Scaling Readiness Innovation Profile

of

"Supplementary Irrigation" Water Management System

in

Iran, Jordan, Syria and Turkey

for

Improving Water Availability and Efficiency In Rainfed Farming

in

2020-12-25

Draft 2

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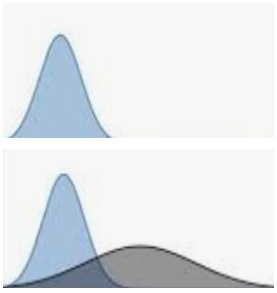
Innovation Profile Sheet



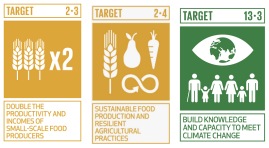
"Supplementary Irrigation" Water Management System

Supplementary irrigation is a customizable complementary water management system which enables the farmers to control the amount and timing of irrigation in rainfed agricultural areas without large scale irrigation infrastructure. It diversifies crop management options (more and higher value-added crop choices, harvest scheduling, intercropping possibilities etc.) available for farmers significantly by enabling individual control on water use, flattening water availability for irrigation and reducing crop failure risk due to drought. Optimizing water usage and using rainwater harvesting it improves resilience of farmers to water related shocks.

Used by
Farmers

Delivered by
Farmer himself/herself

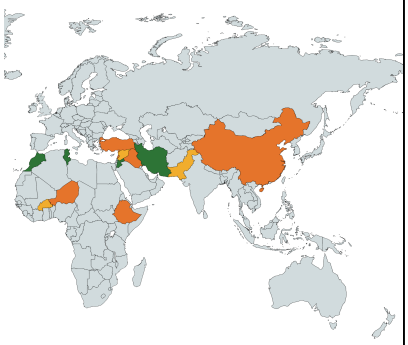
Benefits
Farmers
Local governments



Pros
Customizable to specific irrigation regime
Portable
Enables high value added crop production
When coupled with solar power, works off electricity grid

Cons
Require electricity and basic infrastructure

Require sustainable source of water



Used in
Burkina Faso
China
Iran
Iraq
Jordan
Ethiopia
Lebanon
Morocco
Niger
Pakistan
Syria
Tunisia
Turkey

Works best
The soil is not sandy
Rainfall is 400-500 mm or more in rainfed systems
Shallow ground waters
High value added crops
When there is short and intense rainy season

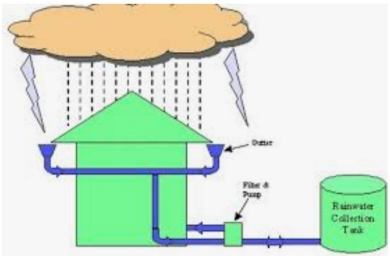
Used by

Syrian Ministry of Agriculture

Ethiopian Ministry of Agriculture

National Agricultural Research Center (INRA) - Morocco

National Agricultural Research Center - Jordan

Novel Components		
		
Agronomy package principle	Location based irrigation optimization	cash crop based design modules
		
Rainwater harvesting technique	Progressive farming principle	Small size pumps

Innovation Readiness Scores

Space : Syria, Jordan, Turkey and Iran
Time : December 2020
Goal : Improving Water Availability and Efficiency In Rainfed Farming

Components of the System	Type	Readiness Level	Evidence Sources
Agronomy Package Principle	Principle	5	6, 7, 8, 9, 11, 12, 13, 15
Location Based Irrigation Optimization	Feature	8	1, 2, 3, 5, 10,
Cash Crop Based Design Modules	Feature	7	4, 8, 12
Rainwater harvesting technique	Technique	8	1, 5, 6, 14
Progressive farming principle	Principle	4	16
Small size pump	Tool	4	16

Highlights

- Supplementary irrigation is a system with 6 key components.
- These 6 components are different types. One of them is a tool, one of them is a technique, two of them are principles and two of them are features.
- Readiness of the components vary between 4, i.e. application model and 8, being tested to work in Syria, Jordan, Turkey and Iran for improving the incomes of small scale farmers.
- Available evidence in Syria, Jordan, Turkey and Iran are mostly agronomic and bio-physical

Recommendations for Research for Development Organizations Aiming to Improve Innovation Readiness

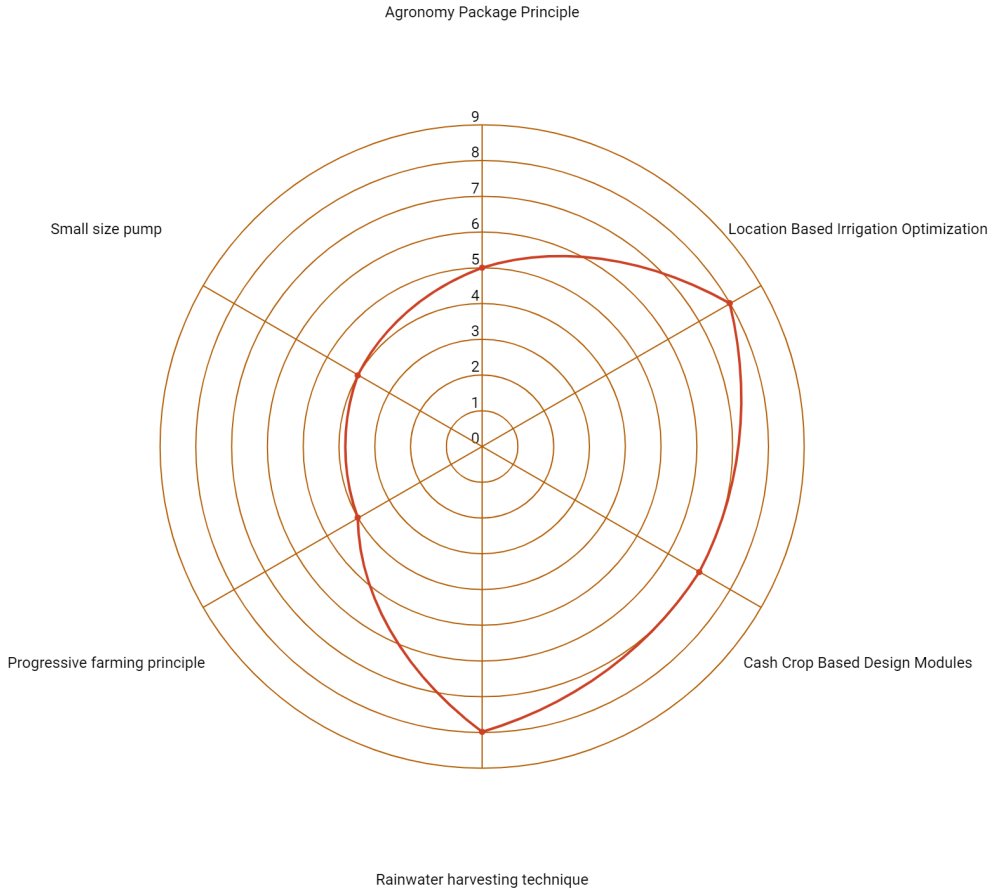
Improving innovation readiness of the supplementary irrigation requires

- Validation of how the inclusion of progressive farming principle (use of new techniques and technologies in farm management etc.) improves water efficiency and yields in comparison to supplementary irrigation without a progressive farming approach using existing applied science evidence
- Validation of the energy and economic gains using a solar-powered small pump in supplementary irrigation using existing applied science evidence
- Testing of the capacity of a well formulated agronomy package around supplementary irrigation to meet productivity and water efficiency gains in a multi-country setup including Syria, Jordan, Turkey and Iran and other countries suitable for supplementary irrigation
- Testing and validating the benefits of supplementary irrigation for producing different crops
- Generating evidence on the benefits of using location based irrigation optimization and rainwater harvesting techniques in implementing supplementary irrigation in uncontrolled/real conditions without support from ICARDA and other R4D organizations

Other recommendations that can contribute to advancing Supplementary Irrigation in Syria, Jordan, Turkey and Iran

- Write a (systematic) review/ meta- analysis article/ book chapter on Effects of Supplementary Irrigation on Agricultural Water Use and Crop Yield. SI has a broad base of evidence in controlled conditions in various countries, altitudes, crops etc. The evidence based on the benefits of supplementary irrigation goes beyond ICARDA countries and mandate crops. Such a global synthesis would improve the interest and scaling investments in supplementary irrigation.
- Consolidation of the evidence on a single canvas / dashboard showing where SI worked for various goals (yield, water efficiency), various crops, various conditions etc. could improve the understanding of the potential of supplementary innovation for policy makers
- Studies on supplementary irrigation beyond agronomy is very limited. There is little knowledge on the social, institutional and cultural implications of supplementary irrigation. To increase the use of sustainable irrigation at scale, such studies need to be commissioned.
- Linking gain in income from crop productivity increase to the cost of applying supplemental irrigation

Readiness Levels of the Components of Supplementary Irrigation
in December 2020 for Improving Water Availability and Efficiency of Rainfed Farming in Syria, Jordan, Turkey and Iran



Further Steps for Assessing Scaling Readiness of the Supplementary Irrigation Water Management System

The innovation profile focuses on the description and the readiness of the innovation, i.e. maturity or effectiveness of an innovation is to achieve its use objectives. Although Innovation Readiness is necessary for assessing impact at scale potential of innovations via using Scaling Readiness scores, it is not sufficient alone. To complete the Scaling Readiness of the Supplementary Irrigation Water Management System, we recommend to complement this study with Innovation Use Assessment, design of the innovation package for scaling the technology and full Scaling Readiness assessment of the Innovation Package. We provide further information about innovation use, innovation package and other relevant Scaling Readiness Concepts in the Annexes.

Bibliography

1. Oweis, T., & Hachum, A. (2006). Water harvesting and supplemental irrigation for improved water productivity of dry farming systems in West Asia and North Africa. Agricultural water management, 80(1-3), 57-73. https://hdl.handle.net/20.500.11766/7937

2. Benli, B., Pala, M., Stockle, C., & Oweis, T. (2007). Assessment of winter wheat production under early sowing with supplemental irrigation in a cold highland environment using CropSyst simulation model. Agricultural Water Management, 93(1-2), 45-53. https://hdl.handle.net/20.500.11766/7939

3. Sato, T., Abdalla, O. S., Oweis, T. Y., & Sakuratani, T. (2006). Effect of supplemental irrigation on leaf stomatal conductance of field-grown wheat in northern Syria. agricultural water management, 85(1-2), 105-112. https://hdl.handle.net/20.500.11766/8038

4. Oweis, Theib, Ahmed Hachum, and Mustafa Pala. "Faba bean productivity under rainfed and supplemental irrigation in northern Syria." Agricultural water management 73, no. 1 (2005): 57-72. https://hdl.handle.net/20.500.11766/7758

5. Oweis, T., Hachum, A., & Pala, M. (2004). Lentil production under supplemental irrigation in a Mediterranean environment. Agricultural water management, 68(3), 251-265. https://hdl.handle.net/20.500.11766/12221

6. Oweis, T., & Hachum, A. (2009). Water harvesting for improved rainfed agriculture in the dry environments. Rainfed Agriculture: Unlocking the Potential; Wani, SP, Ed.; CAB International: London, UK, 164-182. https://hdl.handle.net/20.500.11766/12222

7. Rockström, J., Barron, J., & Fox, P. (2002). Rainwater management for increased productivity among small-holder farmers in drought prone environments. Physics and Chemistry of the Earth, Parts A/B/C, 27(11-22), 949-959. DOI: 10.1016/S1474-7065(02)00098-0

8. Oweis, T., & Hachum, A. (2009). 10 Supplemental Irrigation for Improved Rainfed Agriculture in WANA Region. Rainfed Agriculture, 182. https://hdl.handle.net/20.500.11766/12223

9. Oweis, T., & Hachum, A. (2001). Reducing peak supplemental irrigation demand by extending sowing dates. Agricultural Water Management, 50(2), 109-123. https://doi.org/10.1016/S0378-3774(01)00096-8. https://hdl.handle.net/20.500.11766/12210

10. De Pauw, E., Oweis, T., Nseir, B. and Youssef, J. 2008. Spatial Modelling of the Biophysical Potential for Supplemental Irrigation: Methodology.

11. Tavakkoli, A. R., & Oweis, T. Y. (2004). The role of supplemental irrigation and nitrogen in producing bread wheat in the highlands of Iran. Agricultural Water Management, 65(3), 225-236. https://hdl.handle.net/20.500.11766/12224

12. Oweis, T., Hachum, A., & Pala, M. (2004). Water use efficiency of winter-sown chickpea under supplemental irrigation in a Mediterranean environment. Agricultural water management, 66(2), 163-179. https://hdl.handle.net/20.500.11766/12225

13. Ilbeyi, A., Ustun, H., Oweis, T., Pala, M., & Benli, B. (2006). Wheat water productivity and yield in a cool highland environment: Effect of early sowing with supplemental irrigation. Agricultural Water Management, 82(3), 399-410. https://hdl.handle.net/20.500.11766/7793

14. Fox, P., & Rockström, J. (2000). Water-harvesting for supplementary irrigation of cereal crops to overcome intra-seasonal dry-spells in the Sahel. Physics and Chemistry of the Earth, Part B: Hydrology, Oceans and Atmosphere, 25(3), 289-296. https://doi.org/10.1016/S1464-1909(00)00017-4

15. Kukal, S. S., Jat, M. L., & Sidhu, H. S. (2014). Improving water productivity of wheat-based cropping systems in South Asia for sustained productivity. In Advances in Agronomy (Vol. 127, pp. 157-258). Academic Press. https://doi.org/10.1016/B978-0-12-800131-8.00004-2

16. Nangia V. (2020). Water for Food, Water for Life: The Drylands Challenge. https://hdl.handle.net/20.500.11766/12017

ANNEX -1: SCALING READINESS CONCEPTS

Evidence-based measurement: Innovation Readiness scores (Annex - 2) are calculated using evidence. Specific claims of Readiness are assessed through a hierarchy of sources of verification. High-quality science articles and other peer-reviewed documents are the first sources. In their absence, technical reports or other publicly scrutinized documents are used to back up specific evidence claims. In the lack of any documents, different opinions of experts proven to have sufficient competencies are triangulated to identify the measures.

Innovation Component: A tool, technique, concept, principle, feature that constitutes a part of innovations. Although components can be novel, they can not be considered innovations as they can not address social and economic problems alone. In Scaling Readiness, novel components of innovations are characterized and diagnosed. Research for development interventions can control the design, development, and delivery of innovation components.

Innovation: A novel product, service, approach, an organizational and institutional arrangement with an economic, environmental, health, industrial, etc. use in the society. Innovations can be technical or social. They can be tangible and intangible. In Scaling Readiness, innovations are characterized, diagnosed, and strategized. Research for development interventions can control or strongly influence the design, development, and delivery of innovations.

Innovation Package: The combination of the innovations a project aims to scale and other innovations necessary to scale them. Innovation packages usually consist of technologies and other products, services, approaches, organizational and institutional arrangements required to improve awareness of, accessibility, affordability, and usability of the technologies at scale. Innovation package is the fundamental unit of analysis for scaling innovations in Scaling Readiness. Research for development interventions can influence the design and delivery of innovation packages, but they can not control it. Many innovations in the innovation packages are beyond the control and influence zone of interventions; therefore, partnerships are vital in improving the overall Readiness of innovation packages.

Innovation Readiness Level: It is a number indicating how mature or effective an innovation is to achieve its use objectives. It can be considered as a systematic answer to the question "*how good an innovation works at scale*." It can be between 0, which indicates that the innovation is just an idea in the mind of its potential developers, and 9, which suggests that the innovation has been proven to achieve its use objectives in uncontrolled conditions similar to the context, the innovation is used without a research and development project support. Research and development projects increase innovation readiness levels by improving the design of the innovations, developing and validating the improved designs in uncontrolled and controlled conditions.

Innovation Use Level: It is a number indicating the level of the use of innovations at scale. It can be considered as systematic answers to the combined questions of "*who uses an innovation and in which order of magnitude*." It can be between 0, which indicates that the innovation is not being used in the context a project aims to increase to the use of the innovation, and 9, which suggests that the innovation is being commonly used among the users who are not involved in any innovation design, development or dissemination processes. Research and development projects increase existing innovation use levels by disseminating the innovations and expanding the use of innovations by other innovation professionals who are not involved in the same projects as well as users who are not involved in any innovation processes.

Scaling Readiness Level: It is a single number combining the readiness and use level of all the innovations in the innovation package. It can be considered as a single answer to the question of "*what is the likelihood that an innovation package will achieve impact at scale*." There are different ways of calculating Scaling Readiness Levels based on the preferences of the management system it is used. It can be an average level, a minimal level, or a weighted average level.

ANNEX -2: INNOVATION READINESS LEVELS

Innovation readiness score	Innovation readiness level	Description	Type of science	Type of evidence
0	Idea	The genesis of the innovation. Formulating an idea that innovation can meet a specific goal.	None	None
1	Hypothesis	Conceptual validation of the idea that innovation can meet specific goals and development of a hypothesis about the initial idea.	Conceptual	Generic
2	Basic Model (unproven)	Researching the hypothesis that the innovation can meet specific goals using existing basic science evidence.	Conceptual	Generic
3	Basic Model (proven)	Validation of principles that the innovation can meet specific goals using existing basic science evidence.	Basic science	Generic
4	Application Model (unproven)	Researching the capacity of the innovation to meet specific goals using existing applied-science-evidence.	Basic science	Generic
5	Application Model (proven)	Validation of the capacity of the innovation to meet specific goals using existing applied science evidence.	Applied science	Generic
6	Application (unproven)	Testing the innovation's capacity to meet specific goals within a controlled environment that reflects the specific spatial-temporal context in which the innovation is to contribute to achieving impact.	Applied science	Generic
7	Application (proven)	Validation of the innovation's capacity to meet specific goals within a controlled environment that reflects the specific spatial-temporal context in which the innovation is to contribute to achieving impact.	Applied science (controlled)	Specific to intervention context
8	Incubation	Testing the innovation's capacity to meet specific goals or impact in natural/real/uncontrolled conditions in the specific spatial-temporal context in which the innovation is to contribute to achieving impact with support from an R4D.	Applied science	Specific to intervention context
9	Ready	Validation of the innovation's capacity to meet specific goals or impact in natural/real/uncontrolled conditions in the specific spatial-temporal context in which the innovation is to contribute to achieving impact without support from an R4D.	Applied science (uncontrolled)	Specific to intervention context

ANNEX -3: INNOVATION USE LEVELS

Innovation use score	Innovation use level	Description
0	None	Innovation is not used for achieving the objective of the intervention in the specific spatial-temporal context where the innovation is to contribute to achieving impact
1	Intervention team	Innovation is only used by the intervention team who are developing the R4D intervention
2	Effective partners (rare)	Innovation has some use by effective partners who are involved in the R4D intervention
3	Effective partners (common)	Innovation is commonly used by effective partners who are involved in the R4D intervention
4	Innovation network (rare)	Innovation has some use by stakeholders who are not directly involved in the R4D intervention but are connected to the effective partners
5	Innovation network (common)	Innovation is commonly used by stakeholders who are not directly involved in the R4D intervention but are connected to the effective partners
6	Innovation system (rare)	Innovation has some use by stakeholders who work on developing similar, complementary, or competing innovations but who are not directly connected to the effective partners
7	Innovation system (common)	Innovation is commonly used by stakeholders who are developing similar, complementary, or competing innovations but who are not directly connected to the effective partners
8	Livelihood system (rare)	Innovation has some use by stakeholders who are not in any way involved in or linked to the development of the R4D innovation
9	Livelihood system (common)	Innovation is commonly used by stakeholders who are not in any way involved in or linked to the development of the R4D innovation