INSTITUTIONALIZE WEB-BASED INFORMATION SYSTEM FOR TILAPIA CULTURE IN LATIN AMERICA

Tenth Work Plan, Appropriate Technology Research 2 Study / Honduras (10ATR2)
Final Report

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ABSTRACT

This project focuses on building a web-based information delivery system and decision-making capacity in Honduras for institutionalizing low-input-based tilapia systems for small- and medium-scale farmers.

Appropriate information for the tilapia system was identified through searches of the literature, visits to farms, interviews with decision makers and experts, and input of stakeholders. Data for Honduras and information on the tilapia system was organized to make it compatible with the navigation scheme of the proposed website. The website developed in this project (www.acuacultura.org) includes information on all aspects of production, economics, marketing, and development and extension for tilapia systems. The website also includes information about stakeholders. A discussion board is designed to hold virtual meetings and exchange indigenous knowledge and experiences.

Realizing that the Internet is not available to many small- and medium-scale farmers, we focused on training the trainers, that is, extension agents who work with farmers. From March 2001, 37 training courses provided exposure to the web-based system. Participants in five workshops had the opportunity to navigate the website. Those with some experience using the Internet were keen to use the website. We estimate that over 50% of the participants in our training courses in the last 12 months from Honduras, Nicaragua, and San Salvador regularly accessed the Internet.

We provided a three-week technical training course on designing, building and maintaining of websites. Two Zamorano staff members were given additional advanced courses on content design, databases, and database driven websites. In the last 12 months, these staff updated the database and modified the website. Many training course participants were keen on developing a consortium of stakeholders for regular information exchange through the website. Zamorano is now positioned to engage local educational institutions, agencies, farmers and non-governmental personnel to lead in this effort.

A multi-stakeholder, goal-based decision methodology was developed. In this approach, instead of thinking of what problems are to be overcome, one is asked to create a view of the future and then identify the obstacles that will prevent them from achieving the desired future conditions. A short-course with invited decision-makers from educational institutions, NGOs, agencies and representatives of "voiceless" (women and children) provided an overview and some hands-on experience in goal-based decision making.

This is perhaps the first project in the development of low-income economic countries devoted to the use of the Internet, for creating an enabling environment. Honduras has undertaken a project, funded by the United National Development Program (UNDP), to install wireless Internet to connect rural municipalities throughout the country.
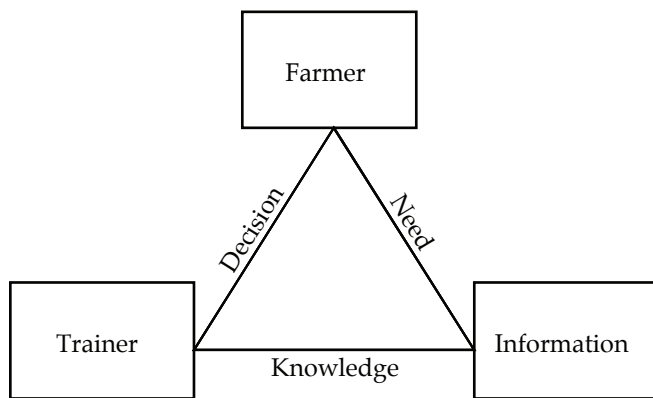
Model for Institutionalization

Figure 1. A model to represent our concept of institutionalization. The corners of the triangle are key actors – Farmer, Information and Trainer. Lines show actions – Need identification, Knowledge acquisition and Decision taken. In an enabling environment that institutionalizes development, all actors and actions are self-motivated and self-implemented.

INTRODUCTION

This project focuses on building information delivery and decision-making capacity in Honduras for institutionalizing low-input-based tilapia systems for small- and medium-scale farmers.

There has been a marked increase in tilapia production in Honduras during the last decade. Commercial scale farms provide significantly to export markets. Medium- and small-farms have introduced tilapia for local markets and improving family nutrition. The contribution of earlier research on tilapia production in Honduras, experimental and demonstration ponds, training workshops and short courses for farmers and non-governmental organizations (NGOs) are attributed to this growth. However, it remains difficult to identify the needs of small- and medium-scale farmers and provide them with relevant information on a timely basis. Usually these farmers are unable to find and interpret research results for their needs, visit demonstration ponds, or attend short courses. However, numerous NGOs, educational institutions, and extension agents in Honduras are available to provide information and alternatives to farmers. We targeted this group with the role of receiving the latest information and educating farmers with alternatives. In other words, we take the approach of fulfilling the needs of the farmers by training the trainers.

The model for institutionalization is presented in Figure 1. The corners of the triangle are the key actors and the lines show actions to be performed. The farmer is shown to have needs and the one who makes decisions to meet his needs. Information (shown in lower right corner) must be obtained before making decisions. In most cases for small and medium-scale farmers, information has to be interpreted for their use. The trainer in the left lower corner represents a person able to create useful knowledge for the farmer's conditions and to train the farmer. When all actors and actions are performed within a country locally, the enabling environment for informed decision making is achieved.

In this project we have taken the approach to achieve the

overall goals of institutionalization by using the emerging information age tools to build a web-based information delivery system with content focused for Honduras and Central American countries. This approach also provides facilities for regular communication among stakeholders and access to domain experts. This report summarizes the activities related to the development of the web-based delivery system and a goal-based decision methodology. Methods where training was provided to local NGOs, extension agents and farmers are reported in more detail by Meyer (2003). Additionally, this report presents progress towards forming a consortium of educational institutions, government agencies, NGOs, and farmers for advancing tilapia in Honduras and Central America.

The overall objective of the project was to develop a web-based information delivery system for tilapia for informed decision making locally and to train personnel with the ability to create decision alternatives to advise small- and medium-scale farmers in Honduras and Central American countries. Specifically,

1. Collect all aspects of information needed for evaluating tilapia culture as an alternative for small- and medium-scale farmers;
2. Organize and present information in the Web-based Information Delivery System for Tilapia (WIDeST) that is usable by extension agents and NGOs to train small-scale farmers;
3. Develop methods for receiving stakeholder input, conducting live conversations through the web among farmers and NGOs to share experiences and identifying needs; and
4. Incorporate decision-making methods in WIDeST useful for employing systematic processes for developing and evaluating decision alternatives.

METHODS AND MATERIALS

<u>Objective 1</u>
Tilapia culture is a system with several inter-connected sub-systems. Figure 2 represents our view of the system in which the user plays a central role. The sub-systems included are reproduction of fingerlings, grow-out of fish, harvest, post-harvest handling and quality, and consumers and local market needs. We focused on low-input systems for small- and medium-scale farmers. Methods and materials for collecting information were as follows:

- Review of published articles, reports, and information sheets,
- Review of commercial and trade literature,
- Interviews with NGOs, educators, Government personnel, farmers, and experts,
- Visits to small and medium scale farms,
- Input from domain experts, and
- Input from attendees at the training workshops.

A considerable body of suitable information on tilapia culture for Honduras was found. In some cases the information was translated to Spanish to make it suitable for use in the host country.

<u>Objective 2</u>
We developed a Web-based Information Delivery System for Tilapia with content focused on the tilapia system for Hondu-

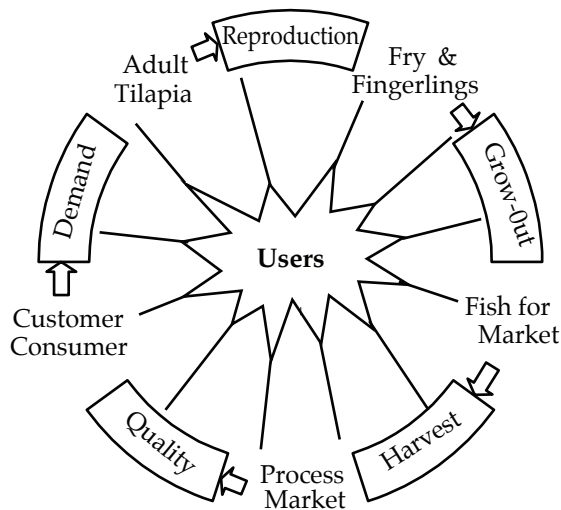**Web-based Information Delivery System for Tilapia**

Figure 2. Illustrates a representation of the tilapia system used for developing subject content of the Web-based Information Delivery System for Tilapia (WIDeST). Sub-systems identified were reproduction, grow-out, harvest for markets, quality of fish for consumers, and marketing and demand by consumers. The key player in the system is the user (the stakeholder). Content in WIDeST was determined by the needs of the users and developed to be user-friendly.

ras and also its applications to the Central American region. From hereon, this will be referred to as "the website". Its web address is <www. acuacultura.org>.

Data for Honduras and information on the tilapia system was organized to make it compatible with the navigation scheme of the proposed website. Principles of website design were used for making a user-friendly website. Collected information was reworded and re-formatted for users with nearly no knowledge of tilapia production methods. Maps of links were created that will capture the intuitive flow from questions of a new user of the Internet and the website.

Several methods were used to teach personnel in Honduras, Nicaragua, Guatemala, and San Salvador about the use of the website. They included formal oral presentations to extension agents, NGOs, faculty of educational institutions, farmers, and students at training workshops (Meyer, 2003). Special sessions were arranged for hands-on experience with the navigation of the website and the use of a discussion board to share experiences and post questions for an expert. The website was used for making presentations during teaching sessions as a way to illustrate the information that will be available for use.

To enhance capacity in the host country and learning methods to upgrade content on the website, a three-week hands-on course was offered in Zamorano. Eight Zamorano staff participated. The course presented basics of design and structure of information for on-line presentations for a particular audience. It focused on teaching the importance and implementation of user-focused architecture. Also, a one-day training session on web design was presented to the Red de Desarrollo Sostenible (RDS) staff. RDS is an NGO that has developed an electronic network and is a major provider of the Internet connectivity and email service in Honduras.
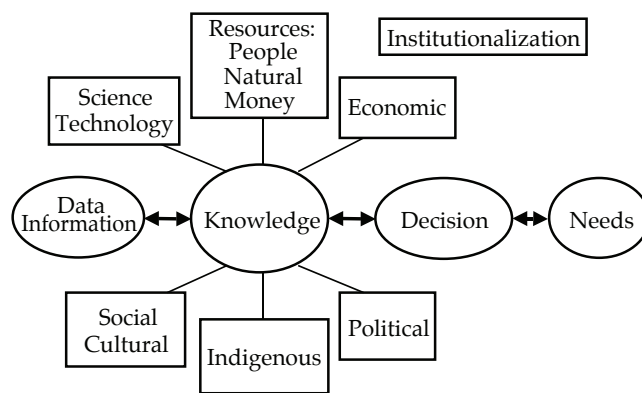

Figure 3. Illustrates critical elements and overall framework of decision making locally. Goals set by stakeholders are represented by needs of users. Decisions to meet the needs are made by objectively using of data and knowledge including indigenous knowledge gained through years of experience.

To ensure that advanced skills are acquired by some personnel in Honduras for building and upgrading relatively complex components of the website and full scope of the database driven web page, individual training sessions were offered to selected individuals in RDS and Zamorano. A week-long intensive course was offered to two Zamorano staff at the University of Georgia (UGA). Additionally, chat and instant messenger facility of the web was used frequently to provide training from the UGA. These institutions were selected for building capacity in Honduras who will continue to develop and independently maintain web-based information delivery systems beyond the duration of this project.

Objective 3
The primary techniques chosen for developing a communication network with stakeholders was the Internet. An effective way to achieve this objective was to add a discussion board to the website. Discussion boards provide facilities for receiving and sending comments in real-time as well as over a pre-determined period. Etiquettes and protocols are important and they become critical in real-time discussions.

To test for effectiveness of communication among several participants via the Internet, virtual meetings of the principal investigators of the Honduras project and several staff of RDS were held periodically. Through these virtual meetings a protocol was developed which proved effective in conducting effective discussions. These virtual meetings also served as a way to share progress and plan activities for the project among Zamorano, RDS, Auburn, and Georgia investigators.

We created a two-hour hands-on forum in a training workshop to have participants logon to an assigned computer and use the discussion board to ask questions of an expert available on-line. At other training meetings time was provided for participants to navigate through the website. This method proved to be effective for assessing potential use of the website by stakeholders.

Objective 4.
Personal interviews of extension workers, participants, and decision makers was the method used to determine the educational background of trainers and decision makers. This provided a basis for identifying an approach for developing

decision-making methodology that can be incorporated on the web for future use. The overall framework for developing the methodology for informed decision making is illustrated in Figure 3. The overall approach is that decisions must fulfill needs and they should be informed by knowledge and objective interpretation of relevant data, principles of science and technology, economic constraints, and political and cultural behaviors. Furthermore, availability of resources and experiences of indigenous people also play a critical role in decisions.

RESULTS

Objective 1
A search for information on all aspects of the tilapia aquaculture was performed including printed literature (journal and popular articles, reports, extension bulletins, pamphlets, and the Internet) was performed. A significant part of the information included in the website is from these sources. Initially we interviewed NGOs, government agency officers, farmers (that included small family farms as well as large commercial farms) not only for indigenous information but also to understand the quality and type of information needed by them for institutionalizing tilapia in the region. We realize that considerable information is already available. However much of this information was either in English or in research reports that are not easily accessible to local farmers and NGOs and not in a useable form. Over the course of this project we conducted training courses that resulted in over 800 contacts. In addition to providing information on tilapia culture and related topics in pond design and decision methodology to the participants, we received input that contributed to the selection of information on tilapia that is included in the website. Meyer (2003) has reported details of training workshops and courses. We found that we needed to include information on estimating water needs and pond design. Under the Honduras project work, a computer model of pond design was developed (Tollner, 2003) and that is included in the website.

Objective 2
Information collected on the tilapia system was organized into four sub-system categories; I. Production, II. Economics, III. Marketing, and IV. Development and Extension. The production sub-system included information on the fundamentals of water, climate, and an overview of tilapia culture; physical structures for production such as ponds, cages, raceways, and canals; production activities such as reproduction, sex-reversal, grow-out, harvest and processing; and input needs such as feed and issues related to water quality maintenance. Similarly, the information on economics was organized into scale of production (small, medium, commercial, and industrial), costs, and record keeping. Marketing information was organized by the market locations (on-farm, neighboring locations, and public markets in urban and rural locations); export; food outlets (restaurants); processing; and presentation and cooking recipes. Information for development and extension included training course materials, seminars, presentations, field trips, conferences, and forums; publications such as manuals, scientific articles, posters, newsletters, and theses; and PowerPoint presentations from training courses; support organizations, and groups such as government offices, NGOs, educational institutions, and producer organizations; and other sources such as websites and commonly known facts about Honduras that could be of interest to farmers.

These four sub-systems also form the content structure of the website. The website has one additional section that contains information about membership and provides a discussion facility. Profiles of participating stakeholders and their activities is a resource that was used to begin a discussion for forming a consortium that promotes tilapia in Honduras. The discussion facility was found effective for communication among stakeholders, holding virtual meetings, receiving expert advice, and sharing local experiences that could provide unique solutions for the indigenous situation. About 10–15 inquiries per month are received, mostly related to some aspect of tilapia production. We have made little effort to expose availability of the website to farmers and NGOs. We noticed that the number of inquiries increased after training workshops giving us reason to think that an effort is needed to promote the website to farmers, NGOs, and decision makers.

Training courses offered under the overall objectives of the Honduras project (Meyer, 2003) included presentations of the website and some hands-on experience. The three-week focused training in Zamorano has resulted in advancing the capacity of the participants in the development and use of the website. Two Zamorano staff were provided extensive training. One person was trained in content and organization of a website and another was trained with computer programming skills for building a database and implementing technical details in website development. They now have advanced knowledge and can independently construct relatively complex database-driven websites. They can also program for various information retrieval strategies that are robust and compatible with adding of new information into the database. Our experience with a local NGO (RDS) was not successful. Its staff was not provided sufficient time to learn these techniques.

Objective 3
The discussion board built into the website was a very effective way to communicate with several individuals. Some functionality built into the design of the discussion board was the ability to post questions to an expert, invite other farmers to provide their experiences, invite a group to participate in a virtual meeting environment, archive text of the discussion, and serve as a means to identify needs and sources of new information. However, effectiveness of communication depended upon the degree to which an individual has experience with computers and familiarity with navigation tools of the web. Virtual meetings with the research team, where all were experienced with the computer and the web, were very effective after a protocol was developed through the experiences of the first two meetings. When this facility was presented to the farmers, NGOs, and other participants at the training sessions (Meyer, 2003) in Honduras, Nicaragua, and San Salvador, it became clear that those with computer experience picked up on this facility very fast and were eager to use it for the designed purpose. However, those who had no prior experience with computers felt intimidated and needed additional time.

During the hands-on sessions with participants at the training forums, those participants with some computer experience became engrossed within the first 30 minutes and focused on asking questions of interest to them.

Objective 4
Informal interviews with the participants in training workshops and the visits to numerous decision makers in NGOs

and governmental agencies provided guidance for developing an appropriate decision-making methodology. It was clear that concerns of many stakeholders in the tilapia system and also of those who share common natural resources (particularly water) must be a part of the decision-making process. Tilapia production in Honduras and Central America can be a significant component of the economic development strategy. It was also noticeable that the visualization of expectations is critical to the creation of a positive mindset in communities with marginal resources. Thus, a multi-stakeholder, goals-based decision methodology was developed to provide a systematic way for building a consensus of shared and conflicting goals among multiple stakeholders, and identify actions that can overcome obstacles for achieving the desired future conditions. The developed methodology is a nine-step process and a guide prepared by Verma (2003) provides rationale and techniques of performing each step.

This methodology was presented at a training workshop with over 30 decision-makers representing educational institutions, governmental agencies, NGOs, extension agents, and farmers from Honduras, San Salvador, and Guatemala. An experiential learning session for the attendees was devoted to developing solutions and decision alternatives for an example goal to "create a consortium of stakeholders for web-based information delivery of educational and training materials." Attendees gained appreciation of the complexity in decision-making and how a decision to fulfill goals of one stakeholder can result in considerable damage to other stakeholders goals.

The importance of data, knowledge and the views of stakeholders drive each step of the decision process. The process is also a catalyst for identifying the gaps in knowledge and needs for making it available to decision-makers. These observations will be useful for providing an impetus for updating data and information on the website in subjects identified in Figure 3. Building capacity in educational institutions and providing students with problem solving and decision making skills are important for building local capacity. A faculty member of a national university in Honduras plans to incorporate the website as a part of an existing course.

DISCUSSION

Objective 1
In this work many iterations were made, each of which sharpened the quality of information we selected and made it more useful for small- and medium-scale farmers. Other important constraints in the selection of information where they primarily focus on low-input production systems and on markets that are not distant. This is inherently the case for small and medium-scale farmers. Whatever information showing tilapia as a way to improve nutrition of farm families and particularly of children, and a source of diversifying farmer income that was available was sought after vigorously and included in our work. Finally, information about building local capacity and achieving independence of external assistance was also of high value. All these issues were found to be critical to the overall objective of building local capacity and institutionalizing tilapia in Honduras.

Objective 2
Information relevant to Honduras and the content organization of the website provides an excellent opportunity to users for receiving information about tilapia culture and marketing considerations. Content development and maintenance is a continuous need for which local capacity has been built. We have achieved this by having Zamorano staff acquire advanced technical knowledge in database driven web technology. Zamorano being an educational institution with excellent facilities and faculty has the potential of developing new relevant information and maintaining the website. The website also provides an excellent source for academic courses as well as for training workshops throughout the region. Farmers, extension agents, NGOs, and agencies have information available at their finger tips for making informed decisions. We have positioned Zamorano to lead in the formation of a tilapia consortium and become the hub of training and information distributions with the website. These results contribute towards building local capacity for institutionalizing tilapia in Honduras.

Objective 3
When we took the approach of using web technology nearly four years ago to create a communication network among stakeholders for Honduras and Central American countries, there was a fair degree of skepticism among many whether these countries would have the connectivity needed for this approach to be a viable solution. We projected that both human capacity to learn and the development of wireless ways to connect to the Internet will trump the need of physical infrastructure for connectivity. This is indeed the case now. Honduras has recently initiated a large project to connect the entire country through satellite-based links. This will connect even the most remote communities in Honduras to the Internet in the next two years. Stakeholders in Honduras and Central America will soon be able to engage in on-line discussions.

Objective 4.
The goal-based as opposed to problem-based decision is an important aspect of the decision methodology. In this approach, instead of thinking of what problems are to be overcome, one is asked to create a view of the future and then identify the obstacles that will prevent them from achieving the desired future conditions. The method requires the engagement of relevant stakeholders in the decision making process and teaches one to appreciate that one's own decisions could indeed affect others adversely.

A one-half hour training session on decision-making was too short for comprehending many aspects of the decision-making methodology. However, it was effective in creating an awareness of the importance of goal setting, stakeholder involvement, and objective information in decision making. A two to three day long workshop with hands-on exercises for each step will be more effective. Many concepts important in decision making were new to the participants. However, the practice session was useful for building a degree of confidence in participants.

CONCLUSIONS

The results of this project are very encouraging for using the Internet and the web technology towards institutionalization of tilapia in Honduras and Central America. This approach is new for building capacity in low-income economy countries. Specific conclusions are:

1. The Web-based Information Delivery System for Tilapia (WIDeST) is proving to be a critical new approach for building capacity in Honduras by having relevant scientific, economic, and indigenous knowledge and data available to NGOs, educational institutions, and farmers.
2. WIDeST served as an important instrument for identifying relevant information for low-input-based tilapia systems useful for small- and medium-scale farmers.
3. Information, links to other websites, and a discussion board in WIDeST has contributed to communication among stakeholders and experts.
4. Training workshops on tilapia culture and WIDeST has increased interest in Honduras, Nicaragua, El Salvador, and Guatemala to form a consortium of stakeholders interested in tilapia.
5. Zamorano is in a better position with staff trained in advanced techniques of designing and implementing database driven websites, upgrading content with new knowledge, and maintaining all aspects of WIDeST.
6. Goal-based decision methodology provides a systematic method for creating realistic expectations, identify practical solutions, and effective implementation decisions.
7. WIDeST can serve as a common platform for using analysis. The computer-based pond design model in WIDeST, developed in a companion study of this project, is an excellent example of this potential.

ANTICIPATED BENEFITS

The primary benefit of this work is the implementation of the Internet and web-based technology for the development of low-income economy countries. Development of WIDeST enhances the capacity of Honduran institutions to develop a tilapia system for small- and medium-scale farms. This approach is not limited for the small- and medium-scale farmer or just the tilapia system. It is likely to be imitated for the needs of large-scale farms. Furthermore, this approach will be adapted by individuals and institutions interested in other agricultural and non-agricultural enterprise for economic development.

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