

# CAPACITY BUILDING FOR THE PRACTICE OF IRRIGATED AGRICULTURE

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## ABSTRACT

Irrigated agriculture is sustainable when irrigation experts join with other community members to develop and apply sound principles and practices in the common interest. Necessary and sufficient principles and practices are presented as an action map consisting of two parts: 1) nine essential processes - ecological, administrative, accounting, educational, integrative, scientific, marketing, entrepreneurial, and service processes; and 2) a development spiral that, when institutionalized, matures into an achievement cycle. When these tools are applied according to a proven protocol, significant and sustainable success has been achieved. The action map and protocol are described in this paper.

The map is based experiences in sustained agricultural and industrial development over the last 150 years in Denmark, the USA, Greece, Guatemala, and elsewhere. The map and protocol allow the user to integrate the principles and practices into a blueprint that provides a framework for the diagnostic analysis and program design needed to develop successful, sustainable irrigated agricultural systems.

## INTRODUCTION

By applying insights and labor to irrigation and drainage activities, human beings manage the output of their ecological system to sustain and improve human life. Principles and practices used by individuals, singly or in community, to create successful, sustainable agricultural and industrial systems have been distilled into in a map-for-action (Argyris, 1985) that consists of a nine essential processes, a development spiral and an achievement cycle. Irrigation community members can use this map as a diagnostic or design tool. Either use will enhance their capacity to produce, sustain and enjoy wealth from irrigated agriculture.

Each development path follows a necessary pattern and yet, like each snowflake, is unique. Thus, irrigation community members will want to use the map to chart their path with creativity and an entrepreneurial spirit. Users will be reassured to know that the action map, when applied using a particular protocol, has proven to be both necessary and sufficient for developing and sustaining a desired output.

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The action map itself rests on three abstractions: 1) the nine essential processes 2) a development spiral, and 3) an achievement cycle. In addition, a protocol is provided for effectively using the map. Seven steps are presented that community members can use to design an action map to initiate, achieve, and sustain the results they desire from their irrigation activity.

By employing these tools, individuals, singly or in community, can engage their capacity to conceive, manifest, and enjoy ever-increasing levels of well being to achieve a sustainable irrigated agriculture.

### THE ACTION MAP

The action map is based on performance requirements formulated from research into successful human endeavor agricultural development over the past 150 years. Four programs in particular are the folk high schools in Denmark, from 1844 (Manniche, 1939); the agricultural demonstration method in the USA, from 1886 (Martin, 1941); the American Farm School in Greece, from 1904 (Lansdale, 1986); and the small farm self-help irrigation projects in Guatemala, from 1977 (Embry and Adams, 1983).

These projects were selected because each resulted in: 1) the transformation of a community, 2) an enterprise that was profitably sustained to the present time, and 3) insights that have been extended to and adopted successfully by other communities. From them, the nine essential processes were distilled.

#### The Nine Essential Processes

A concise statement of the nine essential processes is presented (Table 1). History indicates that the nine processes incorporate the necessary and sufficient elements for achieving success in any enterprise. As such, it can be used as a blueprint for creating action maps for any type of project.

In practice, the nine processes work as a synergistic system, with the result limited by the least strong or viable of its elements. Furthermore, individuals can use the nine essential processes both as a diagnostic tool to determine what needs changing and as a design tool for making improvements.

An Analogy: To get a feel for the nine essential processes, consider how a transportation system works. A vehicle must be designed to meet mechanical, thermodynamic, and ergonomic requirements. At the same time, effectively operating a vehicle requires specific individual behaviors that include knowing and skillfully meeting the physical requirements such as fluids in the appropriate tanks, using the correct key, air in the tires, steering correctly, and so on.

Table 1. The Nine Essential Processes

- 1 **The ecological process** of interacting with the physical and biological environment so as to live and be at ease within it, thereby producing sustainable wealth.
- 2 **The administrative process** of organizing, energizing and monitoring the operations of individuals and institutions that impinge on community members and their environment, thereby managing wealth.
- 3 **The accounting process** of recording, analyzing, verifying and reporting transactions among community members and their institutions, thereby counting wealth.
- 4 **The educational process** of instructing and coaching community members in the skillful use of proven knowledge, information and practices, thereby sustaining wealth.
- 5 **The integrative process** of structuring, maintaining and evolving institutions that blend the diverse beliefs, behaviors and traditions of community members, thereby harmonizing wealth.
- 6 **The scientific process** of hypothesizing, testing, verifying and reporting the laws of nature, both ecological and behavioral, thereby perceiving wealth.
- 7 **The marketing process** of storing, valuing and exchanging goods, information and services of a desired quantity, type and quality, thereby extending wealth.
- 8 **The entrepreneurial process** of innovating, taking risks and changing the ways in which community members think, act, work and live, thereby creating wealth.
- 9 **The service process** of respecting, loving and caring for oneself and for that in which one participates; that is, noticing what is needed and wanted and doing it whether it is one's job or not; thereby appreciating wealth.

Additionally, the community must establish a physical support system of roads, mechanics, spare parts and fuel stations. Behavioral requirements promote safety and community well being. Common requirements include proven ability to operate the vehicle safely and knowledge of the socially accepted rules of operation, symbolized by a driver's license. Liability insurance as well as safety and environmental features may also be required.

Finally, trust and faith are needed. Drivers trust that fuel, parts, roads and all other requirements will be available. Drivers also have faith that the vehicle will work as expected and that each driver will obey socially agreed-upon operating rules.

New or prospective drivers need instruction to operate a vehicle. In addition, if the driver comes from a society where driving is uncommon or has had an unpleasant experience, specific education as well as personal choice may be needed simply to determine whether or not one wants to drive at all.

Similarly, irrigated agriculture imposes specific requirements. Some are purely physical, some biological, some ecological and some behavioral, while others are socially prescribed. All such requirements must be both known and satisfied to secure a sustainable irrigated agriculture.

### The Development Spiral

Sustainable project development can be described as a spiral that is the basis of humanity's ever-increasing wealth (Schumpeter, 1989). The spirals consist of four elements: context, action, and results - enlightened by insight. These may be conceived, as follows:

**Context: a way of being** by which community members synthesize the content of their environment, including their knowledge, attitudes, capabilities, skills, and resources; from which emerges an opportunity to increase wealth.

**Action: a way of doing** through which community members express their knowledge, attitudes, capabilities, skills and resources to create wealth: to organize matter, energy or thought in a way more pleasing or beneficial to someone.

**Results: a way of having** through which community members celebrate their achievement and synthesize it into a new context.

**Enlightenment: a way of experiencing** through which community members integrate previously unknown or disassociated ideas to realize principles that form the basis for new wealth.

The development spiral is characterized by knowledge, volition, and action that are enlightened by insight and vision to attain a newly perceived, desired result. Such spirals are generated by the more creative, innovative, and risk-taking members of a community.

As these insights are integrated into the everyday fabric of individual and community life, the spiral gives rise to an achievement cycle. Thus, practical, productive individuals - without whom the innovator's insight would never be incorporated into community life - dedicate their lives to the achievement cycle,

Elements of the development spiral, along with relevant issues for consideration and action needed to achieve and sustain new levels of wealth are cited in Table 2. Most often overlooked are the context for development and the need to include enlightenment and choice for all participants. The importance of each aspect of the spiral becomes apparent when considering how to apply the protocol.

### THE PROTOCOL

Irrigation professionals can identify performance requirements needed to ensure success by determining how the elements of each essential process relate to the project at hand. The mechanism by which success is secured in human terms is described in the protocol, which follows.

Whereas the action map provides a blueprint for design and diagnostic analysis of sustainable irrigated agriculture, the protocol describes the practical steps for its successful use in the community. The protocol has a sense of familiarity: All have followed its steps whenever success, no matter how small or large, was achieved. Its seven steps are described below.

**Step 1. What to think about.** Identify concretely the requirements for and the value of each of the nine essential processes. This activity enables irrigation professionals to approach the task with certainty, knowing they can clearly communicate the opportunities and requirements to others.

**Step 2. Whose thoughts to change.** Network with people who have the power and authority to work for sustainability. Irrigation professionals must know who has power at each decision point. Whoever these people are, their appropriate and willing participation is essential

**Step 3. Establish relationship.** Involve mutually concerned individuals and organization representatives.

**Step 4. Determine value and requirements.** Consult on the value and requirements of the new behavior so they can contribute and make an enlightened choice of whether to positively support and sustain the proposed activity.

**Step 5. Choice.** Choice is a central activity. It is to be made freely and after consideration of the value and requirements of a project. Choice occurs when persons undertake a course of action, because they see the value of the project and are willing to accept the requirements.

Table 2. The Development Spiral

<b>Context: Ever-changing perceptions, knowledge, attitudes, habits and resources; informing the approach to opportunities by community members</b>	
<b>Existing elements</b>	<b>Relevant issues</b>
Neutral knowledge and boundary conditions	Traditional and current knowledge and constraints
Neutral state-of-the-art	Traditional and current known possibilities
Neutral awareness and beliefs	Traditional and current values, expectations and beliefs
Neutral action	Traditional and current activities
Neutral results	Traditional and current achievements
<b>Action: Ever-changing activities by community members</b>	
<b>Necessary steps</b>	<b>Relevant issues and actions</b>
Become enlightened	Expand consciousness, perceive opportunity, have insight, note more pleasing alternative
Apply volition	Choose to pursue insight and act, or not
Appreciate existing context	Act to know and appreciate existing context
Investigate development context	Act to know and appreciate alternative, potentially more pleasing context
Apply volition	Compare existing and development contexts, consider benefits and requirements, then choose
Create action plan	If choosing to act on potential, create action priorities using action map and protocol
Implement action plan	Enroll specific individuals to act; allocate resources; establish accountability, timelines
Foster feedback and refinement	Monitor actions and results; measure physical and behavioral inputs and output
Celebrate	Notice and enjoy increased well-being
<b>Results: Ever-changing experience of well being by community members</b>	
<b>New elements</b>	<b>Relevant issues</b>
The next context and venture	Intended or other result is integrated, contextual issues shift

Choice is an activity based on human freedom and dignity. Choice is the basis of human empowerment that comes only from personal experiences of one's own strength and integrity. If the choice is to participate, proceed to Step 6. Otherwise, return to Step 4 and interact with the interested community member(s) again or go to Step 2 and identify new individuals or groups. If necessary, go to Step 1 and identify another arena of action.

**Step 6. Close.** The irrigation professional must ensure that enrollees can produce, access, or procure the support and requirements needed to carry out the activity as agreed upon. Often, closure simply reiterates known facts; however, new facts or areas of uncertainty may emerge. A major function of closure is to provide an opportunity for such unknowns to surface, to be communicated and resolved before final commitment to action is made.

**Step 7. Re-close.** Re-closing provides the opportunity to make sure the enrollees have, or can get, the support of those people whose acceptance of the newly chosen activity is necessary. Such people include family and community members, supervisors, co-workers, government and religious leaders. If support from such individuals is needed, but not forthcoming, irrigation professionals must assist the individuals to discover how it can be obtained and support the individual in obtaining it. If so requested or deemed advisable, the irrigation professional may need to return to Step 2 and go through the enrollment protocol with these people. If a major obstacle arises, returning to Step 1 may be appropriate.

By including deliberate thinking, consulting, and enabling purposeful choice about the performance requirements, the protocol plants the seed from which project success can grow. When this happens, everyone involved knows what has been agreed upon, what their individual role is, what community expectations are, and that the choice has been made freely and willingly. Further, by offering numerous opportunities for feedback and revision of plans, carefully conducted enrollment gives community members a sense of enterprise ownership, resulting in interest and pride in the quality of the outcome.

When the commitment to participate is made, freely and after full consideration, the plan can be implemented, the participants supported to keep their agreements, and the achieved results celebrated.

### Implementing the Protocol

R. Buckminster Fuller stated, "... All the individuals of humanity are looking for the answer to what the little individual can do that can't be done by great nations

and great enterprises. The things to do are: the things that need doing: that you see need to be done, and that no one else seems to see need to be done" (Fuller, 1981). The application of the protocol is an individual proposition. However, once grasped, instances of the protocol's use are found to be widespread. For one, consider the following:

From Guatemala: In 1976, an extraordinarily successful, USAID-assisted, small farm, self-help irrigation program was started in Guatemala. The Guatemalan Agricultural Development Bank made loans to organizations of farmers for the purchase of materials to build small, gravity pressure sprinkler irrigation systems. Project beneficiaries furnished all labor. Engineering design, construction, supervision and instruction use was furnished by the Guatemalan government.

By 1981, 40 irrigation projects serving 2000 farmers had been completed. Of these 40 irrigation systems, 17 also provide potable water for the water users. The projects were constructed at a cost of \$600 to \$800 per hectare. The cost included materials for the main line and all on-farm irrigation equipment. The projects promoted crop diversification, with fruits and vegetables frequently replacing production of traditional corn and beans. Farm productivity increased from two to five times and more (Embry and Adams, 1983).

An engineer, Dr. Bert Embry was working in Guatemala on another project at the time the idea of a small-farm irrigation project was brought to his attention by Carl Koone, the USAID Rural Development Officer for Guatemala. Dr. Embry determined to act on this insight. To this end, he and other American and Guatemalan engineers conducted survey trips to various parts of Guatemala and developed hypothetical projects for sites they visited. Ultimately, Dr. Embry was able to bring together the elements needed for the work – the idea, a team with experience to design the scheme, a group of farmers who wanted the project, and financial and other resources to do the job (Divine, 1988).

Dr. Embry reported: "A group in Santa Rita ... first heard of us in one of the traveling school sessions. They had been working on their own to get an irrigation project, but could not find financial or technical help. This was an ideal location for the original project. It could be a gravity-operated sprinkler system with no pumping costs. (Many Guatemalans insist that you cannot have an irrigation system without a pump and tank). And, the main highway between Quezaltenango and San Marcos runs through the project, so everyone could see the sprinklers operating on both sides of the road.

"[Construction of] the first project was supervised by the advisors. Field foremen, who were Santa Rita farmers, supervised subsequent projects. These foremen lived in the community where the project was being built,



and the local farmers supplied their food and a place to sleep. The engineers visited the projects under construction as often as necessary (at least weekly) to check on details and see that the work was being done according to the plan. Several farmers on each project were required to learn how to install the equipment, so they could make repairs or extensions in the future without needing outside help" (Embry and Adams, 1983).

To implement the action plans, Dr Embry organized irrigation teams to work with the farmers. He intended the teams to be cohesive, and he defined everyone hired - engineers, draftsmen, agronomists, secretaries, and chauffeurs - as a team member. Their activities were based on job descriptions, and they were hired and assigned on the basis of their ability to do the job.

Professional project staff worked with the funding agency, so loan money would be available and loan guidelines established. Technical personnel helped farmers estimate the loan repayment period, but the final decision about financing was left up to the farmers. Because of the Embry team's service achievements, local farmers gained significant rewards:

- Farmers own the system and are responsible for operating and maintaining it;
- Farmers maintain the system they learned to fix during and after construction - thus, farmers know the system is dependable and their risk is low;
- Farmers produce and market fruits and vegetables which have higher value;
- Farmer groups manage their own system, so they cooperate to provide maximum benefit for all families involved; and
- Farmers experience pride of ownership and confidence that they can do something for themselves, their families, and for the future of the nation.
- Meanwhile, effectively used resources represent a lasting benefit to the nation
- Human nutrition improves as fruits and vegetables become available in the villages and cities at prices people can afford;
- Increased farm production for local use and for export contributes to the overall food supply and to the economic and social well-being of the nation;
- Eroded areas become productive, new lands are brought under cultivation, and supplemental irrigation makes agriculture less dependent on natural rainfall;
- Land and water resources are used more efficiently, so the present value is increased; while, future generations can expect to inherit the resources in improved condition for their own use and the country's lasting benefit.

In this case, as in others, success began with appreciation of the context associated with the nine essential processes: hilly land, with running springs; a market for

fruits and vegetables, a method for training, a willingness to take the risk, etc. This appreciation, followed by action that duplicated the protocol steps, produced outstanding results - sustainable irrigated agricultural systems that produce healthy levels of well being and prosperity for the community and beyond.

### CONCLUSION

By developing a sound action map and agreeing to use it in the common interest, irrigation and other interested community members embark on the adventure of fostering sustainable irrigated agriculture. As they become adept at using their insights and growing body of knowledge about how the nine processes relate to their endeavor, they will use the map and protocol to achieve increasing levels of success and satisfaction.

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