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Technology generation and transfer using the community approach in West Asia and North Africa: the ICARDA experience

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Abstract. Problems faced by rural populations living in poor-resource areas of West Asia and North Africa cannot be solved by technology alone or by a unique formula. They will likely worsen with increasing population demands unless significant policy and institutional changes occur. Using achievements of the ICARDA, a long-term research for development project implemented in 8 countries of West Asia (Iraq, Jordan, Syria and Lebanon) and North Africa (Morocco, Algeria, Tunisia and Libya), namely Mashreq/Maghreb project, tools and methodologies have been developed to improve the common linear approach of technology generation and transfer. The improved approach, commonly called participatory community approach, evolved from a technology component testing program to one of integrated adaptive research that addresses issues from a technical, socioeconomic, cultural, institutional and policy perspective, and that produces technical, institutional and policy options (TIPOS) for the communities in dry areas. The evolution is also from a top-down perspective to a more bottom-up approach. This innovation is characterized by: (i) testing and evaluating combinations (or packages) of associated technologies at the community level, involving the local institutions as well as farm households; (ii) a resource based rather than a commodity based approach implemented in a multidisciplinary and inter-institutional context; (iii) utilizing community modeling in order to identify solutions that take account of the behavior of the community and how it manages its resources; (iv) strengthening decentralization by transferring the decision making power to local actors; and (v) farmers of the community are involved in monitoring the performance of technology and its adoption. Among key lessons learned from this initiative is the ability of communities to identify appropriate solutions, to solve internal conflicts particularly relating to property rights and land use, additional-income generating activities. The success and the sustainability of the process depend on the promotion of elected community-based organizations that play a key interface role between communities and other actors (government agencies and decision makers, non-governmental agencies, donors, and other communities).

Keywords. Participatory approach – Community development plan – Integrated research – Adoption – Local institutions.

Utilisation de l'approche communautaire pour la production et le transfert de technologies dans les pays d'Asie de l'Ouest et de l'Afrique du Nord : l'expérience de l'ICARDA.

Résumé. Les problèmes auxquels font face les populations rurales des régions arides ne peuvent être résolus par de simples solutions technologiques ; ils auront même tendance à s'empirer si des options de nature institutionnelle et politique ne sont pas mis en œuvre. Le projet Mashreq/Maghreb réalisé par l'ICARDA dans 8 pays d'Asie de l'Ouest (Irak, Jordanie, Syrie et Liban) et de l'Afrique du Nord (Maroc, Algérie, Tunisie et Libye) a développé des outils et des méthodes pour pallier aux défaillances de l'approche linéaire de production et de transfert des technologies. La nouvelle approche testée au niveau des 8 pays mentionnés a évolué du stade de simple testage et transfert de technologie à l'échelle de stations de recherche et d'agriculteurs individuels vers un programme intégré qui englobe des options technique, institutionnelle et politique réalisé au niveau de communautés agropastorales des régions arides. Les populations locales interviennent à tous les stades de mise en œuvre, depuis le choix des options jusqu'au testage et dissémination du savoir. Cette approche, dite participative et communautaire, cible les véritables besoins des sociétés agropastorales et améliorent l'adoption des innovations techniques, politiques et institutionnelles. Le recours à des outils méthodologiques tels que modélisation communautaire, caractérisation agro-écologiques sont utilisés avec succès.

L'approche favorise la décentralisation et permet le transfert du pouvoir de décision des «décideurs habituels» vers les populations rurales démunies ; c'est en fait un exercice de démocratie à la base qui permet l'émergence d'institutions locales fortes et démocratiques qui sont responsables du développement et de l'autonomisation des communautés. Ces institutions ou organisations à la base jouent le rôle d'interface entre la population d'un côté et les agences gouvernementales et les bailleurs de fonds d'autres part.

Mots-clés. *Approche participative – Plan de développement communautaire – Recherche intégrée – Adoption – Institutions locales.*

I – Introduction

The countries of West Asia and North Africa (WANA) are characterized by high population growth rates, large and rapidly increasing food and feed deficits, highly variable income levels, and limited natural resources, particularly arable land and water. Climatic features, especially the low and variable rainfall, limit the options available to farmers. Economic growth, increasing urbanization, and the associated rising consumer demand are forcing changes in production practices that threaten the natural resource base of the region (Haddad *et al.*, 2007). Moreover this zone is considered as one of the 'hot spots' of climatic change, i.e. where temperature and rainfall will be particularly affected (Christensen *et al.*, 2007; Nefzaoui *et al.*, 2011) therefore reinforcing uncertainty in human activities.

In the low rainfall areas, small ruminants (sheep and goats) represent the principal economic output and constitute a large proportion of the income of crop-livestock farmers and nomadic or semi-nomadic herders. The region has experienced a substantial increase in animal numbers. Livestock producers have been encouraged to increase flock sizes by the increased demand for animal products combined with the favorable price ratios between livestock products and barley, the principal livestock feed. Feed subsidies and other measures intended to mitigate the effects of feed shortages in drought years have provided further incentives to retain greater numbers of animals (Haddad *et al.*, 2007).

The poor performance of research and development projects in the WANA region was highlighted in several forums and by many donor institutions. In addition, the experience learned from the IFAD/AFESD/ICARDA supported regional research and technology transfer program indicated that any progress must, in the first place, be based on the demands and participation of the livestock producers as well as the political commitment and support of each country. Since the problems are mainly socio-cultural, any successful research program must be developed following a thorough examination of the social and the cultural implications.

II – Major characteristics of technology generation and transfer in the WANA region

Technology generation and transfer in most of the WANA countries have followed a linear approach (Fig. 1).

This approach which is mainly (i) commodity-oriented to ensure food security or even food sovereignty where the research is focusing on the technology without a holistic approach that tackle technology, economic and social aspects; (ii) the technology is often not responding to end-users needs 'but to national or regional goals' and in most cases researchers identify the problem, develop the solution and test the technology without a full contribution of other stakeholders (top down approach); and (iii) the validation of the technology is implemented on individual farmers' fields targeting the wealthy ones who have higher ability to contribute to the cost. This approach

showed its limits in terms of national food sovereignty with a very low adoption; indeed many technologies developed and costing a lot of time and money are resting on the shelves, even if they have been published in well-known scientific journals. Majority of countries have known their food importation multiplied by three over the two decades (70's and 80's) where this linear approach has been widely used (Alary and El Mourid, 2002). But, obviously they contributed to knowledge improvement of the scientific community.

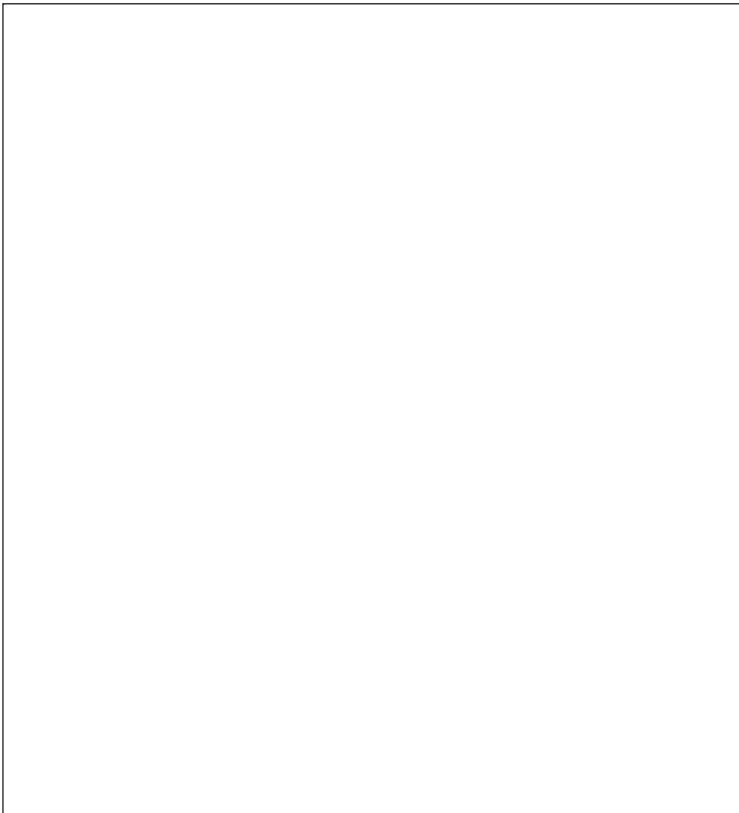


Fig. 1. Simplified representation of technology generation and transfer in WANA countries using the linear process.

III – Overview of the new approach

1. The framework: the Mashreq/Maghreb project

The overall aim of the ICARDA Mashreq/Maghreb Project (M&M) was to foster the integration of improved and sustainable crop and livestock production systems in low rainfall areas in eight countries (Algeria, Iraq, Jordan, Lebanon, Libya, Morocco, Syria and Tunisia). The originality of this project was to address problems from a technical, socioeconomic, cultural, institutional, and policy perspective, with the full participation of the intended beneficiaries and other stakeholders. It supported the development strategy of selected communities, by addressing needs identified by the communities themselves. This project developed in the 90's marked a turning point in the agronomic research in the region by including the social and institutional factors and by shifting

a commodity based approach in an eco-systemic approach based on the interaction between the human and the nature.

In Phase I of the project (1995-1998), appropriate technology components were tested and demonstrated at the farm level, and the results evaluated within a whole-farm context. Phase II of the project was aimed at the community level. Two target communities were selected in each country. The communities were chosen to represent areas where production systems were either based on barley or rangelands with integration of livestock.

The project has made a significant contribution in terms of changing the paradigm of research and development in the dry areas. Valuable lessons have been learned, not only in making the transfer of new technologies more effective, and in developing new decision-making tools for policy-makers, but also in the participatory processes that led to the communities developing their own 'Community Development Action Plans', the project's ultimate goal. The process began with researchers conducting rapid rural appraisal (RRA) and participatory rural appraisal (PRA) exercises in the selected communities, along with comprehensive surveys of selected households. These data, and the results from Phase I of the project, were then presented at a community workshop. This led to the communities deciding that some of the technologies should be dropped, while others should be selected for community-level testing (Fig. 2). The communities identified not only the technological options, but also institutional and policy options that would, potentially, be most beneficial to them, and that would also benefit from further research. These options formed the foundations of a 'Negotiated Plan of Action', developed by each community (Fig. 3).

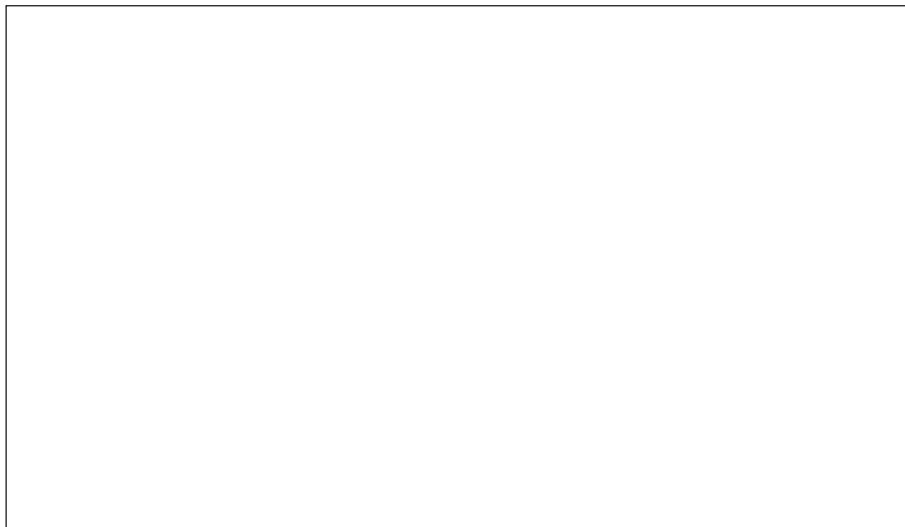


Fig. 2. M & M Project Community Approach to Technology Transfer (Haddad et al., 2007).

2. Shift in the scale of technology testing to the community level

The approach evolved from a technology component testing program to one of integrated adaptive research that addresses issues from a technical, socioeconomic, cultural, institutional and policy perspective, and that produces technical, institutional and policy options (TIPOS) for the communities in dry areas. A summary of how the project evolved from one that focused on individual farmers to a community-based approach is given in Table 1. Not shown in the Table but implied, is the evolution within the participating institutions from a top-down perspective to a more bottom-

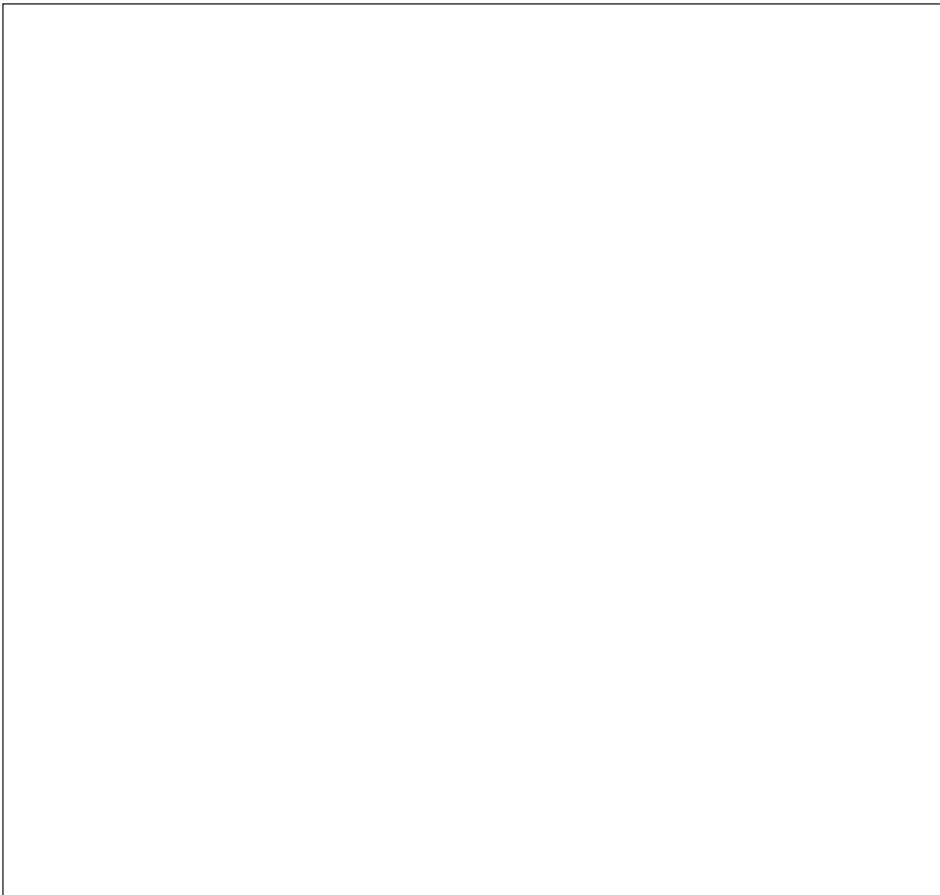


Fig. 3. A schematic illustration of the five main steps leading to the community development plan (CDP) (Thomas et al., 2003).

up approach, and the involvement of at least two learning cycles that span the timeframe of the project from 1995-2007. The first cycle focused mainly on diagnosis, building trust with the participating communities, social mobilization and a change in the approach and perceptions of the research personnel. The second main learning cycle involved participatory action research and action planning, empowerment of local institutions and a focus on community- based organizations and solutions. These learning cycles have been operating over different time scales and periods within the individual countries and communities (Thomas et al., 2003; Haddad et al., 2007).

This innovation is characterized by the following:

- Testing and evaluating combinations (or packages) of associated technologies at the community level, involving the local institutions as well as farm households.
- A resource based approach rather than a commodity based one is used, and this approach is implemented in a multidisciplinary and inter-institutional context.
- Utilizing community modeling in order to identify solutions that take account of the behavior of the community and how it manages its resources.

- Strengthening decentralization by transferring the decision making power to local actors.
- Farmers of the community are involved in monitoring the performance of technology and its adoption.
- The project implemented the participatory, community based approach according to the following set of steps.

Table 1. The shift from working with individual farmers to communities (Thomas et al., 2003)

	Working with individual farmers	Working with communities
Definition of project boundaries	Scientists determined the technology boundaries (physical, economic, institutional organizations, tenure, etc.) based on previous regional collaborative programs and surveys of constraints as perceived by farmers.	Communities participate in the definition of technology boundaries and institutional options (negotiated community action plans).
Definition of problems	Researcher led trials with farmers active in technology testing.	Community expertise (indigenous knowledge) is taken into consideration and communities decide on the options to be tested in their community.
Definition of the objectives	Objectives of farmers/community are mainly defined by scientists, based on their knowledge of the farming communities.	Community objectives (household livelihood strategies, constraints and opportunities) determine technology and institutional options.
Workplan development and implementation	Scientists define the work plan and implementation level (plot, farm level) in consultation with farmers.	Development of the work plan and implementation is negotiated with communities and the responsibilities are shared (Negotiated Action Plan and Community Development Plan).
Roles of teams and farmers	Research team made all the decisions based on their contacts with farmers, and in most cases provided all the inputs and monitored the process. Limited feedback from farmers.	Community based organizations are in the driving seat.
Definition of success	Success is determined by the scientists using increased productivity as the sole indicator for success.	Success is determined by the community (indicators include the perception of the changes at the community level).
Information flow	Seldom is there feedback to the community; information stays in the hand of scientists or is disseminated farmer to farmer.	Feedback to the community is immediate and assured.
Human capacity building	More emphasis is given to technical staff.	More farmer-orientated training programs. Traveling farmers' workshops
Overall approach	Approach focused on productivity at farm level.	Integrated problem-solving and decision-making at multiple levels.
Monitoring and evaluation	Done solely by scientists.	Active participation of communities in assessing the performance of options.

3. The community development plan (CDP)

In response to the frequent failures, methods of “participatory development” emerged during the 70s within international development arenas. Adoption of participatory approaches by national governments and its translation into actual implementation appears not only partial, but also particularly slow. Recent experiences suggest that integrated and participatory approaches may lead to more efficient resources management and to more effective poverty oriented policies. Promotion and empowerment of local development is the most recent approach to face the challenges of rangeland development. It aims at organizing people on a decentralized basis and to applying participatory programming which could lead to effectively empower local people.

The community approach deals with the whole community that is far from being a monolithic block. However, it is characterized by its flexible, dynamic and complex dimension, adapted to local circumstances, and which can be used as a catalyst of development. Moreover, the approach focuses on the initiation of comprehensive development schemes in singled-out communities or villages on the basis of what community members perceived to be their felt needs. These activities are initiated with the presence of specially trained staffs who, by living in the community and working with its members, gain the confidence of the community. They serve as facilitator of thinking and discussing processes, guide members identify and translate into a community development plan.

Community approach is mostly suitable and directly relevant in natural resource management projects. However, important principles for its success must be the following:

- Demand-driven, based on needs and priorities defined by the people themselves;
- Social inclusive, ensuring that all community sub-groups have a voice and benefit from these actions;
- Creating an enabling policy and institutional environment.

Problems faced by rural populations living in poor-resource areas cannot be solved by technology alone or by a unique formula. They will likely worsen with increasing population demands unless significant policy and institutional changes occur. The Mashreq/Maghreb project, whose activities aimed at fostering crop-livestock Production Systems integration in low rainfall areas, applied an “innovative” community development approach in the late 90s, which evolved from on-farm demonstration in the mid-90's to focus on (Ngaido *et al.*, 2002):

- Fostering integration between different disciplines, actors, etc.
- Stimulating farmers and communities participation in steering their own development process.
- Facilitating technology transfer through a participatory technology development.
- Promoting collective action on the basis of a shared consensus.
- Using gained experiences in different regions to the benefit of target Communities.

This community approach has been fine-tuned further within PRODESUD Project in Southern Tunisia. Indeed five phases were defined (Fig. 4):

- Phase 1. Characterization of the community (knowledge/learning phase)
- Phase 2. Participatory diagnosis and planning
- Phase 3. Participatory programming
- Phase 4. Organization of the population
- Phase 5. Implementation of community development plan and Monitoring and evaluation.

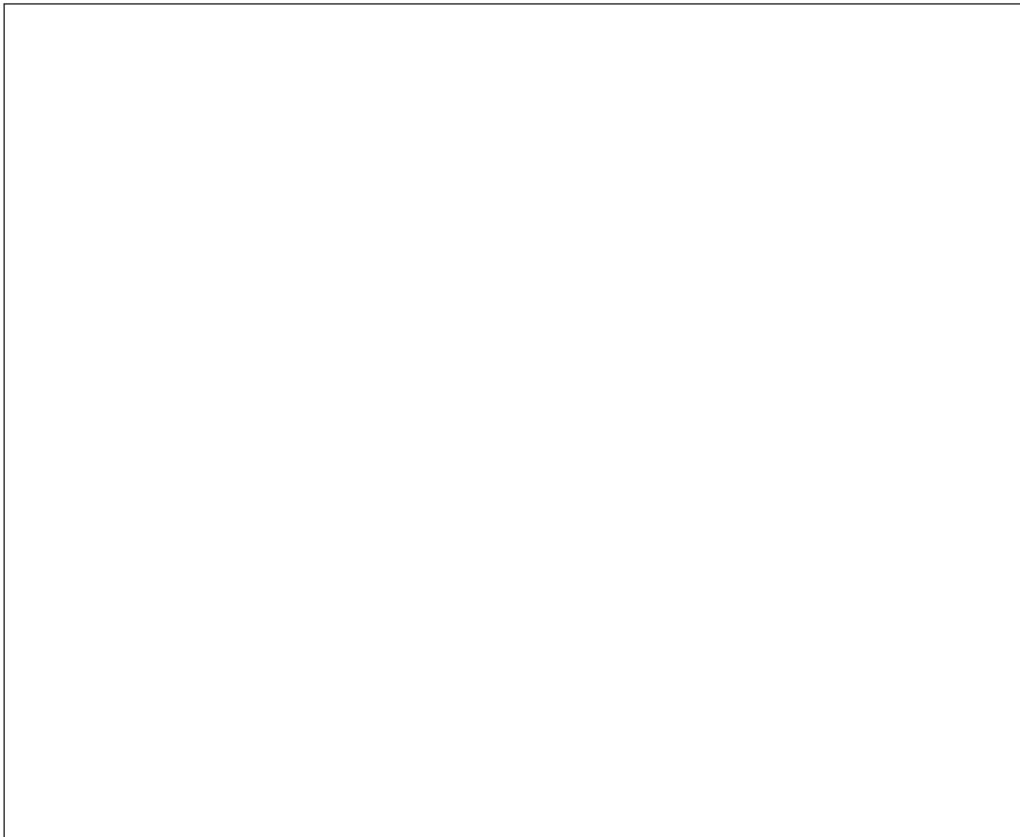


Fig. 4. Main phases of the community participatory approach and community development plan (CDP) (Nefzaoui et al., 2007).

These phases are closely inter-linked. Main innovations are:

- The weight given to the characterization of the community, which serves to create a database to be used both for the following phases (diagnosis, planning, programming), but also for the implementation of the community development plan, including the monitoring and evaluation and the expected contracts (MOU) between the project management unit and the population represented by a “body” established within the participatory process.
- The team implementing the process is composed of project staff, multidisciplinary team from all departments, and professional facilitators.

4. The community modeling

The methodology used in the case of M&M followed a multi-faceted approach. First, impact indicators were developed and the interactive effects of the technology (including economic, agro-nomic and environmental effects) were assessed using a community-based, multi-period mathematical programming model. Second, the rate and degree of adoption were assessed from project records. Econometric analysis was carried out to identify the determinants of adoption, which facilitated projection of the adoption rate over the lifespan of the project. Third, the rates of return on investment at the farmer, aggregated project and society levels were calculated (Shideed et

al., 2007). The purpose is to go beyond the farm level and integrate the complexity of the socio-economic, biophysical and environmental conditions at community level. Moreover, analysis of the impacts of technologies requires integration of the dynamic and heterogeneity effects at different time and geographical scales. The model used in the case of M&M integrates the complexity of the activities at the farm and community level, the individual technical and socio-economic constraints that limit or condition the adoption and the common constraints due to social or economic arrangements or common resources in the community (Fig. 5). The model is primarily being used to investigate the technology adoption among different types of producers. It is also a tool to simulate the impact of technological change (such as the introduction of the cactus in alley cropping) and/or policy change (such as the subsidies) on the level of adoption for each farm type; the model allows capturing of all the changes induced at the farm and community level in terms of new allocation of inputs, change of well-being (increase or not of income) and market strategies. The model also allows the capture within the community of the effects between farms, such as changes in feed supply as a result of technology introduction. Through this, externalities of the technology, which may affect the economic and social conditions of non-adopters, are taken account of (Alary *et al.*, 2004).

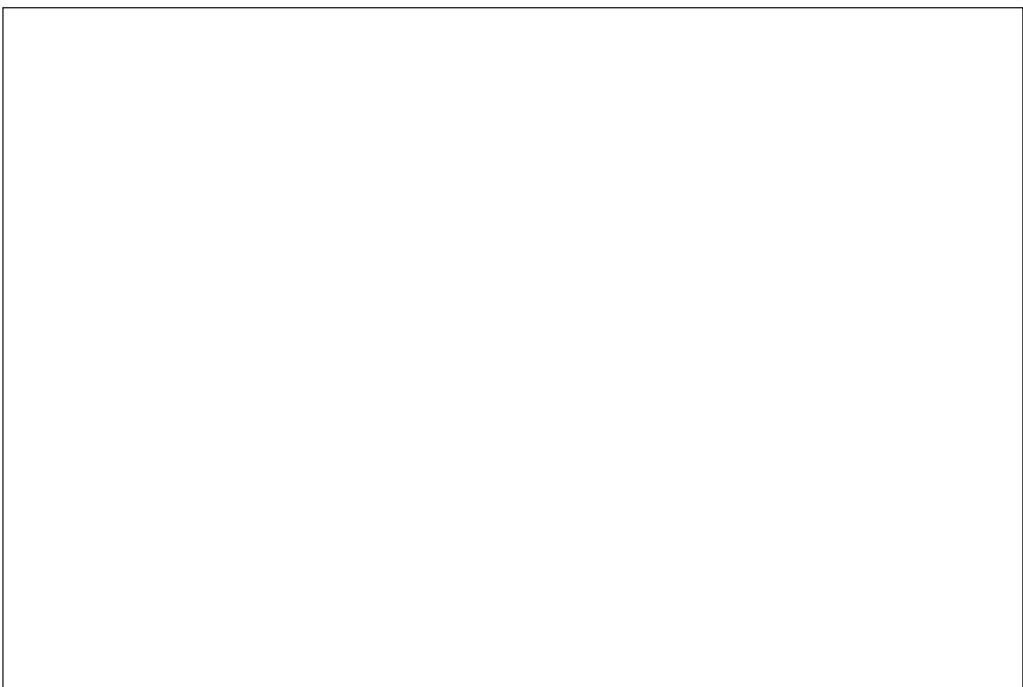


Fig. 5. Structure of the community model (Alary *et al.*, 2004).

The community model comprises several components. First, a set of typical farms had been identified by cluster analysis from household surveys; these typical farms reflect a diversity of family-farm systems according to their capital assets (land, labor, livestock, education, etc.) and technical practices. A typical farm is characterized by its different resource endowments (land, labor and capital) and its management (crop and livestock systems, family objectives). The second component of the community model is the community factor markets depicting farmers' interactions through exchanges of factors like non-storable fodder, exchange labor, land and even cap-

ital. The third component is the incorporation of external markets for input purchases and output sales. Finally, existing institutional arrangements for access to credit land and labor are included (Alary *et al.*, 2004).

This community model showed the complexity of effects due to an innovation or a package including technical and institutional innovations. Firstly each community is an open system and then the introduction of an innovation has also impact on the non-adopters in link with the social and economic rules of exchanges at the community level. Moreover, adoption by neighboring farmers could have environmental effects at the community level. But this approach showed also how personal perception about the information is often more important in the farmers' decision than information about the technology given by outsiders (Alary *et al.*, 2007). And this personal perception result both from the way that the innovation has been introduced and diffused and also the traditional knowledge and experience of each individual.

5. Scaling-up, extrapolation and adaptation

Once a solution to the problem is identified and tested at the research site, the final, and perhaps most challenging task of all, is to overcome the site-specific characteristics of the solution so that it can be applied on a wider and more general scale. Unless this final step in the process is given adequate attention, the strategic relevance of the research product is in jeopardy. Appropriate generic methodologies and approaches are being developed to extrapolate research findings to wider and/or other areas; the procedures used for this include, e.g., the use of GIS in combination with modeling tools (Fig. 6).

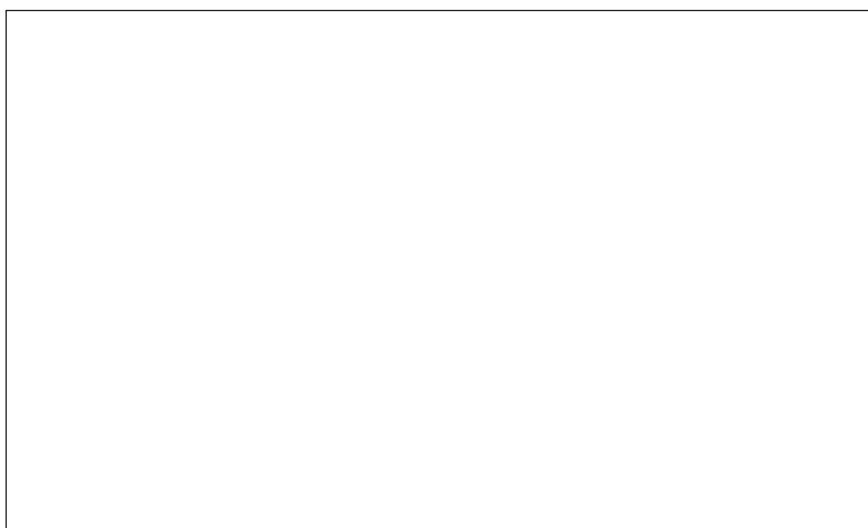


Fig. 6. Scaling out and up using GIS and similarity studies.

But this phase raises many questions due to the social, institutional and natural diversity that imply specific adaptation at each level; and this diversity is often the basis of resilience. Fraser *et al.* (2009) underlined necessity to investigate case studies to better theorize the links between environmental, socio-economic and policy drivers, mainly when conducting vulnerability analysis.

Moreover when considering the community, attention must be given for understanding, managing and governing of complex linked systems of people and nature (Janssen and Ostrom, 2006).

This approach is now integrated in the concept of resilience that implies a change of scale to integrate the ecological dynamics that take place at the local level (spatial changes) and social organization that condition the rules, norms (collective decision vs individual decision). It means to recognize the socio-ecological systems as *complex adaptive systems*. In this framework, technology generation and transfer must be considered as part of the global changes of the system driven by many factors.

6. Putting it together: Higher uptake of technologies

The new ICARDA approach of technology development and transfer is summarized in Fig. 7. The entry gate is the community development plan (CDP) that includes the research component where problems and potential solutions (technical, institutional and policy options: TIPOs) are identified in a participatory manner by all stakeholders to respond to the real concerns and priorities of the target community. Once potential solutions are identified, two situations occur: Either TIPOs are totally available or only partially or not available. In the case where TIPOs are available testing and validation can be implemented with full participation of the community members. If TIPOs are lacking they need to be developed or fine-tuned through research at laboratory or field level prior to their testing and validation at the community level. In both cases there is a need for adjustment through feed-back from stakeholders where potential solutions will be revised and adjusted. Specific tools (agro-ecological characterization, similarity maps and biophysical and bio-economical modeling) are required to assess adoption, upscaling and outscaling of best-bet options.

The pillar of the methodology is a continuous and efficient communication where all stakeholders negotiate community development plan on an equal basis and where all sources of knowledge are explored, encompassing both indigenous and research-based knowledge.

The methodology has been accepted and embraced by communities and development agencies in Tunisia, Algeria, Jordan, and Morocco. It has been documented and disseminated through different channels including: field manuals in English and Arabic, linkage with IFAD Karianet network, and specific websites (www.icarda.org; www.mashreq-maghreb.org).

Training on the community-based development approach has been delivered to, and successfully received by a large number of stakeholders in 8 WANA countries (Algeria, Iraq, Jordan, Lebanon, Libya, Morocco, Syria, and Tunisia) including over 800 farmers and over 160 staff members from additional development projects in the region, including technical staff, extension staff, decision makers, local administration, etc. In addition, 20 project staff members and 200 other project stakeholders were also trained in Mauritania.

Key lessons from this experience include: (i) the participatory characterization of communities is essential for cooperation and trust among stakeholders; (ii) recognition of local know-how as an important step for successful diagnosis; (iii) annual and long-term development plan approved by communities is an efficient tool to mobilize resources and ease project implementation; (iv) the capability of communities to identify appropriate technical solutions and to solve internal conflicts particularly relating to property rights and land use should not be overlooked; and (v) the success and the sustainability of the approach depends on the promotion of elected community-based organizations that play a key interface role between communities and other actors (government agencies and decision makers, non-governmental agencies, donors, and other communities).

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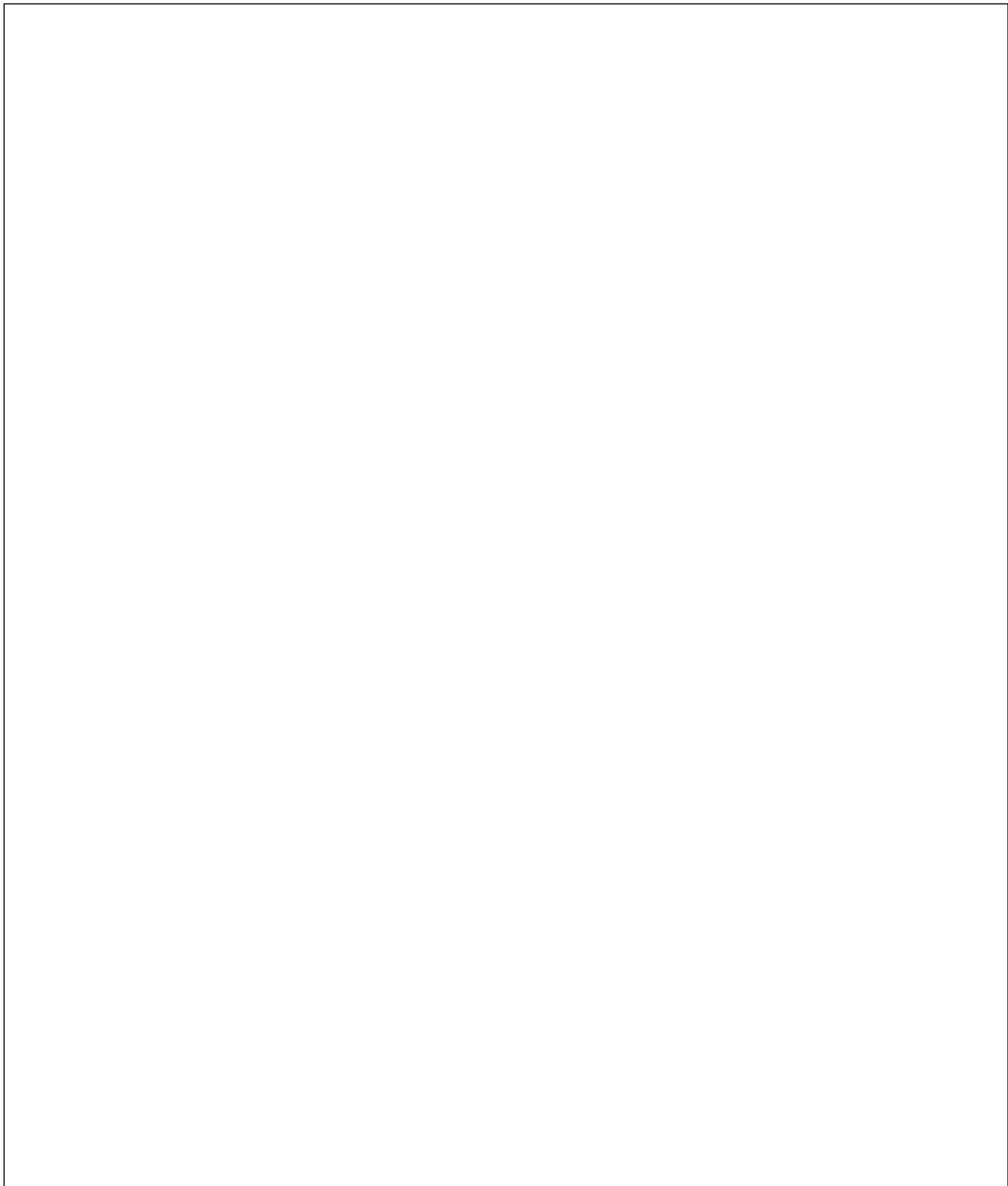


Fig. 7. Integrated Approach to technology generation, transfer and adoption (TIPOs: technical institutional and policy options; CBOs: community-based organizations).

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