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Research Application Summary

Innovation Platforms as accelerators to agricultural technology adoption in Ghana

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Abstract

Following a base line survey of maize farmers in two innovation platforms (IPs), 600 farmers were randomly selected and engaged in mini-kits demonstrations in four districts in Ghana. Under the mini-kit demonstration, a kilogram of drought tolerant quality protein maize variety seeds-an improved variety from research was given to each farmer. The seeds were planted simultaneously within farmers maize fields on a 100 m^2 (10m x 10m) area to enable them manage, observe, and compare with their own varieties on the same fields. At harvest, a 25m^2 area was earmarked from within the improved variety and that of farmers' variety, respectively and this generated time series data between 2013 and 2015. Economic analysis with partial budgeting approach was conducted using data from 2015 harvest. In all cases, the improved variety from research was found to be superior in terms of yield, drought resistance and pest and diseases resistance when subjected to on-farm conditions. The partial budget analysis showed a marginal benefit of GHC 2385.16 and a Marginal Rate of Returns (MRR) of 270 percent. The positive MRR indicates that switching from the current farmer varieties to improved varieties will enable farmers to gain extra income and improve their livelihoods. Further, the MRR of 270% revealed that farmers still have opportunity to earn additional income after recovering all the costs on investment. Given that the MRR was above the minimum acceptable rate of 100% for new technologies, it is therefore concluded that disseminating developed varieties and practices using the Innovation Platform Concept has considerable potential for increasing technology adoption in Ghana.

Key words: Agricultural research for development, Ghana, innovation platform, maize, partial budget analysis

Résumé

Suite à une étude de base des producteurs de maïs sur deux plateformes d'innovation, 600 producteurs, choisis de façon aléatoire, étaient impliqués dans des démonstrations de mini-kits dans quatre districts au Ghana. A travers la démonstration mini-kit, un kilogramme de semences de maïs tolérant à la sécheresse et à haute teneur protéique – une variété améliorée de recherche - a été donnée à chaque producteur. Les semences ont été plantées, simultanément, dans leurs champs de maïs sur une parcelle de 100 m² (10 m x 10 m) pour leur permettre de gérer, observer, et de les comparer à leurs propres variétés dans les mêmes champs. A la récolte, une portion de 25 m² de la variété améliorée et celle du producteur ont fait objet d'observation pour générer des données en séries chronologiques entre 2013 et 2015. L'approche d'analyse économique à budgétisation partielle a été conduite en utilisant les données de la récolte de 2015. Dans tous les cas, la variété améliorée avait une performance supérieure en termes de rendement, de tolérance à la sécheresse et de résistance aux pestes et maladies lorsque soumise aux conditions du champ. L'analyse à budgétisation partielle a montré un bénéfice marginal de 2385.15 francs ghanéens GHC et un taux de rendement marginal (TRM) de 270%. Le TRM positif indique qu'en transitant des variétés actuelles des producteurs à la variété améliorée, les producteurs pouvaient avoir un revenu supplémentaire et donc d'améliorer leurs conditions de vie. En outre, le TRM de 270% a révélé que les producteurs ont encore l'opportunité d'avoir un revenu supplémentaire après avoir recouvré les frais d'investissement. Etant donné que le TRM était au-dessus du taux minimum acceptable de 100% pour les nouvelles technologies, on peut donc conclure que la dissémination des variétés développées et la pratique du concept de plateformes d'innovation ont un potentiel considérable pour une adoption des technologies au Ghana.

Mots clés : Recherche agricole pour le développement, Ghana, Plateforme d'innovation, maïs, analyse à budgétisation partielle

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Background

There is a general call for scientists and researchers to move away from the traditional agricultural research for development (ARD) towards a more integrated approach known as the integrated agricultural research for development (IAR4D). This is because the traditional ARD is of the assumption that the generation, transfer and adoption of technology follow a linear path beginning from research. This assumption is reflected in low adoption rates of technologies, poor linkages among agricultural value chain actors and pervasive unprofitability of farm enterprises (Hawkson *et al.*, 2009; Adekune *et al.*, 2014). The IAR4D on the other hand takes its roots from the principle of constructivism which sees knowledge as a function of how an individual constructs meaning from his or her experience. With this assumption, technology, policy, and development are not independent from people's perception. This approach embraces a broader system of agriculture that facilitates interaction and enhances flow of knowledge among all key actors in agricultural systems and value chains. The IAR4D therefore recognizes the fact that innovation in farming does not always begin with formal agricultural research (Adekunle, 2009). This new system operates through innovation platforms (IPs) which bring together actors from different interest groups, disciplines and organizations to exchange knowledge and take action and solve a common problem. By so doing, scientists avoid developing solutions to problems that do not exist by dealing with the right people with the right interventions thus, promoting action oriented research (ILRI, 2013). The IPs operate under different names such as: concentration and innovation group, innovation network, innovation configuration, and multi-stakeholder platform; however, the underlying principle is the same. The SARD-SC maize project in Ghana decided to use the IP concept to improve farmers' incomes through policy advocacy and productivity enhancing technologies such as mini-kits demonstrations.

Literature review

Stakeholders in agricultural sector face myriads of challenges along the agricultural value chain. This affects the competitiveness of the sector particularly the food sub-sector. To ensure that the sector becomes competitive, the value chain approach is currently being adopted by various projects on innovation platforms. Results from the Challenge Programme indicated that farmers involved in the IAR4D are likely to be female young farmers with small household sizes and low level of productive assets (Adekunle *et al*., 2014). The IAR4D lifted more farmers far above the poverty lines by increasing their incomes (Adekunle *et al*., 2014). The Forum for Agricultural Resreach in Africa (FARA) DONATA project used the IP for technology adoption (IPTA) approach along value chain to facilitate the rapid dissemination and adoption of innovations of cassava and maize in target countries (Djalalou-Dine *et al*., 2009). For example, in Northern Uganda, quality protein maize was promoted with the IP approach (Aseaa *et al*., 2014) as community based seed producers received capacity building to produce adequate volumes to meet both local and neighboring demand from farmers. The IP concept was used to scale out soil acidity ameliorating technologies in Central Malawi as farmers became willing to raise funds to purchase lime (Kambe *et al*., 2012). Value addition and marketing of orange flesh sweet potato and QPM were also enhanced (Kimenye and McEwan, 2014). In Burkina Faso, IP inspired commercial production of certified seed maize among farmers; leading to the emergence of seed maize farmer entrepreneurs each producing two tonnes of quality seed maize per ha (CORAF/WECARD, 2012). In all instances, the IP facilitated communication and information sharing process leading to strong collaborative environment increasing trust among value chain actors along the chain (CORAF/WECARD, 2012). The IP approach was therefore adopted for this study.

Study description

The study sought to promote productivity enhancing technologies such as climate smart quality protein maize (QPM) varieties, fertilizer usage, and other good agronomic practices. Six hundred (600) maize farmers on two innovation platforms (IPs) were engaged in mini-kits demonstrations in four (4) districts. Two maize growing districts each were purposively selected from two agro-ecological (forest and transition) zones to constitute two innovation platforms (IPs). Within the districts, five communities each were selected. The final enumeration took place at the various communities where 30 maize farmers each were randomly selected. This brought the sample to 150, per district and 300 per IP resulting in the total sample size of 600 for the study areas in the year 2015. Under the mini-kit demonstration, a kilogram of drought tolerant quality protein maize variety seeds which is an improved variety from research was given to each farmer. The seeds were planted simultaneously within farmers maize fields on a 100 m^2 (10 m x 10 m) area to enable them manage, observe, and compare with farmers' varieties on the same fields. At harvest, a 25 m^2 area was earmarked from within the improved variety and that of the farmers' variety respectively, generating time series data between 2013 and 2015. The 2015 data were further subjected to an economic analysis using partial budget. This is because although the sampling methodology was the same for the preceding years, the sample sizes were much lower as 10 farmers were selected per community constituting a total sample size of 200 respondents per year.

According to Crawford and Kamuanga (1988), partial budget indicate the net gain attributable to switching from current practices to recommended practices. For a decision to be made, additional benefits are compared to additional costs using marginal analysis (CYMMYT, 1988; Dankyi, 2004; Dugje, 2015). An indicator such as the marginal rate of returns is compared with the minimum acceptable rate of returns (usually 100%) for new technologies (Crawford and Kamuanga, 1988). The potential for adoption exist when the MRR of a proposed technology exceeds 100%. Some basic concept of partial budget is indicated in Table 1.

Results and discussion

Table 2 presents results obtained from mini-kits demonstrations conducted on farmers' fields from the year 2013 to 2015. The average yield of farmer varieties ranged between 2.10 Mt per ha to 3.25Mt/ ha. On the other hand, yields from the improved varieties (which were being promoted by the project) ranged between 4.26 Mt/ ha to 6.13Mt/ ha. This is an indication that the improved varieties performed better than farmer varieties within the study periods. High maize yields resulting from the use of improved varies have similarly been observed in Mexico and Malawi where CIMMYT research varieties had been adopted by farmers (Smale *et al*., 1995; Bellon and Risopoulos, 2001).

Economic analysis of yield. Following the yield differences between farmers' and that of improved varieties, the 2015 data were subjected to an economic analysis using partial budget as indicated in Table 3. Having adjusted grain yield by 90%, the improved variety

Table 1. Partial budget concept

Concept	Explanation
Average grain yield in kg/ha	Total yield in kg/total area in ha.
Adjusted grain yield	Average grain yield adjusted by a coefficient usually 90%
Gross Benefit (GB)	Adjusted grain yield x price/ kg of maize
Net Benefit (NB)	GB – TVC
Total variable cost (TVC)	Summation of all costs that vary
Marginal Cost (MC)	Total variable cost of recommended (TVC_1) - Total variable cost of farmers practice (TVC_2)
Marginal Benefit (MB)	Net benefit of recommended practice (NB_1) - Net benefit farmers variety (NB_2)
Marginal Rate of Returns (MRR)	(MB/ MC) x 100%

Source: Crawford and Kamuanga (1988), Dugje (2015).

Table 2. Results of the mini-kits demonstration

Innovation Platform	District	2013		2014		2015	
		Farmer mt/ha	Improved mt/ha	Farmer mt/ha	Improved mt/ha	Farmer mt/ha	Improved mt/ha
Forest Zone	Mampong	2.10	5.90	2.81	3.26	2.8	7.40
	Sekyere Central	2.50	5.00	2.44	3.36	3.9	4.90
Transition Zone	Nkoransa	2.20	6.70	5.27	7.34	4.8	6.90
	Kintampo	1.60	5.20	1.90	3.08	1.5	5.30
Average		2.10	5.7	3.11	4.26	3.25	6.13

Source: Field Data, February, 2016

Table 3. Partial budget analysis

Indicator	Researcher variety	Farmer variety
Average grain yield (kg/ ha)	6130.00	3250.00
Adjusted grain yield (kg/ha)	5517.00	2925.00
Gross benefit GH	6785.91	3597.75
Total variable cost GH	1685.00	882.50
Net benefit GH	5100.91	2715.75
Marginal benefit GH	2385.16	
Marginal rate of returns	270	

Source: Field Data, February, 2016. GH;3.8 = $1.

gave a gross benefit of GHC 6785.91, a total variable cost of GHC1685, resulting in a net benefit of GHC 5100.91. On the other hand, farmer varieties resulted into a gross benefit of GH; 3597.75, a total variable cost of 882.50 and a net benefit of GH; 2715.75. The marginal analysis gave a marginal benefit of GH; 2385.16, and a marginal rate of returns (MRR) of 270%. The positive marginal benefit is an indication that farmers stand to gain by switching from their current varieties towards the newly improved varieties. The MRR figure (270%) implies that, a GH 1.00 extra investment made in switching to the researchers' variety would be recovered plus an additional GH; 1.70 by farmers. Since the MRR is greater than the minimum acceptable rate of returns which is about 100% for new technologies, farmers are more likely to switch from their varieties and adopt the researchers' variety.

Conclusion

The study revealed that the issue of low productivity and climate change can be addressed if this drought resistant maize variety is adopted by farmers across the various IPs. This is evidenced in the positive marginal benefit and the higher MRR. Additionally, farmers and their dependents would be nutritionally secured as this new variety is fortified with quality protein and vitamin A. By switching from the current varieties grown in the study areas, farmers stand to gain an extra GHC 2385.16 of income in every hectare of maize cultivated. Moreover, since the MRR of 270% exceeds 100%, farmers have real potential of increasing their farm level income.

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