



Sankalpa Research Center

SRC/SLD/TRD07 Revision 3.5

25th September 2007

## ***Total Rural Development—A New Paradigm for Sustainability***

*Introducing object orientation for the development of reusable models for rural development*

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### **Abstract:**

Several trillions of dollars have been spent globally to reduce poverty, but governments everywhere have by and large failed to empower the rural, indigent people and to attack the root cause of poverty—absence of livelihoods opportunities, education and their lack of access to resources. In this paper, we explore in part a holistic, asset-based and market creation approach for establishing ‘public-private partnerships’ that will provide sustainable livelihoods and education with an emphasis on health, energy and shelter security as primary determinants of sustainable rural development. We affirm a core empirical belief, that *‘the essence of sustainability is morality’*. Finally, we explore the merits of an entirely new paradigm for holistic rural development, taking the analogy of the paradigm shifts that have taken place in industry, in general, and the knowledge industry, in particular—over the last two decades—where the ‘hierarchical’ and ‘procedural’ approaches have been displaced by ‘process oriented’ methods and ‘object orientation’—leading to scientific management, less repetitious work and the ability to be strongly modular or structured. Object-oriented methods, in particular, are also more stable over time and improve our ability not only to model and control complexity, but also to make complicated systems understandable and maintainable. We believe that a judicious conjunction of all the preceding elements—using Mother Nature’s ‘hexagonal’ diamond lattice for developing the recursive structure of a reusable model for the convergence in a number of rural development paradigms—will enable the realization of an entirely new paradigm for *‘Total Rural Development’* (TRD).

**Keywords:** rural development, knowledge, morality, public-private partnerships, asset-based, market creation, information, communications, sustainable livelihoods, education, appropriate technology, paradigm shift, object orientation, modeling.

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## 1. Introduction

The indigent<sup>1</sup> people in the rural areas of India tend to congregate in marginal lands, which further increase their vulnerability and helplessness. Barring a few notable exceptions, the government has failed to implement effective land reforms that would have taken these hapless people out of their ‘poverty trap’<sup>[1]</sup>. However, social experiments that have taken place in many states of India, especially over the last ten years or so, have enforced the view that the indigent people can improve their lot by self-organization<sup>[2][3]</sup> and the participatory approach to rural development (see Appendix 1). Through their own individual and collective initiatives, they may become educated and enter into the mainstream of the socio-political discourse and socio-economic development processes. Civil society structures and NGOs have facilitated this process of ‘social empowerment’, which gives voice to the indigent people. However, the prevailing social structure in this country continues to prevent the ‘Voice of the Indigent People’ from being heard. Regardless of this handicap, social experiments that promote the dissemination of knowledge and knowledge-based products and services have helped to enhance the self-image and self-worth of indigent people (See Appendix 2). It has also been seen that the process of usage of modern technology to attain knowledge, by itself enhances self-confidence<sup>[4]</sup>. It is therefore our belief that the indigent people deserve the best that modern science and technology can offer to help them get out of poverty.

It has been wisely said, *that man does not live by bread alone ...* While technological interventions have helped to empower the impoverished indigent people in special experimental places in India and elsewhere in this world and to get them out of poverty, it is seen that technology alone cannot help to make these same socio-economically empowered people happy, in the full sense of the word. This is partly because, the technocrats who understand ‘hard’ technologies very well, alas, have less appreciation for the ‘soft’ technologies (see Appendix 3)—which focuses on the interrelationships between man and machines. Putting a human face to the technological imperative promotes the physical, social and intellectual development of the target rural community. *But more importantly, we believe that the facilitators and change agents as well as the communities undergoing change all have to embrace a higher moral and ethical standard than ever before, for truly realizing sustainable development<sup>2</sup>. We believe that **the essence of sustainability is morality<sup>3</sup>**.*

Finally, we draw an important analogy (See Appendix 4) between the paradigm shift that has taken place in the knowledge industry—the shift from a procedural approach to object oriented technologies—and the paradigm shift that we have proposed in this paper. A yardstick of the new paradigm for ‘Total Rural Development’<sup>[2]</sup> is also its reusability, in time and space.

### 1.1. Rural Development in India

The problems of widespread poverty, growing inequality, rapid population growth and rising unemployment all find their origins in the stagnation of economic life in rural areas. There can

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<sup>1</sup> The word ‘indigent’ describes the poor, needy, impoverished and disadvantaged people who live in the villages; they lack food, clothing, and other necessities of life because of poverty.

<sup>2</sup> *Sustainable Development* as a concept became fashionable in intellectual circles following the 1992 United Nations Conference on Environment and Development (UNCED), and the subsequent emergence of *Agenda 21* and the *Rio Declaration*. The concept addresses the complex and inter-related issues concerning energy and the environment on the one hand, and the incompatibility of present development patterns on the other. Thus the need for a *sustainable method of development* to achieve the goal of a ‘*positive and lasting development of our planet’s resources and population*’.

<sup>3</sup> This hypothesis has been developed as a result of social studies and experiments conducted in Santiniketan and Nadia District in West Bengal and in Sivaganga District in Tamil Nadu<sup>[2]</sup>.

be no national development without rural development<sup>4</sup>. Yet, there is no evidence of a universally accepted procedure for rural development in the literature. The choice of methods and approaches have always been influenced by the individual or collective preferences of the change agent(s), the time of implementation, spatial distribution, cultural orientation and political dispensation<sup>5</sup>.

Rural development in India has traditionally been based on monopolistic, state-controlled policies, emphasizing growth. Then came the telecommunications revolution in the 1990s—which really started in the mid-1980s with C-DOT and the proliferation of RAXes in villages. Telephones and STD facilities entered the rural areas for the first time in a significant way. In conjunction with global trends for open societies and open markets, this fuelled a paradigm shift, where the state was ultimately no longer seen to be the only engine of production, growth and social equity<sup>[6]</sup>. New ideas could blossom, although hindered by the entrenched government bureaucracy, who wished to maintain *status quo* and resisted change. Civil society structures became at least theoretically on par with the government behemoth. Microenterprises challenged the monopoly of state-controlled industrialization, which till then was the only way to create jobs, overcome poverty and achieve rural development.

## 1.2. A new paradigm for rural development

This optimism has spawned several new approaches for rural development in India<sup>[3]</sup>. It has also fuelled the thinking that has led to the development of a new paradigm for rural development in this paper, based on public-private partnerships and human development.

This new paradigm seeks to establish a ‘global’ model for rural development that transcends local barriers to progress. It is inclusive, in the sense that everyone is invited to participate—local community members (children, women and men), local administration, education and academia, commercial and business interests, media, NGOs and governmental organizations. It is also process-oriented and object-oriented, in the sense that development models may be scientifically managed and replicated across state and national boundaries, because the development paradigm is based on universal human needs for prosperity and the pursuit of happiness.

## 1.3. Objectives

A major objective is to accelerate ‘Total Rural Development’ by promoting the seamless convergence of Public-Private Partnerships (PPPs) that will provide the indigent people with access to resources, technology and information that are essential for a sustainable program, coupled with enhanced capacity building programs for their continuous development.

Our conjecture is that, ‘holistic’ institutional spending at the present-value rate of Rs.200 per villager per year for at least seven years will enable that particular rural community to come out of poverty, permanently. If our proposed paradigm shift is successful, then Rs.1, 400 for every villager will be a small price to pay for the end of rural poverty, as we have known it.

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<sup>4</sup> ‘Development means different things to different people. But above all, development means people. The preparation and activation of people is the cause of economic and social development’. According to FAO, “...The ultimate purpose of development is to provide everyone with ever-increasing opportunities for a better life. It, therefore, acquires an equitable distribution of income and other social resources in order to promote justice and efficient production, to raise levels of employment substantially, to expand and improve facilities for education, health, nutrition, housing and social and cultural well-being. The qualitative and structural changes that development thus imposes on society must go hand in hand with economic progress while racial, ethnic and social inequalities must be substantially reduced ...

<sup>5</sup> As a phenomenon, rural development is the end-result of interactions between various physical, technological, economic, social, cultural and institutional factors. As a strategy, it is designed to improve the economic and social well-being of a specific group of people – the rural poor. As a discipline, it is multi-disciplinary in nature, representing an intersection of agriculture, social, behavioral, engineering and management sciences. [Katar Singh 1999]. We add to this: ethics and morality as standard bearers.

## 2. Problems in rural areas

We must first obtain an understanding of the problems faced by the ‘global villager’<sup>6</sup>, in order to develop this new universal paradigm for TRD. Ten ‘global’ problem areas—identified in a gear train—are illustrated in Figure 1. The areas of concern for each of these ten elements are listed in the figure, in a box against each building block.

This graphical depiction emphasizes the inter-relatedness and the problems of meshing, in each problem area. It also suggests the reason(s) why many rural development programs are not sustainable, as the gear train inevitably grinds to a halt when this intricate web of meshes become dislocated. In order for the whole to be moving forward, every gear has to mesh properly and contribute to sustainable rural development. This underscores the need for a holistic, multi-sector approach, and why single-sector development programs have failed, in the past.

### 2.1. Sustainable Livelihoods—the global problem

Figure 1 suggests that the socio-economic status of villagers—stemming from the lack of ‘Sustainable Livelihoods’<sup>7</sup>—is universal: a super ordinate problem in any rural development program, perhaps anywhere in the world. It is at the core of all social malaise in rural areas. According to Chambers and Conway: “A livelihood comprises the capabilities, assets (stores, resources, claims and accesses) and activities required for a means of living; a livelihood is sustainable which can cope with and recover from stress and shocks, maintain and enhance its capabilities and assets and provide sustainable livelihood opportunities for the coming generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term”.

The livelihoods approach embodies three fundamental attributes: (a) the possession of human capabilities; (b) access to tangible and intangible assets; and (c) existing sources of income (economic activities). To deal with the critical issue of people’s assets, capabilities and activities, we need to *design and disseminate* <sup>[3] [9]</sup>:

- Appropriate technologies on a sufficiently large scale;
- Environmental management systems to cope with prevalent practices that lead to environmental degradation;
- Capacity building and training to improve the technological and management base;
- Effective people-oriented institutions and policies for social empowerment.

Ultimately, the effectiveness of any livelihoods approach for solving the problems of the rural poor will depend on our ability to conduct training and education programs. The cyclical procedure for continuous improvement in the design and dissemination of Sankalpa/ARTS educational & training programs is graphically shown in Appendix 5.

<sup>6</sup> Global here means ‘independent of the current environment’. It is the opposite of ‘local’. The adjective ‘global’ and adverb ‘globally’ imply that the verb or noun to which they are applied relates to the entire Earth and all of its species and regions. The ‘Global Villager’ is not limited or provincial in scope; it has attributes that can be applied to all villagers on this Earth, in general. It is at variance with Marshall McLuhan’s characterization of the ‘Global Village’, which describes how electronic mass media collapses space and time barriers in human communication, enabling people to interact and live on a global scale.

<sup>7</sup> *Sustainable Livelihood* is a job that gives a decent income, gives some status in society and some dignity and meaning in life. It also conserves and, if possible, regenerates the environment. It provides opportunities for people to work right in their own community instead of having to migrate to the slums of a big city. And the purchasing power and lifestyle provided by such a livelihood would be at least comparable to that of a factory worker in an urban area, where the wages have to be much higher than in the village to compensate workers for higher costs of living. - Adapted from a lecture by Dr Ashok Khosla at the UN, New York, 30<sup>th</sup> April 2001.

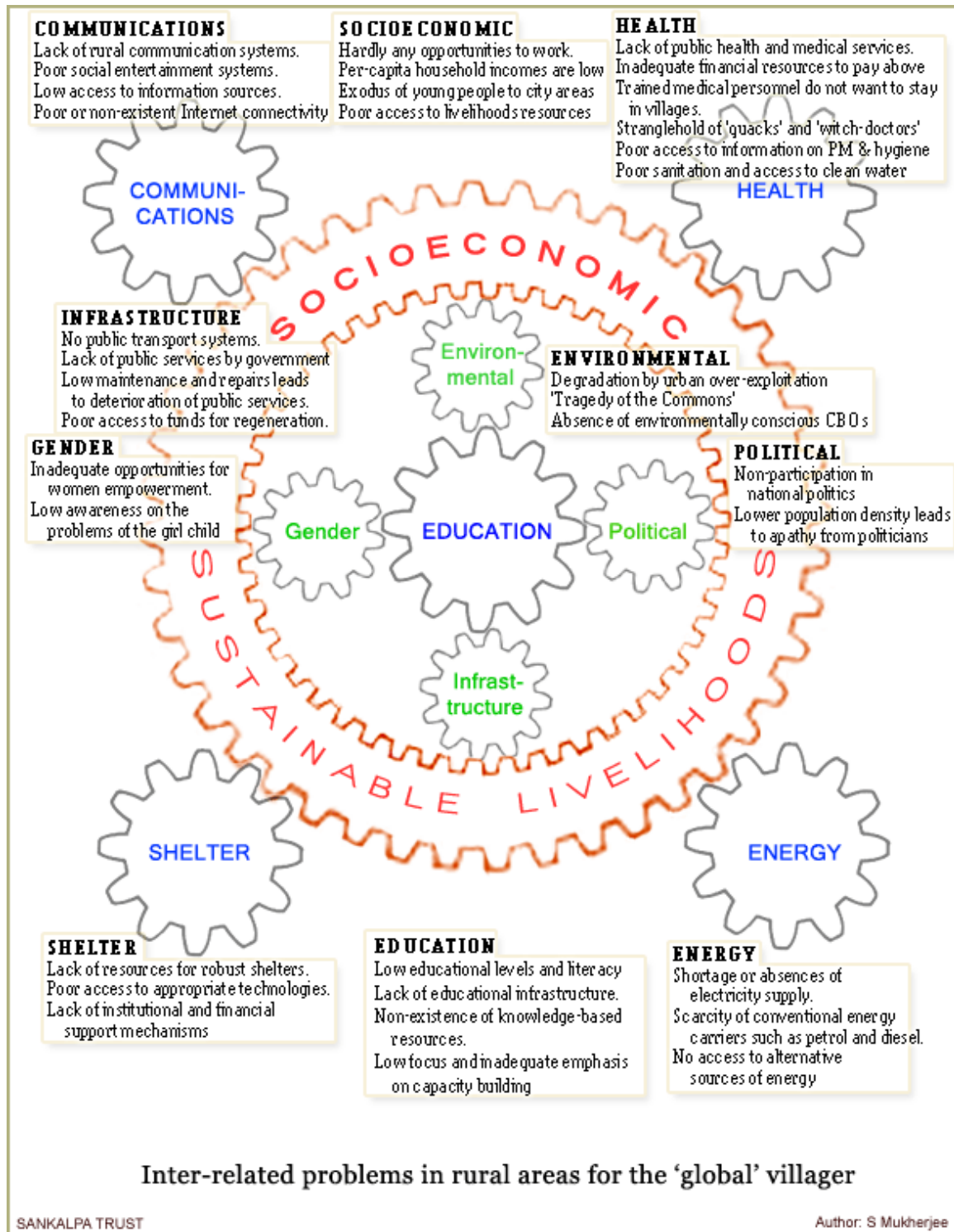


Figure 1: **Problems in rural areas:** The figure dramatizes the impact of 'Sustainable Livelihoods' (SL) on the inter-related problems in rural areas for the 'global villager'. The internal and external gear teeth on the SL contraption exemplify its impact on the major problem areas of 'Communications', 'Shelter' and 'Energy' – with its concomitant impact on 'Health'. On the other hand, 'Education'—more specifically 'primary education—or the lack of it, is at the center of all problems for the global villager. The attributes comprising 'Environmental', 'Gender Issues', 'Political' and 'Infrastructure' problems result from the inability of the rural people to sue for change, as a result of poor education and knowledge.

## 2.2. Education—the central problem

‘Education’—and more specifically ‘primary education’—or the lack of it, is the central problem. Illiteracy is an indicator of human insecurity. According to Professor Amartya Sen<sup>8</sup>, primary education advances human security by enhancing political participation, economic opportunity and human capabilities. Education also generates self-confidence, reduces fear, enables risk-taking and supports an orientation towards the future. (See Appendix 5 for quotations)

Professor Sen believes that no economic development is possible without compulsory universal education. He writes: “*The remarkable neglect of elementary education in India is all the more striking given the widespread recognition, in the contemporary world, of the importance of basic education for economic development. Somehow the educational aspects of economic development have continued to be out of the main focus in our country*”.<sup>[10]</sup>

Good education endows people with better coping capabilities to grapple with crises. There are multiple linkages between education and human security: (a) education provides greater employment security; (b) education enables people to exercise their rights; (c) education empowers the underdog, especially women; and finally, (d) education can socialize children towards tolerance and respect among diverse communities of people.

## 2.3. Model for development of sustainable livelihoods

With reference to the creation of ‘Sustainable Livelihoods’, the Sankalpa model (see Appendix 2) highlights the lack of ‘Communications’, ‘Shelter’ and ‘Energy’ security as the major problem areas, as shown in Figure 1. These attributes impinge directly on the creation of sustainable livelihoods. The absence of these societal necessities results in the absence of adequate medical facilities, which results in ‘Health’ becoming a major problem area, as shown in Figure 1. A weak meshing of any of these four entities will result in a stalled rural development program<sup>[2]</sup>.

The attributes comprising ‘Environmental’, ‘Gender Issues’ and ‘Political’ problems result form the inability of the rural people to sue for change, as a result of poor education and knowledge. The problems of poor ‘Infrastructure’ are principally due to government inaction, and the inability of the rural people to communicate their needs for grievance redressal, which boomerangs back on the subject of education as a prime factor for social development.

## 2.4. The essence of sustainability is morality<sup>[2]</sup>

A compelling reason why sustainable rural development has eluded the indigent people of India—and this is a core belief in this paper—is the absence of morality and ethical standards in most of the rural development activities in the past, in India.

The statement ‘*essence of sustainability is morality*’ is multidimensional, and reflects the need for ethical standards to be maintained in every aspect of development. For instance, on the subject of ‘*Capacity Building for Innovation*’<sup>[11]</sup> in India, Dr. Ashok Khosla says:

*The younger scientists cannot look beyond their salaries, promotions and trips abroad. The older ones spend their time climbing the professional ladder, preparing their post-retirement pastures and keeping the younger ones in their place. All of them believe that society owes them a living, very few of them are prepared to place their science at the service of society. How many scientists ask the questions “Why are there so many poor people in our country, and why are their numbers growing?” or “Why is the loss of the resources of our land — the forests, soils, waters — accelerating so rapidly, and why can it not be reversed?” This situation cannot be brushed off as a kind of societal malaise. Let’s be blunt: it is more a symptom of systemic rot. Even the root*

<sup>8</sup> 'You cannot evaluate what's happening without looking at the people who are on the downside'

*causes are so numerous that a short list of the more important ones can only be arbitrary.*

In another dimension away from technical dishonesty, is the deliberate and premeditated fiscal mismanagement and corruption at every social level. In his ‘Missing Link’ statement<sup>[12]</sup>, Professor Emeritus Maurice Albertson says:

*Since the Marshall Plan was so successful in rebuilding Europe, the World Bank and USAID—together with hundreds of well-meaning NGOs—have poured trillions of dollars (\$2.3 trillion) into the Third World nations to try to reduce poverty. But poverty has only increased instead of decreasing. The money from the World Bank and USAID has lined the pockets of the 20% of the people in power in these countries, and it has increased the GNP of each country, but it has not helped the 80% of the people who live in poverty in rural areas in each of these countries.*

And in between the two, almost every change agent in India worth her salt has encountered that ubiquitous hand that is extended under the table—and often very blatantly in the open for everyone to see—for a very substantial percentage of the pie in return for pecuniary favors. And the bigger the hand, the bigger the greed. Moral change agents cannot oblige this practice and are pushed aside by charlatans disguised as ‘social workers’ who come to the fore to rob the system<sup>[6]</sup>. And hence Prime Minister Rajiv Gandhi’s assertion, that more than 90% of the money earmarked for the country’s development plans do not reach the intended recipients.

Villagers in India are very skeptical of people—other than ‘Naxalites’ and ‘Maoists’—who come to them, saying that they have come to do ‘rural development’, because scores of NGOs are guilty of making money for themselves, at the expense of the villagers’ naiveté.

Therefore, we believe that morality and the maintenance of ethical standards by ALL stakeholders in ‘Total Rural Development’ are at the foundation of sustainable rural development enterprises.

## 2.5. Total Human Development

We have saved the most important and difficult need to satisfy, for the last.

The success of socio-economic development, which comprises principally of sustainable livelihoods and primary education for the masses, on the one hand, and the institutionalization of morality and the ethical stance, on the other, constitutes the foundations of our rural development paradigm. After that has taken place, we need to ask of ourselves: is that enough for the beneficiaries of our rural development programs, to truly approach the ultimate goal—that of total human development—for prosperity and the pursuit of happiness?

Human development is multi-faceted. The subject is so vast and spiritual in nature that it would be impossible to tackle this subject with any degree of confidence and credibility in this paper, which is devoted to grassroots rural development theories and practices.

We end this section on the problems of the villager by recalling the words of Aurobindo<sup>[13]</sup>:

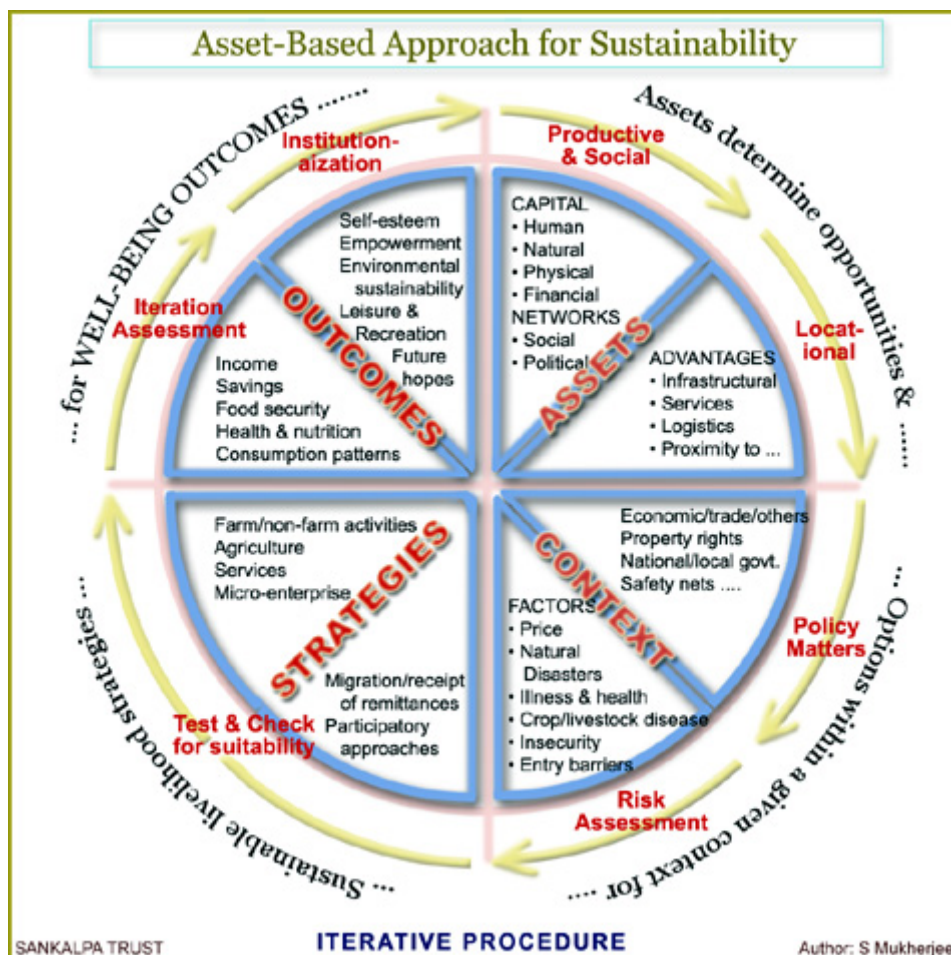
*“It must be remembered that greater social or political unity is not necessarily a boon in itself; it is only worth pursuing in so far as it provides a means and a framework for a better, richer, more happy pleasant individual and collective life”*

How this happy state can be realized is beyond the scope of this paper, and will be left for a later discussion. In this paper, we shall therefore amplify on the foundation level programs that have been described in the first part of the second paragraph of this Section 2.5.

### 3. An Asset Based & Market Creation Approach for TRD

Rural poverty has persisted, despite various governmental, top-down administrative reforms and foreign aid, all of which simply have not worked for the indigent people. <sup>[2][6][9][11]</sup>

However, a literature review of asset-based approaches for sustained rural development <sup>[14]</sup> leads us to the conclusion that household assets are drivers of sustainable growth and poverty reduction in rural areas. An asset-based model for sustainability is shown in the figure below:



The new paradigm therefore focuses on an asset-based approach for sustainable rural development to counteract the impact of the opening of markets and trade competition, which has adversely affected the livelihoods of the indigent people and aggravated rural poverty. There are limits to agricultural development as an engine for rural growth and there is unequal distribution of assets among rural areas and households. The indigent people lack the resources for prioritizing or stimulating farm and non-farm activities for generating socio-economic benefits that would reduce rural poverty. Unfortunately, a single strategy cannot fit all rural households because of heterogeneity of rural areas and household asset distributions. And finally, the design of differentiated strategies for a target community requires an understanding of area specific assets, markets and institutions, and specific household asset distributions.

A further review of the literature suggests that:

- Education levels influence household decisions about (a) technology innovations; (b) saving and investing in farm and equipment; (c) diversification of employment sources; (d) use of private capital and common property for advancement; and (e) participation in community organizations;
- Infrastructure, roads and access to markets promote (a) technology adoption; (b) diversification of farms outputs; (c) earning potential and self employment from non-farm

activities; (d) accumulation of wealth, including land and livestock; (e) participation in community organizations; and (f) development of credit-worthiness which, in turn, affects household well-being.

It should be emphasized that asset-based investments for the target community by themselves have limited growth and poverty reduction impact *unless they are also based on participatory practices*. Education, roads and other market-related infrastructure amplify the positive impact of asset-based investment interventions on household assets.

In conjunction with asset-based approaches that create opportunities for social development, we observe that the market creation approach<sup>[15]</sup> is also a profitable delivery channel—preferably run by micro-enterprises—to supply large quantities of products which have a high poverty alleviation impact or have ecological advantages, or both—thereby reducing rural poverty, sustainably. The objective of the MCA is to promote market development, and it combines two aims: (a) to supply useful and affordable products with a high poverty alleviation impact to indigent people, and (b) to create a viable business as a private delivery channel, run by the poor people.

Experience tells us that the early adopters of MCA are not the poorest, but the village elite, the rich consumers, the rural middle-class. In the past, ‘mistakes’ have been made by targeting ‘useful’ products—such as microconcrete roofing tiles—too closely to the poorest segment, where there are simply not enough roofs to be built! Incorrect positioning also attracts the opprobrium of products being branded as a ‘product for the poor’, which is often then translated as a ‘poor product’ that nobody wants to buy, and certainly not the poor.

We therefore conclude this section in the belief that—from the socio-economic point of view—there is a need to move from untargeted, single sector approaches to multi-sectoral asset-based investments for the target rural community—based on participatory practices and in conjunction with the market creation approach—which can increase overall complementarities of household assets according to their specific, locational and regional needs.

*And always ... we learn from Mother Nature.*

#### 4. Structure and Framework

From the preceding discussion it is clear that the new paradigm that we seek for ‘Total Rural Development’ must be holistic<sup>9</sup>.

The ‘global villager’ needs access not only to educational resources for appropriate technologies, environmental programs and capacity building programs, but also access to physical models and infrastructural support that will enable her to seize on opportunities for sustainable livelihoods and thereby improve the quality of her own life, that of her family members and extending to her immediate community, at the least. From a holistic point of view, the ‘global villager’ needs access to the following ‘**focus areas**’ for TRD and social empowerment:<sup>[2]</sup>

- **Education & Livelihoods:** Provide knowledge and information that will (a) bring education—especially ‘primary’ education—to the masses; (b) promote awareness of socio-cultural issues and the need for political involvement; and (c) empower indigent people to choose their own preferred livelihood options;
- **Agriculture & Environment:** Provide food security through ecological farming technologies and promote awareness of environmental protection and global warming;

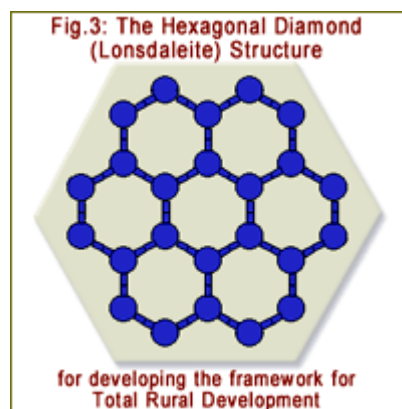
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<sup>9</sup> Holistic (from *holon*, a Greek word meaning entity) – sometimes spelt ‘wholistic’ – relates to or is concerned with wholes or with complete systems rather than with the analysis of, treatment of, or dissection into parts. According to the Oxford English Dictionary, Jan Smuts who coined the term in the early 1920s defined holism as ‘The tendency in nature to form wholes that are greater than the sum of the parts through creative evolution,’ because the ‘system’ adds something in addition. Another term is ‘systems thinking’, which emphasizes the organic or functional relation between parts and the whole.

- **Health:** Promote preventive health programs, provide primary health care facilities and revive local and traditional medical practices;
- **Energy:** Provide energy security with the development of eco-friendly, renewable energy technologies and expansion of the economic viability of biomass-based projects;
- **Shelter:** Provide for shelter security and create public infrastructure.
- **Advanced Technologies<sup>10</sup>:** A range of economic activities and processes from agricultural, ICT, education health, energy, shelter, advanced materials and others that increase security, productivity and enhance the quality of life of the indigent people.

For the design, dissemination, effective control and monitoring of the TRD program—a nodal ‘hub’ or ‘**Resource Access Center (RAC)**’, which will eventually be operated by representatives of the indigent community (see Section 4.4)—at the notional ‘center of gravity’ of the community—is needed to ensure that these holistic programs are implemented and operated in an acceptable manner.

We shall use the analogy (see Appendix 4) of the ‘Lonsdaleite’ hexagonal structure<sup>[17]</sup>, which has 24 ‘cells’ in its lattice structure<sup>11</sup>— shown on the right, as the starting point to conceive the structure and framework of this new paradigm—‘Total Rural Development’ (TRD). Each cell in this figure corresponds to a ‘**Community Center**’ that is IT-enabled<sup>[16]</sup>, which will disseminate knowledge-based products and services, with emphasis on a particular ‘focus area’ that has already been described at the beginning of this section. The 24 ‘cells’ divided by the six foci areas therefore yield four numbers of community centers of each pattern within this overall hexagonal structure. As we shall see later, it will be possible to develop a strategy for equitably distributing these four ‘cells’ for each type of focus area, such that the indigent people at any location within this hexagonal area, will not have to travel very far to access any one of these ‘focused’ services of their choice.



#### 4.1. Modular ‘holistic’ structure of the new paradigm

The ‘Lonsdaleite’ hexagonal structure permits the construction of an innovative, modular and repeatable<sup>12</sup> homogeneous arrangement of rural ‘community centers’ that are ‘IT-enabled’, as shown in Fig 4 below. As mentioned at the end of the last section, there will be four numbers of for each of the six foci areas, distributed within this hexagonal area, as follows:

- |  |  |
|--|--|
| <b>Type ‘A’:</b> Education & Livelihoods | <b>Type ‘B’:</b> Agriculture & Environment |
| <b>Type ‘C’:</b> Health                  | <b>Type ‘D’:</b> Energy                    |
| <b>Type ‘E’:</b> Shelter                 | <b>Type ‘F’:</b> Advanced Technologies     |

Figure 4 shows that the six types from ‘A’ to ‘F’ are uniquely contained in the ‘Central Ring’ as well as the six hexagons circumscribing the ‘Central Ring’, around the RAC.

This innovative arrangement economizes on the number of ‘community centers’ that may be needed to serve a particular community. In the event that the central hexagonal pattern for the ‘Target Community’ is repeated all round it as shown in Figure 8, even those indigent people who live on the fringes—in the cusp regions between any two hexagonal divisions, marked by the light yellow rings—may have access to the ‘holistic’ knowledge based products and ser-

<sup>10</sup> Advanced Technologies in this context relates to rural development, from biotechnology to nanotechnology, medical electronics, satellite imagery, hydrogen economy, computing & advanced communication networks; video-conferencing & virtual reality networking for reaching the ‘Global Village’, and such others.

<sup>11</sup> This carbon allotrope diamond is formed when meteoric graphite falls to Earth. The great heat and stress of the impact transforms the graphite into diamond, but retains graphite’s hexagonal crystal lattice.

<sup>12</sup> This ‘repeatability’ feature is one of the main innovations in this new paradigm for TRD, and will be discussed in greater detail in Section 5: ‘Reusability of the ‘New Paradigm’

vices for any one of the six focus areas—from 'A' to 'F'—without having to travel relatively great distances. Remarkably, this is true of even the 'derived' small hexagons that form between two major hexagons, as a result of this innovative arrangement.

Combining the empirical data at Village Earth and our own experience in working at the grass-roots, we may infer that each 'ITECC'—shown in Figure 4 as hosting six different types of VICs and its complement of GICS—will cater to between 50,000 and 100,000 people. This number will obviously be influenced by the particular intervention strategy, and is not rigid. The model is therefore scalable. In other words, the number of beneficiaries from the TRD model shown in Figure 4 is elastic, and is dependant on the scale of services and complexity in the design and dissemination of the TRD components. *The size of a typical 'Target Community' will therefore be between 300,000 and 600,000 people.*

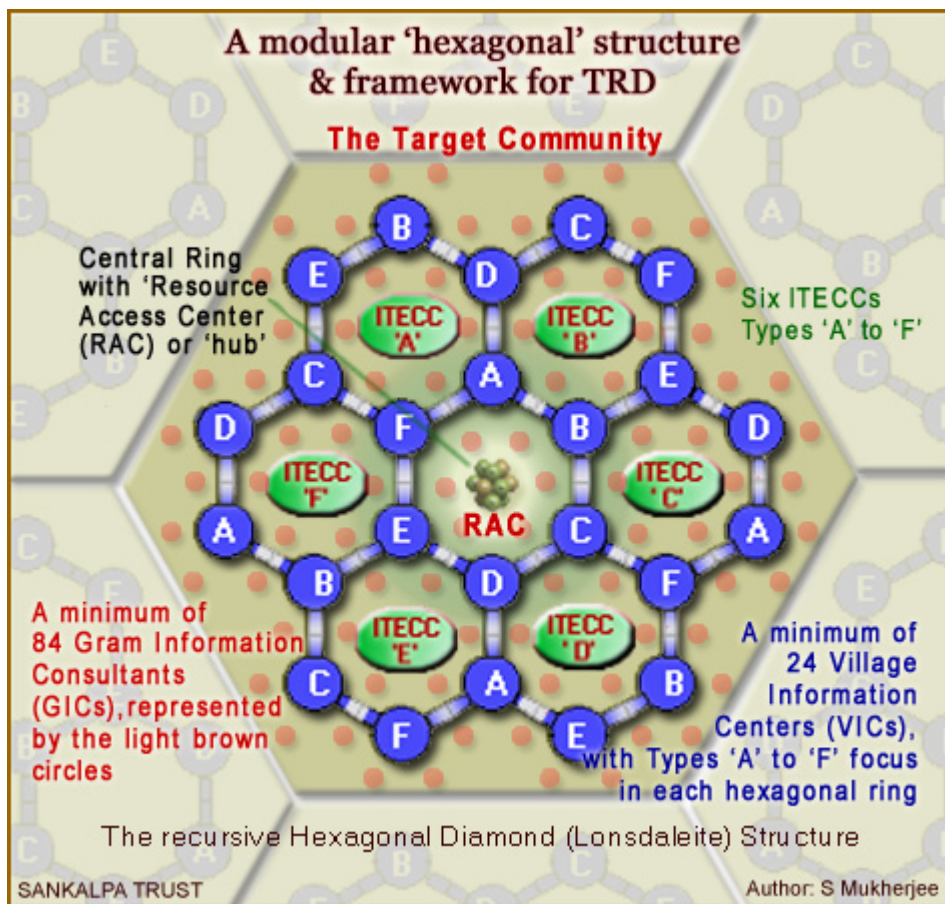


Figure 4: **Modular**<sup>13</sup> 'hexagonal' structure and framework for TRD. Shows how the 'Lonsdaleite' hexagonal structure<sup>[17]</sup> can be **recursively** adapted to develop a framework for equitably distributing (a) one 'Resource Access Center' (RAC); (b) six 'IT-Enabled Community Centers' (ITECCs), from Type 'A' to Type 'F'; (c) a minimum of 24 'Village Information Centers' (VICs) and (d) a minimum of 84 'Gram Information Consultants' (GICs), represented by the light brown circles, to disseminate IT-enabled products and services to the 'Target Community'. *It should be observed that the 24 VICs (tablets in blue with letters ranging from 'A' to 'F') in the target community are distributed in such a way that the six types are represented within each of the seven hexagonal areas, including the 'Central Ring'.* The spatial distribution of the VICs and GICs is such that all indigent people may have access to knowledge products and IT-enabled services from all six focus areas, from Type 'A' to Type 'F'.

<sup>13</sup> Modularity relates to the grouping together of related entities into recognized modules, and the partitioning of a system into modules (which may be composed of other modules)

## 4.2. The Rural Convergence Program

It is believed that the concept of using a hexagonal structure for the framework of a rural development service delivery program *is* a new innovation. In conjunction with the ideas presented in Figure 8, we put forward the view that this structure provides the basis for a global model for total rural development. Hence, we have attached the ‘new paradigm’ tag to it.

However, the internal components of the implementation model for this ‘new paradigm’ are based on tried and tested methodologies for rural development, and is the culmination of lessons learned and taught by some of the foremost thinkers and grassroots rural development organizations, in India and abroad. Hence, we refer to this process as the ‘**Rural Convergence Program**’ (RCP), which brings together a convergence in the knowledge and experience of several experts from a growing list of organizations<sup>14</sup> that have a track record of doing things successfully in their own domains, and putting them on a common platform to integrate various rural development paradigms into a coherent strategy for implementation—keeping the indigent peoples’ interest first.

There has been a few iterations for developing the structure of this unified ‘Rural Convergence Program’ (RCP). The current thinking for its design & implementation is shown in Figure 5.

The most important element of the RCP program is the beneficiaries of the TRD project, without whom this paper could not be written. They are present everywhere within the scope of the program. The two elements that have been identified so far are (a) the ‘**Resource Access Center**’ (RAC), and (b) the ‘**IT-Enabled Community Centers**’ (ITECCs)

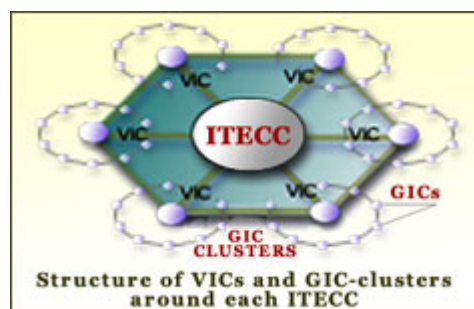
Let us review the characteristics of all the elements of the ‘Rural Convergence Program’:

1. The **RAC** is the first tier and shall administer the total project, including coordination of the design and dissemination of knowledge and education programs, the application of various ‘soft’ and hard’ technologies, the design and acquisition of asset-based technologies and programs for market creation approach, as well as other change management programs, in order to achieve the overall goals & objectives of the RCP.
2. The ‘**RCP Secretariat**’, which is on the second-tier and at the core of the program, interfaces with the external program elements and will facilitate transparent ‘Program Governance’; ‘Program Planning and Development’; ‘Network Mobilization and Management’; ‘Funds Mobilization and Management’; ‘Information Management and Communications’ and ‘Policy Analysis and Advocacy’. An important division within the RCP Secretariat is the ‘Training and Education’ division, which will be responsible for all ‘Capacity Building’ and ‘Livelihoods Skills Development’ programs, which will focus on programs to: (a) alleviate poverty, unemployment, socio-economic inequity, disaffection and disenfranchisement among youth and families in the target area; (b) to mitigate against rural and coastal environmental degradation; (c) reduce migration from the village to urban centers by enhancing capacity-building mechanisms to strengthen civil society structures; (d) promote community building programs and networking in and between village organizations; (e) provide vocational, leadership and life skills training, environmental awareness programs, teacher training and ‘Training for Trainers’ programs and support for new economically and environmentally sustainable enterprise development; and (f) microfinance assistance programs.

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<sup>14</sup> The original strategic partners for this ‘Rural Convergence Project’ are (a) Development Alternatives, New Delhi; (b) Village Earth, Colorado State University, Fort Collins; (c) Alagappa University, Karaikudi and (d) Sankalpa Trust, Calcutta. To this coalition, Auroville is added in the capacity of the nodal partner, as we are in the process of developing and operationalizing an RCP project at Auroville, for the benefit of approximately 600,000 people who live in the targeted Auroville bioregion.

3. The third-tier comprises of the ‘**IT-Enabled Community Centers**’ (ITECCs)<sup>15</sup>, which have already been reviewed<sup>[16]</sup>. It is the first level at which a differentiation in program delivery takes place. As in Figure 4, there are six types of ITECCs, marked in green ovals, from ‘A’ to ‘F’, and each focus area has already been defined as ‘Education & Livelihoods’, ‘Agriculture and Environment’, ‘Health’, ‘Energy’, ‘Shelter’ and ‘Advanced Technologies’, respectively. Each ITECC will spread over an area of between three to five acres, and will be (a) constructed on the asset-based and market creation approaches that has been described in Section 3; (b) specifically equipped to handle the knowledge and information requirements of the target rural community, (c) lead the ‘process’ oriented change management practices, and in general be responsible for the design and dissemination of programs that are focused on:
  - i. One of the six foci areas, from Types ‘A’ to ‘F’ (see Figure 4 for their distribution);
  - ii. The four foundation-level sustainable programs defined under the ‘Sankalpa Pyramid’ (see Appendix 2): Information, Livelihoods, Energy and Shelter.
4. The fourth-tier comprises the ‘**Village Information Center**’ (VIC), which is a micro-cosm of an ITECC, complete with the capability to deliver basic IT-enabled services for knowledge and information and for the dissemination of ideas, products and service that are most relevant to the immediate village community. The structure is again based on the ‘Lonsdaleite’ hexagonal structure for ITECCs—the diamond lattice structure in the reference model—with six VICs recursively built around each ITECC, to maximize the dissemination of knowledge services and change management practices. They shall have scaled down classrooms for education and training and dissemination of appropriate technologies to community members in the village, and liaise between the rural community members and its host ITECC.
5. The fifth-tier, the ‘**Grameen Information Consultant**’ (GIC) functions as the ‘last meter’ linkage between the RCP program and the beneficiaries: the indigent people. Provisions will be made to empower at least six ‘Grameen Information Consultants’ in each VIC (shown above), who will champion the cause of total empowerment through the participatory approach, which will be to vigorously pursue the dissemination of rural ICT in a structured way with a human face—the application of ‘soft technologies’. They will function as a committed group of motivated local entrepreneurs, to promote awareness of the RCP’s asset-based and market creation approach, and IT-enabled services in general, but also on a commission basis for their sustainability—by charging a small fee to send or retrieve an e-mail to distant relatives, a fee to browse the Web and obtain information for an agricultural project. Going door-to-door, these ‘information brokers’ will be able to quickly ascertain and meet the needs of local community members. They can also be trained to arrange for translation services from English to the local language, if necessary. It is this ‘last meter’ linkage that could be the most important element of the sustainability debate in this new paradigm, and deserves as much importance as any other tier of activity.
6. The sixth and last tier are the ‘**Beneficiary Community Members**’, the indigent people and the rural poor, for whom this paper has been dedicated, and without whom, the



<sup>15</sup> Each ITECC will have for their respective communities many examples of demonstration projects in sustainable livelihoods, renewable energy technologies and shelter technologies, with an adequately resourced IT Center to promote knowledge-based services and education & training for continuous improvement and regeneration (see Appendix 2 for a representative list of sustainable livelihoods projects), and a robust market creation approach for poverty alleviation.

RCP would not be possible. It is their socioeconomic and spiritual upliftment at the end of the program—perhaps after seven or eight years—that will bear testimony to the success of this new paradigm for ‘Total Rural Development’.

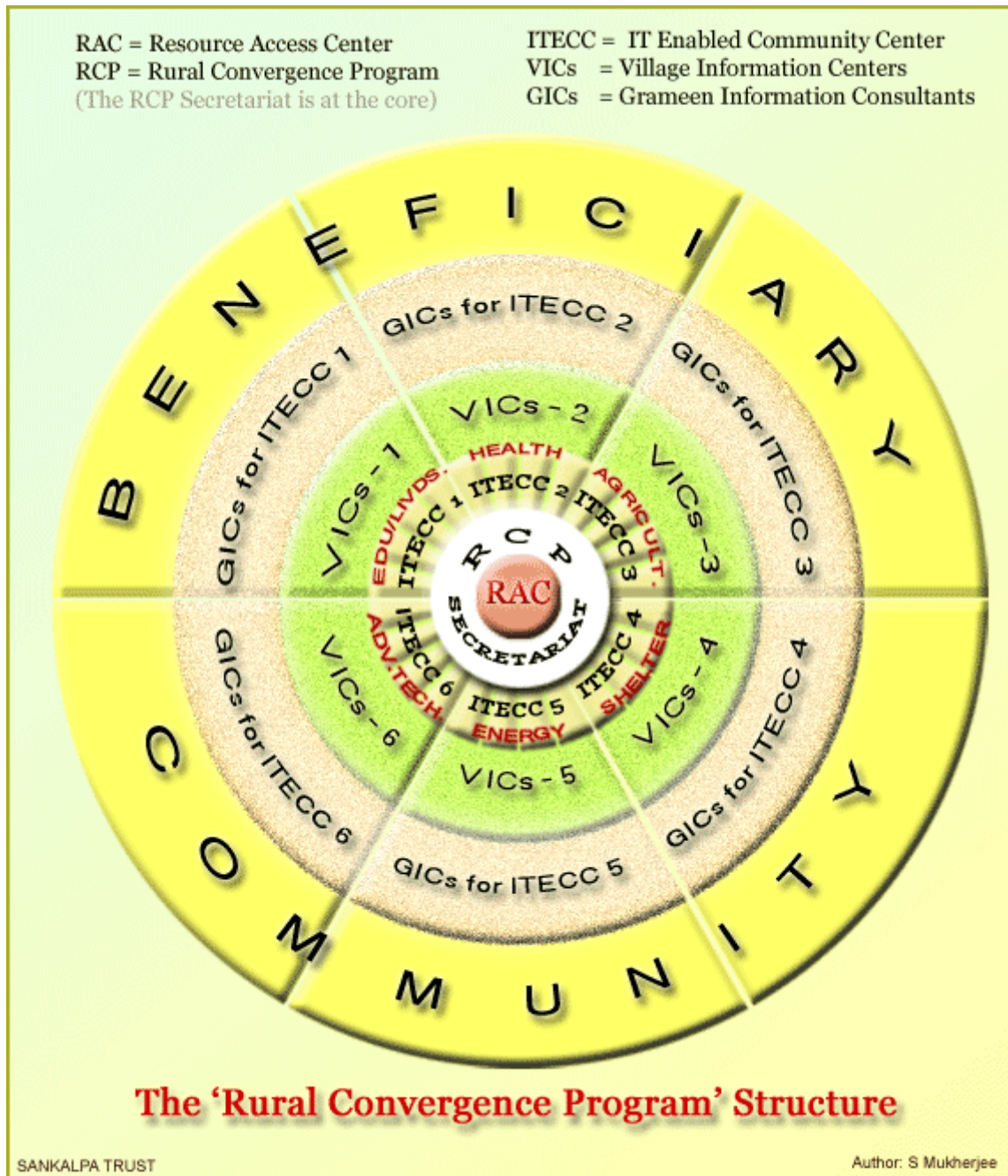


Figure 5: **The ‘Rural Convergence Program’ Structure.** The figure highlights the ‘flat’ structure of the RCP. The most visible and important entity within the RCP is the ‘Beneficiary Community’, who will determine the shape and contents of the RCP. On the basis of that determination, the ‘Resource Access Center’ (RAC) will be developed, with its core ‘RCP Secretariat’ to oversee the design and implementation of the program. The six type of ITECCs (four in each type) comprise the third-tier. The ‘Village Information Centers’ (VICs) liaise between the indigent people and the host ITECC. Finally, the ‘Grameen Information Consultant’ (GIC) functions as the ‘last meter’ linkage between the RCP program and the indigent people, and is an important determinant of program sustainability.

These six tiers are shown in concentric circles in Figure 6, starting with the RAC at the center. The RCP Secretariat encompasses it completely, interacting with the next tier—the ITECCs—the circular segments outside the RCP Secretariat, which have been divided into six segments, to reflect the hexagonal structure, with each segment reflecting a particular focus area, as defined in Section 4.1

The 4<sup>th</sup> tier, shown in green, represents the ‘Village Information Centers’ (VICs); six to each ITECC, making a total of 24 in each ‘Target Community’ as shown in Figure 4

The 5<sup>th</sup> tier (pink) represents the ‘Grameen Information Consultants’ (GICs); again six for each VIC, making a total of 84 GICs in each ‘Target Community’, as shown in Figure 4.

### 4.3. Alternate RCP Implementation Model

An alternate representation of the implementation model showing the interrelationships of the ‘Rural Convergence Program’ is shown in Figure 6, below.

It is a pattern that is based on the recursive structure developed in Figure 4, with the overlapping ‘VICs’ and ‘GICs’ separated into their separate constituencies, to model the impact in each community.

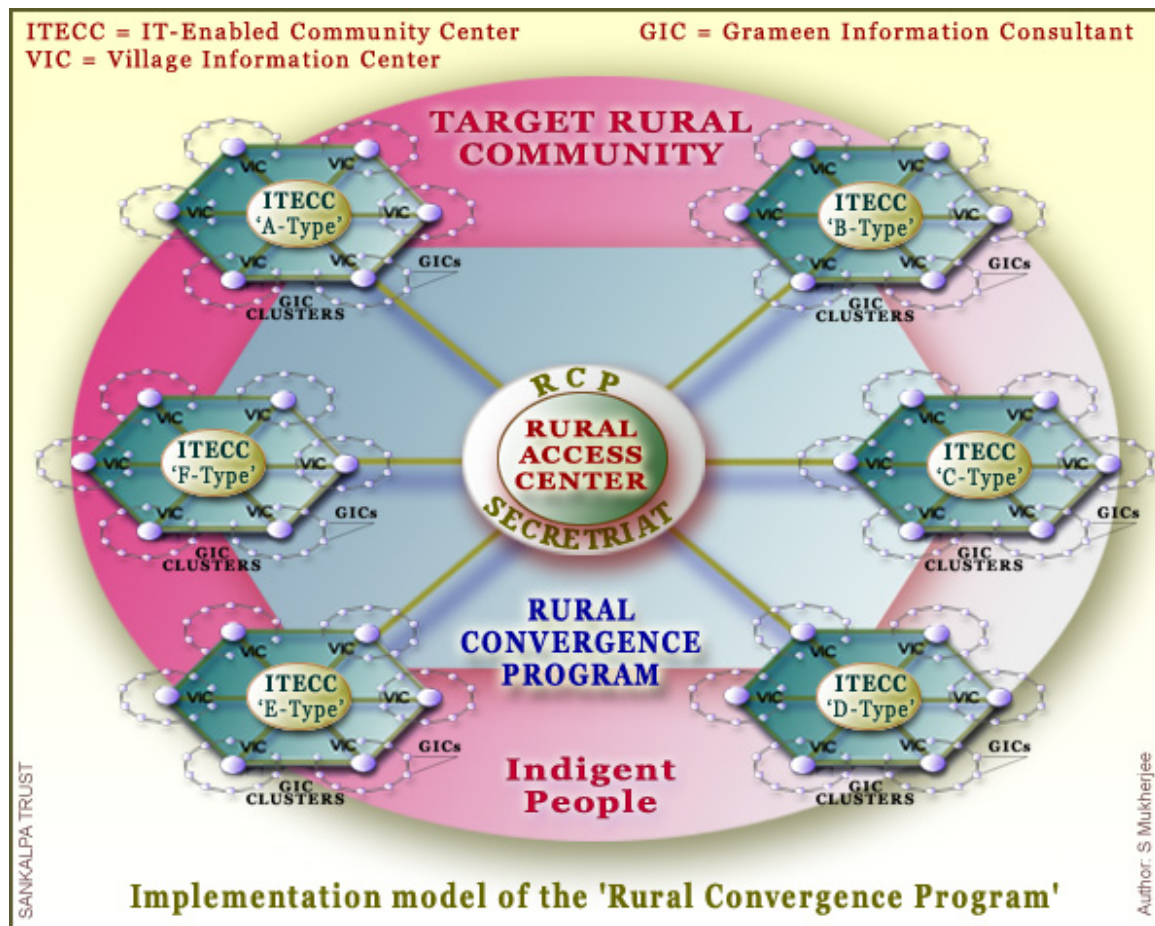


Figure 6: **Alternate implementation model of the ‘Rural Convergence Program’**. This representation reinforces the importance of the ‘flat’ structure of the RCP. The model also demonstrates the impact of the recursive ‘Lonsdaleite’ hexagonal lattice structure for the different entities/tiers in the implementation of the RCP.

The highlights of this implementation model of the RCP are (see Section 4.2 for details):

- (a) Develop a participatory (see Appendix 1) ‘**Rural Convergence Program**’ (RCP) by building a ‘**Resource Access Center**’ (RAC) as the hub of the RCP; the ‘**RCP Secretariat**’ will spearhead ‘Capacity Building’ and ‘Livelihoods Skills Development’ programs;
- (b) Develop ‘**IT-Enabled Community Centers**’ (ITECCs) in surrounding village *Panchayats*, with the participatory involvement of the men, women’s self help groups (SHGs) and the youth of the community (see Appendix 2—‘Sankalpa Pyramid’ model); create ‘**Village Information Centers**’ (VICs) around each ITECC, which support ‘**Grameen Information Consultants**’ (GICs); these rural community structures will help to empower the indigent people to access education, capacity building programs and various ‘soft’ & ‘hard’ technologies (see Appendix 3) for their own benefit and at their own pace.

#### 4.4. Exit Policy

At the start of the RCP Program, the project staff will fully control the operations of the RAC, the RCP Secretariat, and the other facilities, including the ITECCs and VICs, as the indigent people will probably not be ready initially to assume a leadership role and manage the program by themselves. However, they are the final beneficiaries of the RCP Program. Therefore, the assets that are created—especially the ‘ITECCs’, ‘Village Information Centers’, equipping the GICs and even parts of the ‘Resource Access Center’ (RAC) will ultimately devolve to the indigent people of the target community.

However, that can happen only if the indigent people become sufficiently trained as a result of the capacity building programs, over a reasonable period of time, to be able to incrementally take charge of these physical assets. These training and capacity building programs shall be controlled and administered by the RAC.

On the assumption that the ‘new paradigm’ project will run for seven years, this transfer of control may be graphically depicted as follows:

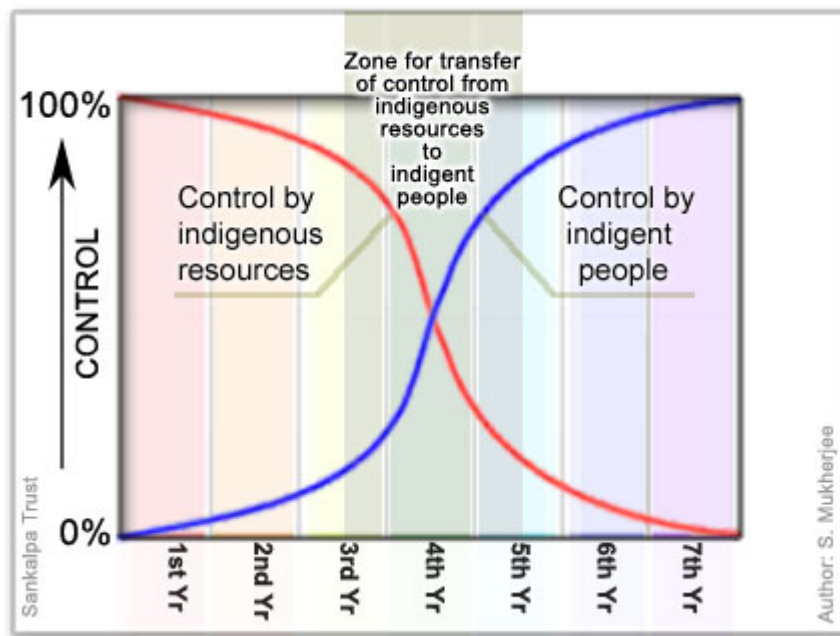


Figure 7: Transfer of ‘control’

At the beginning of the project, these physical assets will be run by temporary ‘indigenous’ human resources—either volunteers from the host institutions or contracted from nearby urban areas—or both. The human resources could also come from national, or even international

sources, as is convenient. The brief of these ‘indigenous’<sup>16</sup> resources would be to operate these physical assets in terms of the project guidelines and their terms of reference, while promoting capacity building and selecting leaders within the ‘indigent’ community and empowering them, **and incrementally transfer the ownership and control of these physical assets to the indigent’ people.**

It is possible that the actual trajectory of the graphs may vary. However, a symmetrical transfer of control appears to be the most elegant approach at this point—which suggests that the zone of transfer of effective control from indigenous resources to the indigent peoples begins around the middle of the third year and matures in the middle of the fifth year. This timeline may vary from place to place.

## 5. Process oriented, scientific approach

The objective of the ‘process oriented’ approach in rural development is to promote ‘interactive participation’ between the change agents and the villagers, as the rural poor are the key actors in improving their own living conditions, as well as in managing their natural resources sustainably. Thus, their participation is essential to the success of the project activities.

Accordingly, the villagers need to be trained to carry out specific categories of village-based development activities that are defined by the villagers themselves. This will eventually lead to locally formulated action plans, which will empower the villagers to carry out by themselves various rural development programs and activities—such as Participatory Rural Appraisals (PRAs), transects, joint analysis and other relevant community building activities.

A key consideration in this community-driven rural development project is the propagation and institutionalization of the scientific enquiry, method and processes. An example is in implementing livelihood training and opportunities. The scientific action here consists of the typical ‘Plan-Do-Check-Act’ (PDCA) cycle of four linked phases or feedback loops:

1. **Plan:** Participatory design and development of outreach programs;
2. **Do:** Outreach networking and priority setting through village organizations; co-ordination of village-based and IT-enabled community centers, training centre offering training and education, access to a wide range of interconnected activities grouped under the general categories of: vocational training, life skills training, and teacher training, asset building programs, access to markets;
3. **Check:** Monitor progress with village organizations and training centers, learn and adjust activities as necessary; and
4. **Act:** Institutionalization of gains through transfer of educational, environmental, and enterprise development skills and opportunities through trainees and expertise to village centered actions and institutions.

It is important to institutionalize continuous improvement methodologies and systems – e.g. through the adoption of Kaizen methodologies, continuous improvements will be made and the brightest trainees will be empowered to become teachers and shoulder the responsibility for the continuance of these ‘home-grown’ and ‘socially relevant’ education and training programs, which will be made available through the existing network of SHGs. This will promote community ownership, by ensuring that training needs analysis and decision-making remains the prerogative and responsibility of local civil society organizations, thereby ensuring sustainability and maintainability at the closure of this project and providing an exit mechanism for the facilitators.

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<sup>16</sup> The word ‘indigenous’ includes all people of the region, including at the national level.

## 6. Reusability of the ‘New Paradigm’

An important yardstick of the new paradigm for TRD is its reusability, in time and space. This approach is analogous (see Appendix 4) to another paradigm shift that has taken place in Information Technology—the shift from procedural programming to object oriented technologies, which are more disciplined than conventional structured techniques.

### 6.1. Paradigm shift—procedural to object orientation

Although procedural programming<sup>17</sup> is often a better choice than simple sequential or unstructured programming, it has been overtaken in recent years by a new paradigm for software development in the IT industry—object-oriented technologies, for a number of reasons<sup>18</sup>.

The most commonly touted benefit of object orientation is reuse. One of the major benefits of objects<sup>19</sup> is that they are reusable<sup>20</sup>.

Object orientation<sup>21</sup> (OO) is a natural outgrowth of the human mind’s tendency to think in visual metaphors and is therefore a natural way to view and construct models of the world. It results in less repetitious work and has the ability to be strongly modular or structured. Object-oriented methods are also more stable over time than other representations and improve our ability not only to control complexity, but also to make complicated systems understandable and maintainable.

In a well-designed object-oriented system, it should be possible to (a) implement a systemic change without having to make alterations at other unrelated points in the system; (b) reduce the overall amount of maintenance required since many problems can be detected and corrected in the design phase.

*There is nothing more powerful than an idea whose time has come ...*

### 6.2. Applying object orientation concepts to TRD

In Section 4.1, we have already been introduced to the concept of modularity *vis-à-vis* the ‘Lonsdaleite’ hexagonal structure for TRD. If we assume that there are no urban centers anywhere near to this target community, it would logically imply that the region around it would also be rural, and therefore eligible for TRD intervention, again, on the assumption that we want to eradicate rural poverty everywhere. It is in scenarios such as this, that the power of ‘reusability’ in object orientation comes to the fore. Let us see how object orientation would work.

We will first need to know what the system has to do.

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<sup>17</sup> Procedural programming is a top-down approach, in which the problem is decomposed into sub-problems, which are solved recursively. Procedures, also known as routines, subroutines, methods, or functions (not to be confused with mathematical functions, but similar to those used in functional programming) simply contain a series of computational steps to be carried out. Any given procedure might be called at any point during a program’s execution, including by other procedures or itself.

<sup>18</sup> Object Oriented Programming (OOP) is a pattern which enables applications to be developed economically and delivered easily. It permits delegation of specializations, which makes application development more manageable.

<sup>19</sup> An object is an implementation of one or more roles; roles are a set of related responsibilities; responsibility is an obligation for collaboration; collaboration is an interaction of objects or roles (or both).

<sup>20</sup> It should be noted that no one method, technology or technique would solve all the problems associated with reuse. There will always be complications, and these must be expected and planned for.

<sup>21</sup> The OO framework is based on three foundational concepts: (a) *Classification*: the grouping of objects that have a common set of properties and operations; (b) *Specialization*: the identification of a subset of objects within a classification or type that have an additional common set of properties and operations; and (c) *Polymorphism*: the ability of different types of objects to realize the same properties and operations in different ways.

In other words, we need ‘Domain Experts’, who will determine what needs to be done to get the indigent people out of poverty, globally. Fortunately for us, we already have the answer to this question, as we have already defined the approach for TRD in Section 4, which is as follows:

1. Use a hexagonal structure, with a ‘Central Ring’ that has an RAC at the center and 24 VICs distributed around it, as shown in Figure 4;
2. Develop the ‘Rural Convergence Program’ Structure, as shown in Figure 5;
3. Use an implementation model of the ‘Rural Convergence Program’, with (a) RAC + RCP Secretariat; (b) six GICs, each with six VICs, and its complement of between six and ten GICs, as shown in Figure 6.

It would be useful at this point to redraw Figure 4, without the labels to distract us, and by restoring the hexagonal structures around the ‘Target Community’ to their original luminosity. The result is shown in Figure 8, below:

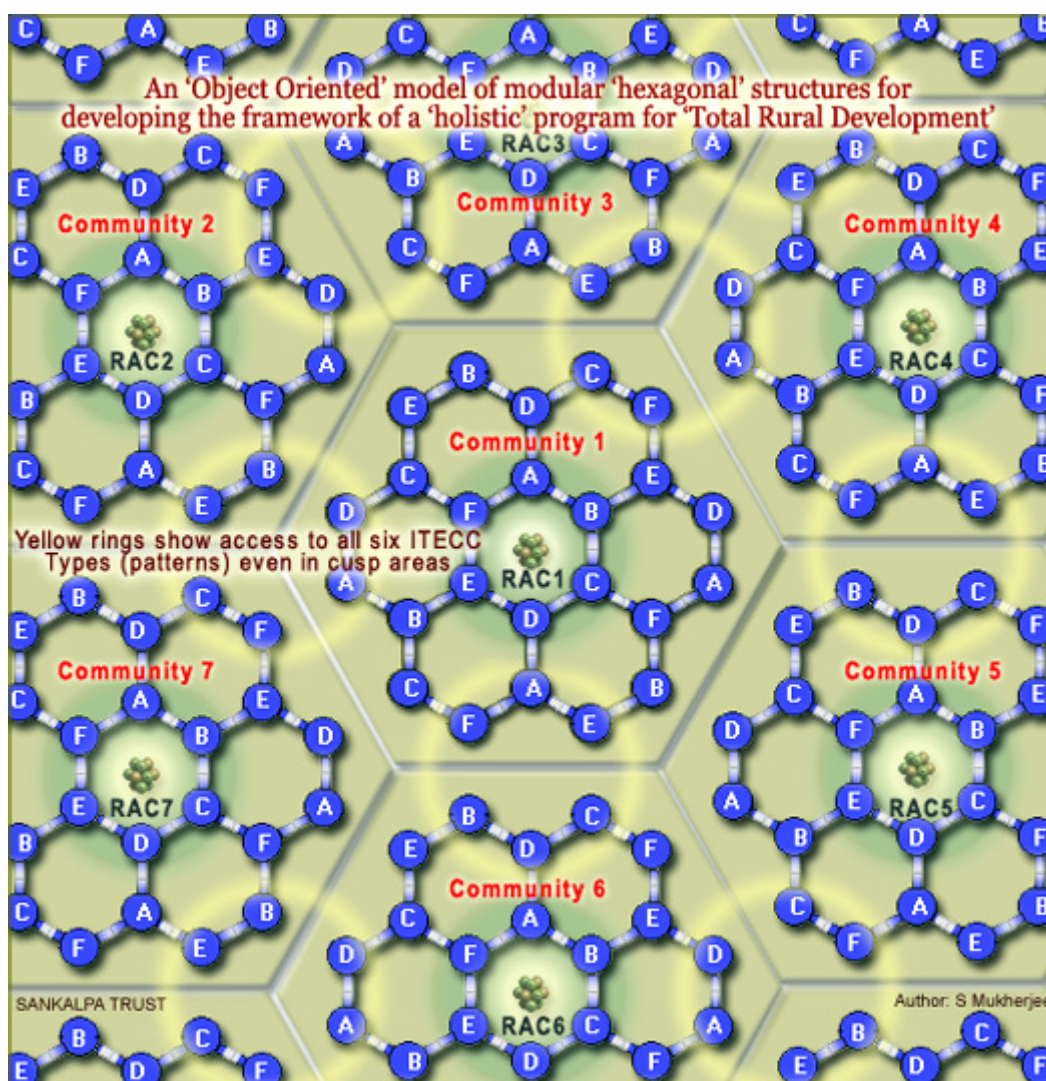


Figure 8: **Object Oriented Model of Modular Hexagonal Structures for TRD.** The ‘Target Community’ in Fig 4 is shown above as the referential ‘Community 1’, with the remaining six communities numbered from 2 to 7, clockwise. The corresponding ‘Rural Access Centers’ are marked from RAC1 to RAC7. The sprinkling of yellow rings shows that the indigent people—even in the peripheral fringe areas between two communities—have access to all six ITECC Types (patterns) ‘A’ to ‘F’. This will ensure a uniform transfer of knowledge-based products and service, and the uniform development of the entire community.

This results in the hexagonal object shown at the center of Figure 8—marked ‘Community 1’, which we will refer to as the ‘RCP Module’. It defines a pattern for ‘Total Rural Development’, which can be reused—and has been reused six more times in Figure 8 above—to produce the regional TRD program, spread over seven such communities, and can theoretically extend to as wide an area as may be needed.

*This is the essence of object orientation—the power of reusability. Once the ‘Domain Expert’ has determined that—at the macro level—the ‘RCP Module’ is the pattern of rural development that can bring entire communities of indigent people out of poverty, then we can reuse this pattern, globally, without having to reinvent the model every time we visit a new, rural place that needs ‘Total Rural Development’.*

Simultaneously—at the micro-level—we need to address the special needs of each community. This aspect has already been stressed in Section 3—for effective participatory development. In terms of the Object Oriented framework briefly described in footnote # 20, these special requirements of each particular village or community can be factored into the object framework as ‘specializations’. This will enable the service delivery to be customized for local conditions.

Superimposed over this general pattern, our ‘Domain Expert’ would also have defined (a) the special attributes of the [RAC + RCP Secretariat] combine at the hub of the ‘RCP Module’; (b) the design features and attributes of the ITECCs and VICs, and (c) the equipment, the special training requirement of GICs, and other details that will be needed for ‘customizing’ a successful TRD program for, say, ‘Community 1’.

In a similar fashion, the ‘specialization’ requirements for all the adjoining communities #2 to #7 can similarly be determined and entered into the object oriented framework.

*To reiterate:* We have therefore used a pattern at the macro level to define the common underlying principle or pattern for developing a TRD program, which will get the indigent people out of poverty. We also have the means to define the special attributes of each community at the micro-level, which must be customized for the TRD Program to be effective, perhaps right down to individual families in villages, and if needed, right down to the level of individual members of the community!

***It must be emphasized here that, whereas this detailed level of planning and execution is not possible with the conventional and traditional methods of monitoring, evaluation and control in the older paradigms of rural development, it becomes immediately apparent that, with the advent of advanced computing hardware, and now with the maturity of object oriented technologies for the development of appropriate software, we can achieve hitherto unimaginable levels of precision in the design, implementation and control of this rural development process. In this new paradigm for rural development, we can truly empower the erstwhile neglected and impoverished indigent people, with modern science and technology, if it is applied appropriately. This is the essence of the new paradigm. Empowerment of ALL indigent people with a human face, keeping the following motto uppermost in our minds, that: the essence of sustainability is morality.***

With this explanation, we conclude our brief and introductory discussion on the analogy between object-oriented technologies in the IT industry and the proposed application of object orientation for total rural development.

Just as there has been a paradigm shift in software development from procedural programming to object oriented programming, we propose that we initiate a paradigm shift from the traditional ‘procedural’ and ‘top-down’ rural development regimes to the modern and object oriented and ‘bottom-up’ technique exemplified by the preceding discussion on object orientation for ‘Total Rural Development’.

### 6.3. Modeling of TRD with UML®

This discussion on the application of object oriented technologies for rural development will not be complete, if we did not also discuss the impact that the Unified Modeling Language™, or UML<sup>22</sup> as it is more well known in the industry, can have in simplifying the modeling and study of rural development initiatives, especially one which is as complicated as TRD.

The fundamental reason to use the UML is to communicate certain concepts more clearly than natural language, which can be imprecise and gets tangled when it comes to more complex concepts. UML permits a certain amount of precision without losing or avoiding the details; and on the contrary, we can use UML to highlight important details.

It is easy to ‘lose sight of the forest for the trees’ on a large project. UML helps planners to acquire an overall view of the system. For example, a look at a ‘class diagram’<sup>23</sup> can quickly tell the planner what kinds of abstractions are present in the system and where the questionable parts are that need further work. Probing deeper, we can see how ‘classes’ collaborate, and that bring on ‘interaction diagrams’<sup>24</sup> that illustrate key behaviors in the system.

With a few choice diagrams in hand, we can find our way around the project much more easily. To build a ‘Road map’ of a large system, we can use ‘package diagrams’<sup>25</sup> to show the major parts of the system and their interdependencies. For each package, we can then draw a class diagram, taking a specification perspective.

These are just a few examples of visual tools to help capture the intricacies of the project and document them for posterity. See Footnote # 22 for information on how one can get more details of this modeling approach.

Patterns help to explain why our project design is the way it is, and can be used to describe the important ideas in the system that appear in multiple places. It is also useful to describe the designs and concepts that have been rejected, and why they were rejected. Usually, in large projects, this kind of crucial information is forgotten, and we end up repeating avoidable past mistakes. UML helps to keep a control on the communication process, make it brief and document it for posterity. An important part of an effective communication strategy is in highlighting the important things, while leaving out the unnecessary or unimportant things.

One of the biggest challenges in the development of TRD is that of building the right system—one that meets the beneficiary community’s needs at a reasonable cost. The communication imbroglio makes this difficult, if our beneficiaries and domain experts talk in a different language. However, achieving good communication, along with good understanding of the beneficiary’s world, is the key to developing a good solution system. With UML, individual ‘use case’<sup>26</sup> diagrams help us to overcome the language barrier in understanding the beneficiary needs. The sum of all use cases provides us with a ‘dynamic’ model of the system, and what it will do.

The goal of any modeling effort is to try to identify a vision that has a good chance of working. The UML-based model is a good starting point, for this. Even if we do not take the next step of using this UML-based model to develop a software approach for design and control of the new paradigm, it is enough that we obtain a mature understanding of our problems and the solutions that we may need.

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<sup>22</sup> OMG™ is an international, open membership, not-for-profit computer industry consortium. The Unified Modeling Language™ - UML - is OMG's most-used specification, and the way the world models not only application structure, behavior and architecture, but also business process and data structure. More details on UML can be obtained from <http://www.uml.org/>

<sup>23</sup> A UML class describes a set of objects that share the same attributes, operations, relationships & semantics.

<sup>24</sup> Shows how several objects collaborate in single use case.

<sup>25</sup> Shows groups of classes and dependencies among them.

<sup>26</sup> A ‘use case’ is a set of scenarios tied together by a common user goal.

#### 6.4. Reusability of internal objects in the ‘RCP Module’

We have reviewed the advantages of reusability of the ‘RCP Module’ in Figure 8. This is at the macro level, where a successful development paradigm can be reused *en bloc*, globally.

However, there are equal, if not greater advantages, to reuse when we consider the internal patterns and objects of the ‘RCP Module’. For instance, there are six types of ITECCs as explained in Sections 4.1 and 4.2. In each of these six types of ITECCs, there will be the same pattern of organizational functions: program management, accounting, M&E, maintenance and so on. Application of object oriented techniques to the design, resource planning and implementation of these 24 ITECCs will not only yield significant cost benefits; it will also contribute to the building of a robust system, that is also better maintainable, which is the principle advantage of modeling techniques<sup>27</sup>.

Model Driven Architecture® (MDA®) <sup>[19]</sup> is an approach to system development, which increases the power of models in that work. It is model-driven because it provides a means for using models to direct the course of understanding, design, construction, deployment, operation, maintenance and modification.

The advantages of applying modeling techniques<sup>28</sup> become even more apparent in the case of (a) ‘Village Information Centers’ (VICs) where there are six to each ITECC, making a total of 144 VICs, and (b) ‘Grameen Information Consultants’ (GICs) which total between 360 and 600, in each ‘RCP Module’. For example, reuse of patterns and objects in the framework for the design and implementation of the training, resource planning and control applications for the hundreds of GICs requires working with only generic packages and substitution of the problem-specific elements for the generic model elements, as appropriate—instead of handling each one a case-by-case basis, in the traditional approach.

The benefits of reusability are reduced implementation time, significant improvement in productivity, increased software quality and test coverage, and localized code modifications when a change is required.

### 7. Monitoring and Evaluation

The object of the M&E programs is to enable project staff to understand how the project is functioning and what programmatic decisions have to be taken throughout the lifetime of the project.

Traditionally, the ‘Logical Framework Analysis’ (LFA) for the project is usually the starting point of the M&E program, which performs the following functions:

- (a) Regular measurement of the performance indicators (based on the LFA);
- (b) The information and data collection mechanism will be established at the various centers, emanating outward from the RAC and terminating at the level of the GICs, who would generate a large amount of very crucial data related to the indigent people. A special effort will be made to conduct PRAs and RRAs at the village level, led by the indigent people—for making the data collection mechanism more robust.

<sup>27</sup> The essence of Model Driven Architecture (MDA) <sup>[19]</sup> is that the creation of an executable software architecture should be driven by the formulation of models rather than by manually writing source code. Source code is generated from the models by a compilation step, much as machine code is generated from source code. The MDA initiative aims to move software development to a higher level of abstraction.

<sup>28</sup> Modeling ensures that the software systems deliver the functionality that the enterprise requires, is comprehensive and stable, and yet able to evolve in a controlled manner as the environment changes over time.

- (c) Staff members at all levels are responsible for data collection and the compilation of metrics. The PRA committees at the village level will be responsible for generating village level data. The GICs will be responsible for data
- (d) The frequency of data collection will meet with standards for data collection, and otherwise be adapted to the particular situation and prevailing need.

Evaluation is essential in any attempt to assess the relative effectiveness of one approach against the other. It provides a feedback on whether the program is adhering to the expected trajectory, and an opportunity for constantly reassessing the performance against the aims and objects of the program. It also allows for the setting of new goals and incorporation of new ideas, as the program rolls on.<sup>[20]</sup>

Most evaluation situations require quantification and measurement while others require qualitative, descriptive and subjective data. A mixed-methods approach is often favored as it leads to a better understanding and appreciation of the items under evaluation and also provides a means for triangulation, convergence and corroboration of results from different methods. The evaluation methodology may be structured as follows:

1. Focus questions
2. Objects or events to be evaluated
3. Data or evidence
4. Analysis and interpretation using judgment perspectives, and
5. Conclusions.

The human resources needed for the M&E program also relates to the discussion on ‘Transfer of Control’ depicted in Figure 6. Trained staff would be engaged at the beginning of the program. The capacity building programs at the RAC and VICs must empower the local, indigent people to upgrade their skills and perform the M&E functions on their own, within a five-year horizon.

We do not yet have any clear ideas how object orientation would impact future M&E regimes.

## 8. Cost of eliminating rural poverty

On the subject of ‘*Cost of Eliminating Poverty Worldwide*’, Dr. Maurice L Albertson says:

*Cost estimates can be made based on the way the VE Model is now operating in India, Nepal, Azerbaijan and Indonesia. This past experience indicates that the Village Earth Model could be carried out for about \$5 per person per year, and it would take about 5 years for each village to become independent of the initial outside support. This means that for a single project of 20 RAUs (one million people) \$5 million per year is needed for about 5 years. Using these estimates of unit costs, and assuming that 4 billion people could be reached during a 20-year period, poverty in the world could be eliminated for a total of about \$100 billion spread over 15 to 20 years-- a small fraction of the present American military expenditures....*

Our own experience leads us to the conclusion that Dr. Albertson’s figure of ‘\$5 per person per year’—which translates to about of Rs.200 per person per year, in India—is a valid conjecture.

In Section 4.1, we have said that each RCP Module will be suitable for between 50,000 and 100,000 people. The timeline in Section 8 indicates that the project will actively continue for about seven years, at a minimum. This translates to the figure of Rs.1,400 for every villager quoted in Section 1.3 and implies that the ‘Present Value’ cost of initiating a seven-year TRD Program for a target community comprising of about 100,000 indigent people will be about Rs.14 Crore (Rs.140 million).

## 9. Project Timeline

The tasks and schedules for implementing the modular ‘hexagonal’ structure for TRD described in Figure 4 and Figure 6 are defined in the following timeline:

#	Activity Description	Time Taken (Years)								
		1	2	3	4	5	6	7	8	
<b>Phase 1: Develop the RAC + RCP Secretariat</b>										
1	Systems development for strategic planning and design	[Preliminary work]								
2	Network mobilization, capacity building and mgmt. systems	[Preliminary work]								
3	Funds mobilization & transparent mgmt. system + accountability	[Preliminary work]								
4	Quality assurance - including M&E, learning and governance	[Preliminary work]								
5	Mechanisms for outreach, policy analysis and advocacy		[Preliminary work]							
6	Build and commission the <b>RAC</b>		[Preliminary work]							
										Publish Monograph - Phase 1
7	Build and commission the <b>RCP Secretariat</b>		[Preliminary work]							
<b>Phase 2: Develop Auxiliary ‘Centers of Excellence’</b>										
8	Build and commission the 24 <b>ITECCs</b>		[Preliminary work]							
9	Build and commission the <b>Village Information Centers</b>		[Preliminary work]							
										Fully Operational RCP
10	Train and operationalize the <b>Grameen Info. Consultants</b>		[Preliminary work]							
<b>Phase 3: Institutionalize the new paradigm for rural development</b>										
12	Build institutional systems and linkages with govt. inst. + PPP									
13	Build & publish replicable model and project closure.									
										Replicable Model & Project Closure

The following are the milestones of a model ‘Rural Convergence Program’:

1. Start of 1<sup>st</sup> Year: Start of ‘Rural Convergence Program’ (RCP).
2. End of 2<sup>nd</sup> Year: Fully functional RCP Secretariat.
3. End of 3<sup>rd</sup> Year: Fully operational ‘Resource Access Center’ (RAC)
4. End of 4<sup>th</sup> Year: Fully functional ‘ITECCs’.
5. End of 5<sup>th</sup> Year: Fully functional ‘Village Information Centers’.
6. End of 6<sup>th</sup> Year: Fully operational ‘Rural Convergence Program’.
7. End of 7<sup>th</sup> Year: Institutionalize the new paradigm and building of PPPs.
8. End of 8<sup>th</sup> Year: Publication of replicable model and project closure.

## 10. Conclusions

The essence of the new paradigm for ‘Total Rural Development’ is—*empowerment of ALL indigent people in the rural areas, with a human face*—keeping this motto uppermost in our minds, that: *the essence of sustainability is morality*.

The ‘Rural Convergence Program’ (RCP) for eradicating rural poverty is a holistic program, with an asset-based and market creation approach for ‘public-private partnerships’ that will provide for sustainable livelihoods and education, with an emphasis on health, energy and shelter security as the primary determinants of sustainable rural development. The attributes comprising ‘environmental’, ‘gender issues’, ‘political’ and ‘infrastructural’ problems result from the inability of the rural people to sue for change, as a result of poor education and knowledge.

An innovative ‘hexagonal’ modular structure has been conceived for the RCP, for equitably distributing the ‘IT-Enabled Community Centers’ around the central ‘Resource Access Center’ (RAC), which has an ‘RCP Secretariat’ that will spearhead the ‘Capacity Building’ and ‘Livelihoods Skills Development’ programs. ‘Village Information Centers’ around each ITECC will support ‘Grameen Information Consultants’ who will help to empower the indigent people to access education through various capacity building programs and ‘soft’ & ‘hard’ technologies, for their own benefit and at their own pace. This ‘hexagonal’ modular structure economizes on the number of physical assets that need to be built in order to reach the indigent people, while providing the villagers with easy access to the knowledge-based products and services that will take them out of poverty.

We have also introduced the idea of process-centric and object orientation for reusability of modular strategies for rural development, taking the analogy of the paradigm shift that has taken place in the knowledge industry over the last two decades, where the ‘procedural’ approach has been displaced by object orientation—leading to less repetitious work and the ability to be strongly modular or structured. The tools of object orientation allow us to develop models, which gives us the means to test the various approaches that have been developed in this paper. The data derived from simulating the performance of these models will provide information and analysis that will be useful for developing future village-based poverty elimination programs.

The ‘Present Value’ cost of initiating a seven-year TRD Program for a target community comprising of about 100,000 indigent people is estimated to be about Rs.14 Crore (Rs.140 million).

### References:

- [1] Suan-Pheng Kam, ‘*The changing paradigm of rural governance for sustainable development: Defining the niche and role of GIS*’, International Rice Research Institute, <[http://www.gisdevelopment.net/proceedings/gisdeco/sessions/key\\_suan.htm](http://www.gisdevelopment.net/proceedings/gisdeco/sessions/key_suan.htm)>
- [2] S. Mukherjee, ‘*The Essence of Sustainability is Morality*’, Sankalpa Publications, August 2005.
- [3] Ashok Khosla, ‘*Innovation and Poverty Eradication*’, Editorial, DA Newsletter, Vol 10 No 9 September 2000.
- [4] Mission 2007: ‘*Every Village a Knowledge Centre*’, M S Swaminathan Research Foundation
- [5] B.G.Banerjee and A.K. Sinha, ‘*Chapter 17: Anthropology and Development: In Search of a Paradigm*’, Anthropologist Special Issue No. 1: 201-212, 2002.
- [6] Susanne D. Mueller, ‘*Rural Development, Environmental Sustainability, and Poverty Alleviation: A Critique of Current Paradigms*’, DESA Working Paper No. 11, ST/ESA/2006/DWP/11, January 2006.
- [7] Mehta, Shiv R, ‘*Rural Development Policies and Programmes*’, Sage Publications India Pvt. Ltd., New Delhi, 1984.
- [8] Ashok Khosla, ‘*The Internet Portal Connecting Rural India to the Global Village - TARA-haat.com*’, DA Newsletter, Vol 10 No 9 September 2000.

- [9] Ashok Khosla, 'Need for a Commission on Sustainable Livelihoods', DA Newsletter, Vol 10, No 2 February 2000.
- [10] Lincoln C. Chen, 'Education, Equity and Security', Kolkata, 2002.
- [11] Ashok Khosla, 'Capacity Building for Innovation', DA Newsletter, Vol 10 No 9 September 2000.
- [12] Maurice L. Albertson, 'The Missing Link For Sustainable Village Development', Village Earth publication.
- [13] Sri Aurobindo, 'The ideal of Human Unity', Birth centenary edition, Vol. 15, page 263.
- [14] 'Using an Asset Base Approach to Identify Drivers of Sustainable Rural Growth and Poverty Reduction in Central America', World Bank LAC Rural Strategy Learning Event, March 25, 2004.
- [15] Dr. Urs Heierli, 'The Market Creation Approach to Development - poverty alleviation as a business for the poor', DA Newsletter, Vol 10 No 10; October 2000.
- [16] S. Mukherjee, 'Why do we need an IT-Enabled Community Center in every Village in India?', Powerpoint presentation, <ITECC-070517.ppt>, May 2007.
- [17] 'The Hexagonal Diamond (Lonsdaleite) Structure'; <<http://cst-www.nrl.navy.mil/lattice/struk/hexdia.html>>
- [18] Martin Fowler, Kendall Scott, 'UML Distilled: A Brief Guide to the Standard Object Modeling Language', Publisher: Addison Wesley, Second Edition, August 18, 1999.
- [19] 'MDA Guide Version 1.0.1', Object Management Group, Document Number: omg/2003-06-01, 12th June 2003
- [20] Oto J. Okwu, C. P. O. Obinne and O. N. Agbulu, 'A Paradigm for Evaluation of Use and Effect of Communication Channels in Agricultural Extension Services', J. Soc. Sci., 13(1): 31-36, 2006.
- [21] Amartya Sen, 'Education and economic growth: The three Rs as levers of change'; First appeared in The Statesman on Wednesday, 26 August 1964, and reprinted in 'Perspective' dated October 19, 1998; page 9.
- [22] Amartya Sen, 'Education is the cradle of economic success'; Excerpts from an interview during a visit to Calcutta, published in The Telegraph on 15th October, 1998; front page.
- [23] Amartya Sen, 'Undue sacrifice of primary education'; First appeared in The Statesman on Wednesday, 19 April 1967, and reprinted in 'Perspective' dated October 21, 1998; page 9.

**Appendix 1****Participatory Approach to Rural Development**

Village Earth's model is a bottom-up participatory approach that catalyzes the development of community-based organizations, so that local residents can visualize and implement what they want in their communities in the future and have access to the necessary resources to improve their neighborhoods and communities. The objectives are: a) leadership development, b) community empowerment, c) organizational capacity building, and d) resource linkages.

Through 'Participatory Strategic Planning Workshops', village community members and organizations are empowered to successfully carry out local improvement projects. Organized groups are encouraged to develop the necessary organizational structures which will allow community members to access the necessary resources for community development projects long into the future.

The Village Earth approach to development can be very effectively applied to the problem of eliminating poverty. The organizational structures and the processes are right at the grassroots of humanity, where the local people organize and plan their own programs to take themselves out of poverty in a sustainable way by means of a "bottom-up" process. They are encouraged to take advantage of pre-existing local knowledge as well as the innate intelligence and ability of the poverty-stricken people, which can guide them towards creating a vision for the future, identifying obstacles that prevent the achievement of this vision, and then developing and implementing plans to remove these obstacles, thereby achieving the vision of a better future. The people do it themselves with the help of the staff of the various centers—Rural Access Center, IT-Enabled Community Center, Village Information Centers and Grameen Information Consultants—which should be accessible and be able to provide access to information, financial services and other resources. Once the villagers have gone through this process, they "identify with" and "own" the solutions.

**Purpose and Objectives of the Village Earth Model**

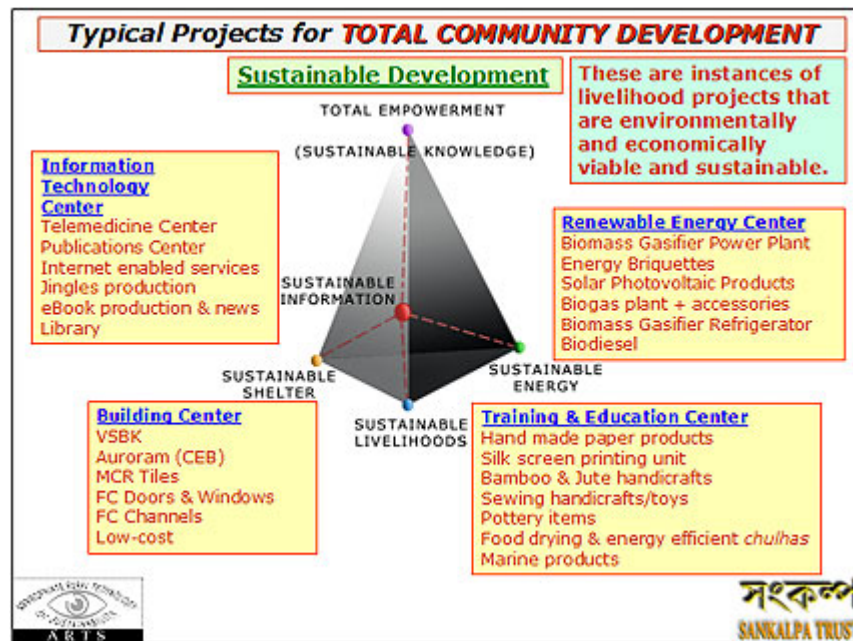
The Purpose of the Village Earth Model is: To address global poverty by bridging the gulf between the two-thirds of the world's population that live in poverty and the technical, financial, social and informational resources enjoyed by the remaining one-third of the population. To accomplish this purpose, the Village Earth Model adopts the following specific objectives:

- (a) Institutionalize a Participatory Orientation
- (b) Make the Necessary Resources Accessible to the Villagers
- (c) Build a Bank of Scientific Knowledge about Sustainable Development
- (d) Establish Global Communication Networks for Poverty Elimination
- (e) Emphasize In-Depth Development of Each Village and Rapid, Systematic Expansion to Other Villages
- (f) Facilitate Hard and Soft Technology Generation from Local Knowledge
- (g) Attract and Generate Indigenous Technical Ability to Rural Areas
- (h) Build a Collaborative NGO Network
- (i) Create a Collaborative Global Village Network

These Objectives are explained in detail in [www.villageearth.org](http://www.villageearth.org).

## Sankalpa’s ‘Pyramidal Model’

Sankalpa’s strategy for working towards total empowerment of rural communities—beginning at the grassroots level in the **IT-Enabled Community Centers of Excellence** in the village nodes and working all the way upwards to the **Resources Access Center**—are based on the pyramidal model for sustainable development, shown below.



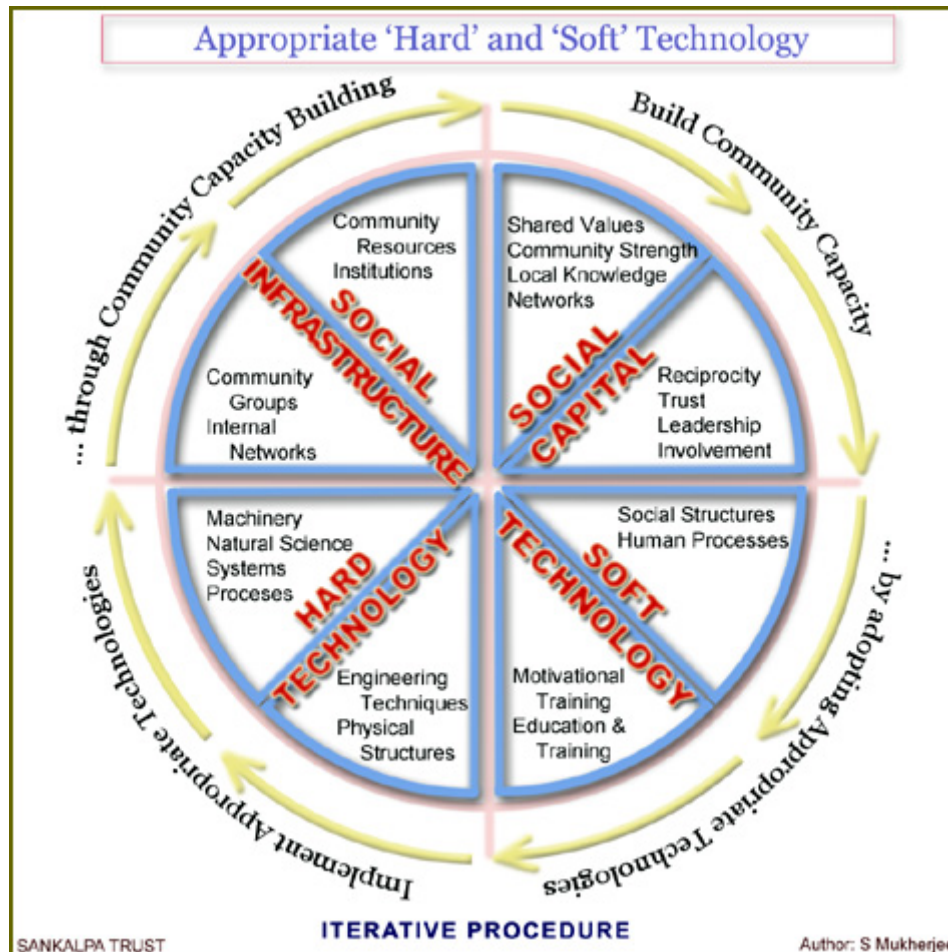
Participatory practices promote total empowerment of rural communities (*‘Sustainable Knowledge’*) through the following **four foundation-level** developmental programs:

1. **Sustainable Livelihoods:** The *‘Training & Education Center’* provides the resources for employment generation through a variety of community and infrastructural development programs, including watershed development, arts and handicrafts, vocational training programs, etc.
2. **Sustainable Shelter:** The *‘Building Center’* provides for eco-friendly shelter products and services, as well as eco-friendly building technologies;
3. **Sustainable Energy:** The *‘Renewable Energy Center’* facilitates dissemination of appropriate technologies for rural electrification and rural household and commercial energy requirements, including biomass-based energy programs;
4. **Sustainable Information:** The *‘Information Technology Center’* provides Internet-based and IT-Enabled Services, and is the focal point for continuous improvement, dissemination of appropriate technologies and sustainable development.

*It is believed that, besides poverty elimination, the ultimate goal of achieving the overall socio-economic development of rural communities, including primary education, health and hygiene, social networks, human rights, gender equality and social equity will be possible after these four foundation-level developmental programs have been firmly established and sustainably actualized in the target rural communities.*

## Appropriate ‘Hard’ and ‘Soft’ Technology

Appropriate technology addresses a need by providing a solution that fits the village resources and goals within the local culture. “*Appropriate technology is the skills, knowledge and procedures for making, using and doing useful things, while making optimum use of human, natural, and person-made resources in the village -- with ‘optimum’ determined on a village-specific basis by the villagers themselves.*”



“Hard technology” describes an operable and mechanistic system that is derived from knowledge of natural sciences. It relates to the skills, tools and rules that are employed by people to alter, accommodate and manage nature for human survival and development. On the other hand, “soft technology” is derived from knowledge of the social sciences and non-natural science. It is based on the common laws or experiences in economic, social and humanistic activities, and organically generates its own rules, mechanisms, means, institutions, methods and procedures that contribute to the improvement and control of its environment and surrounding community.

Hard technology does not stand-alone. “Appropriate hard technology relates to engineering techniques, physical structures and machinery that meet a need defined by the village, and use materials at hand or readily available.”<sup>29</sup> Hard technology must be surrounded by appropriate

<sup>29</sup> “Tandem Use of Hard and Soft Technology: An Evolving Model for Third World Village Development”, by Audrey Faulkner and Maurice L. Albertson, Int. Journal on Applied Engineering Education, Vol. 2, No. 2.

soft technology, such as social and organizational structures, human interactive processes, motivational techniques and a wide variety of education and training programs. Soft technologies are now considered to be vital for the success of hard technologies.

It is this combination of hard and soft technologies that enable communities to successfully implement capacity building and community development programs, which fuels the continual redevelopment of newer and better forms of appropriate technologies. This is '**Continuous Improvement**' at its best.

## Theory of Analogy

An analogy is a comparison of two things that are similar in some way, but otherwise not alike. The two things have shared characteristics (similarities) and unshared characteristics (differences). An analogy compares a familiar or known concept (the analog) to a less familiar or unknown concept (the target). The term analogy, used in its specific sense, denotes an explicit comparison of the elements of the analog and target. To propose an analogy, or simply to understand one, requires taking a kind of mental leap. A successful analogical reasoning process requires a map or transfer appropriate characteristics from the known identity to the unknown identity in one-to-one correspondences.

For example, a person makes sense of the analogy that relates an atom to our solar system by recognizing the shared central location of a nucleus and sun respectively. Likewise, a person sees a shared similarity in location of the electrons that circle the atoms nucleus and the location of the planets circling the sun. These mappings involve one-to-one correspondences between the nucleus and the sun and between electrons and planets. This analogy uses the more familiar planetary system as an analog to help explain the less familiar atomic structure.

A simile is basically a metaphorical comparison that uses the words “like” or “as” in its statement. For example, the metaphor “*A cell is a city*” can be converted to a simile by adding the word “like”. The explanatory power of the expression: “*A cell is like a city*” is not revealed until explicit points of comparison of a cell (the target) and a city (the analog) are delineated. For example, there is a metaphorical correspondence between a power plant generating energy for a city and the mitochondria of a cell generating energy for that cell. Another possible one-to-one correspondence match is a city government and a nucleus based on their shared role of controlling what happens in a city or cell respectively. Such clear mappings of one-to-one correspondences between the analog and the target are essential for effective use of analogical scientific explanation. This analytical mapping does not deny the aesthetic appeal of a metaphorical expression. Even before students map cell organelles to parts of a city in one-to-one correspondence, they may enjoy thinking of the cell’s functioning in terms of a city’s hustle and bustle.

### Kinds of Analogies

A domain is a broad field of knowledge. In analogizing, the two things compared may be drawn from the same domains (within-domain) or from different domains (between-domains). An example of a within-domain analogy is using a solution to a particular chemistry problem to serve as a model for solving a similar chemistry problem. An example of a between-domain analogy may be taken from the history of science. The structure of an atom (from the domain of physics) was first compared to our solar system (from the domain of astronomy) in that electrons revolve around the nucleus of an atom as planets circle our sun.

Analogies may require more critical thinking to identify how two things drawn from different domains may be said to be alike. For example, it may be challenging to find links between a city and cell structure to support the analogy: “*A cell is like a city*”. It takes time to decipher how it is possible to call a cell a city. It may be easy to map the city limits to the concept of the cell membrane, since both entities define boundaries and must be passed through by anything entering or leaving. However, it is more difficult to match the ribosomes or endoplasmic reticulum of a cell to appropriate parts of a city. But as each part of a cell is matched to a correlate in a city (e.g., endoplasmic reticulum and the city’s highway system), the analogy becomes a powerful explanation for cell structure and function.

The challenge to analogical reasoning relates to the accessibility of the similarity that must be recognized along the continuum from the almost literal to the metaphorical or simile. In the case of the analogy: “*A cell is like a city*”, the similarities are deeply embedded. Ultimately, the similarities between the two things compared in any analogy must be meaningful to the thinker.

### **Analogizing Processes**

The essential processes required for analogizing are: selection, mapping, inference, evaluation, and learning. A familiar analog is selected or chosen as an analogical source of enlightenment regarding the target concept. The shared characteristics or similarities are mapped from the analog to the target. At the same time, unshared characteristics or dissimilarities are noted. Inferences about the target are made based on this comparison and contrast of analog and target. These inferences are evaluated or judged for their efficacy in explaining the target. Ultimately, the thinker gains a better understanding of the unfamiliar target concept through analogical thought.

**Selection** of a familiar thing, an analog to help explain a less familiar thing—a target—is a difficult task. Each person has a different knowledge base and different life experiences, which together determine the quality of familiarity in a potential analog. Selections should therefore be based on identification of fruitful linkages, or similarities, between the analog and target. These similarities must be mapped from the analog to the target.

**Mapping** transfers descriptive attributes, conceptual relations, or both from the analog to a target. In some analogies, the two things compared may share similar descriptive properties perceived by the senses. For example, a plant cell may be compared to a box on the basis of a similarity in shape. In such an analogy, a shared characteristic of the objects is highlighted. Identification of such perceptual surface properties of the analog and target may be useful in building meaning.

An **inference** is part of the analogizing process. The analogy seeker somehow must use what she knows to reason from an initial guess or surmise to a conclusion based on what she knows or researches. From this perspective, inference is a process essential to and incorporated into the steps of selection, mapping, and evaluation.

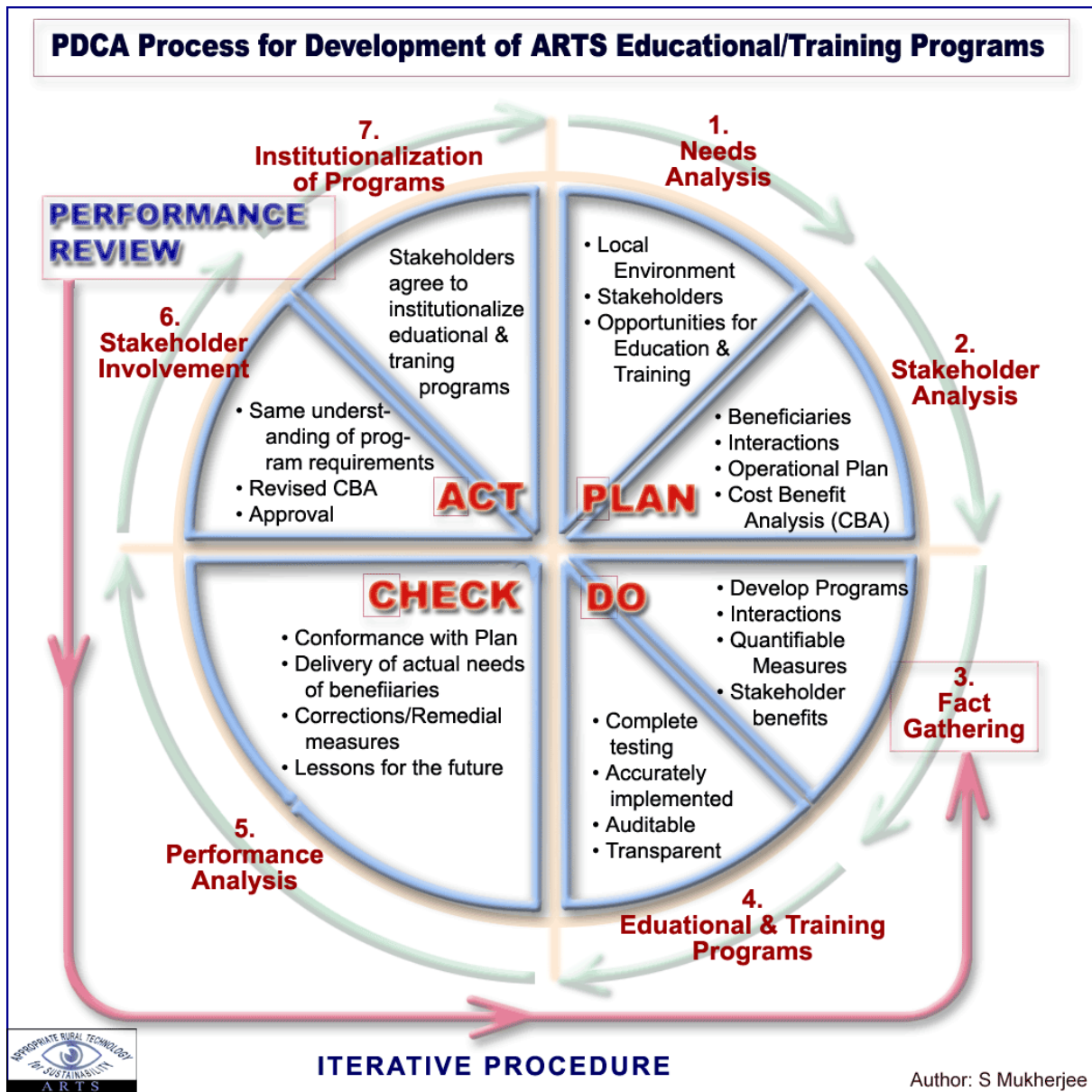
**Evaluation** relates to the efficacy of inferences made and their usefulness in understanding the targeted concept. It is important for the thinker to judge the learning potential of the analogy, since it is possible for analogical reasoning process to lead the thinker to a wrong conclusion.

**Learning** evolves from the dynamic processing of prior knowledge and novel concepts. From the start, the learner feels empowered by her understanding of at least half of the analogy—the familiar analog. She also accesses prior knowledge within the targeted domain to help her learn the new target concept. Eventually, the learner takes full ownership of the target concept and no longer uses the analog as a prompt for understanding.

#### References:

- [A4.1] Hackney M W and Wandersee J H, *The Power of Analogy*.
- [A4.2] O. Kolditz, W. Wang, J. de Jonge, M. Xie, and S. Bauer. A process-oriented approach to compute the problems in porous media - part 1: Theoretical and informatics background. In T. Schanz, editor, *Unsaturated Soils: Numerical and Theoretical Approaches*, pages 53–66. Springer, 2004.

**Cyclical Procedure for Continuous Improvement in Design and Dissemination of Sankalpa/ARTS Educational & Training Programs**



Note: Details of the above procedures will be made available on request

**Excerpt of quotations from Professor Amartya Sen:** <sup>[21][22][23]</sup>

“ ... Our industrial productivity is still low, but there is no doubt that the essential process of learning to grow into an industrial civilization has already begun in the Indian economy. But in agriculture we are still far behind even the first stage of learning. Agricultural productivity per acre remains dismally low, much lower than even in other Asian countries, not to mention countries further away from us.

The two problems that make such a mess of our agriculture are poverty of material inputs and the inefficient systems of ownership and cultivation. There is no dearth of labor, and for the same reason there is little need for laborsaving equipment like tractors and threshing machines.

But there is need for water where water is scarce, and the need for fertilizers and pesticides is perhaps even greater. That this requires a massive expansion of industries which provide material inputs to agriculture is obvious.

What is more difficult to see, though no less true, is the link between all this and the peasants' education, motivation and skill. There have been cases where even the small amounts of modern inputs for agriculture that we produce today have not been properly used. And when we start producing these commodities on a massive scale, as we must very soon, the wastage may increase many times.

There is an ever closer link between the two aspects, given the nature of the Indian political economy. Governed by day-to-day political pressures, the government has shown itself ready to give its full attention to a problem only when there has been a strong public clamor for it. The peasants' lack of motivation and interest in demanding modern inputs has contributed considerably to official lethargy in this field.”

\* \* \* \* \*

“ ... Our lack of emphasis on elementary education has cost us much. Our relative success in the industries and failure in agriculture are not unrelated to our success in expanding secondary and higher education rapidly, and failure to achieve satisfactory expansion in primary education, especially rural primary education.”

\* \* \* \* \*

“ ... While it is often pointed out, correctly, that literature is only a small part of education, it does not seem to be adequately recognized that it opens up other possibilities of education in a way nothing else does. The complaint is often heard that the Indian rural youth who is lucky enough to learn his letters forgets them rapidly once he leaves school. This is not surprising, for there is very little literature today in India that a rural youth can easily get a hold of and that he can read with interest and profit.

It is not sufficient to leave the rural boy with some knowledge of letters and a couple of boring textbooks indicating the position of the cat on the mat. In all countries where the rapid spread of rural education has been achieved, discussions on vital political, economic and social questions have played an important part.

This is true not only of Communist countries but also of others such as the UAR. A more purposive educational policy can bridge a vital gap in the Indian rural community. If the peasant does not use much fertilizer because he is suspicious of it, and does not make full use of the irrigational facilities because he does not have permanency in the land he cultivates, expansion of rural education can play a vital part in solving these problems.

Amartya Sen, *Education and economic growth: The three Rs as levers of change*; First appeared in *The Statesman* on Wednesday, 26 August 1964, and reprinted in *Perspective* dated October 19, 1998; page 9.

**Glossary:**

*Explanation of terms in TRD—‘New Paradigm’*

**Asset:** A resource having economic value that a microentrepreneur owns or controls with the expectation that it will provide future benefit.

**Biodiversity:** The variety of ecosystems and living organisms (species); the totality of genes, species and ecosystems in a region.

**Capacity building:** Efforts aimed to develop human skills or societal infrastructures within a community or organization needed to reduce the level of risk; includes development of institutional, financial, political and other resources, such as technology at different levels and sectors of the society.

**Coastal ecosystem:** The coastal zone represents transition from terrestrial to marine influences, and vice-versa; comprises not only shoreline ecosystem but also upland watersheds draining into coastal waters & the near shore sub-littoral ecosystems influenced by land-based activities.

**Community Center (CC):** CCs change the power structures and remove the barriers that prevent people from participating in the issues that affect their lives.

**Community development:** Building active and sustainable communities based on social justice and mutual respect.

**Conflict management:** The ability to manage conflict effectively.

**Conservation:** The management of the present human use of the biosphere, to yield the greatest sustainable benefits while meeting the needs and aspirations of future generations.

**Convergence:** A representation of common ground between theories or phenomena; cooperation among various NGOs and civil society organizations to deliver the best possible community development services to large, village-based beneficiary communities, using a variety of delivery systems to reach the widest possible audience.

**Domain expert:** Or subject matter expert—is a person with special knowledge or skills in a particular area.

**Ecosystem:** A community of plants and animals (including humans) interacting with each other and the forces of nature. Balanced ecosystems are stable when considered over the long term.

**Environmental resources:** Parts of nature that that human-kind considers to be useful or valuable

**Framework:** A set of assumptions, concepts, values, and practices that constitutes a way of viewing reality; the underlying structure.

**Gasification:** Conversion of solid or liquid fuel into combustible gas.

**Grameen Information Consultants (GICs):** Village-based personnel are the link between the IT-Enabled Community Center and the beneficiary village community members, with whom they deliberate, seek information or give advice on commercial terms.

**Greenhouse gas:** A gas that traps heat from the sun causing the Earth’s atmosphere to warm up (eg carbon dioxide or methane).

**Grid:** The system of transmission cables that is used to transport electricity around the country.

**Holistic:** Sometimes spelt ‘wholistic’—relates to or is concerned with wholes or with complete systems rather than with the analysis of, treatment of, or dissection into parts

**Hub:** A focal point around which events revolve; a center around which other things revolve or from which they radiate; a focus of activity, authority, commerce, social development.

**Human development:** A complex concept of development, based on the priority of human well-being, and aimed at ensuring and enlarging human choices which lead to equality of opportunities for all people in society and empowerment of people so that they participate in—and benefit from—the development process.

**Indigent:** Describes the poor, needy, impoverished and disadvantaged people who live in the villages; they lack food, clothing, and other necessities of life because of poverty.

**Information and communications technology (ICT):** Information technology (IT) or information and communication technology (ICT) is the technology required for information processing. In particular the use of electronic computers and computer software to convert, store, protect, process, transmit, and retrieve information from anywhere, anytime.

**Institutional overheads:** Fixed costs of running an organization, indirect costs; facilities and administrative costs; infrastructure and service costs.

**IT-Enabled Community Centers (ITECCs):** They integrate traditional knowledge with modern communication science—principally the Internet—and ‘Appropriate Technology’ for social empowerment and sustainable development.

**Livelihoods Skills Development:** To mainstream institutional support and capacity building for existing & new civil society organizations i.e. networks and federations of self-help groups (SHGs) in villages, so that they can drive the participatory formation of a replicable model of rural livelihood skills training & economic opportunities development.

**Maintainability:** A measure of the ease with which changes necessitated by new requirements, error corrections, new environments & enhancements may be introduced into a product.

**Market:** A social arrangement that allows buyers and sellers to discover information and carry out a voluntary exchange of goods or services; the location where goods are traded.

**Microenterprise:** A type of small business; a business having 5 or fewer employees; typically have no access to the commercial banking sector; microfinance institutions are their common sources of funding, particularly in the Third World.

**Modifiability:** The extent to which the object itself facilitates the incorporation of changes, once the nature of the desired change has been determined.

**Model:** A schematic description of a system, theory, or phenomenon that accounts for its known or inferred properties and may be used for further study of its characteristics; a hypothetical description of a complex entity or process.

**Modular:** Designed with and composed of standardized units or dimensions, as for easy assembly and repair or flexible arrangement and use.

**Monitoring and Evaluation:** A management tool that is built around a formal process for evaluating performance and impact using indicators that help measure progress toward achieving intermediate targets or ultimate goals. Monitoring systems comprise procedural arrangements for data collection, analysis and reporting.

**Morality:** The quality of being in accord with standards of right or good conduct; a system of ideas of right and wrong conduct.

**Organic farming:** In order to be labeled “organic” a product, its producer, and the farmer must meet stringent organic standards and must be certified by an approved food-certifying agency. Organic foods cannot be grown using synthetic fertilizers, chemicals, or sewage sludge, cannot be genetically modified, and cannot be irradiated.

**Pattern:** A pattern is a model or set of rules which can be used to make or to generate things or parts of a thing, especially if the things that are generated have enough in common for the underlying pattern to be inferred or discerned, in which case the things are said to exhibit the pattern.

**Paradigm:** A set of assumptions, concepts, values, and practices that constitutes a way of viewing reality for the community that shares them, especially in an intellectual discipline; an example serving as a model or pattern.

**Policy:** A plan of action adopted by an individual or group

**Public-Private Partnerships (PPPs):** A variation of privatization in which elements of a service previously run solely by the public sector are provided through a partnership between the government and one or more social/NGO or private sector organizations. Unlike a full privatization scheme, in which the new venture is expected to function as a private business, the government continues to participate in some way.

**Puissant:** Powerful; mighty; potent.

**RCP Secretariat:** The officials or office entrusted with administrative duties, maintaining records, and overseeing or performing secretarial duties of the international organization for the *‘Rural Convergence Program’*

**Renewable energy:** The term used to cover those energy flows that occur naturally and repeatedly in the environment and can be harnessed for human benefit. The ultimate sources of most of this energy are the sun, gravity and the earth’s rotation”.

**Resource Access Center (RAC):** Centrally coordinates the human development models and dissemination of information and the application & implementation of various ‘soft’ and ‘hard’ technologies, in order to bring the fruits of development to the targeted village community members, irrespective of gender, age or creed.

**Reusability:** The extent to which a module can be used in multiple applications (*IEEE Standard Glossary of Terms*)

**Risk:** The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.

**Rural:** All land areas that are not urban.

**Rural Convergence Program (RCP):** A planned, coordinated group of activities and procedures for realizing a *convergence* in a number of *rural development paradigms*.

**Rural development:** Improving the physical, economic and social conditions of people living in the open countryside and in coastal areas; a process leading to sustainable improvement in the quality of life of rural people, especially the poor; the process of strengthening the ‘liveability’ in rural areas according to the quality of life and landscape identity;

**Shelter Technologies:** The specific methods, materials, and devices used to build structures that provide privacy and protection from danger to rural households, in this instance.

**Socioeconomic program:** A planned, coordinated group of activities and procedures to deliver social and economic impacts on any product or service offering, market intervention or other activity on a rural economy—in this instance—and on the companies, social organizations, NGOs and individuals who are its main economic actors.

**Specialization:** Allows you to define new kinds of information—new structural types or new domains of information—while reusing as much of existing design and code as possible, and minimizing or eliminating the costs of interchange, migration, and maintenance.

**Structure:** The way in which something is arranged or organized; the way in which parts are arranged or put together to form a whole.

**Sustainable agriculture:** Sustainable agriculture is a way of raising food that is healthy for consumers and animals, does not harm the environment, is humane for workers, respects animals, provides a fair wage to the farmer, and supports and enhances rural communities.

**Sustainable development:** Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of “needs”, in particular the essential needs of the world’s poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment’s ability to meet present and the future needs. (*Brundtland Commission, 1987*)

**Sustainable livelihoods:** A work opportunity that gives (a) a decent income; (b) some status in society and (c) some dignity and meaning in life; it provides opportunities for people to work in their own community instead of migrating to the slums of a big city.

**Technology:** The scientific method and material used to achieve a commercial or industrial objective; the practical application of science to commerce or industry.

**Total Rural Development:** A development strategy aimed at providing every indigent person with ever-increasing opportunities for a better life; to expand and improve facilities for education, health, nutrition, housing and social and cultural well-being, while substantially reducing racial, ethnic and social inequalities.

**Village Information Center (VIC):** A microcosm of an ITECC, complete with IT-enabled services for knowledge and information dissemination of ideas, products and service that are most relevant to the immediate rural community.

**Vocational training:** Training for a particular occupation, business, or profession in industry or agriculture or trade.

**Watershed:** The land area from which water drains to a given point.

**Water table:** In a shallow aquifer, a water table is the depth at which free water is first encountered in a monitoring well.

**Work plan:** Describes the technical, social, management and other activities to be conducted during the various phases of a project; it is a living document that defines co-operations between project partners to help them reach common goals.