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PLATICAR – A KNOWLEDGE ECOSYSTEM FOR AGRICULTURAL TECHNOLOGY TRANSFER

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ABSTRACT

The Technological Platform for Agricultural and Rural Information and Communication (PLATICAR) is a knowledge ecosystem developed by farmers, extension agents and researchers in Costa Rica in a participatory fashion. It is based on the communication-for-development and knowledge-management approaches and has been successful in substantially reducing the time frame for agricultural technology adoption by farmers. It fosters the development of communities of practice, in which the farmers own the process and lead the adoption of agricultural technology. The farmers raise their problems and seek solutions in conjunction with agricultural technicians and researchers. The agromatics information and communications technology (ICT) approach seeks to develop an information and computer culture for farmers so that they can use these tools and information to maximise their profit; at the same time it reduces the digital gap. Through PLATICAR's Web 2.0 portal, the farmers contact national and international researchers and extension agents, create virtual communities and contribute content on local knowledge that they collect. Through knowledge management, farmers learn about and make sense of agricultural processes and phenomena, developing enhanced capacity to make educated decisions. Knowledge Management Centers are decentralised condensation nuclei. With these tools and approaches, the time taken for technology adoption was reduced (e.g., hydroponics was adopted in less than 2 years). Twenty women farmers were trained who, in turn, trained 150 families to improve their food security and income sources; the low-cost farming was adopted in less than a year (500 families impacted).

KEY WORDS: *KNOWLEDGE MANAGEMENT, AGROMATICS (E-AGRICULTURE), COMMUNITIES OF PRACTICE, SELF-MANAGEMENT, VIRTUAL COMMUNITIES*

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INTRODUCTION AND OBJECTIVES

The Costa Rica national institute of innovation and agricultural technology transfer (*Instituto Nacional de Innovación y Transferencia en Tecnologia Agropecuaria*, INTA) was created by legislation in 2001 as the governmental authority for investigation and technology transfer. INTA and its partners generated technology that was relevant, up to date and freely accessible to extension agents and growers, but it did not have a formal mechanism for transferring that technology. Neither did it have any instrument to systematise local empirical knowledge developed by growers and extension agents, nor any formal mechanism to promote knowledge-sharing among growers, extension agents and researchers that would improve the focus of research and the adoption of technology. Agricultural production faces new requirements in terms of quality, traceability, safety, environmental friendliness and sustainability – new challenges that impose a constantly changing 'hyper-unstable environment' (O'Dell and Hubert, 2011) for growers, in which information alone is insufficient (Frappaolo, 2006). Knowledge and learning are beginning to play a fundamental role at the practical level (Clemmons Rumizen, 2002; Collison and Parcell, 2004), since it is necessary to provide quick and creative responses to the ever-changing conditions of agro-ecosystems.

To implement this new paradigm, it was necessary to find a revolutionary approach that would promote and facilitate this transformation of growers and the new types of relationship between them, extension agents and researchers: the 'knowledge ecosystem'. Following von Krogh *et al*. (2000), 'knowledge cannot be managed it can only be activated' or promoted; therefore, the knowledge ecosystem stewards and promotes knowledge and innovation, not only so that growers can find effective and efficient solutions quickly, but also so that they become better decision-makers, a skill vital for their survival. They have always made decisions; the difference lies in fostering their ability to access knowledge and learning that enables them to 'understand the mechanics and causes of the problems' (Gladwell, 2006) they face and the solutions they implement – developing in this manner better criteria for decision-making.

The Technological Platform for Agricultural and Rural Information and Communication (PLATICAR) uses elements of the learning approach, in terms of facilitation, co-learning, social learning and learning organisations (Röling and de Jong, 1998). It takes the constructive perspective that assumes that people build a reality in a creative manner through their language, work and technology, based on intentions and experience (Röling, 1996; Woodhill and Röling, 1998). It also uses participatory technology development (PTD; Hamilton, 1995), which is based on the assumption that any modern development of technology must use the knowledge of the growers in 'learning groups'. And it uses Rapid Appraisal of Agricultural Knowledge Systems (RAAKS; Engel and Salomon, 1997), which states that the process of agricultural innovation is not a process of technology dissemination, but rather a social process of learning between diverse actors. The learning groups have a strong similarity with the PLATICAR communities of practice and share with RAAKS the emphasis placed on knowledge rather than on information (without diminishing the importance of the latter). They also share the participatory approach of knowledge management. The PLATICAR is different in that it is presented as a holistic approach that leads to a system composed of several sub-systems: the knowledge ecosystem.

In PLATICAR, communication for development provides the communication concepts, the participatory processes, pedagogic mediation and it pervades the entire platform. Agromatics (E-Agriculture) provide flexible methodological approaches, the vision of information and communications technology (ICT) as an instrument, and the emphasis on knowledge and learning – all adapted to agriculture and the agro-ecological vision. Knowledge management provides the conceptual framework, and tools and methodologies (Vestal, 2005), communities of practice (Wenger *et al*., 2002), the processes of stewarding knowledge (Frappaolo, 2006) and formal networks (Egger *et al*., 2006).

Constructivism and connectivism (Siemens, 2004) are pedagogic proposals, with the latter the catalyst of the concept of the knowledge ecosystem. This ecosystem is a complex and adaptive system of persons in communities, located in the same physical or virtual space, in which they cultivate relationships, tools and practices to create, integrate, share and use knowledge. These systems comprise inter-connected knowledge resources, databases, human experts and artificial knowledge agents that collectively provide on-line knowledge to perform organisational tasks at any time or in any place (Pata, 2008). The components of the knowledge ecosystem are the structure, composed of relationships (connectivism), and the function, composed of spaces for learning (constructivism). The ecosystem is determined by the socio-economic, cultural, religious and infrastructure environment, as well as the productive activities and the digital gap. The PLATICAR knowledge ecosystem is a model or approach – it is a set of principles or guidelines that enable the development of organisations that may have distinct traits from each other because of their adaptation to different conditions.

PLATICAR was implemented in 2008 as a pilot project in three regions of Costa Rica with groups of leading growers, extension agents, INTA researchers and strategic partners. The implementation in each region took into account the priority activities of that region. Given its proven viability, it is being expanded to cover the entire country. The objective of the PLATICAR knowledge ecosystem is to create an information and communications platform at the disposal of extension agents to strengthen and facilitate their work. It seeks to shorten the time frame for the adoption of new agricultural technologies developed by INTA and its partners and to improve growers' decision-making ability through the use of technological and agricultural information and knowledge.

MATERIALS, METHODS AND DATA SOURCES

The PLATICAR pilot project took place in Costa Rica in three regions – North Caribbean, South border and Central Region, the latter as the hub of the network – between August 2008 and January 2011. The knowledge ecosystem is composed of three Knowledge Management Centers (GECOs) that bring together agricultural organisations, technicians and growers, providing them with an identity as a community. The GECOs were located in the Atlantic region (GECO Huetar Atlántica), Brunca region (GECO FICOSA) and centrally (GECO PLATICAR Central). Each GECO includes some or all of the following: a telecentre, documents (teaching and training materials), meeting rooms, services to growers and technicians, and a telephone. Modules for interactive training are administrated by the growers themselves and are diverse: protected environments, technological demonstrations, under the concept of *learn by doing*, following the principles of constructivism. The human skills used for the development and implementation of the knowledge ecosystem are: communication for development, agromatics, re-packing, agronomy, knowledge management and leadership. Computer laboratories or internet cafés were used for training farmers to close the digital gap, using the PLATICAR Web portal (http://www.platicar.go.cr), developed (using freeware) to support the processes of communities of practice and knowledge management. Telematics infrastructure is available that enables the integration of the GECOs and the web portal to other information systems in the agricultural sector. Other support materials are the training documents and the documents that are the result of the systematisation of growers' experience and local knowledge.

The PLATICAR knowledge ecosystem is composed of a structure and a function. The structure is composed of: informatics and telematics infrastructure (the technology), the GECOs and the training modules. The function is based on the communication and learning spaces, integrated by: communities of practice, physical or virtual meeting places, methodologies, instruments, protocols and local plans for information and communication (PLICs). These knowledge ecosystems are immersed in a socio-cultural, economic, religious and environmental

context, taking different forms in response to these variables – it is therefore a dynamic and adaptive model. The organisational structure of PLATICAR follows the model of the *starfish* (Brafman and Beckstrom, 2007), consisting of a decentralised participatory process working among extension agents, researchers and leading farmers (who are the first to adopt technologies). Among the participating actors, the following are identified: a champion, someone from the region with credibility and leadership skills; a catalyst, someone to help and facilitate the processes, but not directly intervene in them; and existing groups and networks. This approach is flexible, self-managed, low cost, participatory, adaptable and based on knowledge. The objective is for all participants to have a specific function and to be active in the search for solutions to the problems raised. The process began by developing an infrastructure and then defining the functions of the ecosystem. The strategy consists of training leading farmers as trainers, so that they can later replicate the knowledge-management processes. Leading farmers and technicians were trained in the principles of PLATICAR, to ensure that the ideology would act as a cohesive element for the operation of the ecosystem in accordance with the decentralised model of the 'starfish'. One of the challenges was to achieve dialogue between the agricultural technicians and farmers; to achieve and improve this horizontal dialogue, knowledge-management processes need to be in place and to promote the closure of the digital gap. Learning dialogues were fostered that led to shorter validation time frames, to feedback on experiences with new technologies, and to the proposal of new needs and solutions. In addition, the systematisation of the processes and the democratisation of access to new knowledge were strengthened. Strategic alliances were made with other institutes, universities, NGOs and growers' organisations that enabled each organisation to provide human, economic, infrastructure and knowledge resources; the aim is to make all knowledge ecosystem activities sustainable.

RESULTS AND DISCUSSION

Two communities of practice were created in the GECO FICOSA (collection of native seeds/seed bank and low-cost agriculture) and three communities of practice in the GECO Huetar Atlántica (hydroponics/organoponics, low-cost agriculture and ICT). Farmers and technicians learned to have a learning dialogue and jointly developed a system for diagnosing needs. They ranked priorities and implemented solutions through a PLIC, which empowered farmers and fostered self-management. Among the many achievements, local knowledge codification processes were implemented for livestock husbandry and organic control of diseases.

The hydroponics community of practice has been documenting the adaptations and innovations made by growers who adapted a technology for cold highland zones to hot lowland zones. Another important milestone was the community of practice itself spontaneously starting the adoption of organoponics in an effort to decrease costs, achieve sustainability and decrease their carbon footprint. They also expanded from a single crop (lettuce) in which they received training, to more than 12 crops, becoming experimental farmers generating practical solutions. At least 20 of these farmers were trained in the fundamentals of nutrition and plant protection. Some 250 growers have been trained in hydroponics, more than 500 in low-cost agriculture and 50 farmers and technicians in the use of ICTs and the website. The livestock community of practice trained 50 farmers and the seeds community of practice trained nearly 75 growers. An additional 80 farmers and technicians were trained in knowledge management. These training processes took place over two years. One of the most significant achievements was the development by the growers of four training modules in hydroponics, which led to the creation of 45 hydroponic protected environments in the Huetar Atlántica region. The low-cost agriculture community developed 15 technological demonstrations (within a year). These periods for adoption are encouraging since previously adoption time frames varied from 5 to 10 years,

according to the diagnostics made in the regions served by these GECOs.

In the pilot zone, there are 26 farmers' organisations associated with PLATICAR and 30 more that have expressed interest in integrating with the platform. There are more than 12,000 families within PLATICAR's scope of influence and that population is growing. The training processes for the closure of the digital gap were made possible because of an alliance with the University of Costa Rica, which provided access to its computer laboratories. The instrument used for training in ICT was the PLATICAR website, with 32 information and communication services. The development was open-source under the paradigm of Web 2.0, to ensure ease of replication, expansion and scalability. Knowledge managers add content to the website in a secure manner, since all GECOs have virtual private network (VPN) secure connections between them. Publications are also used for the documentation and sharing of knowledge and experiences. Some 15 publications were prepared, covering agricultural technologies and facilitation methodologies; five of these were written by farmers, either on their own or in conjunction with agricultural technicians; in particular, the manual *Production Alternatives for Hydroponic Crops* was published by PLATICAR to support training in this subject. More than 12 strategic public–private alliances were established with a participatory and collaborative approach, which fulfilled many of the goals.

One of the major impacts of PLATICAR was that farmers improved their self-esteem and came to believe in their own capabilities; women growers reached such a level of emancipation that they proposed hydroponics as a way of addressing the food crisis, and they are now independently leading this ongoing activity, supported by PLATICAR or INTA technicians. Women play a dominant role in low-cost agriculture and collection of native seeds, working in co-ordination with male growers. Since there is excess production of vegetables, communities including those practising hydroponics are now able to access fresh vegetables and are benefiting from improved diets. Growers now lead and participate in solving their own problems. They define the priorities, and search for alliances and financing resources (for which they have acquired negotiation skills). Finally, the value of traditional practice and knowledge is being recognised; it is being recovered, systematised (collected and written down) and shared. Economically, the solutions implemented by the farmers (i.e., hydroponics and low-cost agriculture) give them greater autonomy and food security, since they are now capable of producing their own food, mainly using only farm resources. These initiatives have been so successful that they have generated excess production, which provides additional income and means that women now contribute to the family income. Production data and income received by small-scale farmers who opt for soft credit lines indicate that gross income can reach US$500 per month and net income can be US$300–400 per month; this is a high level of profitability for this socio-economic class. The services provided by PLATICAR are free and allow growers to contact national and international experts to obtain first-class information and knowledge, for free; this would be a significant expense if the technical assistance services were contracted. Farmer organisations are strengthened and they have begun to cooperate among themselves. The use of ICT for business and communication has become democratised: some growers have begun to use the internet for business, product placement and obtaining quotes. Finally, farmers now use short message services (SMSs) to send product offers, pricing information and early alerts – a positive result from the process of closing the digital gap.

From the start, PLATICAR has promoted the use of environmentally friendly technology, including organic agriculture, fodder banks and integrated farms. The rapid adoption of these technologies resulted in these growers having smaller carbon footprints, while contributing to carbon sequestration and producing crops of high nutritional content at low cost economically and environmentally. Production is sustainable due to the use of mostly local resources.

CONCLUSIONS, RECOMMENDATIONS AND IMPLICATIONS

PLATICAR is a model that can be adapted to every group and context. Growers learn about agricultural processes and phenomena, developing a greater capacity for informed decision-making. The PLATICAR approach arose as a response to turbulent times, where change is rapid and there must be enough capacity to adapt in order to respond and survive in an ever-changing environment. The model of a knowledge ecosystem is a powerful conceptual tool that allows for the organisation of a multidimensional and multilevel process as complex as PLATICAR; it also serves as a framework to be adapted according to the environmental conditions of the implementation area, while avoiding preconceived solutions.

The knowledge ecosystem facilitated rapid adoption, the development of communities of practice, the establishment of relationships and the development of new competencies among the farmers. The instruments and approaches of PLATICAR must be validated in different contexts; it is not enough to use a single tool, there must be a combination of tools and this is why we speak of a knowledge ecosystem – it must be adapted and adjusted to each locality. Our approach is based on participatory activities in which farmers take part in identifying the problem and finding the solution – they must participate in solving their own problems. The development of competencies is important, but it must be an approach based on training the trainer, in order to ensure replicability. Communities of practice serve as the articulation entity and the website as the highway for the development of these participatory activities to seek solutions, exchange experiences, acquire new knowledge and allow extension agents and farmers to take informed decisions while understanding their activities.

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