Research Report

Adaptation Technologies in Agriculture: Adoption and Impact Assessment of Raised Bed Farming System Technology (RFST) in Egypt

Pursuing a Suitable Mix of Public and Private Technology Delivery Mechanisms

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Synopsis
Efficacy of public and private MRBT service providers: One ICARDA led research initiative, in collaboration with national Egyptian partners has, over the past decade, developed, tested and modified a mechanized raised bed planter which has shown to deliver outcomes of lower fertilizer and seed application, together with improvements in water use productivity and efficiency. With significant yield increase potential, there is great demand from farmers for this piece of equipment which is limited in supply. In part, this restriction in supply is due to a lack of incentives for private machinery service providers to purchase equipment given gratis provision through national systems of public extension, as well as donor funded projects which aim to enhance national wheat production potential. Understanding the differences in technology delivery mechanisms and its impact from various types of service provision (public, private, civil society, etc.) is very important for taking the developed technology to scale (broad uptake). This is will be used to inform the development of policy notes, as well as collaborative engagements with developmental partners to promote as well as the broad uptake and use of MRBT.

1. Introduction

The extension system to disseminate agricultural technologies in general, and the MRB in particular, both in Assuit and Sharkia governorates comprise of several service providers including public extension agents, agricultural cooperatives, Water User Associations (WUA), and the private sector. Differences and similarities among the service providers in terms of types of services they provide, the beneficiaries they cater to, their sources of agricultural information, etc. are presented below.

2. Research Objective

The aim of this research is to assess and evaluate the differences in technology delivery mechanisms employed by private and public service providers including targeted beneficiaries, criteria for service delivery, equitable accessibility of the services to all groups of the society, incentives provided to promote as well as use the technology.

3. Methodology and Data Collection

Information for the analysis was collected through interviews held with 69 key informants representing each type of service provider. A total of 32 Key Informant Interviews (KIIs) were held in 8 villages in Assiut, and 37 KII were held in 12 villages in Sharkia governorate (Table 1). The number of KII representing WUAs is relatively lower as WUAs are not active in the sampled villages in Sharkia.

Table 1: Sample Distribution

Governorate	District	Village	Types and number of Service Providers			
			Agricultural Extension Societies	Cooperative Societies	Private Sector	Water Users' Associations
Assiut	El-Fat'h	Awlad Badr	1	1	1	1
		El-Atawla	1	1	1	1
		Basra	1	1	1	1
		Bani Morr	1	1	1	1
	Abnoob	El-Hammam	1	1	1	1
	Manfaloot	El-Hawatka	1	1	1	1
		Manfaloot	1	1	1	1
		El-Atamta	1	1	1	1
Total Assiut (32)			8	8	8	8
Sharkia	Zaqaziq	Beshet Qied	1	1	1	
		Bani Amer	1	1	1	
	Hehia	El-	1	1	1	
		El-Qawaqsa	1	1	1	1
	Abo Hammad	Meet Radin	1	1	1	
		Bahteet	1	1	1	
		El-Asadia	1	1	1	
		El-Araqi	1	1	1	
	Faqos	El-Tawila	1	1	1	
	Awlad Saqr	El-Sofia	1	1	1	
		Bani Mansor	1	1	1	
	Meniat El-	Sinhoot	1	1	1	
Total Sharkia (37)			12	12	12	1

Source: Own elaboration from KII's database 2018.

4. Results and Discussion

4.1. Agricultural Extension Services

The Agricultural Cooperative Directorate which falls under the Central Administration of Agricultural Cooperatives at the Federal level, is responsible for organizing cooperatives in each governorate. At the village level, the cooperatives are led by farmers' representatives who are elected by the members to cover specific roles. Land ownership is one of the main membership criteria. Cooperatives role in extension include: provision of advisory services including general information on technology packages and irrigation timing, provision of subsidized but high quality agricultural inputs such as improved seeds and fertilizers, and in some cases facilitating agricultural credit. While a few cooperates also provide agricultural machineries to their members, this is not a common practice.

WUAs, on the other hand, are organized by the Ministry of Irrigation and their role mainly focuses on facilitating irrigation both in terms of timing and quantity. In some cases, WUAs also facilitate the use of improved agricultural inputs and mechanization. The private sector is also a key player in the pluralistic extension system, especially in relation to renting agricultural machineries such as tractors, facilitating

credit, and supplying agricultural inputs such as seeds, fertilizers, and pesticides. A summary of the types of services provided by the different service providers is presented below (Table 2).

Table 2: Types of services provided by the different service providers in the two governorates

Service Provider	Water Users' Associations		Private Sector		Agric. Coop'vs		Agr. Ext. Societies	
Type of Services Provided / Governorate	Assiut	Sharkia	Assiut	Sharkia	Assiut	Sharkia	Assiut	Sharkia
Irrigation (proper timing)	3	1			1		1	3
Applying agricultural mechanization	2		2	1	1		2	
Irrigation (timing) & applying Agr. mechanization	1	2			1		1	
Raised-bed Machine only			1	2				
Providing Inputs (improved seed and fertilizers)	1		2			6	1	1
Consultancy regarding adequate irrigation timing and type and application rate of pesticides.	1						1	
Farm Operations and Required Services; i.e. proper irrigation timing, right quality & appln of pesticides.								5
Applying agr. mechanization and improved inputs	3	1		1	1	2	2	1
Proper timing of irrigation and using MRB								3
Agricultural mechanization, Providing Inputs, MRB				1		1		2
Agricultural machinery, MRB				7			1	

Source: Own elaboration from KII's database 2018.

As is the case with the conventional extension agents, WUAs and Cooperatives mainly get their information on improved and new agricultural technologies, and inputs from the Ministry of Agriculture and Land Reclamations (MALR) and the Agricultural Research Center (ARC). The private service sector, however, mainly relies on the media and other sources. The geographical coverage of the service providers often depends on the size of the villages targeted as well as availability of sufficient budget and staff to effectively and inclusively deliver services to intended beneficiaries. This was the case in the villages considered for this study, where a service provider covers several small villages or one village depending on their sizes (Table 3).

Table 3: Geographic coverage of service providers

No. of Villages	Agricultural Extension Societies		Agricultural Cooperatives		Private Sector		Water Users' Associations	
	Sharkia	Assiut	Sharkia	Assiut	Sharkia	Assiut	Sharkia	Assiut
More than one village	4	4	3	2	2	8		7
One Village	8	4	9	6	10		1	1

Source: Own elaboration from KII's database 2018.

We found through the KIIs that almost all the service providers use similar criteria to identify potential users of improved technologies - including farmers with large land holding, and farmers who are willing to learn and apply new methods. They also rely on extension agents who know the area well to make specific recommendations before approaching a farmer.

From the demand perspective, a lot of the service is also sought after by farmers for various reasons. For instance, quality agricultural inputs at a subsidized price is highly sought after and hence farmers themselves establish contact with agricultural cooperatives. The same is true for selected agricultural machineries that are in high demand, especially around planting and harvesting seasons. Farmers with larger land holding and those whose fields are not too far off, get some level of preferential treatment in terms of renting machineries as renters' charge per acre of land and get better returns from renting it to larger farms than smaller ones.

The quality of agricultural inputs supplied by the private sector is often compromised and pricy, and therefore not the preferred choice of a farmer. However, farmers are forced to buy these inputs from local traders because of limited and timely availability of high quality subsidized seeds and fertilizers from agricultural cooperatives. Nevertheless, only members of cooperatives can benefit from such privileges. Farmers without land ownership cards, including renters, thus entirely depend on the market for their agricultural inputs.

Women's role as advisory service providers is limited due to cultural reasons. Women extension agents cannot cover large geographic areas as their male counterparts who use motor bikes to get around and face some cultural restrictions to free movement and engagement of male farmers. From the beneficiary perspective, women's membership in cooperatives is uncommon because of the criteria of land ownership. Those who own land and could qualify often have their male relatives represent them in meetings due to cultural norms in rural areas.

4.2. Extension and the Mechanized Raised Bed (MRB) Technology

We learned that almost all the service providers considered as key informants for the study were well informed of the MRB package and play an active role in the extension delivery system that disseminates information about the technology in their respective villages and communities. Conventional agricultural extension agents focus on raising awareness on the technology and giving guidance on its application.

Agricultural cooperatives provide similar services, but also engage in the marketing of subsidized agricultural inputs and offer guidance on the application and use of the package. The private sector rents the tractors, and WUAs regulate irrigation water use as it applies to the effective implementation of the technology. The raised bed machine which is mounted on regular tractors is so far the only component of the package that is provided through ARC and other government supported projects for free. Together these extension service providers have managed to reach over 2,700 farmers with information and packages to support adoption of the MRB technology in the two governorates (Table 4).

Table 4: Farmers reached by different extension service providers concerning the MRB

Agricultural Extension Societies		Agric. Cooperatives		Private Sector		Water Users' Associations	
Sharkia	Assiut	Sharkia	Assiut	Sharkia	Assiut	Sharkia	Assiut
321	720	235	540	260	250	15	400

Source: Own elaboration from KII's database 2018.

Of the total numbers of farmers reached by the different extension service providers, the majority were older men, followed by young men, and women (Table 5). A closer look at the percentage of women reached, it is evident that relatively more women were able to access information and services through the private sector as compared to services offered through the public extension agents, agricultural cooperatives, and WUAs. This can partly be explained by the restrictions women face in accessing services from Agricultural Cooperatives due to their lack of land ownerships cards, and cultural barriers that limits their active involvement in WUAs. Accessing information through the agricultural extension agents is also difficult for women farmers due to lack of sufficient number of female extension agents.

Table 5: Percentage of men, women and youth reached by extension service providers

	Agricultural Extension Societies		Agric. Cooperatives		Private Sector		Water Users' Associations	
	Sharkia	Assiut	Sharkia	Assiut	Sharkia	Assiut	Sharkia	Assiut
Women	0	1	2	1	9	0	0	0
The youth	28	12	26	15	26	17	50	50
Men	72	87	72	84	64	83	50	50

Source: Own elaboration from KII's database 2018.

Similarly, the lack of land ownership by young men restricts their abilities to access essential extension services through agricultural cooperatives and to a lesser extent from agricultural cooperatives. However, they have the same access to WUAs as older male farmers because land ownership is not criteria for involvement and benefiting from the Association. The youth's access to extension services from conventional public extension agents is, however, low as compared to older men. This can partly be explained by size of land owned by young farmers in the two governorates (Table 6).

Table 6: Size of land owned by young farmers reached by extension service providers

Size of Farm Holding	Agricultural Extension Societies		Agric. Cooperatives		Private Sector		Water Users' Associations	
	Sharkia	Assiut	Sharkia	Assiut	Sharkia	Assiut	Sharkia	Assiut
Less than one acre	10	55	0	60	10	55	30	48
1-3 acre	65	35	75	30	70	30	50	39
More than 3 acres	25	10	25	10	20	15	20	13

Source: Own elaboration from KII's database 2018.

5. Concluding Remarks and Policy Implications

The KIIs clearly indicate the benefits of using a pluralistic extension system to disseminate information and provide guidance and essential agricultural inputs. Involving different service providers has lessened the effect of insufficient and poorly funded public extension agents. The interviews also revealed the limitations and advantages of the different extension service providers including their accessibility by different groups of the society – distinguished by sex and wealth as indicated by size and title to land ownership. While the private sector which is driven my market dynamics of supply and demand seems to offer a less biased service as compared to the Cooperatives and to a certain extent WUAs, it nonetheless suffers from quality control to regulate the type and quality of agricultural inputs offered. This is an issue that needs urgent attention as the timely and sufficient availability of improved seeds and fertilizers is key to sustainable and large-scale adoption of the MRB.

Currently, subsidized and higher quality agricultural inputs are only accessible through cooperatives which solely cater to their own members. Timely and sufficient availability of these inputs is also an issue forcing even members of the cooperatives to purchase inputs of inferior quality from the market in order not to miss the planting season. Therefore, the private sector plays a key role in technology dissemination for a wide group of farmers – including members and non-members of the cooperatives. The private sector is also the only service provider that is involved in providing large agriculture machineries such as tractors based on market economics. Making the MRB available to farmers for free is not sustainable and efficient strategy for large-scale dissemination. Based on our assessment, we recommend a business model both for the large-scale manufacturing and renting of the machines based on market forces to equitably avail the technology to all groups of the society.