Creating Impact Pathways: Conservation Agriculture on Smallholder Farms

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Key Points

- Smallholder farms with largely subsistence production underpin the food security of the vast majority of the world’s poor, but in these systems productivity is usually well below its potential.

- Many conventional agricultural practices have resulted in widespread degradation, which constrains productivity and threatens the long-term sustainability of production systems.

- Increased adoption of conservation agriculture on smallholder farms in developing countries has great potential to curtail degradation and increase productivity.

- To assist with the implementation of conservation agriculture practices, extension services are required to create impact pathways to connect farmers with research and technologies.

- Australian agriculture has pioneered the adoption of conservation techniques and has great capacity to contribute knowledge and support to developing countries.

Summary

In the context of a growing population and declining resource availability, adaptation will be required to increase agricultural productivity - producing more food with fewer resources and in a way that also reduces environmental degradation. Around 80 per cent of the world’s farms are smallhold establishments and they feed approximately one-third of the
global population. Smallhold farms should be a focus for agricultural development because they form the basis of food security for the world’s poorest citizens and could, in most cases, achieve higher productivity levels. Much of the technology and knowledge required to enable smallhold farms to reach their production potential is already in existence.

Failure to adopt these techniques is predominantly due to technology barriers and limited access to information. To bridge the gap between research and on-farm impact requires expanded extension services, which are critical to the development of agriculture in the developing world. In the past, however, many programs have been plagued by sub-optimal resource allocation or poor design; leading to reluctance by farmers to adopt them and a failure to achieve return-generating outcomes. This report considers the challenges associated with extension services for smallholder agriculture in developing countries, it also discusses recommendations for their design, aiming to maximise the net benefits. The key challenge for agricultural extension is to successfully move towards a ‘best fit’ model, in which programmes are designed specifically to suit local conditions, while also aiming to optimally allocate the scarce available resources.

Analysis

Conservation agriculture for future food security

Conventional agricultural practices have resulted in the degradation of land resources and inefficient resource uses that threaten the long term sustainability of agricultural production systems. Problems like erosion, salinity and nutrient depletion, are among the key degrading processes that have resulted from conventional practices and constrain agricultural productivity. According to the UN Food and Agriculture Organization, one-quarter of the world’s cultivated lands are already highly degraded, mostly in regions that support large proportions of the global population. As global food needs increase and water and land resources become scarcer, there is an urgent need to adopt more sustainable agricultural practices on a global scale.

The techniques of conservation agriculture (CA) are touted as a solution to this problem, for both smallholder farmers and large-scale broadacre agriculture. Central to this approach are minimal soil disturbance, ground cover retention and diverse crop rotation. This reduces topsoil loss due to erosion when ground cover is removed, increases soil organic content, improves the soil’s water retention capacity and is also less labour-intensive than traditional practices. If implemented effectively, these techniques have the potential to not only reduce degradation, but to increase yields and profit.

Estimates indicate that CA practices have been adopted on 8.5 per cent of global arable cropped land. This is predominantly in large scale, intensive agricultural operations in developed countries, including Australia, Canada, Spain, Finland, and France. While CA has also been extensively adopted in South America, adoption has been negligible in most developing countries, particularly those in Africa. The failure to integrate conservation agriculture practices is attributable to a lack of impact pathways to enable research and technology to reach farmers. For example, a lack of access to, or understanding of, direct seeding technology, which differs from traditional seeding methods, may constrain adoption
of zero tillage. This lack of adoption is of concern, because if smallholder farmers in developing countries fail to adopt more sustainable practices the result will be a loss of arable land due to degradation, this, in turn, will lead to loss of livelihoods and food insecurity.

The importance of extension

The world already possesses much of the knowledge and technology required to increase the productivity of agriculture in developing countries. The dissemination of this technology is prevented, however, by a lack of ‘impact pathways’ to deliver knowledge to farmers. To address this problem, extension and advisory programmes that spread information and knowledge to producers are crucial. Effective extension services increase the long term sustainability of smallholder agriculture in developing countries and improve food security for the world’s poorest people. Such programmes can be facilitated by governments, private consultancies, or NGOs.

Typical end goals for agricultural extension include increased productivity, profit, environmental sustainability, or strengthening markets. Unfortunately, however, the programmes often fail to achieve their goals. Common causes of failure include: lack of government commitment, lack of resources, poor accountability by programme staff and poor financial sustainability of the programmes themselves. These programmes were historically designed using a ‘best practice’ approach, incorporating standardised models that were thought to be widely applicable. Smallholder farming systems, however, are highly variable at global and local scales, even to the household level. The adoption of a best practice approach that failed to take adequate consideration of local socioeconomic, political, and market conditions, has led to the failure of many extension programs.

The ‘best fit’ model for extension programme design

Social considerations

Social structure and organisation are important considerations that influence the success of agricultural extension, but they are often neglected. The existence of farmers’ organisations and groups, if incorporated effectively into programmes, provides social capital and can be instrumental in their success. When ignored, however, they can present a major impediment. Where such organisations do not exist, extension and advisory programmes should focus on building them, to strengthen social capital and thus encourage adoption of CA techniques.

Another crucial aspect of social structure that is too often ignored is gender relations. A pertinent example is in cultures where male-female interactions are limited but where women are responsible for the majority of food production. In Kenya, for example, the vast majority of extension agents are male. Consequently, programmes have failed to successfully reach the majority of producers and so have had limited impact. Similarly, other social factors, such as population, ethnic and age structure and relations, should be considered in the design and implementation of programmes to improve their chances of success.
Social attitudes underlying current practices also need to be considered if the programmes are expected to create change. Many farmers are unwilling to adopt zero-tillage, as they perceive that their traditional tilling practices are good for the soil. This attitude is supported by the yields obtained and the useful functions performed by tilling, in particular weed control. Extension can be more effectively designed if these factors are considered; for example, by including local demonstration plots where CA is implemented to demonstrate its benefits to farmers, and the inclusion of education about the shortcomings of conventional practices.

Political considerations

Political conditions often determine the likelihood of success of agricultural extension. The institutional setup and provision of resources for programmes in developing countries, is largely determined by the commitment of governments. Other groups often play important roles, but without a centralised programme, the activities conducted are prone to inefficient use of scarce resources because of the lack of coordination. This is problematic, given that governments in developing countries often lack the necessary resources and for various reasons, such as conflict, may not prioritise agricultural investment. Where this is the case, privatisation of demand-driven services may address the need for information to some extent, but will not necessarily address the problem of a lack of coordination and may lead to a problematically unequal distribution of resources. In general, cooperation between different sectors and actors, including public agencies, private companies, NGOs and Farmer Based Organisations (FBOs), should be enhanced to make best use of available resources.

Economic considerations

Market conditions are important determinants of adoptability. Producers’ access to land and capital is a major factor in determining the appropriateness of different extension models. Additionally, weak or absent markets for both inputs and outputs often constrain adoption. For example, the absence of a viable market for selling legumes would limit the likelihood of farmers adopting the diverse crop rotations recommended by CA. On the input side, the change in technology required to seed with minimal tillage, is often unavailable or too expensive for poor farmers in developing countries. This is also the case with inputs, such as herbicides, that are often required for successful implementation of CA, to replace the weed control function performed by tilling. This problem can prohibit the adoption of agricultural improvements, but may also present opportunities for entrepreneurs to innovate and address gaps in input availability.

The African Conservation Tillage Network has helped encourage local entrepreneurs in Burkina Faso to develop no-till seeding technology. They rent out their seeders and labour to farmers, thus addressing the technology access constraint, while also generating jobs and income. Another problem with weak markets, characterised by poor access to credit and insurance, is that these are associated with risk aversion in farmers, meaning that they are inherently less likely to adopt new practices or technologies. This factor must not be neglected in the design and implementation of extension programmes.
Incentives to improve adoptability

For extension services to be successful, particularly where markets are weak, they must be accompanied by incentives to encourage the adoption of new practices or technologies. For example, herbicide subsidies could increase the adoption of CA among farmers who could not otherwise afford the transition. Subsidy programmes need to be carefully designed, however. Input subsidy programmes, such as those for electricity, fuel, and similar inputs in India, can be detrimental to the adoption of sustainable practices. If inputs are heavily subsidised, the incentive to attain greater efficiency in resource use is removed and the cost-benefit profile of adopting CA practices is drastically altered. Subsidy programmes should be designed in such a way that they enhance, rather than preclude, the adoption of CA practices.

Positive incentives to encourage adoption of CA practices are especially important where there is discord with traditional agricultural practices. In these situations, if no viable alternatives are provided, extension alone is unlikely to result in behavioural change. A notable example of this is the limited adoption of maintained crop cover on farms in sub-Saharan Africa, despite extensive education about CA practices. Traditionally, crop residues are used to feed livestock and are often sold by poor crop farmers to livestock herders. Unsurprisingly, these farmers have been reluctant to leave crop residues in the fields to maintain soil health, as this becomes a direct and tangible economic loss. This needs to be considered in the design of programmes intended to prevent land degradation. Without provision of an alternate feed source for livestock herders and alternate sources of income for crop farmers, constant crop cover will not be adopted. The ensuing degradation will threaten the long-term food security of these regions.

A problem with providing positive incentives is that they greatly increase programme costs, which is a major limiting factor in developing countries. One possible solution for better allocation of public funds could be using regulatory mechanisms to provide inputs in exchange for adoption of desired practices, in place of blanket subsidy programmes. This would be viable, however, only where the government concerned has sufficient regulatory capacity for enforcement and distribution.

Institutional design and effective implementation

Without sound design and effective implementation, extension programmes can waste scarce resources and fail to fulfil their potential impact. Programmes that have good intentions but poor execution are common and can sometimes do more harm than good. This has been observed in the adoption of CA in sub-Saharan Africa. While adoption of CA practices has increased yields in some areas, several studies have found them to often be associated with yield decreases, due to inadequate management. This represents a failure of agricultural extension to follow through with effective implementation – farmers were encouraged to adopt the practices, but training in the management actions required to reap their benefits was inadequate. It is imperative that the extension framework is not limited to the provision of information, but also includes embedded management training for producers.
Education should also be a central focus. The overwhelming consensus in the scientific literature about extension is that the level of awareness of the problem itself is a key factor in determining adoption. Extension programmes designed to mitigate problems such as degradation, should therefore focus not just on recommending adaptations, but also on ensuring that farmers understand the problems and their consequences.

Appropriate design of the institutional structure and implementation mechanisms for extension programmes is essential for success. Goals should be clearly stated, understood and measurable. Roles and responsibilities should also be clearly defined, with performance-based incentives for extension agents, because lack of institutional capacity is often cited as a reason for the failure of these programmes. Connectivity should be fostered, between extension agencies and other stakeholders, but especially with researchers. These institutional design measures could also address the problems of a lack of accountability and credibility, which also arise with extension agents in many developing countries. Specific delivery tools and methods should be designed on a case by case basis in a way that suits local conditions and priorities and the characteristics of the information to be delivered.

Communication style is another important component of effective extension. It is increasingly acknowledged that the traditional top-down method of information dissemination is ineffective. In response, the focus for extension programmes is increasingly on participation. This is beneficial and should be enhanced, with a focus on engaging stakeholders, including farmers, FBOs, extension agents and other relevant institutions, such as private companies involved in providing inputs or purchasing outputs and NGOs. The communication process should be iterative and focus on knowledge sharing and integration between different groups for maximum benefit. Fostering good relationships between all stakeholders is very important; unless information providers have trustworthiness and credibility in the eyes of producers, their recommendations are likely to be ignored, especially given the risk averse attitude of smallholder farmers. Furthermore, social capital, in the form of the degree of social cohesion and the strength of connectivity between members of a community, has been found to be correlated with the extent of adoption of extension programmes.

**Achieving improved outcomes with increasingly limited resources**

In developing countries, there will not be sufficient resources to reach all farmers with all beneficial innovations from extension frameworks. At present, resources are sub-optimally allocated, leading to waste and a lack of positive outcomes. This could be improved by increasing cooperation between governments, intergovernmental and non-governmental organisations, to ensure the best distribution of scarce resources. Improved design of extension programmes, to ensure they are suited to local conditions and have a focus on stakeholder participation, would give the greatest likelihood of success and thus a better use of resources. Furthermore, prioritisation based on cost-benefit analysis, with the likelihood of project success as an important criterion, should be used to allocate available resources.
Australia’s role

Australia has the greatest proportion of farms using CA production of any country in the world. This creates a great opportunity for Australia to transfer knowledge and technology for the benefit of food security in developing countries. This has been a focus of recent aid programmes. Through Australian Aid and the Australian Centre for International Agricultural Research (ACIAR), Australia indirectly influences the food security of an estimated 400 million people around the world, through the provision of R&D and extension services. Providing expertise through these programmes is very important, but should not be the sole focus. Providing credit and grants, and access to new technologies, can also facilitate adoption of CA techniques, by alleviating the associated barriers. ACIAR and Australian Aid programmes do aim to achieve this; for example, by providing capital to farmers to invest in no-till seeding technologies in Bangladesh and modifying Australian seeding technologies for use in the dryland systems of Iraq.

The programmes of these agencies demonstrate the participatory and capacity-building approach, which should continue to be enhanced. When successfully implemented, the benefits of such investments for local food security and welfare in developing countries can be far-reaching. It is important, however, that the contributions of developed countries, such as Australia, to extension in developing countries are conducted in collaboration with host country governments and other local agencies, not independently. This should maximise the efficiency of resource allocation, as well as assist in the building of the trust and credibility that is necessary for effective extension programmes.

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