy program. Certification is tied to a specific manufacturing plant for the purpose of qualifying for the subsidy; therefore, it is not the generic "Fortifer"TM that is certified, but the product from a specific plant.

The certification testing process in MOFA is normally quite slow, with repeated testing. The then-Director of Crop Services facilitated the entire process to achieve certification of the product as organic, and then to modify the Fertilizer Subsidy Program to include organic fertilizer. In a letter dated 30 June 2016, the Director expressed the government's appreciation to IWMI for its technical support during the stakeholder consultation process on including organic fertilizer in the subsidy program.

Why did the Director take such a strong interest? One reason is his history collaborating with IWMI. His unit of the Ministry covers land and water management. Personal relationships have developed over this period. The Director claimed he uses IWMI publications and includes copies of them in the unit's library. This is an example of a pattern we found repeatedly in interviews: IWMI has been working in Ghana for nearly 20 years. Personal relationships have developed over time, and IWMI has a very strong reputation for its science and collaboration with Ghanaian institutions. This observation is elaborated further in Section 6.2.

Finally, we note that this achievement – assisting the Government to include organic fertilizers in its Fertilizer Subsidy Program – was not initially a major goal; rather, it emerged as an important step in creating a demand for FortiferTM among other fertilizers.

6.1.2. Including septage management in the Sri Lankan sanitation policy

Sanitation has traditionally not been a high priority area of concern of the Sri Lankan Ministry of Water Supply and Drainage (now known as the Ministry of City Planning and Water Supply⁷). The

⁶ The certification letter is available.

⁷ Although 'Drainage' is no longer included in the title of the Ministry, its Vision and Mission statements do refer to "providing people with safe drinking water and improved sanitation facilities". However, we found that the Sanitation Policy has not been uploaded on the Ministry website; only the Drinking Water Policy is available (<http://www.mcpws.gov.lk/> accessed 7 March 2019).

ministry itself was created in 2007 and its main focus has been on the water supply sector. The emphasis on sanitation probably coincided with the advent of the Millennium Development Goals that, inter alia, has seen over 95% of the country's population now having access to adequate sanitation⁸; open defecation is practically non-existent. In addition, the website of the National Water Supply and Drainage Board (NWSDB) underlines its intention to "Provide pipe-borne sewers in selected growth centers and major urban areas and acceptable on-site sanitation to those not connected to sewer systems".⁹

NWSDB also describes the following Sanitation Development Goals for Sri Lanka: "By 2020, all the emerging metro cities such as Kandy, Hambantota, Trincomalee, Dambulla, Jaffna, Galle, Gampaha, Kurunegala and Nuwara-Eliya as well as large township such as Vavuniya, Badulla, Matara, Anuradhapura and Ratnapura, which attract a substantial portion of the population and increase economic activities in coming years, will have centralized sewerage systems, which in turn will ensure environmental sustainability."

Access to piped centralized sewerage in Sri Lanka is very limited with current coverage restricted to around 3% of households, mainly confined to the densely populated major metropolitan areas of the country¹⁰. The 2020 target for coverage with these centralized sewerage systems remains at a modest 3.49%.

A draft sanitation policy for Sri Lanka had been prepared in 2010 but had never been approved. The collection, transport, treatment and disposal of fecal sludge from on-site sanitation systems (latrines and septic tanks) had not been taken into consideration in the draft policy. IWMI's involvement in the policy finalization process began in 2013 when it drew attention to the absence of provision for septage management in the draft policy.

IWMI and the (then) Ministry of Water Supply & Drainage signed a Memorandum of Understanding (MoU) for cooperation in the field of septage management in 2013¹¹. As a result, IWMI was invited to participate in the Water and Sanitation (WATSAN) committee and its working groups charged with producing the final sanitation policy for cabinet approval.

The inclusion of septage management in the policy was facilitated by IWMI's MoU with Sri Lanka's Central Environment Authority (CEA) aimed at supporting RRR participation in the Government's "PILISARU" ("waste reuse" in Sinhala) integrated solid waste management program^{12 13}

The collaborative technical and commercial pilot studies of municipal solid waste and fecal sludge pelletizing and co-composting that WLE-RRR undertook under an MoU that IWMI entered into with the CEA and the Kurunegala Municipal Council provided a platform for WLE-RRR to demonstrate to policymakers, not only the magnitude of the septage question but also its potential as a resource for recovery and reuse.

⁸ The ministry adopts a simple definition of sanitation encompassing 3 aspects: (a) access to and use of a toilet; (b) hand-washing with soap after toilet use; (c) disposal of waste.

⁹ http://www.waterboard.lk/web/index.php?option=com_content&view=article&id=59:sanitation-development-goals-in-sri-lanka&catid=29:sewerage&Itemid=174&lang=en (accessed 5 March 2019).

¹⁰ According to the Deputy General Manager (DGM) for Sewerage of NWSDB the cost of connection to a piped municipal sewerage system ranges from LKR 3 to 5 million (USD 16,700 to 27,800) per household.

¹¹ The MoU was signed on 8 May 2013 for an initial period of two years; it doesn't appear to have been renewed, revised or terminated since.

¹² This MoU also facilitates the entry of the Ceylon Fertilizer Company into the RRR arena. Making use of the Fertilizer Company's extensive distribution network for marketing RRR fertilizer products would seem like a logical win-win scenario for municipal and other entities if they reach commercial scale production.

¹³ See also: <http://www.sundaytimes.lk/130901/plus/pellets-solid-solution-to-twin-problems-60133.html>

IWMI's contribution resulted in the inclusion of septage management as well as possible options for resource recovery and reuse (mainly co-composting¹⁴ and ecological sanitation) – all based on RRR research -- in the policy. The policy finalization process took nearly five years. In addition to leading the process of inclusion of septage management, IWMI was also closely involved with the overall drafting of the Sanitation Policy, notably supporting the services of a legal expert (funded by WLE) to ensure the consistency of the new Policy with respect to the country's constitution and other pieces of legislation.

The national sanitation policy was approved by the cabinet of ministers in late 2017. IWMI's contribution to the process of development of the policy, specifically its leadership to ensure inclusion of septage management, has been duly acknowledged by the ministry¹⁵.

6.1.3. WLE engagement with implementing the Sri Lankan Sanitation Policy

Our ToR did not include assessing the subsequent engagement of IWMI-WLE with the implementation of the Sanitation Policy. However, we felt it is important to try to understand what lessons are being learned at this very early stage of implementation. We make no comparison with the research-for-development process in Ghana (Section 6.2), as the work in that country involves a 20-year process.

With WLE support, IWMI is actively contributing to the implementation of the policy, notably via participation in relevant platforms and committees constituted by the government with a view to achieving SDG target 6.2.¹⁶ It continues to be represented on the WATSAN committee and IWMI has also been invited to contribute to the biennial Sri Lanka report to SACOSAN¹⁷. For example, the Sri Lanka country paper to SACOSAN 7 in 2018 includes a chapter on Septage Treatment (Sri Lanka 2018).

The Ministry of City Planning and Water Supply (MCPWS) has overall responsibility for ensuring that sanitation-related activities carried out by agencies such as NWSDB, the Department of Health and provincial and local government authorities conform to the approved sanitation policy. The Central Environment Authority (CEA) provides additional support to ensure compliance with approved standards for effluent discharge.

Insofar as septage treatment is concerned, the World Bank-supported Water Supply and Sanitation Improvement Project (WaSSIP) includes the construction of septage treatment plants for urban centers within seven priority districts: Badulla, Kegalle, Kilinochchi, Monaragala, Mullaitivu, Nuwara Eliya, and Ratnapura. The plants in two districts (Kilinochchi and Mullaitivu) have already been completed and handed over to the local authorities for operation. In addition, NWSDB is constructing 'compact septage systems' in small towns.

Unfortunately, it appears that no proper institutional arrangements or business models have been put in place for ensuring adequate operation and maintenance of the plants, bringing their sustainability into question¹⁸. Some of the issues these installations are grappling with are lack of technical skills at local government level, unclear systems for cost recovery, and no provision for constituting financial reserves for repairs and renewals of pumps and other equipment.

The scientific and technical reputation and credibility that the IWMI-RRR program has acquired, thanks to the work supported by WLE (W1/2), has opened other (funded) opportunities where its

¹⁴ Drawing on IWMI's track record and experience of over 15 years on this topic in Ghana.

¹⁵ [Ministry correspondence dated 6 February 2018 addressed to IWMI's Director General.](#)

¹⁶ "By 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations".

¹⁷ WATSAN: Water and Sanitation; SACOSAN: South Asian Conference on Sanitation. <https://sacosan.com/>

¹⁸ NWSDB: personal communication.

knowledge can add value. A direct and concrete consequence of the key role IWMI-RRR played to obtain inclusion of septage management in Sri Lanka's sanitation policy is that IWMI-RRR expects to be contracted by the World Bank (WB) to advise on the design of sewerage (and septage) treatment plants that the WB is financing in Sri Lanka (to the value of some USD 130 million). This approach offers better prospects than attempting to influence the design and operation of already built fecal sludge and MSW compost treatment facilities. IWMI-RRR will support the WB in assessing the performance of decentralized and on-site sanitation interventions geared towards improving containment of fecal sludge on community and household levels under WB-funded projects in Sri Lanka¹⁹. We understand that the planned plants are meant to treat both waste coming from piped sewer systems and septage from septic tanks, including Decentralized Wastewater Treatment System (DEWATS) units for small sewer networks linking several septic tanks²⁰.

6.1.4. Partnerships, uptake and scaling-up in Sri Lanka

We understand that the response from local authorities in regard to septage plants has been generally positive. Many of them are already accustomed to composting of municipal solid waste. The realization that the quality and value of their compost fertilizer could be dramatically improved by the addition of nutrient-rich septage has resulted in a supportive win-win situation.

IWMI entered into a MoU with the Ministry of Agriculture in 2016 to study the development of compost generated from all kinds of organic waste (e.g. municipal solid waste, agro-industrial waste, dried septage etc.) and to support the adoption of associated business models. Progress has been rather slow, and no joint trials have been undertaken as yet. Moreover, the Ministry of Agriculture has raised concerns in respect of septage-based resource recovery, around health and safety of reuse as well as cultural sensitivities.

This has also given rise to the need to develop national standards and guidelines for sludge management. Sri Lanka is still working on standards for organic fertilizers, which should include standards for co-compost that consists (partially or fully) of safely treated fecal sludge. In the meantime, fecal sludge enriched co-compost is expected to comply with the prevailing World Health Organization (WHO) standards. Tests carried out by IWMI indicate that although the co-compost is microbiologically safe, the mineral (or nutrient) content is highly variable, resulting in sub-optimal plant response to fertilizer application. Fortification can help to bring the product up to the required standard, but this would require further laboratory analyses. This also highlights the need to put in place a system for quality assurance, carrying out regular checks to assure customers that what is written on the bag corresponds to what is inside. As there can be much variation, it is safer (and cheaper to achieve) to indicate ranges or a minimum content on the label if this initiative is to go commercial.

The pilot-test experience with the Kurunegala Municipal Council under the umbrella of IWMI's 2014 agreement with the Central Environment Authority (CEA) and the Municipal Council for pilot-testing the viability of fecal sludge pelletizing and (value added) co-composting of municipal solid waste (MSW) also brought to light some shortcomings. For example, it became clear that IWMI's role as a technology provider, although necessary, was not sufficient. Assumptions about the interest on the part of municipal employees and the incentives provided to them to go beyond merely making the product to also think about marketing and selling it proved to be unfounded. It would appear that a lot of facilitation and support is still required to enable the Municipal Council to convert this RRR technical toolkit to a business model. This experience helped the RRR program to re-think its

¹⁹ Communication from IWMI-RRR research group.

²⁰ IWMI-HQ is currently hosting Andreas Ulrich, an engineer by training and former executive director of [BORDA](#), one of the foremost companies promoting DEWATS; Andreas functions as a senior advisor on fecal sludge and wastewater management; his position is supported by the German Centre for International Migration and Development (CIM).

assumptions and approach and the lessons learnt are being taken into consideration in subsequent partnerships with other local government bodies as well as academic and private sector entities.

An (unintended) positive outcome of this collaboration with local bodies is that it seems to have led to the local fabrication of a pelletizing machine. The machines initially handed over to the municipal councils for the pilot-tests were of Indian manufacture. The locally-built machine was made for the Negombo municipal council and was paid for by the Western Provincial Council Ministry of Agriculture. A letter dated 14 March 2017 from the Ministry addressed to the IWMI-RRR program leader²¹ thanks IWMI for the technical assistance it provided to improve the municipal compost plant and the septage treatment facility and undertakes to invest in manufacturing a compost pelletizing machine locally. We have been informed that the machine is currently awaiting installation at the municipal council.

The small number of septage treatment plants in Sri Lanka, especially those close to compost stations, might not warrant "industrial scale" production of a pelletizer machine as yet. Furthermore, there is no market data from across 'Pilisaru' composting sites to confirm the demand for pellets from the farmer community. So, the business of manufacture and dissemination of the technology to more locations is at an early stage.

The MoUs that IWMI entered into with plantation and horticultural companies (Horana Plantations PLC and Mike Flora Pvt Ltd respectively) in late 2017 represent a scaling-up of the RRR target market for co-compost and fortified organic fertilizer towards larger farmers and tree crops. These entities are cognizant of long-term soil health concerns and are willing to make the longer-term investment before they begin to see the positive impacts of organic fertilizer. The small farmer, on the other hand, tends to look for quick returns and may be less willing and able to invest the time and effort before reaping the benefits of organic fertilizer – the quantities required are much larger than mineral fertilizer leading to an additional handling and storage burden.

The collaborative research conducted with Horana Plantations PLC and Mike Flora Pvt Ltd. centered on the agricultural use of municipal solid waste and fecal sludge co-compost and notably involved field trials on the use of co-composted fertilizer (e.g., which crops, what doses etc.). It was supported by WLE via the BMZ funded project “[Research and capacity building for inter-sectoral private sector engagement for soil rehabilitation](#)” that ran from January 2016 to April 2019.

A point brought to our attention was that the partnerships with Horana Plantations and Mike Flora were highly demand driven. However, this demand could not be entirely fulfilled due to limited production and delivery of co-compost. Large-scale field trials at Horana suffered delays. In contrast, the nature of operations of Mike Flora (enriched growing media and horticulture plant propagation) required smaller quantities of co-compost and allowed relatively faster operations compared to the experiments with the tree crops of Horana plantations.

We also noted that implementing these partnerships with the plantation and horticultural companies necessitated the adoption of an agricultural entry point on the part of the RRR program. This, in turn, highlighted possible capacity constraints within the RRR program. For the time being the agricultural research work is being led by a scientist from Ruhr-University Bochum (RUB) in Germany posted to IWMI on a CIM-supported PhD fellowship. But it was pointed out to the evaluation team that his impending departure will create a capacity gap. On the other hand, it might be argued that such situations also create opportunities for greater inter-flagship collaboration within WLE.

Table 2 recapitulates the partnership agreements signed by IWMI pertaining to the RRR program in Sri Lanka.

²¹ We have seen this letter.

Table 2: Partnership agreements entered into by IWMI-RRR in Sri Lanka

Nature of Agreement	Parties to the Agreement	Scope	Date & Duration	Remarks
MoU	CEA, IWMI	Assess the viability and sustainability of composting initiatives in Sri Lanka (including 15 compost plants under the Pilisaru project) and conduct a feasibility study on two composting business models in Colombo, Sri Lanka	19 July 2013; 3 years	Lapsed
MoU	CEA, Kurunegala Municipal Council, and IWMI	Technical and commercial pilot studies of municipal solid waste and fecal sludge pelletizing and co-composting	2 June 2014; 2 years	Pelletizing machine provided by IWMI; Agreement lapsed
MoU	Ministry of Agriculture and IWMI	Promoting compost generated from all forms of organic waste including market demand for compost	4 March 2016; 3 years	
MoU	Balangoda Urban Council, IWMI	Testing technical and commercial strategies for fecal sludge compost enrichment and pelletizing	1 Dec 2017; 3 years	Pelletizing machine provided by IWMI
Project Agreement	Wayamba University of Sri Lanka, IWMI	Collaborative research and capacity building for inter-sectoral private sector engagement for soil rehabilitation (BMZ-funded project)	1 June 2016; 32 months	Amended on 25 Sept 2018 revising payments and deliverables
MoU	Horana Plantations PLC and IWMI	Collaborative research on agricultural use of municipal solid waste and fecal sludge co-compost	1 Dec 2017; 2 years	
MoU	Mike Flora Pvt Ltd, IWMI	Collaborative research on agricultural use of municipal solid waste and fecal sludge co-compost	1 Dec 2017; 2 years	
MoU	Kuliyapitiya Urban Council, Wayamba University, IWMI	Collaboration on the technical and commercial pilot study on fecal sludge compost and co-compost pellets	1 Feb 2018; 3 years	Municipal composting and fecal sludge treatment plant already established; Pelletizing machine provided by IWMI
MoU	Makandura Regional Agricultural Research Centre, Ministry of Agriculture, IWMI	IWMI HQ is unable to locate this one		

These MoUs appear to have been a good way to formalize and consolidate partnerships with a variety of national organizations (ministries, central government institutions, local authorities, academic institutions and the private sector). They contribute to enhancing IWMI-RRR visibility and demonstrate that IWMI-RRR's work is well grounded, is collaborative, and is responding to national needs and priorities. We understand that these partnerships also helped attract (bilateral) project funding such as the BMZ project mentioned above.

The IWMI-RRR program continues to provide advisory services, outreach and capacity strengthening to support business development thanks to WLE W1-2 funding. However, it is somewhat premature

to judge the prospects for PPPs related to RRR in Sri Lanka. One fairly obvious channel is linking the marketing network of the Ceylon Fertilizer Company to producers of co-compost. However, for such an arrangement to work successfully, production levels need to be up-scaled, quality control must be improved, and prices need to be competitive.

There is a potential policy impediment to the use of organic fertilizer. Chemical fertilizer in Sri Lanka is heavily subsidized. For example, we were told that urea purchased at about USD 350 per ton (USD 17.50/ per 50 kg bag, without costs of freight, handling etc.) is distributed locally at around LKR 500 (less than USD 3.00) per 50 kg bag. The price (USD 5.00 to 7.00 per 50 kg) of organic fertilizer thus remains relatively high; this price differential may pose a considerable challenge to its widespread use. It is, however, important to note that the government is encouraging the use of organic fertilizer by requiring farmers to purchase a certain quantity (25%) of organic fertilizer in combination with chemical fertilizer, in order to benefit from the subsidy for chemical fertilizer. If correctly enforced, this would mitigate some of the potential negative effects of the chemical fertilizer subsidy on the fertilizer market.

However, the chemical fertilizer industry is well-connected and influential politically, involving the highest-ranking public sector representatives (see, for example, Figure 3, a news item from the *Daily Mirror* newspaper of 4 March 2019). It therefore seems difficult to make headway in the absence of a heavyweight political champion in favor of promoting RRR concepts and business cases.



Figure 3: Headline of a former president hoping to return to office

Source: Daily Mirror Newspaper, 4 March 2019

6.1.5. Challenges and suggestions

All external interlocutors in Sri Lanka emphasized that IWMI requires greater visibility in the country's water supply and sanitation sector; its recognition and reputation as a resource in this field is relatively recent compared to its longer history of involvement in the agricultural water sector. The partnerships so far have been built on personal contacts and accumulated mutual trust and confidence; lobbying and personal relationships have been determining factors. A systematic mechanism to showcase IWMI products to national partner agencies and officials is worth considering, especially the work carried out in Sri Lanka and also findings from elsewhere that are potentially relevant to the country. This would be in addition to the various national platforms and opportunities already made available to IWMI to highlight and share its work and products.

6.2. Impact pathway 2: Recycling urban waste in Ghana

6.2.1. Overview of the RRR-RUL program: Pre-WLE period

Rapid urbanization is underway in many developing countries, with West Africa having an especially rapid growth rate. This is creating enormous challenges: how to accommodate, employ, and provide services to this growing population in a context of limited financial, human and institutional resources. Among the greatest challenges is safe processing, disposal or reuse of all forms of waste material, including human fecal waste. However, this “challenge” is also an “opportunity”. Waste material can in principle, be processed and recycled into useful products. It is potentially a critical “resource” in a “green” or circular economy. Application of organic compost and fertilizer is the most important way to reverse the serious soil degradation of millions of hectares of African soils.

A major focus of the RRR Program has been to identify how to do this cost-effectively and indeed profitably and therefore create a win-win outcome. IWMI’s work on this topic pre-dates the CRPs. Box 1 helps understand the historical trajectory along which the RRR program evolved, enabling it to position itself as one of the SRPs in WLE Phase 1.

Box 1: Historical recap of WLE-RRR in Ghana

In the late 1990s, the International Board for Soil Research Management (IBSRAM) had a small office in Kumasi, Ghana. This office pioneered research on how to process fecal sludge and other waste into compost. The leader of the WLE RRR-RUL Flagship (Pay Drechsel) was heading that office. The current Head of IWMI’s West Africa Regional Office in Ghana (Olufunke Cofie) was a postdoctoral fellow at IBSRAM implementing this research.

In 2001, IWMI took over IBSRAM including the office and staff in Kumasi.²² Within a couple of years, the new IWMI team moved to Accra as the core of its West African regional office. Work continued in Kumasi but was also extended to the Accra and Tamale regions. Having become part of a water management institute, the researchers added work on reuse of urban wastewater for irrigation. This work proved to be pioneering and highly influential but is beyond the scope of this study (see e.g. Scott et al. 2004; Thebo et al. 2017). Work also continued over the years on transforming fecal sludge into compost and fertilizer.

In 2001-2004, the IWMI team implemented a French- and Swiss-financed project on co-composting solid and liquid waste in partnership with a Swiss institution: the “Department Sanitation Water and Solid Waste for Development” (SANDEC), which is a unit of a larger Swiss research institution, “EAWEG” (<https://www.eawag.ch/en/aboutus/portrait/organisation/>). SANDEC brought a high level of technical expertise that IWMI did not have and was a key partner in raising IWMI’s capacities and further extending IWMI’s network in this field. IWMI contributed its agricultural expertise.

During the period up to 2013, work continued on how to enhance the quality of composted fecal sludge by adding Nitrogen or other forms of waste (for example to enhance Nitrogen in the compost; e.g. Adamtey et al. 2009). We were told that the idea of pelletizing the compost was borrowed from work done in Nigeria. A major advantage of pelletization is that much of the moisture is extracted, reducing the weight and therefore transportation costs. A great deal of research under a variety of projects continued to refine the co-composting and pelletization process and test the efficacy of various compost recipes for a range of soil types and crops²³. The pelletization study was funded by BMGF’s Grand Challenge. (\$100k) from 2011-2013. Immediately after this, the BMGF asked WLE/ IWMI to submit an application for a larger ‘scaling’ grant in 2013 (\$1.1m) – that was when business idea (with support from WLE) came in.

In Ghana, management of urban waste is the responsibility of local governments, called “Municipal Assemblies”. There is a locally elected assembly, but the central government appoints the Mayor and heads of technical departments. This means that after an election, if a new party has come to power,

²² Disclosure: Doug Merrey was then IWMI’s Director for Africa and became the overall supervisor of this newly-acquired office and team of researchers. He met both of the key individuals at that time.

²³ See the description in WLE (2011: 116-117) and references cited.

many of the personnel, especially the mayor, are changed. This political reality is one of the challenges faced by the program. Most municipal assemblies have a Waste Management Department headed by a technical civil servant. These local governments face severe resource challenges, as they depend on a combination of allocations from the central government and local fees and taxes. They are encouraged to enter into partnerships with private firms through PPPs or franchising. For example, most of the trucks that bring fecal sludge to the municipal assemblies' processing areas are private. They pay "tipping fees" to the municipality for the right to dump their loads. The processing areas tend to be waste stabilization ponds that are poorly maintained, often overflowing and leaking, as there are no funds to manage them properly. This is the context within which the RRR program has been working.

At an early stage, according to IWMI researchers, they understood that the main challenges in this field are not technological, but social and economic. Collecting and dumping urban waste, especially fecal sludge, is costly, especially given the limited budgets of local governments. Dumping the sludge, or using it on farms without adequate processing, which is also common, lead to serious environmental and health impacts. These impacts increase over time as the amount of sludge collected (and spread on fields) is growing rapidly. This recognition led to the insight that what is required to reverse this trend is to identify potential business models that would generate the resources needed to finance the management of urban waste. The work on the analysis of existing business models for resource recovery and reuse was initiated as this research program was integrated into the first phase of WLE. We note here that there were synergies between the local (Ghanaian) and international work discussed in Section 6.3.

6.2.2. The RRR program in Ghana supported by WLE: 2011 to the present

In phase 1 of WLE, the central focus of research investments was a global search for urban waste management business models and identification of models that seem to work in developing countries (Otoo and Drechsel, eds. 2018). Specifically, public-private partnership models were identified as a viable way forward: identifying how to profit from converting fecal sludge into products (especially agricultural products, in view of the mandate of CGIAR) that could be sold profitably. This work was complemented by, and directly supported, the program in Ghana. Because of the strong foundation based on previous work, Ghana was the major site to test potential business models for "making wealth out of waste" (WLE 2014-2015 highlight). From 2010-2011 to the present, IWMI has attracted funding from a number of donors that enabled it to test its new ideas on business models and PPPs on the ground with municipalities and continue to refine the processing techniques while also developing the value chain on the demand side. Table 3 is a list of important donor projects aimed at improving recovery and reuse of urban waste in peri-urban landscapes in Ghana.

Table 3: Sample of RRR donor projects in Ghana, 2010 to the present

Project	Donor	Period
From Waste to Food (Wafo) Ghana	BMGF	2013-2016
Design For Reuse: Reuse-oriented sanitation in Ghana	AWF	2010-2014
BeQuE: Biofil Evaluation	BMGF	2014-2016
RRR impact and upscaling	IFAD/EC	2014-2016
Composting lessons in Africa and Asia	WB	2014
Capturing Value in Waste (CapVal)	Dutch	2015-2019
Guiding investment decisions	WLE	2015-2016

Source: Cofie no date.

While all of these projects made important contributions to the overall program (they are each described briefly by Cofie no date), the two that are most central are “Scaling Out the Recovery of Nutrients and Organic Matter from Faecal Sludge for Food Production in Ghana: From Waste to Food” (WaFo), and “Creating and Capturing Value: Supporting Enterprises for Urban Liquid and Solid Wastes Recycling for Food, Energy and Clean Environment” (CapVal). WaFo (2013-2015, extended to 2018) was supported by the Bill and Melinda Gates Foundation (BMGF), the United Kingdom’s Department for International Development (DFID) and Grand Challenge Canada (GCC) at a level of USD 1.1 million. It supported the development of a fecal sludge treatment facility in Tema Metropolitan Assembly (TMA) in the Greater Accra Region²⁴. This is a joint venture (PPP) with Jekora Ventures Ltd. (JVL), a private waste management firm. Another partner was the Training Research and Networking for Development (TREND). This plant was inaugurated in May 2017 and is operational, though not at the planned level of production.²⁵

Under WaFo, IWMI established an “Advisory Team” consisting of representatives of key partners. It met twice a year, but also interacted informally as needed. It provided advice on the overall design, construction and implementation process. A business development consultant was engaged to support the Advisory Team. Near the end of the project, a Board of Directors was initiated to provide long-term oversight (see below).

CapVal (2015-2019) is essentially a follow-up project funded by the Netherlands Enterprise Agency at a level of 1.2 million Euros. It is supporting a PPP in Kumasi for aquaculture in fecal sludge ponds (recently World Fish collaborated in preparing a paper based on this activity) and another in Yilo Krobo Municipal Assembly (YKMA), a small local government near Accra to process fecal sludge into Fortifier™ and solid wastes into charcoal briquettes²⁶. These projects are still under development – the plants are not yet completed or producing. There is also a plan to develop another plant for co-composting and making briquettes, but we understand this is still under consideration.²⁷ The project partners currently include YKMA, TREND, JVL, RUAF-Foundation (which co-leads the WLE phase 2 RUL program), and World Agroforestry Centre (ICRAF). Some of the original partners dropped out; for example, the Volta Ghana Investment Co. Ltd. could not bring the expected assets into the project, and YKMA replaced another municipal assembly when Volta could not provide the land required.

6.2.3. Roles of key partners in Ghana

Table 4 lists the key actors operating in the RRR-RUL field in Ghana. A more detailed description can be found in Annex 5.

6.2.4. Challenges and responses

The PPP program is at the “proof of concept” stage: while IWMI’s work had established the technical feasibility of, for example, converting fecal sludge into compost, the main unknown is whether it is possible to create a viable mutually beneficial business model. Many challenges were highlighted during the interviews, and also in the WaFo final report (IWMI 2017). Some of the challenges faced are inherent in the program itself, for example the lack of sufficient long-term committed funding. But many of the challenges are exactly the reason why pilot testing and proving the viability of the PPP

²⁴ Doug Merrey visited this plant. He was unable to visit others, which, except for Kumasi, are not yet operational.

²⁵ IWMI 2017 is the final report on WaFo submitted to the donors and provides considerable detail on what was accomplished, challenges faced, and solutions to these challenges.

²⁶ Doug Merrey was able to meet the key YKMA people including the mayor.

²⁷ Some descriptions refer to four PPP pilots. They are Tema (co-compost), YKMA (briquettes), Kumasi (fish), and this planned co-composting plant.

business model is needed: to identify potential challenges and issues and find solutions. The main types of challenges and responses are as follows:

Table 4: Key RRR-RUL actors in Ghana

Partner	Nature of activity	RRR role/ contribution
Tema Metropolitan Assembly (TMA)	Responsible for urban waste management in its area of jurisdiction	Hosting the development of a fecal sludge treatment facility
Yilo Krobo Municipal Assembly (YKMA)	Responsible for urban waste management in its area of jurisdiction	Engaged in PPP to process fecal sludge into charcoal briquettes
Jekora Ventures Ltd. (JVL)	Locally-owned waste collection firm operating in Greater Accra; pioneer in segregating waste streams rather than dumping all of it into landfills	JVL has entered into PPP agreements with TMA (for co-composting and pelletization) and with YKMA (for manufacturing briquettes out of fecal sludge)
Zoomlion Ltd	Competitor to JVL; Larger footprint. Operates throughout West Africa	Declined to participate in the IWMI RRR program in 2013 but showed interest later
Training Research and Networking for Development (TREND)	NGO, facilitator for the entire business development process	Responsible for drafting PPP agreements, obtaining environmental permits and approval, and MoFA certification of the fertilizer product
Ministry of Local Government and Rural Development (MLGRD)	Until recently, it housed the Directorate of Sanitation, which supports the municipal assemblies in carrying out their waste management responsibilities (this Department was recently transferred to the new Ministry of Sanitation and Water Resources)	Has played a critical supportive role. E.g., in 2016, when a financial shortfall threatened the construction of the Fortifer™ plant in Tema, the Ministry contributed around USD 156K to cover this shortfall.

1. Financial limitations and uncertainty

We understand the original intent of CRPs was to develop longer-term research programs on critical global agricultural and environmental challenges and attract more stable long-term funding. However, Windows 1-2 funding has not been stable and has been at lower levels than anticipated²⁸. The bulk of the financial support for the RRR work in Ghana has come from bilateral projects. WLE has been able to provide modest flexible funding from CGIAR Windows 1 and 2 – though the amount available tends to be unstable and unpredictable year-to-year (see Box 2). Bilateral projects tend to be for limited periods – 2-4 years at best. Researchers noted that convincing bilateral donors to cover all of the researchers’ time plus all other institutional costs is impossible. Managing applied multi-partner innovative research programs takes a great deal of time, and the agreed milestones often require more time and resources to achieve than is provided in projects.

Raising funds to address specific issues along the impact pathway can be slow and haphazard – one has to be very opportunistic. In the case of WaFo, the funding was not adequate: WLE covered some of the additional staff time, and the MLGRD fortunately filled a significant funding gap in Tema.

Perhaps, as some government officials suggested, the researchers simply under-estimated the time needed at the implementation stage. After all, as they note, the research which led to the pilot projects took a number of years. It seems clear to us that most of the challenges such as the need for various

²⁸ This statement is based on Doug Merrey’s own involvement with CRPs since they were initiated.

permits and certification were anticipated, but the time required to obtain them was under-estimated. However, the donors tend to want results quickly, and researchers, therefore, prepare optimistic proposals. As noted in section 6.2.6, WLE funding was critical for the success of the program to date.

Box 2: A note on the budget

We did not carry out a detailed analysis of the RRR/ RUL budget but here provide some indicative figures. In the 2017 Plan of Work and Budget, the total Windows 1-2 budget was USD 7.93 million. The RUL flagship estimated it would generate USD 3.5 million in Windows 3 and bilateral funds and budgeted for USD 1.1 million Windows 1-2. In 2018 WLE budgeted conservatively USD 7.6 million for Windows 1-2 funding; USD 950,000 of this was allocated to RUL, combined with an estimated USD 1.995 million in Windows 3 and bilateral funding. In 2019, RUL's Windows 1-2 funds for IWMI are about USD 650,000. About half (USD 321,000) is allocated to Ghana and Sri Lanka, USD 214,000 covers overhead costs, and about USD 115,000 is available for operations. Clearly, the amounts are modest and on a gentle downward trend.

According to an email from the Flagship Leader, during 2014-2018, an average of USD 173,000 was spent annually to cover part of the time of five researchers. These funds covered about 25% of the total charged time of each researcher (the actual amounts varied year to year).

A question to which we could not get an answer is why the three WaFo donors did not finance another phase²⁹ – IWMI managed to compete for Dutch funding (CapVal) to continue the work. Part of the answer may be that BMGF puts a high priority on developing new sanitation technologies – an arena in which IWMI cannot compete. IWMI works at the tail end of the sanitation chain and has no comparative advantage in sanitation technology development – which is a priority for BMGF.

2. Local policy and institutional challenges

Unlike the case for Sri Lanka, Ghanaian policy is broadly supportive of the PPP business model for recycling and reuse of urban waste (MLGRD 2010; Ministry of Finance and Economic Planning 2011): local municipalities, which are responsible for waste management (and in a sense “own” the waste giving them opportunities to profit from its conversion into useful products), are encouraged to make use of the services of private firms. That said, JVL noted that the “green” or circular economy concept is not yet central to government policy; this program is ahead of policy. That would suggest that IWMI and its partners have an opportunity to influence future policy. There is also an attempt underway to establish a National Sanitation Authority to build the capacity to scale out more effective waste management practices³⁰.

Perhaps the most critical institutional challenge has been working with the local municipal governments. They are responsible for waste management but are seriously under-resourced. For example, the YKMA authorities identified finance as its biggest challenge. Civil servants have little incentive to actively implement innovations, which leads to slow responses and delays in getting decisions made and agreed actions implemented. An especially thorny problem they face is acquiring the land needed for the recycling plant; at least one municipality had to be dropped because Volta dropped out when it could not secure an appropriate piece of land with clear title. Municipalities also struggle with management of the dumping sites – effluent overflow is a problem in some cases

²⁹ In a comment on the draft final report, we were informed BMGF supported some follow up ‘small’ activities. Their funding strategy changed as they redirected funding support for projects like WaFO, through Grand Challenge Africa.

³⁰ Its future is not clear—the idea began during the previous government. We understand Cabinet has reviewed it and asked for changes.

(observed in Tema), and repair of the access road to the plant site in Tema proved to be a serious challenge for the cash-strapped TMA. Management of relationships with local stakeholders is a potential issue, though we understand this is managed well in the pilot sites.

Exacerbating the low capacities of local governments is politics: after the recent election led to a new political party coming into power, mayors (who are appointed) and technically qualified civil servants were replaced. The Director of Waste Management in Tema, who was very supportive of the program, was transferred to Accra and his replacement has still not taken over at the time of our interviews. New mayors have to be briefed and may choose not to support a program initiated by the previous government. On the other hand, the new mayor of YKMA is supportive – apparently because he recognizes the potential for earning political capital.

Even at the national level, the bureaucracy can work slowly, creating a serious challenge for time-bound projects. Obtaining an Environmental Protection Agency (EPA) permit for the land chosen for construction of a processing plant is required at each site, and in YKMA, the first two proposed sites were rejected. Obtaining MOFA certification of Fortifer™ as an organic fertilizer eligible for the fertilizer subsidy program, and certification of each Fortifer™ plant are other time-consuming challenges. The time required for these processes has been greater than anticipated and has become a serious problem as the clock is ticking on time-bound three-year projects (e.g. WaFo).

Vested interests in the existing system are another impediment: larger waste management companies can lobby for greater subsidies, making it more difficult for these relatively low-volume pilot plants to compete. In addition to competition for the waste resources and contracts to process it, there is potential for corruption, though we did not hear of any specific examples³¹.

3. Technical challenges

The pilot projects have faced a number of technical challenges. One set of challenges revolves around the design and construction of the recycling plants. In Tema, IWMI was responsible for supervising the construction through a subcontracted engineer. The quality of the construction became an issue, and JVL, which is responsible for plant operation and maintenance, has had to make some repairs. In YKMA, JVL will take responsibility for ensuring the construction quality as it will be in charge of supervision.

After construction of the Tema plant, design issues surfaced. The plant is not able to produce at full capacity (we were told it is producing 200 mt/year, while the plan was 500 mt/year) because the composting space is too small. The area is being expanded, and future plants will be designed based on this experience.

The lesson learned is that in these pilot projects, there is a need for a strong implementation partner. This is not IWMI's strength. TREND was of some assistance; but it is also not strong in this area.

There are operational challenges as well. For example, the Tema plant can take only a small percentage of the total fecal sludge produced in the municipality; therefore, by itself, it will not have a significant impact in this municipality. In YKMA, a smaller municipality, the percentage is likely to be significant. The plant business model assumes the tipping fees charged to truckers will create 8-10% of the total revenue. However, the additional time for dumping that is required at the plant compared to the waste stabilization ponds is not attractive to the truckers. Apparently, there are places that do not charge such fees, making truckers reluctant to pay³². Another risk is competition for waste material: for example, in Tamale, farmers purchase untreated sludge for their farms.

³¹ Ofori-Amanfo et al. (2018) describe a competing fecal sludge composting facility in Accra.

³² We visited this plant in the afternoon, when work would normally be nearly completed for the day. However, we were surprised that there had clearly been no deliveries of fecal sludge that day (the receiving

Finally, a serious continuing challenge is the lack of a strong private value chain for organic fertilizers in Ghana. We discuss this below in Section 6.2.8 (Sustainability).

6.2.5. Observations on use of ToC and impact pathways by researchers

The final WaFo report (IWMI 2017) contains an interesting *ex post facto* impact pathway showing how the current work to pilot test PPPs and optimize the production process is the culmination of research work that began around 2000-2001 (Figure 4). This pathway is a simplified version of the history of the RRR work in Ghana outlined above in sections 6.2.1 and 6.2.2. The same report includes an impact pathway for the WaFo project itself (Figure 5). This is a simple illustrative diagram showing the main steps from project outputs to outcomes and anticipated development impacts.

However, neither of these figures captures the complex nuances involved in the actual implementation of the program, the roles of multiple partners, the unanticipated challenges that had to be addressed, and the resulting stretching of the time required for implementation. We asked a number of the researchers about their understanding of ToCs and impact pathways, and the extent to which they were used or are useful. Most researchers had no firm ideas on this topic.

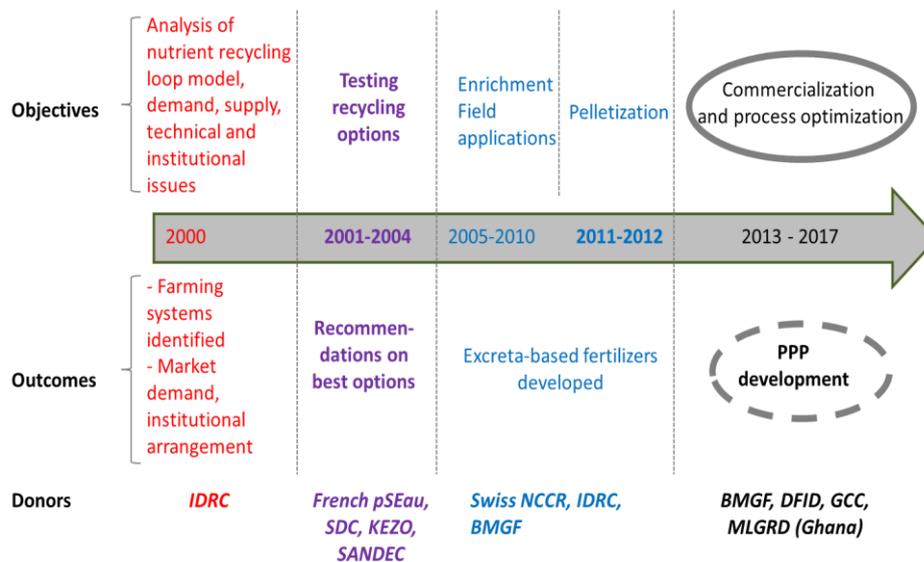


Figure 4: The history of Fortifer™ 2000 to the present

Source: IWMI 2017: Figure 1 [final WAFO report]

tanks were clean and bone dry). When we raised it with JVL we did not get a clear response. We therefore suggest the plant is not being run at full capacity even given the design issues.

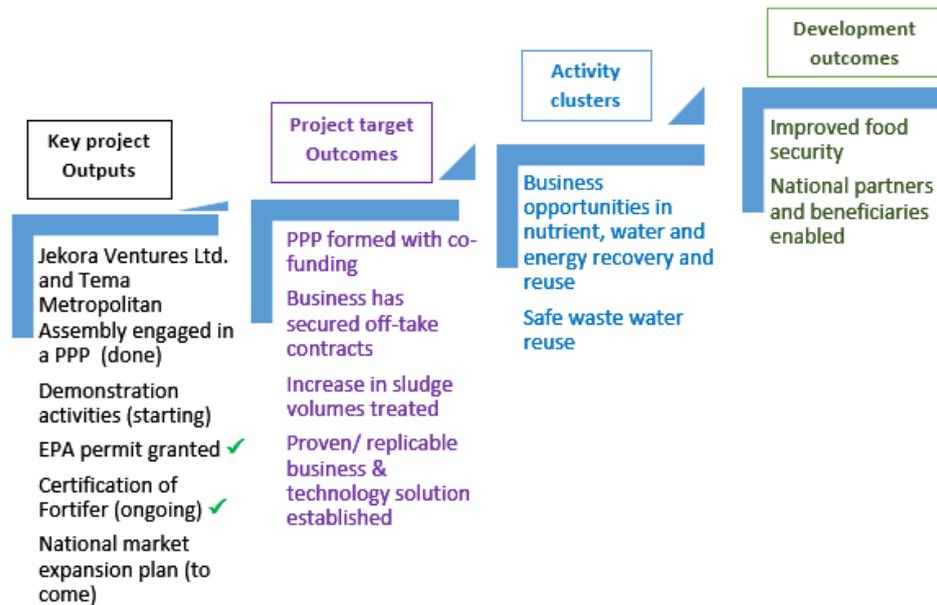


Figure 5: Selected project outputs and impact pathway of the WaFO Project

Source: IWMI 2017: Figure 7.

What emerges from discussions with the leading Ghana-based scientists is that they see the importance of a ToC at the higher global program level and when conceptualizing a project, but the RRR and later RUL impact pathways are not seen as directly relevant at the project level. Impact pathways are okay for initial conceptualization but are not seen as useful project management tools. Impact pathways are “intuitive, in our minds”. The team had a vision of what it wanted to accomplish but had no well-laid out long-term plan, largely because of the uncertainty of funding. They have had to be pragmatic and opportunistic, cobbling together funds from various donors (none of whom were willing to commit to long-term support), and using the WaFo Advisory Team and other partnerships developed over the years to influence decision-making and overcome impediments to progress.

This does not mean the team has no “theory of change”. Rather, it means the researchers have an implicit “theory” of how the results of their work could lead to its widespread uptake and use. Its elements include the following: 1) building local capacity through supporting postgraduate students, often in collaboration with local universities (e.g. KNUST in Kumasi; see Section 6.4); 2) creating a network of partnerships with people and institutions, both government and others, that can become champions or facilitators to help the implementation of the research results; 3) publication of research results in scientifically credible outlets while also presenting these results at multiple local and international forums; and 4) personal advocacy by researchers with long-standing relationships in Ghana. All of these elements have come together to support the current set of pilot tests, with significant contributions from the WLE program since 2012.

6.2.6. The contributions of WLE to the Ghana program

We asked both researchers and other partners about their understanding of WLE and its role in the program. The non-IWMI partners had either not heard of WLE or had at best a vague understanding of what it is. It appears that IWMI has not made a major effort at “branding” WLE; indeed at least one researcher thought it would cause considerable confusion to do so. IWMI researchers varied in their understanding of WLE and its roles, with more junior researchers being mostly aware of its financial contributions. However, the senior scientists had a more nuanced understanding of the important roles WLE has played. We have classified their perceptions of WLE’s contributions to the program in Ghana into six categories.

1. Financial support

The financial support to the Ghana RRR program was the contribution mentioned most often, and most emphatically. We understand the amounts involved are quite modest, though we have no data on the specific amounts involved and how the funds were used (see Box 2, above). The researchers appreciated that WLE has been flexible and strategic about how the funds were used. This flexible funding continued over several years to cover shortfalls in bilateral funding of staff time and to meet unanticipated costs, for example clearing equipment through customs. Given the novelty of the program, in preparing the project proposals, the researchers felt they could not have anticipated all the unexpected delays and additional costs. Put differently, this modest funding leveraged relatively large bilateral projects. Several researchers asserted that the WaFo and now CapVal projects could not be completed successfully without WLE support.

2. Intellectual leadership

Several researchers highlighted the critical role of effective strategic adaptive leadership at the Flagship level. We would add that this seems to be the case at the country level as well. The Flagship-level leadership provided overall guidance and support and helped maintain a focus on the delivery of agreed products that contribute to achieving the long-term vision. A related strength is that unlike the other WLE flagships, the RRR theme is very focused. It constituted the entire Strategic Program in phase 1 but is embedded in a slightly larger but still very focused theme in phase 2 (i.e. rural-urban food systems).

3. Innovative business model approach

Although IWMI first began experimenting with the use of “business models” under the [AgWater Solutions Project](#), the RRR program pioneered the full development of this methodology and applied it to identifying financially and environmentally beneficial and sustainable ways to create revenue streams from processing urban waste. The WLE RUL program has been learning lessons on how this model can be practically implemented in Ghana and extending these lessons to other countries. At least one other WLE flagship (LWS) has also adopted this methodology to find ways to scale out innovations such as solar irrigation pumps (Otoo et al. 2018).³³

4. Partnership network

A key goal of the CGIAR Research Program reform was to facilitate stronger partnerships both within the CGIAR and between the CGIAR and other institutions. Several researchers emphasized this as an important contribution of WLE to the RRR program in Ghana. It has several dimensions. First, it has enabled collaborating with World Fish on using sewerage evaporation ponds to raise fish in Kumasi. In addition, it has enabled collaborating with ICRAF on making charcoal briquettes out of processed fecal sludge, as planned in YKMA. Second, while RUAF was a partner in WLE Phase 1, in Phase 2 this partnership was strengthened as RUAF co-leads the Flagship. The CapVal project required a Dutch partner – RUAF was the natural choice because it is already part of the Flagship. RUAF has also helped IWMI expand its network internationally in the water and sanitation and urban food system fields. WLE has enabled IWMI researchers to engage with a wider set of global partners (see next point), while also supporting engagement with local partners in Ghana.

5. Knowledge sharing

Knowledge sharing is an important strength of WLE: it packages and shares WLE research through multiple communication channels and products. One mechanism WLE uses to ensure there are a lot of

³³ A key leader of the RRR business model work, M. Otoo, has also worked with the WLE Land and Water Solutions for Sustainable Intensification (LWS) program on solar pump business models and is the lead author of the paper solar pump business models in Ethiopia.

information products to share is by tying production of such deliverables to the staff time support it provides, as discussed above. These, in turn, are widely disseminated, and also used by the researchers to inform their donors and partners of their work. The researchers say these products have increased their credibility as a scientific institution. WLE has also supported the RRR researchers and their partners to participate in, and organize special sessions at, a variety of international conferences, enabling them to showcase their work. Conferences mentioned included [International Fecal Sludge Management](#) (FSM) conferences, [WEDC](#)³⁴ and [International Water Association](#) (IWA) conferences, and Stockholm Water Week. Knowledge sharing has multiple feedback effects: it contributes to enhancing the RRR team’s reputation for solid science, making it easier to obtain the support of donors and policymakers; its products are used to inform and educate people, contributing to capacity strengthening; its participation in international conferences has enabled the RRR team to share its work and build additional support. We understand that partners’ participation in such conferences can be supported but learned of no examples from Ghana (there are examples from Sri Lanka)³⁵.

6. Inter-flagship collaboration

We asked several of the Ghana-based researchers about synergies of the RRR program with other WLE Flagships. For example, we were told that the team had done trials on the use of Fortifer™ in collaboration with farmers in Ghana. WLE has a Flagship aimed at restoring soil fertility (“Restoring Degraded Landscapes” in phase 2). In our interviews, we were told that the Fortifer™ trials were not done in collaboration with that Flagship. The only other examples we were given were the business model analysis of solar pumps in Ethiopia, cited above, and the claim that the LWS Flagship had tested Fortifer™ through the USAID-supported Africa Rising Program in northern Ghana (we could find no evidence of this on the Africa Rising website, but this point was repeated in a comment on the draft final report). In essence, we concluded that there are few synergies with other WLE Flagships.

6.2.7. The role of IWMI, past and future, in Ghana

We asked both researchers and partners what had been IWMI’s role in the RRR program in Ghana; whether IWMI should have an exit strategy; if so, what that should be; and if not, what should its future role be. Our assumption was that as an international research organization, IWMI has no competitive advantage (or legitimate role) once a program reaches full-scale implementation.

Most of those interviewed agreed that IWMI has played multiple critical roles. These include technical leadership (based on its research experience), bringing in international experiences, identifying the right partners, coordination of all the partners, and assisting in solving problems, for example lobbying for land for the processing plants and obtaining needed certifications. Key words used by IWMI’s partners included “energized,” “galvanized,” “passion,” “commitment,” and “leadership”. Several of the people interviewed stated there is no alternative institution in Ghana that could have played the roles that IWMI has; one of them noted that no Ghanaian institution is sufficiently independent of politics to play this role. In other words, in their view, there would have been no pilot PPP programs testing the technical and financial feasibility of creating businesses to process urban waste.

There were various views among the partners interviewed as well as some researchers as to how much longer IWMI needs to remain engaged, and whether the program would be sustainable without IWMI. One partner suggested IWMI can help foster sharing experiences and lessons with other municipal assemblies. Several suggested that IWMI could withdraw after two to three years, while others

³⁴ Water, Engineering and Development Centre, Loughborough University, UK.

³⁵ In a comment on the draft final report, we were informed one of WEDC’s conferences was organized in Ghana and IWMI organized a session and supported partners to participate.

thought it might take somewhat longer. One researcher saw no major role for IWMI in future implementation.

However, the senior researchers had somewhat different ideas, as did one partner: JVL. They pointed out there are still many research gaps, and as the pilot “proof of concept” moves to an implementation phase, these research gaps will need to be addressed. For example, JVL noted that additional social, environmental and economic analyses and development of business models that would help commercial banks appreciate the potential are needed, and no local universities can do this. While they agreed IWMI should exit from project implementation, it should remain engaged in a monitoring and applied research role.

The researchers see many opportunities for continued IWMI research, particularly as a laboratory to test new ideas. IWMI should exit from non-research parts of project implementation (in the near future) but continue monitoring the program, learning lessons and implementing supportive research, including market research, business issues and appropriate financing mechanisms, long term impacts (pathogens, environment, chemicals), ways to improve the quality and quantity of the products (e.g. optimizing palletization), and better understanding of uptake of nutrients by plants. Parallel to this it was suggested that IWMI could build a large postgraduate program to address new issues aimed at closing the circular economic loop, while also developing curricula for training institutions (e.g. the Institute for Local Government) and backstopping and building the capacities of municipalities. They noted that some donors (they mentioned AfDB, BMZ, IFAD, BMGF) want to see the CGIAR engage in scaling up and out its innovations; this creates potential opportunities to build a research program that supports scaling the RRR program out.

6.2.8. Sustainability of the Ghana PPPs

The ToR asked a specific question on the future sustainability of the RRR program. The financial viability and profitability of the business is critical for continued involvement of the private sector; while generating a sufficient revenue stream to subsidize some of the municipalities’ costs is also critical from their perspective. To date, the researchers claimed there is no serious deviation for the projected time required to break even (three to four years), but continued support is required to address ongoing issues such as the tipping fees problem. Our observations suggest that three years may be optimistic, but we were unable to obtain financial reports from JVL to enable us to come to any conclusion on this point.

A Board of Directors for the Tema plant has been established and apparently met once in October 2018. It was expected to have a more formal meeting and launch soon, but as of mid-February 2019, this had not happened. Its role will be to provide strategic guidance and oversight and ensure transparency, including of financial reporting. Members include representatives of TMA, JVL, IWMI, TREND, MLGRD, MOFA, and the new Ministry of Sanitation and Water Resources. Currently, there is no provision to compensate Board members. Its intention is to ensure long-term sustainability and upscaling of the PPP. A similar Board is envisioned for the other pilot projects, such as the one at YKMA.

A very serious impediment to sustainably scaling this program is the lack of an effective value chain on the demand side: on the one hand, the Fortifer™ production capacity is so far too low to be a viable business or to meet the fertilizer subsidy quota. (The charcoal briquette plant is not yet operational.³⁶) On the other hand, there is not yet sufficient demand for Fortifer™ to even be sure of selling all that is currently produced. The demand for organic fertilizer is not very strong as yet (there is no certified organic industry in the country). The production capacity is too low; but even if capacity were higher the demand level is not clear. JVL, with assistance from IWMI and TREND, has

³⁶ The YKMA team claimed there is a market for the charcoal briquettes they will be producing—among fish smokers, bead producers, and education institutions.

developed a detailed marketing plan (JVL 2017). The plan describes the fairly extensive market research carried out and focuses on creating demand through a variety of agricultural organizations and NGOs. Examples include the Farmers Organization Network in Ghana, Ecumenical Association for Sustainable Agriculture and Rural Development, Kpong Irrigation Project, and Vegetable Producers and Export Association of Ghana. The report also mentions reaching out to the plantation sector. In addition, JVL has been establishing links to extension services, and IWMI has been managing demonstration sites with some of these farmer organization and facilitating engagement with agri-dealers. An important item is the adaptation of different varieties of Fortifer™ for different types of crops or soils. At the Tema plant, we were told that farmers and others such as landscapers come to them to purchase the compost or fertilizer. JVL has no previous experience in this area; this remains a work in progress.

There remain serious questions about whether the business model is lucrative enough to attract more private firms. JVL admitted it is still out-of-pocket, though the good publicity it has received has attracted more business. At the current commercial pilot scale, the business is not likely to be sufficiently profitable to attract additional investments: scaling up is essential. This will require long-term, low-cost capital investments. It appears to us that the pilot test results have not quite reached a point where IWMI can confidently recommend large-scale investments. We understood from the researchers that, understandably, the team has not yet developed a scaling-out and -up strategy and has not approached potential financial partners such as the World Bank and the government about this. This will likely be an urgent requirement in the near future if the commercial pilots are as successful as we anticipate they may be.

Finally, we are not certain that IWMI has carried out sufficient analyses of the full range of actual and potential competition in the urban waste business³⁷. There were hints of this in our interviews in Ghana; for example, we were told tanker truck drivers do not find it attractive to deliver to the Tema plant as unloading takes longer than dumping into the evaporation basins, but the tipping fee they pay is the same (offering discounts may affect the bottom line of the plant). We are aware of other plants in Accra that are converting waste into pelletized compost (Ofori-Amanfo et al. 2017); in Tamale we understand farmers use untreated fecal sludge for fertilizer, which we understand is why IWMI did not attempt to build a fertilizer plant there.

6.2.9. Gender

Gender has not been a major focus of the RRR program in Ghana. On one hand, it may be argued that most of the outputs are gender-neutral, such as curricula, guidelines and manuals. On the other hand, according to one IWMI researcher (the only one with publications on gender in this program), gender emerges as an issue and gender sensitivity has been explicitly considered in the studies of business models (see papers in Otoo and Drechsel, eds. 2018) and in studies in other countries (see papers in Njenga and Mendum, eds. 2018). For example, in East Africa women control the charcoal briquette value chain. In Ghana, it is not seen as an issue in the co-composting projects, but it is an important consideration for the plant that will produce charcoal briquettes. This is because a major potential market is women who run small businesses smoking and selling fish (Gebrezgabher, Amewu and Njenga 2018). The Tema plant producing Fortifer™ fertilizer employs women as well as men; the supervisor claimed women are paid the same as men, but we could not confirm this statement. We are not aware of, and do not believe there are, any negative impacts of the RRR program on women or men but suggest it may need further in-depth study. For example, we understand in Kumasi an Indian company collects forest waste and converts it to charcoal for export to Europe; if it were not operating, would there have been opportunities for local businesses, including those run by women?

³⁷ In a comment on the draft final report, we were informed that IWMI has recently recruited someone to do precisely this.

6.2.10. Concluding remarks: Lessons learned in Ghana

We held a debriefing meeting on the final day in Accra, where researchers shared some of the lessons learned from the RRR program to date.

A major lesson is the importance of having a long-term vision as a basis of the program, ideally supported by long-term funding. In the absence of such funding, strategic adaptive management, i.e. opportunistically seizing funding opportunities that contribute to achieving the vision, is essential. With hindsight, it was suggested that such change programs must avoid over-estimating the capacities of partners (for example, municipalities), and avoid unrealistic time frames for change processes. It is important to “expect the unexpected”: new challenges constantly arise in any innovative change process. However, that said, one wonders if any donor would have the patience to invest for the long term and accept longer time frames to compensate for solving unanticipated problems and making up for low partner capacities.

Another lesson is that investing earlier and more substantially in capacity development at multiple levels would have enhanced the process. This refers to postgraduates, training for key partners, and institutional strengthening. The team also suggested that building stronger links to a wider set of partners (e.g. business, environment, financial institutions) would have improved the process. They noted they had not established a strong platform for exchanges of lessons and experience (i.e. while they used workshops and other mechanisms for sharing lessons, there were no innovation platforms established).

We inquired as to whether earlier and stronger engagement on policy issues would have strengthened the process. While some elements of Ghana’s policy framework are supportive (for example PPP joint ventures to deal with waste), there is no strong “green economy” policy framework, and no clear support for small and medium businesses to engage in PPPs.

The researchers noted that the CapVal project was designed based on lessons learned during WaFo. For example, providing for a project leader who has a large percentage of time devoted to managing the project, rather than using several people for shorter periods. Another was making better use of local partners with capacity: delegating non-research tasks so that researchers can focus on their strength: research (an example is the use of a local NGO like TREND for facilitation and engagement). They also found it is easier to work with smaller municipalities (like YKMA) who have fewer competing projects and lower expectations as to resources expected from the partner).

6.3. Impact pathway 3: International engagement

The International Public Goods (IPGs) resulting from IWMI’s WWR and RRR work laid the foundation for influencing an ‘international engagement impact pathway’, notably by way of contributions to the guidelines and manuals of agencies such as the Food and Agricultural Organization of the United Nations (FAO), the World Health Organization (WHO), United Nations Environment Program (UNEP) and the United States Environmental Protection Agency (US-EPA), and to flagship publications such as the UN World Water Development Report of 2017. This became an increasingly important impact pathway during both phase 1 and phase 2 of WLE.

6.3.1. IWMI (WLE) partnerships with international agencies

Starting from its early years, even prior to the WLE-RRR program, IWMI had begun engaging as a knowledge partner with international organizations, notably WHO and FAO, on wastewater irrigation (WLE 2011: 116) and capacity development initiatives³⁸.

³⁸ One key output from this collaboration was the publication (in 2013) of ‘Safe use of wastewater for agriculture’. *N.B. the focus at the time was on wastewater reuse; RRR approaches and business models were not included.*

There are broadly two pathways by which IWMI (WLE) came to influence and contribute to IPGs produced by international agencies:

1. UN and other international agencies inviting IWMI to support and complement the agency’s in-house expertise in carrying out work that the agency is doing or plans to do.
2. IWMI-WLE and the agencies jointly identifying opportunities to generate IPGs that fill an existing gap.

Both pathways help IWMI to reach broader (and different) audiences for its research findings and outputs, in addition to the usual scientific community.

Table 5 summarizes the international partnerships that IWMI-WLE has entered into.

6.3.2. IWMI comparative advantage³⁹

IWMI’s scientific reputation and track-record were seen as key reasons for invitations to IWMI to contribute to such initiatives. IWMI was highly regarded for being knowledgeable about the global scientific literature and as an authority on the state of the research in regard to RRR. It is considered a primary source of information on the technical, policy and institutional aspects on the subject. IWMI’s RRR business model work, in particular, is considered to be pioneering and important. Furthermore, one international agency correspondent emphasized that “IWMI is responsive to requests, makes serious and well-prepared contributions to expert consultations and its commitment and work quality is appreciated”.

Table 5: IWMI-WLE partnerships with international agencies

International Agency	Nature of partnership	Collaborative activities related to RRR
FAO	<ul style="list-style-type: none"> • MoU signed between FAO and IWMI (on behalf of WLE)⁴⁰ in January 2015 for an initial five-year period for joint activities in research, development and capacity building. • The scope of the collaboration includes among others, use of wastewater in agriculture, water quality, and support to the AQUASTAT database. 	<p>Development of several manuals and guidelines mainly related to the safe reuse of marginal quality water in agriculture</p> <p><i>N.B. agricultural water quality is conceptualized in terms of two pillars: (1) agriculture as a user/recipient of pollutants; e.g. (re)use of wastewater; (2) agriculture as a source/producer of pollution; e.g. generating agrochemical waste streams through inappropriate use of inputs.</i></p>
WHO	<p>Two MoUs between WHO and IWMI:</p> <ul style="list-style-type: none"> • A project-related MoU for the specific deliverables under the SDC funded project • MoU signed in June 2012 (valid till 31 December 2018) defining a broader collaboration around the development of WHO guidelines, joint studies related to resource recovery and reuse and generation of knowledge products⁴¹. 	<ul style="list-style-type: none"> • Implementing a SDC funded project on the safe reuse of waste. WHO was responsible for the health and safety component while IWMI provided the RRR technical and business model inputs • Collaboration, within the UN Water umbrella, in running regional capacity building workshops and consultations • Providing expert advice and advocacy in the run-up to developing indicators and targets for SDG 6.2 and 6.3

³⁹ This is based on feedback received from our international agency interlocutors.

⁴⁰ This is the only example we have come across so far where WLE has been a party to an agreement (albeit via IWMI).

⁴¹ Our WHO interlocutor was not sure if the MoUs were still active or had lapsed; however, it was stressed that the formal status of the MoU does not impede continuing collaboration given the longstanding the IWMI-WHO relationship and the strong personal and professional linkages between key staff of the two organizations.

International Agency	Nature of partnership	Collaborative activities related to RRR
		<i>N.B. WLE Windows 1-2 supported the staff time inputs of RRR program staff to these influential events.</i>
UNEP	We understand there is no MoU but that a 2013 meeting between Jeremy Bird (IWMI's then Director General) and Thomas Chiramba from UN-Environment resulted in the identification of potential areas of collaboration that were formally listed in an exchange of letters between the two organizations.	Production of a sourcebook on the economic valuation of wastewater (UNEP 2015).
USAID	USAID has until recently hosted an IWMI staff member who supported its Office of Water on areas of mutual interest. This person played an essential role in the relationship.	IWMI contributed to the updating of US-EPA Guidelines on water reuse with specific responsibility for writing the chapter dealing with global experiences on water reuse (US-EPA 2012: Chapter 9 ⁴²).

6.3.3. IWMI (WLE) contribution to IPGs produced by international agencies

The partnerships between IWMI-WLE and international agencies resulted in several IPGs, as detailed in Table 6 below. The labeling and branding of the work on published material was initially confined to IWMI but now includes WLE. The level of visibility (in terms of logos, co-authorship etc.) depends on the type of agreement entered into between the international agency and IWMI-WLE.

Table 6: IWMI-WLE contributions to IPGs produced by international agencies

Details of IPG	IWMI-WLE contribution
<p>FAO-WLE. 2018. <i>More people, more food, worse water?: A global review of water pollution from agriculture</i>. Rome, Italy: FAO; Colombo, Sri Lanka: International Water Management Institute (IWMI). CGIAR Research Program on Water, Land and Ecosystems (WLE)⁴³.</p> <p>http://www.fao.org/3/ca0146en/CA0146EN.pdf</p>	<ul style="list-style-type: none"> • IWMI researcher is one of three co-editors; • IWMI (and ex-IWMI) researchers are co-authors of several chapters; • WLE and IWMI logos appear on cover page; • FAO and IWMI (on behalf of WLE) are co-publishers

⁴² This was a product of EPA-USAID collaboration, implemented by a consulting firm. The document specifically acknowledges IWMI's contribution to chapter 9.

⁴³ This publication received wide media coverage:

<https://sdg.iisd.org/news/report-identifies-agriculture-as-greatest-source-of-water-pollution/>

https://thewaternetwork.com/_/sustainable-agriculture/article-FfV/global-review-of-water-pollution-from-agriculture-by-fao-fVT1uzl9-44KUVwk5NoKrQ

<https://www.rural21.com/english/news/detail/article/agricultural-pollutants-a-serious-threat-to-the-worlds-water-00002888/>

<http://www.businessworld.in/article/Developing-Nations-Account-For-99-Percent-Deaths-Due-To-Pesticides-FAO-report/27-06-2018-153159/>

<https://www.thesourcemagazine.org/fao-links-water-pollution-to-agricultural-practices/>

<https://bobrtimes.com/farms-and-not-factories-named-as-the-main-cause-of-global-water-pollution/66765/>

FAO. 2018. *Training handbook for Farmer Field Schools: On-farm practices for the safe use of wastewater in horticulture in Urban and Peri-urban Agriculture*. Rome: FAO.

<http://www.fao.org/3/a-i3041e.pdf>

- IWMI researchers are co-authors of several chapters;
- IWMI researcher coordinated the finalization of the handbook;
- IWMI contribution is explicitly recognized in the acknowledgements

Details of IPG	IWMI-WLE contribution
<p>FAO-WLE. 2017. <i>Water pollution from agriculture: a global review</i>. Executive summary. CGIAR research program on Water, Land and Ecosystems (WLE) and Food and Agriculture Organization of the United Nations, Rome.</p> <p>http://www.fao.org/3/a-i7754e.pdf</p>	<ul style="list-style-type: none"> • IWMI researcher is one of three co-editors; • IWMI (and ex-IWMI) researchers are co-authors of several chapters; • WLE and IWMI logos appear on cover page; • FAO and IWMI (on behalf of WLE) are co-publishers
<p>FAO. 2017. <i>Safe and productive use of wastewater in Latin America and the Caribbean: Principles, status and needs</i>. Food and Agriculture Organization of the United Nations, Santiago de Chile. http://www.fao.org/3/a-i7748s.pdf</p>	<ul style="list-style-type: none"> • IWMI researcher is the book editor; • IWMI and WLE logos appear on back cover
<p>UNEP. 2016. <i>A Snapshot of the World's Water Quality: Towards a global assessment</i>. United Nations Environment Programme, Nairobi.</p> <p>http://uneplive.unep.org/media/docs/assessments/unep_wwqa_report_web.pdf</p>	<ul style="list-style-type: none"> • IWMI researcher is a book reviewer; • IWMI researcher is a contributing author. • Two IWMI researchers served on the advisory committee
<p>UNEP. 2015. <i>Economic Valuation of Wastewater - The cost of action and the cost of no action</i>. United Nations Environment Programme, 2015.</p> <p>http://www.cep.unep.org/meetings/documents/1d0d6e19260b5e5d9b466bd78a3703e0/@@download/en_file/-Economic Valuation of Wastewater The Cost of Action and the Cost of No Action-2015Wastewater Evaluation Report-en.pdf</p>	<ul style="list-style-type: none"> • IWMI researcher is a co-author; • Two IWMI researchers were peer reviewers of the report; • IWMI logo appears on the cover page
Details of IPG	IWMI-WLE contribution
<p>UNWDPC. 2013. <i>Safe use of wastewater in agriculture. Proceedings of the UN-Water project on the safe use of wastewater in agriculture</i>. UN-Water Decade Program on Capacity Development (UNWDPC).⁴⁴</p> <p>http://www.ais.unwater.org/ais/pluginfile.php/62/course/section/29/proceedings-no-11_WEB.pdf</p>	<ul style="list-style-type: none"> • Three IWMI researchers are among the co-authors of this report; • IWMI logo is displayed along with that of other partners in the collaborative effort of UN-Water Members: FAO • WHO • UNEP • UNU-INWEH • UNW-DPC • ICID • IWMI
<p>US-EPA. 2012. <i>Guidelines for water reuse</i>. Washington, C.C.: US-EPA Office of Wastewater Management; and Cincinnati, OH: National Risk Management Research Laboratory Office of Research and Development.</p> <p>https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR-1530.pdf</p>	<ul style="list-style-type: none"> • IWMI's technical, financial and in-kind support for the development of Chapter 9 (Global Experiences in Water Reuse) is explicitly highlighted; • The direction, advice, and suggestions of five individuals, including two IWMI researchers, are acknowledged; • The contributions of five IWMI scientists are recognized.
<p>WHO. 2015. <i>Sanitation safety planning. Manual for safe use and disposal of wastewater, greywater and excreta</i>. World Health</p>	<ul style="list-style-type: none"> • IWMI is recognized as a partner in the development of the manual;

⁴⁴ This was the final product of a global multi-partner capacity development project for the safe use of wastewater in agriculture. All the resources that were generated in addition to the final proceedings are available at: <http://www.ais.unwater.org/wastewater>.

Organization, Geneva.

https://apps.who.int/iris/bitstream/handle/10665/171753/9789241549240_eng.pdf;jsessionid=063FD6ABEC738B0F03BBFA10D13F096E?sequence=1

- Two IWMI researchers are listed as contributors

WWAP (United Nations World Water Assessment Programme). 2017. *The United Nations World Water Development Report 2017: Wastewater, The Untapped Resource*. Paris, UNESCO.

<https://unesdoc.unesco.org/ark:/48223/pf0000247153>

- IWMI researcher is a contributor to several chapters;
- IWMI research and publications are extensively referenced

6.3.4. Support to global databases

IWMI and FAO agreed to collaborate on a global assessment of wastewater use in agriculture through an exchange of letters in September 2013. (This instrument is considered a more operational level of collaboration compared to the higher-level Letter of Agreement or MoU). Contributing to the AQUASTAT database, FAO's global water information system, was a specific part of this agreement. Thanks to resources made available by WLE, IWMI was able to enrich the wastewater segment of AQUASTAT. A formal MoU followed in 2015 (see section 6.3.1).

IWMI-WLE developed a methodology to systematically collect wastewater data and harmonize the quality of data received from different sources; validation criteria were also developed for this purpose. This collaboration is clearly acknowledged on the AQUASTAT wastewater web-page which carries logos of IWMI and WLE and states: “*The CGIAR Research Programme on Water, Land and Ecosystems, led by the International Water Management Institute (IWMI), and the Land and Water Division of FAO are collaborating to collect, analyze and validate the best available data on municipal wastewater production, collection, treatment, discharge and direct use for irrigation purposes. The results of this collaboration are available in AQUASTAT, also announced on IWMI's website.*”⁴⁵

The AQUASTAT support relationship continued up until 2017; no investment was made by IWMI-WLE in 2018. We understand that AQUASTAT is currently undergoing a major reorganization, notably to ensure compatibility with other FAO statistical databases and website design and structure. Furthermore, a change in how data are collected is being introduced: official country nominated AQUASTAT correspondents will be responsible for data collection (instead of consultants). We suggest that IWMI-WLE consider continuing its support to FAO with a view to consolidating the investments and efforts already deployed to harmonize and validate data collection for the wastewater segment of AQUASTAT.

6.3.5. Mutual benefit

IWMI-WLE derived benefits from its partnership with international agencies through opportunities to showcase its work to a wider global audience that it might not have otherwise reached. For example, its partnership with FAO in water reuse research helped enhance IWMI's visibility among a wider audience thanks to FAO's global network and its convening power, notably vis-a-vis policy and decision makers in government. The level of media exposure has also been quite extensive, as evidenced by the links to the articles (in Spanish) that have appeared in well-known newspapers in Spain and Latin America.⁴⁶

⁴⁵ FAO-AQUASTAT Global wastewater database:

<http://www.fao.org/nr/water/aquastat/wastewater/index.stm>

<http://sdg.iisd.org/news/fao-iwmi-launch-global-wastewater-database/>.

⁴⁶ https://elpais.com/elpais/2017/08/29/planeta_futuro/1504000301_392732.html

<https://www.lavanguardia.com/vida/20170212/414272445443/aguas-sucias-pero-no-inservibles-para-cultivar.html>

https://www.elconfidencial.com/ultima-hora-en-vivo/2017-02-12/aguas-sucias-pero-no-inservibles-para-cultivar_1137324/

In addition, IWMI-WLE was able to convert some of the work it accomplished under these partnerships to IPGs of its own. One example is the Resource Recovery and Reuse Series publication No. 4 based upon the chapter IWMI-WLE contributed to the US-EPA guidelines (Lautze et al. 2014).

On the other hand, these relationships were also of benefit to international agencies. For example, they were able to draw on IWMI-WLE knowledge and staff resources to generate seminal IPGs related to safe wastewater reuse. In the case of USAID, it appears likely that it was only because an IWMI staff person was sitting within USAID that IWMI-WLE was able to influence the US-EPA guidelines. Whether IWMI-WLE services would be called upon in the event of a revision or update of the 2012 guidelines is unclear.

WHO, for its part, was a partner in the production of the Resource Recovery Business Models Sourcebook. Our WHO interviewee emphasized that they consider this a highly operational product and actively promote it within their network and at appropriate forums, including its use as teaching material.

The RRR program leader clarified that WLE covered its own staff costs under these partnerships using Windows 1-2 funds; agencies such as WHO might have occasionally covered travel and per diem costs of IWMI staff who were invited to participate in a workshop or consultation.

6.3.6. Dissemination and uptake

UN agencies adopt two channels for dissemination and promotion of its guidelines: 1) through their network of regional and country representations; 2) uptake by other agencies such as development banks, development cooperation agencies, and other UN organizations. However, they admitted that it was not possible to systematically monitor, track and attribute uptake. We encourage IWMI-WLE to continue broadening its set of collaborating partners. Engaging with implementation and international financing agencies in addition to academic and UN institutions would improve ownership of outputs and enhance the chances of positive outcomes.

6.3.7. Branding: IWMI vis-à-vis WLE

In general, it is IWMI that international agencies consider as their partner; the relationship to WLE is not well known. Typically, in presentations and public interactions, research staff highlight IWMI but with acknowledgement of the funding support afforded by WLE. It takes time to explain the linkages between IWMI and WLE and why and how this relationship needs to be acknowledged and branded.

Different UN agencies have different policies and criteria to include partners' logos on their publications, and these policies and criteria change with time. Sometimes these criteria are not clear or there is a reluctance to discuss them upfront. FAO now does not include others' logo unless there is a co-publishing agreement signed. UNEP does not accept others' logo on the cover unless there was a joint intellectual contribution as well as cost-sharing in producing the report (beyond staff time).

6.3.8. Impact pathways

The IWMI-WLE international engagement pathway has given rise to partnerships with FAO and other UN agencies whereby IWMI-WLE has contributed to a range of documents such as guidelines and sourcebooks on the subjects of wastewater reuse and RRR. At times, IWMI-WLE has been proactive in suggesting topics to be addressed in collaborative work and co-publishing arrangements with FAO and others. At other times, the agencies seek to tap into IWMI's research-based knowledge to help them address specific topics. e.g. the case of the UNEP manual on economic valuation of wastewater.

In terms of the global awareness and capacity enhancement pathway, international partnerships with the UN agencies have helped IWMI-WLE to synthesize and consolidate material and knowledge that

<https://elperiodicodemexico.com/nota.php?id=847445>

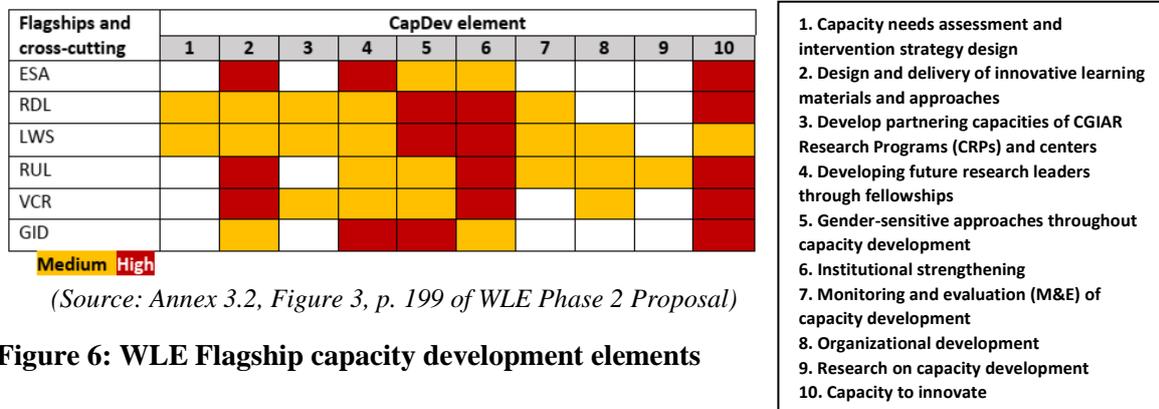
<https://www.20minutos.es/noticia/3121287/0/uso-inadecuado-pesticidas-amenaza-contaminar-aguas/>

are scattered across different sectors, countries and regions. For example, the global multi-partner capacity development project for the safe use of wastewater in agriculture compiled the most relevant knowledge products and training resources from different partners on the topic of safe use of wastewater.

Other examples are the FAO AQUASTAT wastewater database, which compiles thousands of data points from hundreds of different sources, and the FAO/WLE 2018 report cited above which compiled the existing disperse literature on water pollution from agriculture at global level. These IPGs helped to bring the results to the attention of a wider global audience via the UN system’s global network, including wide media coverage (such as in the list provided previously).

6.4. Impact pathway 4: Capacity enhancement

The 2016 evaluation of WLE Phase 1 evaluation stated: “WLE capacity strengthening efforts have been somewhat scattered and lack a coherent plan.” (CGIAR-IEA 2016: 59-60) and “is not particularly purposeful” (p. 64). The WLE Phase 2 proposal does include a capacity building strategy, to be implemented through the flagships as shown in Figure 6 below.



(Source: Annex 3.2, Figure 3, p. 199 of WLE Phase 2 Proposal)

Figure 6: WLE Flagship capacity development elements

Capacity strengthening has been a key deliverable of the RRR program since its inception in Ghana.

In those early years, the IWMI team developed multiple local and international partnerships and began creating a network of academics and government officials with whom it continues to work.⁴⁷ In addition, IWMI supported a number of postgraduate students (M.Sc., Ph.D., post-docs) who have continued working with IWMI in various roles or have gone on to important professional positions elsewhere.

In this section we briefly discuss two streams: 1) RRR business model curriculum development and its integration into university programs; and 2) capacity strengthening and outreach in the two country programs (Ghana and Sri Lanka), broadly covering WLE CapDev elements 2, 4 and 6 (Figure 6).

6.4.1. Curriculum development

Curriculum development constitutes an important vehicle for RRR outreach and capacity strengthening. It results from a conscious decision to broaden the set of end-users of RRR research results and influence future thinking. Beneficiary groups include professionals and policymakers (short courses) as well as undergraduate and postgraduate courses offered in engineering, economics, environmental and business school programs.

⁴⁷ An example is Tony Mensah, now Director of Sanitation in the Ministry of Sanitation and Water Resources. He was the Head of Waste Management for the Kumasi Municipal Assembly. He collaborated on the co-composting work in Kumasi and stayed involved with IWMI from that period.

Table 7 summarizes the status of curriculum uptake as at February 2019. It will be observed that both undergraduate and postgraduate programs are covered. There appears to be three levels of collaboration and uptake in relation to academic and training institutions at present:

- (1) Institutions where the adaptation of RRR training materials to their specific academic programs is at an advanced stage; curriculum implementation is planned to take place during 2019/20; formal institutional agreements are being prepared;
- (2) Institutions where the process of adaptation and integration of substantive material and content is ongoing and institutional agreements are being negotiated;
- (3) Institutions with which discussions have been initiated and are underway.

Table 7: Curriculum uptake Status as at February 2019

<p>Curriculum implementation (materials adapted to programme)</p>	<p>Integration process in progress (incl. material/content adaptation, institutional agreements)</p>	<p>Discussions underway</p>
<p>1. Asian Institute of Technology, Thailand As a 3-credit postgraduate course in the Environmental Engineering and Management programme of the School of Environment, Resources and Development</p>	<p>5. African Leadership University, Mauritius and Rwanda campuses * Modules integrated in “Managing Sustainable Business Excellence” course in Department of Business Management</p>	<p>9. An-Nanja National University, Palestine - https://www.najah.edu/en/academic/academic-news/2019/01/13/holding-the-resource-recovery-and-reuse-rrr-entrepreneurship-workshop/ <i>(workshop already conducted)</i></p>
<p>2. Makerere University, Uganda * As a 4-credit course in the Master of Engineering programme (Environmental Engineering specialization track) - <i>Course code: CIV7275</i></p>	<p>6. Open University, Sri Lanka Modules integrated as 4-credit course unit Bachelor of Technology Honours in Engineering degree programme</p>	<p>10. University of Moratuwa, Sri Lanka 4-credit elective module in MSc. Chemical and Process Engineering programme</p>
<p>3. Birla Institute of Technology & Science, Pilani, India As an open elective in Department of Biological Sciences</p>	<p>7. Institute of Technology, Cambodia * Modules integrated in the 2-credit unit <i>Entrepreneurship course in the Masters of Water and Environment programme</i></p>	<p>11. Ruhuna University, Sri Lanka Open elective in: a) B.Sc. in Green Technology, b) B.Sc. in Ag. Management, c) M.Sc. in Green Technology; Ag. Management; Ag. Econ programmes</p>
<p>4. IHE – Delft, Netherlands Integrated in “Sanitation Financing” module in MSc in Sanitation programme</p>	<p>8. via Ghent University, Belgium Modules integrated in International MSc. in Environmental Technology and Engineering</p>	<p>12. Institute for Technology and Resources Management in the Tropics and Subtropics (ITT-Köln), Germany</p>
<p>A free online version of the RRR Business Model course will be shortly uploaded on www.sswm.info</p> <p>*Intensive masterclass seminars planned for a select number of universities (March – April, 2019)</p>		<p>13. Wayamba University, Sri Lanka</p> <p>14. University of Peradeniya, Sri Lanka</p> <p>15. University of Dar es Salaam, Tanzania Department of Water Resources Engineering</p> <p>16. Egerton University, Kenya* Department of Civil Engineering</p> <p>17. University of Zambia in Lusaka, Zambia* Department of Civil Engineering.</p> <p>18. University of Addis Ababa, Ethiopia * Department of Environmental Science (pollution and sanitation specialization)</p> <p>19. Shiv Nadar, India</p>

An intensive seven-day training program has been held in IWMI-HQ for 25 university teachers who would be delivering the course material and 50 undergraduate and graduate students⁴⁸. Workshops and ‘training the trainer’ programs such as this are considered essential from several standpoints: (a) to fine-tune and tailor the course material to suit specific needs; (b) to bridge gaps between the RRR material and the engineering, health, economics, or business orientations of the respective schools; and (c) to build the capacity of the trainers to enable them, in turn, to capacitate a wider cadre of teacher colleagues.

There have been requests from two universities (IHE-Delft, Ghent University) for WLE staff member Miriam Otoo to teach the RRR business model curriculum in the 2019 summer term. Typically, the university covers international travel and local costs while WLE-IWMI covers staff time costs.

We were hoping to be able to talk with some of these institutions, particularly those in the first group, but were informed that this was not opportune because letters of agreement between IWMI and the universities had not yet been formalized. We understand that the aim is to develop a standard agreement, notably covering protection of intellectual property. This is targeted for 2019.

Uptake of RRR curricula has mostly been from universities offering sanitation, wastewater and engineering type courses. Outreach to business schools has been comparatively limited. Therefore, RRR is undertaking an inventory and ranking of business schools across the world (including China, India, Russia, in addition to Western European and North American institutions) and spanning all languages with a view to identifying potential ‘customers’ for RRR research and training material.

Such studies were mostly undertaken by research interns. Research interns have also helped to compile a recent inventory of compost producers in Sri Lanka and to conduct exploratory research on food-waste reduction strategies by, for example, carrying out a review of global experiences on the topic. The RRR program hosts about 7 to 10 interns per year in Ghana and Sri Lanka. Several of them go on to earn higher degrees; the relevant work experience gained with the RRR program undoubtedly contributes to uplifting their knowledge, skills and capacities. Support to interns is largely made possible thanks to WLE (W1-2) funding.

The RRR program is also actively engaged in promoting business thinking and approaches with regard to RRR among public (local government) and private sector actors. The various partnerships and agreements discussed previously offer a sound platform for this purpose. Key partners in these collaborative relationships, such as municipal managers and university academics, have been afforded opportunities for study tours and attendance at international conferences and workshops to gain exposure to business-based approaches to waste management.

RRR contributes to the WLE objective of introducing ‘new methods, tools, and approaches to decision makers to meet development challenges at landscape and global levels’. The RRR program initially decided to ‘piggy-back’ on an existing international FSM platform, that of Sandec-Eawag in Switzerland, which runs a Massive Open Online Course (MOOC) on «Sanitation, Water and Solid Waste for Development». RRR offered its business model curriculum module for inclusion in the MOOC but the material does not appear to have been used. Meanwhile, IWMI is converting its curriculum on business options for resource recovery and reuse into an e-version which will initially be housed on the International Centre for Water Management Services (CEWAS) Sustainable Sanitation and Water Management (SSWM) platform as part of a larger water and sanitation toolbox – <https://sswm.info/perspectives> - and be available for free online access.

⁴⁸ See link <http://cb4soilreha.iwmi.org/2018/08/13/iwmi-introduces-university-curriculum-on-developing-businesses-in-resource-recovery-and-reuse/>.

6.4.2. Capacity strengthening and outreach in Ghana and Sri Lanka

Since its inception in Kumasi about twenty years ago, capacity strengthening has been an important activity of the RRR program. In that early period, IWMI worked with the Kwame Nkrumah University of Science and Technology (KNUST), for example hosting and co-supervising postgraduate students. We understand KNUST is now a center of excellence for water and sanitation research in Ghana. Over the years, in addition to multiple MSc students, the RRR program has supported a number of Ph.D. students and post-docs, some of whom are either with IWMI even now or have careers in other international organizations. Drs. Philip Amoah, Solomie Gebrezgabher, Miriam Otoo and Daniel Van Rooijen are IWMI staff members still working on RRR issues; and Bernard Keraita is a former Ph.D. student now with UNICEF (as WASH Specialist-Knowledge Management and Research). Other examples are George Danso (now with the Government of Canada) and Krishna C. Rao.

A report on training under the WaFO project (Nartey et al. 2017) lists a large number of training and awareness courses for partners (e.g. JVL), students hosted (MSc and a bachelor's degree), interns, and people supported to attend conferences. As part of the field testing and demonstration of Fortifer™, some 250-300 farmers and an uncertain number of extension officers received training of some kind on the use of this fertilizer and other cultural practices. We were told IWMI had contributed to a variety of capacity strengthening activities for the private sector, municipalities and even the University of Ghana.

In Sri Lanka, IWMI has only recently engaged with the sanitation sector. Therefore, there are fewer examples of postgraduate student support and short training courses compared to Ghana.

Nevertheless, IWMI-RRR researchers in Sri Lanka are already involved in joint supervision of postgraduate students and hosting of interns. An ongoing example is the support extended to a project to design and set up a sewage treatment facility for the Negombo Municipal Council. The project, including supporting postgraduate student research, is funded by a grant from the Lien Foundation of Singapore administered by the Nanyang Technological University of Singapore and implemented by the University of Moratuwa.

To recap, the business models, as initially developed, remain somewhat theoretical – that is, they would be expected to work in an ‘ideal’ world under ‘ideal’ conditions. The challenge is to test their feasibility under real-world conditions (biophysical, institutional, regulatory, socio-cultural, ...) in countries such as Ghana and Sri Lanka⁴⁹. The ultimate goal is to move towards implementation; hence the need to demonstrate potential benefits and returns and ‘sell’ feasible models to investors.

We understand from IWMI-WLE researchers that accessing data and information was sometimes a challenge, especially from private sector entities that tended to be protective of their intellectual property. Furthermore, there was some initial discomfort at the prospect of venturing into an unfamiliar field, that of RRR. The team spent efforts to earn the confidence and trust of the partners and to present the testing and adoption of RRR business models as a win-win situation for the parties concerned.

6.4.3. Global outreach

An important example is the inter-agency multi-sectoral collaboration to promote safe practices on wastewater use in agriculture carried out under the aegis of UN-Water and coordinated by the UN-Water Decade Programme on Capacity Development (UNWDPC). IWMI's partners in this two-year

⁴⁹ A multi-criteria framework was developed and used to assess the applicability of the business models in financial, economic, environmental etc. terms. Around 25 business models emerging from an in-depth analysis of 50+ case studies from in Africa, Asia and South America were analyzed with a special focus on learning from successful cases. The testing was carried out in partnership with relevant stakeholders depending on the particular waste stream in question.



initiative (2011-2013) were FAO, WHO, UNEP, United Nations University Institute for Water, Environment and Health (UNU-INWEH), UNWDPC and the International Commission on Irrigation and Drainage (ICID). This project involved nearly 160 participants from 73 countries in a series of five regional workshops covering Africa, Asia and Latin America. The project culminated in the publication of a report on the Safe Use of Wastewater in Agriculture:
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⁵⁰ Access to this site has been blocked; the note on the site states: "The server is temporarily unable to service your request due to the site owner reaching his/her bandwidth limit."

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Annexes

Annex 1: Terms of reference

INVITATION FOR EXPRESSIONS OF INTEREST FOR CONSULTANCY SERVICES TO CONDUCT AN OUTCOME EVALUATION OF RESEARCH FOR DEVELOPMENT WORK CONDUCTED IN GHANA AND SRI LANKA UNDER THE RESOURCE, RECOVERY AND REUSE (RRR) SUBPROGRAM OF THE CGIAR RESEARCH PROGRAM ON WATER, LAND AND ECOSYSTEMS (WLE)

Title of assignment: Evaluation of the research for development work carried out in Ghana and Sri Lanka under the Resource, Recovery and Reuse (RRR) subprogram of the CGIAR Research Program on Water, Land and Ecosystems (WLE).

Place of assignment: The consultant will be based at home and undertake travel to the project sites in Ghana and Sri Lanka.

1. Summary

The International Water Management Institute (IWMI) on behalf of the CGIAR Research Program on Water, Land and Ecosystems (WLE) is seeking Expressions of Interest (EOI) from professional evaluator(s) to conduct an outcome evaluation of research conducted on new value propositions and business thinking around resource recovery and reuse in the waste and sanitation sector. The research, originally carried out as part of the Recovering and Reusing Resources in Urbanized Ecosystems (RRR) Flagship in WLE Phase 1 (2011-2016), constitutes a major ‘cluster of activities’ (3.2) in WLE Phase 2 (2017-2022) within the Sustaining Rural-Urban Linkages (RUL) Flagship. This work, which began in earnest in 2012, contributed to the development of new guidelines and models in the area of water, nutrient and energy recovery. Notable examples of achievement include, but are not limited to, the following:

- The initiation of several public-private partnerships in Ghana for recycling human waste and wastewater into fertilizer pellets and other waste-derived products.
- Influenced the Ghana fertilizer subsidy program to include waste-based composts.
- In Sri Lanka, RRR played a highly influential role in including septage management in the 2017 National Sanitation Policy.
- Contribution to several international public goods published by United Nations organizations and the United States Agency for International Development (USAID).

With a significant research investment in this body of work, WLE now requires an evaluation to understand better how its support for the programmatic approach employed by RRR has led to the successes we see today. The evaluation will focus on achievements in Ghana (where WLE was able to build on previous research), Sri Lanka (where WLE initiated the related research work) and at the international scale, in order to demonstrate the value of the program’s contribution, and to learn what worked for whom and why in specific contexts. We expect the evaluation to produce recommendations that are more broadly applicable across our portfolio.

2. Background

WLE (<https://wle.cgiar.org/>) is a global research-for-development program connecting partners to deliver agriculture solutions that sustain our natural resources – and the people who rely on them. The program is led by IWMI (www.iwmi.org) and supported by CGIAR (<https://www.cgiar.org/>), a global research partnership for a food-secure future.

WLE combines the resources of 11 CGIAR centers, the Food and Agriculture Organization of the United Nations (FAO), the RUAF Foundation, and numerous national, regional and international partners to find integrated and sustainable solutions.

The program is supporting a growing portfolio of policy and technical solutions across ecosystems, sectors and scales. These connect and consider key natural resources (land, water and biodiversity)

and identify how to manage these to ensure we connect rural-urban environments, deliver gender equity, and manage risks and trade-offs. Capacity building cuts across many of the program's tools and approaches. WLE brings together constellations of projects led by different partners, which are mapped to the program's flagships and outcomes. In this way, WLE plays more of an advisory role on top of partners' own strategies and project management. This constellation requires a sensitive investment of resources and approaches to achieve maximum value, and requires continuous reflection and evaluation.

WLE is interested in fostering partnerships with the private sector, universities and/or other research institutions to help conduct a number of (as many as six) *in itinere* and *ex-post* outcome evaluations over the next 3 years. By helping us better understand the complex mechanisms that support innovation that lead to long-term impacts at scale, the purpose of the evaluations is to facilitate learning and demonstrate how we can, as a crosscutting program, add value to catalyze change. In conducting these evaluations, we hope to employ a methodology(ies) that helps us reduce overall cost and the duration of the evaluation process, by avoiding the use of complex surveys administered to large sample sizes.

3. General purpose of the evaluation

In the first phase of our evaluation process, WLE wishes to appoint a consultant(s) to conduct an outcome evaluation of the RRR subprogram, focusing on the ability of WLE to support its programmatic approach, branding and results, and identify how, why and for whom outcomes were achieved in Ghana and more recently in Sri Lanka. The evaluation will also consider the contribution made by the RRR subprogram to global partners, such as FAO, World Health Organization (WHO) and United Nations Environment Programme (UNEP), in the form of international public goods. Through this process, the evaluation will provide an insightful diagnosis of how and in what ways WLE contributed to an overall system of innovation. To achieve this, the evaluation will examine the RRR flagship management approach, its cumulative contribution to intended and unintended outcomes, the likely sustainability of these outcomes and the probability of these outcomes contributing to long-term impacts.

In examining this, the evaluation will specifically seek to identify lessons learned relating to the following:

- How and in what ways WLE's support influences decision-making processes within core partners and in specific geographical contexts.
- The mechanisms through which attitudinal change occurred within core partners and what factors catalyzed commitments to action in particular settings.

Additionally, the evaluation will seek to deepen WLE's understanding of how to effectively design, adaptively manage, and appropriately monitor and assess research-for-development programs, which are conducted by its CGIAR core partners. The evaluation will do this through examining how WLE influenced, and could influence in the future, its contributing and financially supported partners in:

- the engagement process with external key partners throughout the research cycle;
- the use of a theory of change framework throughout the research cycle; and
- WLE's approach to learning and adaptation throughout the research cycle.

To the extent possible, the evaluation will also seek to assess whether these factors contributed to the achievement of desired outcomes in the RRR case studies.

4. Draft evaluation questions

A complete list of evaluation questions will be developed in consultation with the evaluator(s) during the contracting stage. Potential questions include the following:

1. How and in what ways did WLE's RRR subprogram support the contribution of intended outcomes?

1.1. Did RRR knowledge products and engagement activities make a sufficient and appropriate contribution to observed outcomes? What alternative explanations exist for the achievement of these outcomes?

- 1.2. Did WLE help influence/contribute to partners designing and promoting research work that consider gender or the needs of marginalized groups?
- 1.3. Were there any negative or unexpected outcomes from this body of work?
2. Are outcomes likely to be sustainable over the long term?
 - 2.1. How enduring is the influence of the RRR subprogram (through its partners) at the national and subnational levels?
 - 2.2. Did the RRR subprogram work with partners (research and development) who were appropriate to achieve its desired outcomes?
3. What lessons can be learned from this body of work to enhance the effective design, management and assessment of WLE research-for-development programs in the future?
 - 3.1. What mechanisms from RRR's programmatic approach proved to be particularly effective? What can we learn from these mechanisms for WLE's engagement with CGIAR centers and its other flagships?
 - 3.2. What factors facilitated or constrained the implementation of work under the RRR subprogram?
 - 3.3. What insights can be gained from the use of the theory of change framework, as used by CGIAR centers and WLE?

5. Evaluation approach and methods

While the evaluation design and methods should be suggested by the applicant, WLE anticipates that the evaluation will adopt a theory-driven approach to understanding how its support has contributed to outcomes achieved by its partners. Theory-driven evaluation uses a testable, causal model (e.g., the theory of change) to demonstrate a clear line of sight between what activities were carried out and how this contributed to equipping decision-makers, influencing policy and practice, and ultimately supporting wider social and environmental impacts.

WLE recognizes that other approaches may be appropriate, and encourages applicants to propose other innovative designs and methods.

The applicant is expected to provide guidance in the design and management of the evaluation. The final approach, tools, methods, schedule, deliverables and budget will be determined in collaboration with the WLE Evaluation Manager. The applicant will provide quality assurance of the evaluation from beginning to end.

6. Timing

The evaluation will commence as soon as possible after the applicant is selected. The evaluation is expected to be underway by January 2019 at the latest.

7. Budget

The maximum total available budget for the assignment is US\$ 40,000.

8. The process

Applications should be submitted within 14 days of publication of this notice on the IWMI website. Refer to the website for the deadline.

This request for EOI is to enable WLE to determine whether there are qualified evaluation providers with the skills and capabilities to complete the evaluation. WLE will select the most appropriate EOI for the task based on skills, experience, proposed approach and budget as follows:

- Skills and experience of Lead Evaluator: 50%
- Proposed approach: 30%
- Budget: 20%

9. Expression of interest content

Applicants should provide a brief EoI, which is no more than four single-spaced pages (font: Calibri, size: 11) and includes the following information:

- Name of Principal Evaluator / Consulting Organization.
- Registered address, legal status, and e-mail address of the consulting organization.

- Contact information (name, title, phone number, Skype ID, e-mail address) of individual evaluators.
- Experience with research-for-development outcome evaluations.
- Experience of working with CGIAR.
- The general approach and methods recommended to accomplish the overall purpose and objectives of the WLE outcome evaluation, including number of days needed to complete the assignment.
- Daily rate and anticipated total budget.
- Availability to start in January 2019.
- Contact information of three professional referees who may be contacted, if you are short-listed for the consultancy.
- Full curriculum vitae of the Principal Evaluator and brief curriculum vitae of members of the evaluating team.

Questions for clarification should be sent via email to:

Ms. Emma Greatrix, Senior Program Manager - WLE (E.Greatrix@cgiar.org)

Only shortlisted applicants will be contacted. All costs and expenses related to development of the four-page EOI are the responsibility of the applicant.

If an applicant's EOI is selected, WLE will contact the applicant to begin the design, budgeting and implementation planning for the evaluation.

10. Eligibility

Any experienced individual evaluator, consulting organization, or a combination of individuals and/or consulting organizations, whether for-profit, non-profit, or academic institution.

The Lead Evaluator should have the following qualifications:

- Proven knowledge and experience in evaluation of large, complex research-for-development programs.
- Experience in using mixed methods to answer evaluative questions.
- Particular strength in theory-based evaluation design.
- A record of publications related to research-for-development evaluation.
- A recognized evaluator in the field of evaluation.
- Experience of working in both Africa and Asia.

11. Conflict of interest disclosure

All applicants should disclose all contractual or financial relationships with IWMI.

To apply, visit www.iwmi.org/jobs

EoI must be submitted by 23:30 GMT on November 15, 2018 (Thursday).

Annex 2: Guiding questions used to structure interviews

Interviewee, Institution, and Role (e.g. researcher, policy maker, manager, etc.):

Date and mode of interaction (physical, Skype, telephone):

Innovation(s) discussed with this interviewee:

Note: The questions in **red** are the main evaluation questions taken from the TOR.

Q. No.	Questions (the grey shaded ones are those explicitly included in the ToR)	Findings, Evidence, Explanation
I. HOW AND IN WHAT WAYS HAS WLE SUPPORTED AN OVERALL SYSTEM OF INNOVATION LEADING TO LONG-TERM IMPACTS AT SCALE?		
1.1	<p>Explain your roles and involvement in the program including dates. Specify the relevant outcome/ innovation.</p> <p><i>Potential data sources: All participants in RRR (researcher, partner, policy maker, manager, etc.) interviewed</i></p>	
1.2	<p>What is your understanding of the roles of IWMI and of the Water Land and Ecosystem (WLE) Program? Probe, regarding WLE/ IWMI in general, and with regard to the specific outcome/ innovation.</p> <p><i>Potential data sources: All participants in RRR interviewed</i></p> <p><i>Indicators: Participant responses. N.B., Most non-CGIAR people may have at best a hazy idea. If so, record this, and substitute “IWMI” for “WLE” in the subsequent questions below. But probe a bit to get a full response.</i></p>	
1.3	<p>In developing, testing, implementing, evaluating the innovations/ outcome, please explain in as much detail as possible what roles WLE [IWMI] has played (advisory, executive, substantive, admin & finance mgmt)</p> <p><i>Potential data sources: RRR participants plus review of written material</i></p> <p><i>Indicators: Strengths & weaknesses of different roles/ modes of intervention</i></p>	
1.4	<p>If there had been no IWMI [WLE], would the innovations/ outcomes have occurred in any case? Explain reasons for your answer [i.e. testing null hypothesis]</p> <p><i>Potential data sources: RRR participants</i></p> <p><i>Indicators: List of innovations; Analysis of responses in relation to each of them; Commonalities/ trends based on category of participant</i></p>	
1.5	<p>How and in what ways did WLE’s RRR subprogram support the achievement of intended outcomes/ impacts?</p> <p><i>Potential data sources: RRR researchers and partners who are aware of WLE; Written material</i></p>	

Q. No.	Questions (the grey shaded ones are those explicitly included in the ToR)	Findings, Evidence, Explanation
	<i>Indicators: Examples/ listing based on participant responses and analysis of documentation [we may not necessarily ask this directly, but an assessment will emerge through responses to other questions]</i>	
1.6	<p>WLE [IWMI] produce a wide range of products including journal articles, technical papers, policy briefs, blogs, webinars, etc. Please tell us how familiar you are with these, and whether any of these played a role in promoting the innovation in question? Please provide examples.</p> <p><i>Potential data sources: RRR partners</i></p> <p><i>Indicators: Do people actually read this material? Are they aware of it? May need to probe a bit.</i></p>	
1.7	<p>WLE [IWMI] sometimes organizes workshops and training programs. It also offers support for young researchers. Please tell us whether you participated in any of these, or if you are aware of others who have? Please also tell us whether the subject matters were relevant and useful, i.e. played any role in rolling out the innovation, and if they were, please tell us how. Please be as specific as possible.</p> <p><i>Potential data sources: RRR partners</i></p> <p><i>Indicators: Levels of awareness and participation; Appreciation of these products; Level of (active) involvement; Responsiveness to partner/ client needs</i></p>	
1.8	<p>Describe WLE's [IWMI's] approach to learning and adaptation throughout the research cycle. Did RRR catalyse change? If so, how? If not, why not? Did WLE help/ hinder achieving the change? Provide examples/ evidence in support of the above.</p> <p><i>Potential data sources: RRR researchers</i></p> <p><i>Indicators: Ways in which WLE [IWMI] supports the RRR programmatic approach, the RRR branding and RRR results</i></p>	
1.9	<p>How and in what ways did WLE [IWMI] influence change and decision-making within core partners? Enumerate /give examples of mechanisms through which such attitudinal change occurred. What factors catalyzed commitments to action?</p> <p><i>Potential data sources: RRR researchers and partners; Documentation</i></p> <p><i>Indicators: Ways in which WLE [IWMI] triggers change; Examples & determinants of such change</i></p>	<i>[N.B. Comparing responses in Ghana and Sri Lanka may bring to light differences, if any, according to geographical/ policy contexts]</i>
1.10	<p>Is there a (formal) mechanism within WLE-RRR [IWMI] to enable it to respond to new demands and opportunities (e.g., changes in policies, priorities and emerging issues and challenges) related to fulfilling its mandate? If the answer is no, explain reasons and circumstances. If yes, provide examples.</p> <p><i>Potential data sources: RRR researchers and partners</i></p>	

Q. No.	Questions (the grey shaded ones are those explicitly included in the ToR)	Findings, Evidence, Explanation
	<i>Indicators: Examples/ evidence of how WLE [IWMI] has been able to effectively respond to such situations at global/ regional/ national levels?</i>	
1.11	<p>What is the balance between activities driven by (a) demands from partners and intended beneficiaries, and (b) needs and opportunities as envisioned by WLE [IWMI]?</p> <p><i>Potential data sources: RRR researchers, partners; Documentation</i></p> <p><i>Indicators: Examples/ evidence of responsiveness to partner/ client requests; Description of RRR problem identification & strategic planning processes</i></p>	
1.12	<p>How has WLE-RRR [IWMI] done (and is doing) in terms of promotion/ development of strategic partnerships and alignment with priorities/ interests of relevant agencies and organizations? How could it do so more effectively?</p> <p><i>Potential data sources: RRR researchers and partners; Documentation</i></p> <p><i>Indicators: Examples & description of such strategic partnerships; Current status; Assessment of experience to date</i></p>	
1.13	<p>Was the WLE theory of change framework (explicitly) used throughout the research cycle? How, in what ways, for what purposes? Was the ToC periodically reviewed and updated during the research cycle? How, at what frequency, by what process?</p> <p><i>Potential data sources: RRR researchers; Reports</i></p> <p><i>Indicators: Evidence of reporting against ToC and Impact Pathway; Examples of modification/ change to ToC and relevant explanation; evidence on relevance and salience of ToC</i></p>	
1.14	<p>Did WLE [IWMI] help influence/ contribute to partners designing and promoting research work that consider gender or the needs of marginalized groups?</p> <p><i>Potential data sources: RRR researchers and partners; Reports</i></p> <p><i>Indicators: Examples/ evidence of how the results and products of the program take into consideration cross-cutting issues relating to poverty, gender, climate, integrity, etc.</i></p>	
1.15	<p>Did RRR knowledge products and engagement activities make a sufficient and appropriate contribution to observed outcomes? What alternative explanations exist for the achievement of these outcomes? [Test the null hypothesis—no contribution]</p> <p><i>Potential data sources: RRR researchers and partners; Reports</i></p>	[N.B. We may not pose this as a specific question but the responses to other questions will help us answer it]
<p>II. WHAT CONTRIBUTION HAS WLE MADE TO INTENDED AND UNINTENDED OUTCOMES, THEIR LIKELY SUSTAINABILITY & THE PROBABILITY OF THESE OUTCOMES CONTRIBUTING TO LONG-TERM IMPACTS?</p>		

Q. No.	Questions (the grey shaded ones are those explicitly included in the ToR)	Findings, Evidence, Explanation
2.1	<p>To what extent have the intended results of WLE-RRR [IWMI] (i.e., outputs and outcomes as described in work plans, for example) been achieved or are expected to be achieved (i.e. progress towards realizing results)?</p> <p><i>Potential data sources: All RRR participants; Document review</i></p> <p><i>Indicators: Results reported; Published material; Internal evaluations</i></p>	
2.2	<p>What role has serendipity played? That is, to what extent have the outcomes achieved resulted not from planned activities and following the impact pathway, but because of chance and taking advantage of opportunities? Explain.</p> <p><i>Potential data sources: RRR researchers</i></p> <p><i>Indicators: Supporting examples and evidence</i></p>	
2.3	<p>Is outcome harvesting & outcome evidencing carried out within WLE-RRR? If so, how?</p> <p><i>Potential data sources: RRR researchers; Reports & Published material</i></p> <p><i>Indicators: Examples of outcome harvesting; Description of processes</i></p>	
2.4	<p>What is the nature of the outcomes that emerged? What proportion constituted ‘anticipated outcomes’, as opposed to ‘unanticipated outcomes’? Examples....</p> <p><i>Potential data sources: RRR Researchers & Partners</i></p> <p><i>Indicators: Examples, listing & analysis of different types of outcomes</i></p>	
2.5	<p>Identify how, why and for whom outcomes [including PPP outputs] were achieved in Ghana and more recently in Sri Lanka. i.e., what is the process by which outcomes emerged? Did such changes and outcomes occur, and/or were boosted, as a result of WLE [IWMI] support? How and in what ways? Did the results of past (pre-WLE) work by IWMI and other entities contribute? In what ways? Would these outcomes have occurred without WLE [IWMI]?</p> <p><i>Potential data sources: RRR Researchers & Partners</i></p> <p><i>Indicators: Examples, listing & analysis of different types of outcomes</i></p>	<p><i>[Note: the answer to this question may well have emerged in answering some of the above questions; this is more of a check to be sure we obtain this information.]</i></p>
2.6	<p>What are the major strengths and (positive) factors that helped/ are helping the achievement of results/ outcomes?</p> <p><i>Potential data sources: All RRR participants</i></p> <p><i>Indicators: Examples, listing of ‘enabling’ factors</i></p>	
2.7	<p>What are the major weaknesses and (negative) factors that hinder the achievement of results/ outcomes?</p>	

Q. No.	Questions (the grey shaded ones are those explicitly included in the ToR)	Findings, Evidence, Explanation
	<p><i>Potential data sources: All RRR participants</i></p> <p><i>Indicators: Examples, listing of 'disabling' factors</i></p>	
2.8	<p>With hindsight, did WLE [IWMI] work with the right partners (in research, development, policy, business, etc.)? Were there some that should have been included but were not and what might have been their added value? Please be specific.</p> <p><i>Potential data sources: All RRR participants</i></p> <p><i>Indicators: Listing of 'missing' partners and potential contributions</i></p>	
2.9	<p>In what ways did the RRR subprogram (through its partners) influence change at the national and sub-national levels? How enduring do you think this influence is, and why? Please give examples and reasons as appropriate</p> <p><i>Potential data sources: All RRR participants</i></p> <p><i>Indicators: Examples and evidence of changes effected; Feedback/ assessments of durability of influence</i></p>	
2.10	<p>Are outcomes likely to be sustainable over the long term? If not, why? Were there any negative or unexpected outcomes from this body of work?</p> <p><i>Potential data sources: All RRR participants; PPP financial reports if any; business plans.</i></p> <p><i>Indicators: Feedback and reasons for outcome durability (or not); Examples of unanticipated outcomes</i></p>	
2.11	<p>Does WLE-RRR [IWMI] provide timely and effective guidance and support (resources, monitoring, feedback etc.) to partners? If so, in what ways? If not, give examples. What has been the feedback from partners?</p> <p><i>Potential data sources: All RRR participants</i></p> <p><i>Indicators: Ways in which support is extended; Examples. Appreciation of service quality & performance</i></p>	
2.12	<p>How effective is WLE-RRR's [IWMI's] approach for building national capacities, developing relevant training materials and delivery of capacity development services? Kindly provide examples and reasons for their effectiveness (or lack thereof).</p> <p><i>Potential data sources: RRR partners and RRR researchers</i></p> <p><i>Indicators: Feedback and evidence of appreciation of these products</i></p>	<p>[Also link with Q 1.7 above]</p>

Q. No.	Questions (the grey shaded ones are those explicitly included in the ToR)	Findings, Evidence, Explanation
III. WHAT LESSONS CAN BE LEARNT FROM WLE-RRR TO IMPROVE THE DESIGN, MANAGEMENT AND ASSESSMENT OF FUTURE R4D PROGRAMS?		
3.1	<p>If WLE had not existed, could the same outcomes/ outputs have been achieved assuming the same level of funding were available? Explain your answer. [i.e. neither IWMI nor WLE were involved, would the outcome have occurred anyway? If IWMI existed by not WLE, what would have happened?]</p> <p><i>Potential data source: Researchers</i></p> <p><i>Indicators: Responses including explanations.</i></p>	
3.2	<p>Are adequate resources and inputs (funds, expertise, time) made available to RRR under WLE to produce the desired results? Were alternative activities and approaches considered by RRR to ensure best value for money? Did WLE funding continue for a sufficient period and at a sufficient level to support achieving the outcome?</p> <p><i>Potential data sources: RRR researchers; Reports and published material</i></p> <p><i>Indicators: Examples and evidence</i></p>	<p>[Note: we are aware funding has been somewhat unpredictable and unstable year to year; this question may help identify the impacts of this uncertainty and also adaptive strategies used by researchers.]</p>
3.3	<p>What can be said about the (cost) effectiveness and efficiency of the WLE approach to achieve the desired outcomes? i.e., The extent to which the activities undertaken represent the most cost-effective way of transforming available resources into intended results. What could have been done differently? Any suggestions of how the WLE approach might be reorganized or restructured to improve effectiveness and efficiency?</p> <p><i>Potential data sources: RRR partners and RRR researchers</i></p> <p><i>Indicators: Feedback and evidence on the quantity, quality, timeliness of generating project outputs and outcomes.</i></p>	
3.4	<p>What factors facilitated or constrained the implementation of work under the RRR subprogram?</p>	<p>[this is dealt with under Q 2.7 and Q 2.8]</p>
3.5	<p>What insights can be gained from the use of the theory of change framework, as used by CGIAR centers and WLE?</p> <p><i>Potential data sources: RRR researchers; Project reports and other documentation</i></p> <p><i>Indicators: Researcher feedback and evidence of use/ updating of ToC during project cycle</i></p>	
3.6	<p>In hindsight, what were the strengths and weaknesses of the engagement process with external key partners throughout the research cycle? What strategic partnerships were established? Were synergies</p>	<p>[Note: this question asks for more elaboration of question 1.12 above and may be asked as part of</p>

Q. No.	Questions (the grey shaded ones are those explicitly included in the ToR)	Findings, Evidence, Explanation
	<p>fostered and overlaps avoided? Any suggestions (do's and don'ts) for future R4D programs?</p> <p><i>Potential data sources: All RRR participants</i></p> <p><i>Indicators: Examples of partnerships; evidence of synergy (and leverage); strengths & weaknesses</i></p>	<p><i>that question. But it is intended to contribute specifically to identify lessons for the future.]</i></p>
3.7	<p>What mechanisms from RRR's programmatic approach proved to be particularly effective? What can we learn from these mechanisms for WLE's engagement with CGIAR centers and its other flagships?</p>	<p><i>[Note: the answer to this question will emerge from responses to several others, notably Q 1.8, Q 2.7, Q 2.8, Q 3.2, Q 3.3 and Q 3.5. Therefore we may not ask it directly; it is here to make sure we obtain views on this issue.]</i></p>
3.8	<p>What systems are in place to check if partners continue to use, adopt and transfer WLE-RRR [IWMI] approaches, tools, skills and materials? Are WLE [IWMI] products and information readily accessible and utilized?</p> <p><i>Potential data sources: All RRR participants</i></p> <p><i>Indicators: Partner feedback; Evidence of extent of use (e.g. web hits, email inquiries, testimonials)</i></p>	
<p style="text-align: center;">IV. QUESTIONS SPECIFICALLY AIMED AT UNDERSTANDING RRR CONTRIBUTIONS TO INTERNATIONAL PUBLIC GOODS</p> <p><i>Note: The three major draft evaluation questions in the ToR are not sufficient to cover RRR contributions to international public goods produced by UN and other agencies. Therefore, we have added these questions.</i></p>		
4.1	<p>What is the evidence for WLE [IWMI] contributions to Manuals, Guidelines, Training Materials, etc. produced by international public organizations (e.g. UN agencies, international donors)?</p> <p><i>Potential data sources: References in specific IPGs [e.g. acknowledgements, authorship of chapters, references to WLE outputs]</i></p> <p><i>Indicators: Number, quality of references, specific mention of WLE vs IWMI</i></p>	
4.2	<p>What was the process or set of steps or pathways through which WLE [IWMI] came to influence/ contribute to the IPGs? (Examples include direct use of WLE products, participation in workshops, personal networks, etc.)</p> <p><i>Potential data sources: Interviews with researchers & international partners</i></p>	

Q. No.	Questions (the grey shaded ones are those explicitly included in the ToR)	Findings, Evidence, Explanation
	<i>Indicators: Evidence of engagement leading to the outcomes</i>	
4.3	<p>If WLE did not exist, could IWMI have had the same level of influence on IPGs? In other words, what value did WLE add, if any, and how? What could WLE have done differently to increase its effectiveness/ influence?</p> <p><i>Potential data sources: Interviews with researchers</i></p> <p><i>Indicators: Examples of WLE contributions</i></p>	

Annex 3: People interviewed

Interviews in Ghana

Date, Place	Person Interviewed	Position/ Role
Interviews by Doug Merrey		
11/02/2019 IWMI Office, Ghana	Olufunke Cofie	Head, IWMI West Africa Office; has led/ helped implement RRR work from before 2000
“	Group meeting—researchers: Olufunke Cofie; Philip Amoah; Rebecca Amoh; Eric Nartley; Solomie Gebrezgabher	
“	Rebecca Amoh	Consultant to IWMI [formerly intern and was masters degree student]
“	Solomie Gebrezgabher	Economics Research, IWMI, 2012-now. Business model & economic analysis
12/02 TREND office	Benedict Tuffuor	Managing Consultant/ Facilitator of PPPs
21/02 IWMI	Eng. Solomon Noi	Was Head, Waste Management Dept., Tema 2015-2018
12/02 Dutch Embassy	Janet D Arthur	Water & Sanitation Policy Officer, overseas IWMI project (“CapVal”)
12/02 & 15/02 Ministry of Sanitation & Water Resources	Ing. Anthony Mensah	Director of Sanitation now, late 1990s to present engaged with IWMI research. 2016- 2018 Director Water Management Accra
13/02 IWMI	Reid Wiles	Business consultant, member of WAFO Advisory Team
“	Philip Amoah	Senior Researcher-Regional
“	Olufunke Cofie	Head of Office, PI on most RRR projects, pioneer from IBSRAM period
“	Visit to plant in TEMA [no interview; see photos]	
14/02 IWMI	Emmanuel. Asante Krobea	Was Director, Crop Services, MOFA; now Technical Advisor to Ministry
Jekora Office	Eng Immanuel Nartey-Tokoli	Managing Director, Jekora Ventures Ltd [JVL]
	Martha A Nartey	Innovations Manager, JVL
	Samuel D Amoah	Organizational Development Manager, JVL
	E Buerna Nartey-Tokoli	Finance Manager, JVL
	Ing. Anthony Adukpo	Technical Manager, JVL
Soumanya	Hon. Ebenezer Tetteh Kupualor	Municipal Chief Executive, Yilo Krobo Municipal Assembly (YKMA)
	P K Asamoah	YKMA
	O. M. Branson	YKMA
	Joseph K Ata-Baah	YKMA
	Y Kumani	YKMA
	Ahmed Seidu	YKMA
15/02 IWMI	Eric Nartey	IWMI Research Officer
IWMI	Olufunke Cofie, Philip Amoah, Eric Nartey	Brainstorming initial ideas with researchers

Date, Place	Person Interviewed	Position/ Role
Interviews by Doug Merrey		
19/02 Skype	Josiane Nikiema	IWMI Senior Researcher, project leader for WAFO, co-leader CapVal projects

Interviews in Sri Lanka

Date, Place	Person Interviewed	Position/ Role
Interviews by Hilmy Sally		
08/02/2019, IWMI HQ	Pay Drechsel; Sudarshana Fernando	IWMI Strategic Program and WLE-CGIAR Flagship Leader, Rural-Urban Linkages; Researcher - Resource Recovery and Reuse Expert, IWMIHQ
15/02/2019, IWMI HQ	Miriam Otoo	Agricultural Economist and Research Group Leader – Resource Recovery and Reuse (RRR) at IWMI-HQ
26/02/2019, IWMI HQ	Javier Mateo-Sagasta	Agricultural and Environmental Engineer and Research Group Leader – Water, Health and Nutrition (WHN) based at IWMI-HQ
01/03/2019, IWMI HQ	A. Abeygunasekara	Former Secretary to the Ministry of City Planning and Water Supply, Sri Lanka (2009 to 2014) and former Chairman of Ceylon Fertiliser Company, Sri Lanka
01/03/2019, University of Moratuwa	Dhanesh Gunatilleke	Deputy General Manager (Sewerage) at the National Water Supply & Drainage Board (NWSDB), Sri Lanka
01/03/2019, University of Moratuwa	Sanja Gunawardena	Head, Department of Chemical and Process Engineering, University of Moratuwa, Sri Lanka
07/03/2019, IWMI HQ	Priyanie Amerasinghe	Senior Researcher, Human and Environmental Health
07/03/2019, IWMI HQ	Group meeting with RRR researchers – Pay Drechsel, Sudarshana Fernando, Felix Grau	
11/03/2019, IWMI HQ	Andreas Ulrich	Senior advisor on fecal sludge and wastewater management attached to RRR program at IWMI-HQ
Interview requested	K.G.D. Priyanka	Director Development, Ministry of City Planning and Water Supply, Sri Lanka
Interview requested	XXXX	CEO/COO Horana Plantations PLC

N.B. In addition, the evaluation team had continuous interactions with RRR program research staff based in IWMI-HQ during the period 05 to 20 March 2019

International interviews

Date, Place	Person Interviewed	Position/ Role
Interviews by Hilmy Sally		
26/02/2019, IWMI HQ	Javier Mateo-Sagasta	Water Quality Officer at FAO in Rome for 3 years (2010-2013) and currently IWMI senior researcher and research group leader (water, health and nutrition)
28/02/2019, Email, WhatsApp	Birguy Lamizana-Diallo	UN-Environment (UNEP)
04/03/2019, Skype	Kate Medicott	Technical Officer-Water at WHO, based in Geneva, Switzerland
05/03/2019, Skype	Jonathan Lautze (interviewed jointly with Doug Merrey)	Former USAID based IWMI staff, now Senior Researcher IWMI South Africa
Interview requested	Sara Marjani Zadeh	Land and Water Officer, FAO

Annex 4: Note on the evidence base

This evaluation relies on interviews with key informants as the primary source of data. We interviewed researchers (junior as well as senior), a selection of partners in Ghana and Sri Lanka, and international partners. We also obtained documentary evidence where possible and appropriate, and reviewed many of the publications produced by the RRR program. We made strong efforts to triangulate: that is, obtain data from as many sources as is possible, to enhance the reliability of the data provided. We did not find any major contradictions among informants or between informants and documents. Nor did we detect any evidence that respondents were being dishonest or trying to “sell” a particular viewpoint. We had assured respondents we were not doing a standard type of evaluation and were not trying to find out negative things. Rather, we emphasized we were trying to identify lessons for the future.

It was suggested that we consider scoring the reliability of our data sources. We considered this but concluded it would only offer a false sense of precision regarding the reliability. Ultimately, the reliability of the information we obtained is a judgement call. We therefore chose, instead, to rate the robustness of our conclusions as being of “high confidence”, “moderate confidence”, or “uncertain”. The meaning of the first two is straightforward. By “uncertain” we mean that we believe the stated conclusion is correct, but we do not have enough evidence to be confident.

Annex 5: Key partners in Ghana

Jekora Ventures Ltd. (JVL) is a locally owned waste collection firm that operates in the Greater Accra Region and prides itself on its professionalism and innovation. It is a pioneer in segregating waste streams rather than dumping all of it into landfills. The company has an Innovations Department and plans to create a “Research and Development” department. As part of its corporate social responsibility policy, JVL has been providing training to teachers and pupils in 57 Accra schools on quality segregation of waste. The company is well aware of the need to shift to a “Green Economy” and wants to be a leader in this endeavor. Indeed, a company brochure calls JVL “the innovative waste management service provider” and states its vision is “to be the leading integrated waste management and resource recovery company improving Ghana’s environment and public health.”⁵¹ JVL currently only works in the Greater Accra area.

JVL faces stiff competition from a much larger company, *Zoomlion Ltd.*, a much larger company that operates throughout West Africa (Zoomlion declined to participate in the IWMI RRR program). One impediment for many private firms is the requirement that the private firm must co-invest in the partnership – which is not the usual form of PPP in Ghana. JVL was willing to do this, while others either were not interested or found they could not do so.

In 2014 JVL was seeking partners when approached by IWMI. The company has entered into PPP agreements with TMA for co-composting and pelletization, and with YKMA for manufacturing briquettes out of fecal sludge (this plant is to be constructed in 2019). They are in charge of these processing plants and have agreements enabling them to retain all the income generated for 3-4 years to recover their costs, after which profits are to be shared 50-50 with the municipality. At the moment they are not breaking even – costs still exceed the income generated – but in the interviews, this did not seem to be a major concern as they are optimistic about the future.

Training Research and Networking for Development (TREND) is an NGO that acts as a facilitator for the entire business development process. It has been responsible for drafting the PPP agreements, obtaining environmental permits and approval by the Ministry of Food and Agriculture, and certification of the fertilizer product. It has also led to local stakeholder engagement processes.

The *Ministry of Local Government and Rural Development* (MLGRD) has played a critical supportive role. Until recently, it housed the Department of Sanitation, which supports the municipal assemblies in carrying out their waste management responsibilities (this Department was recently transferred to the new Ministry of Sanitation and Water Resources). In 2016, when a financial shortfall threatened the construction of the Fortifer™ plant in Tema, the Ministry contributed USD 155,889.10 to cover this shortfall.

The WaFo final report (IWMI 2017) and other documents list several other “secondary” partners. Most are Ghanaian research institutions, universities and private consulting firms.

⁵¹ Five senior JVL managers, led by the Managing Director and company founder, participated in the meeting with Doug Merrey. All hold postgraduate degrees in a relevant technical field.

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