Urban Microenterprises using Appropriate Technology Principles

Carl A. Erikson, Jr., Robert A. Kilmer
Messiah College

Introduction

Greater than 50% of the world's population of 6.1 billion people live in cities[1]. By the year 2020 it is estimated that 65% of the world's population of 8.1 billion will live in cities[2]. Basic subsistence requirements of food, shelter, energy, jobs, and medical services for these urban areas will be greatly needed. What can we do to assist the multitudes of needy people around the world?

Appropriate Technology(AT) principles, normally associated with Third World and rural areas, can be successfully applied in urban areas to help urbanites help themselves by developing microenterprises which will assist in sustaining their families. Appropriate technologies are "local, self-help, self-reliant technologies that local people themselves choose, which they can understand, maintain, and repair. They are generally simple, capital saving, labor enhancing, and culturally acceptable. Ecologically, appropriate technologies are environmentally sustainable, as much as possible using renewable energy, and limiting atmospheric, chemical, and solid waste pollution."[3] These principles can be taught and concretely demonstrated to urbanites so they catch a new vision for their own future.

Importance of the City to the Survival of Our Planet

The way we grow and maintain our cities in the 21st century will either allow our future generations to enjoy a great quality of life or will cause great harm to their chances of basic survival. The following gives us an insight on how important cities are to our survival.

> "For thousands of years, cities have existed apart from nature. Why should we begin now to think of cities in terms usually reserved for the natural environment?
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> The fact is, in the world that we've created for ourselves, cities occupy pivotal positions, for better or worse, in the patterns of global ecology. This becomes clear when we put aside our standard images of cities and consider their ecological functions.
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> Cities of the industrial era have consciously excluded natural processes, substituting mechanical devices made possible by intensive use of fossil fuels. Rather than using the solar energy continuously falling on their streets and buildings, they dissipate it as excess heat. At the same time, they import immense quantities of concentrated energy in various forms, most of it derived from petroleum coaxed from the ground in distant landscapes.
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> They rush the water falling upon their roofs and streets as rain out through concrete pipes and channels into the nearest bay or river and, at the same time, bring water in from distant landscapes through similar concrete channels.

From outer landscapes, too, they import nutrients in the form of food, use it once, then send it out through pipes as sewage waste."[4]

If local governments can become effective planners and plan implementers concerning our cities, then the following quotation may indicate one way we can protect our planet and its natural resources as well as its inhabitants:

"If we concern ourselves with the materials of primary life support – water and nutrients– the medium for recycling in the city, as in nature, is the landscape. In cities of the future, the working landscape becomes the unifying, integrating network of urban form, rather than a decorative addition as in the industrial city.

The urban landscape collects water when it rains and holds it in ponds or tanks for future use or allows it to infiltrate slowly into underground storage. Thus, the surface will be sculpted with swales and retention ponds, some holding water through the year, some usually dry.

The working landscape also processes water – both sewage and water polluted by contact with roofs or streets – filtering it through plants in ponds and wetlands. Plants and microorganisms assimilate nutrients and other materials, recycling them through the landscape and in many cases eliminating the need for a mechanical treatment system.

The same working landscape that filters, assimilates and stores water and nutrients also serves to filter, cool, and direct the flow of air. Masses of trees are located around heavily traveled streets, industrial plants, and other sources of air pollution, where they assimilate some pollutants, such as carbon dioxide, and produce oxygen. They also create micro-climates within the city.

Food production also becomes an important part of the urban landscape. Just how great the potential for growing food actually is remains a question, but the examples of Chinese cities show that urban farms can produce a great deal of food. And certainly the biomass produced can be used in a great many ways – for composting, for energy, and for making other products."[5]

Systematic Process

The following anonymous story illustrates one way that problems can be solved.

The only survivor of a shipwreck was washed up on a small, uninhabited island. He prayed feverishly for God to rescue him, and every day he scanned the horizon for help, but none seemed forthcoming. Exhausted, he eventually managed to build a little hut out of driftwood to protect him from the elements, and to store his few possessions.

But then one day, after scavenging for food, he arrived home to find his little hut in flames, the smoke rolling up to the sky. The worst had happened; everything was lost. He was stunned with grief and anger. "God, how could you do this to me!" he cried.

Early the next day, however, he was awakened by the sound of a ship that was approaching the island. It had come to rescue him. "How did you know I was here?" asked the weary man of his rescuers. "We saw your smoke signal," they replied.

It is easy to get discouraged when things are not going well. It is easy to give up and rely upon a miracle to save us when the situation looks grim. However, as the saying goes and as the story illustrates, "God helps those who help themselves." In the real world, as in the story, there are times when a lone individual is faced with short and long term problems and they appropriately focus almost all of their energy on solving the most urgent problem. In urban settings it is more likely that there are groups of people struggling to solve a multitude of problems. Getting people to agree on priorities of problems let alone the solutions can be extremely difficult.

As a result, a simple straightforward systematic approach is necessary. One such approach is systems analysis which has been defined as: "The diagnosis, formulation, and solution of problems that arise out of the complex forms of interaction in systems, from hardware to corporations, that exist or are conceived to accomplish one or more specific objectives. Systems analysis provides a variety of analytical tools, design methods and evaluative techniques to aid in decision making regarding such systems." [6]

Systems analysis has typically been used to solve large-scale complex problems in an explicitly formal process using sophisticated techniques such as linear programming. Engineers may be familiar with the tools and techniques of systems analysis from systems engineering or industrial engineering. Today, because of the rapid growth in computer technology and the widespread use of the term "systems analyst" in the computer industry, most people associate systems analysis with computers and information systems. However, the basic concepts of systems analysis are applicable and quite useful for anyone facing difficult problems involving a variety of people and things.

There are three basic concepts from systems analysis that would be particularly useful in developing urban microenterprises using appropriate technologies. The first concept is to identify all of the stakeholders (i.e., the people that could be impacted by the urban microenterprises) and include them where and when appropriate in the process of creating the urban microenterprises.

The second concept is to use "systems thinking." Basically in this context it means to think about an urban microenterprise as a system. A system is "a set of elements or components that interact to accomplish goals." [7] A system is contained within an environment and can have subsystems and be part of larger super-systems. Due to synergistic effects, the sytem as a whole is larger than just the sum of its parts. Systems have life cycles, ranging from conception to destruction. Systems have inputs and outputs. A particularly useful tool for understanding a system, and communicating that understanding to others, is an Input/Output flow diagram that shows the relationships between a system, its subsystems and its environment.

The third concept is that complex problems involving a variety of stakeholders require an up-front agreed upon problem solving strategy. While there is no one strategy that will be appropriate for all situations [8][9][10], most systems analysis problem solving strategies involve a series of steps. It is widely accepted that the process is an iterative one that quite frequently requires repeating earlier steps as additional information becomes available in successive steps. The following steps outline a generic systems analysis problem solving strategy:

1. Identify the problem to include constraints (i.e., restrictions) on solving the problem.
2. Clearly articulate the problem, including objectives and criteria for measuring accomplishment of the objectives.
3. Develop alternative solutions to the problem.
4. Evaluate alternative solutions according to the costs, benefits, and risks for best achieving the objectives within the established constraints.
5. Select and implement the preferred solution.

6. Monitor the situation and make improvements to the solution.

Systems analysis training is not necessary for understanding or using these three fundamental concepts from the field of systems analysis. For a particular situation with a given set of circumstances the following types of enterprises are potential components of alternative system solutions.

Types of Microenterprises

Using the systems analysis approach and the concepts of Appropriate Technology, urbanites with minimum training and some capital investment can begin microenterprises such as those listed below:

Related to food preparation or processing

- Grain grinding - use of mill with DC motor and photovoltaic source or use bicycle/human powered mill
- Baking/bakery - with solar ovens
- Solar drying - Vegetables, fish, snacks such as peanuts or local treats, coffee
- Aquaculture - growing tilapia, trout, or catfish to supply local restaurants and individuals
- Hydroponics - growing vegetables such as tomatoes and lettuce to supply local restaurants and individuals
- Urban agriculture - use of roof tops, concrete/asphalt areas, community gardens

Related to mechanical handiwork

- Blacksmithing/Welding - bicycle repair, cart/carriage repair
- Woodshop - cutting, lathes, drilling, grinding(sharpening tools) can be human powered to make furniture, toys, etc.

Miscellaneous

- Soap making
- Rainwater harvesting
- Treadle/PV powered sewing machine
- Candlemaking

Proposed Plan for a Demonstrable Vision

Most visions need to be put into “flesh” to see if they can be successful. To do this one proposed plan is to purchase an old or condemned building in the city, develop a sound renovation plan, obtain outside funding, and begin the actual renovation/implementation with specific microenterprises in mind for each floor of the building. Families would be able not only to sustain themselves through their work efforts but also allow other urbanites to buy essential products or services. Given a four-story building, it is estimated that employment opportunities for at least 10 families could be developed; in addition, learning centers, medical clinics and service opportunities would become available, limited only by one’s creativity and desire. The results/success of this

vision becoming real would provide a model for other cities in the USA and around the world.

The initial hardware part of this vision would include a four story building with each floor being developed around a specific theme. For example,

Roof - would have alternative energy producing equipment such as solar heating and photovoltaic panels, wind turbines, and rainwater catchments. Roof-top gardening could be available as well.

4th Floor - Production of vegetables/flowers hydroponically, mushroom growing

3rd Floor - Production of fish(aquaculture) and small animals(chickens initially for eggs/meat); manure used to feed fish and as fertilizer

2nd Floor - Wood working shop for furniture and toys using hand- or leg-powered tools or a small waterwheel powered by falling water from the roof

1st Floor - Small stores and learning centers - fish/meat market, flowers/vegetables market, furniture shop, learning center for day and evening use, non-emergency medical clinic

An expanded vision of many of these integrated microenterprise buildings can be realized if developing countries effectively plan and coordinate their policies for economic growth within urban areas. The following quotation provides some insight.

> "The successful evolution of an eco-city will depend on our developing an understanding of the ecological systems that we live with and how we need to relate to them, and on our willingness to act on that information.
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> Three imperatives will form the basis for eco-city evolution: social justice, prosperity, and a healthy natural environment. These are sometimes viewed as separate and even contradictory, but are now merging in the overarching vision of sustainability.
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> Social justice is the gateway to sustainability. Mutual trust and cooperation between neighbors will be essential. A widening gap between the haves and have-nots and the associated high crime rates would frustrate and retard the evolution of eco-cities.
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> Secondly, an eco-city requires a coalition of businesses capable of responding to, serving, and generating new enlightened consumers. The tasks will include reweaving the urban fabric along ecological lines, and planning and building the new urban infrastructures.
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> These businesses will be synergistic. For example, a gray water plumbing retrofit business needs another business to produce a non-toxic detergent. An electric car manufacturer will want to purchase efficient non-toxic batteries. Energy conservation firms need non-toxic insulation and efficient roof-top solar panels. Organic farmers and gardeners will want to purchase mulch and compost products produced by recycling firms.
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> These eco-businesses will be reinforced by changing consumer preferences and new government policies. An extraction tax for oil, coal, and uranium will favor energy conservation firms and suppliers of solar energy products. Similarly pollution taxes and high fees for landfills, in conjunction with lower taxes on reused and recycled products, will encourage the manufacture of non-toxic and recyclable products. To insure fairness, these policies will have to insure that low-income people are protected from carrying the major share of these extra burdens.
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> The link between the natural environment and human survival, prosperity, and quality of life is a third potent evolutionary force. Environmental destruction is inevitably accompanied by a decline in health and quality of life, and ultimately, a decline in the health of the economy.
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> It is encouraging that the three-stage process of reduction, reuse and recycling is well underway. The first stage of awareness and application of conservation techniques has gained widespread acceptance. The second stage–the creative reuse of what is already built– is in the pilot or demonstration phase. And already on the drawing boards

are plans to recycle existing roads, buildings, and landscapes into quantitatively new forms that will mark the eco-cities' mature stage.

There is a lot of interesting work to do and optimism is warranted. An evolutionary perspective can illuminate the way toward forging of a new urban space, lifestyle, and ethic that harmonizes the heretofore conflicting elements of fairness, prosperity, and ecological survival."[11]

Conclusion

Because the employment needs of a city are best known by the local inhabitants, the ways to meet these needs ought to be left to the local inhabitants to choose and implement. The use of a systems analysis approach will allow these urbanites to select and develop highly successful local microenterprises based on appropriate technology principles. With the population of many cities growing at a tremendous rate, it is essential for these types of models for economic growth to be developed and implemented to solve local problems in a way that reduces the logistics and transportation requirements of the city. The long term survival of their people and their city depends upon it!

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CARL A. ERIKSON, JR.

Carl Erikson is currently Assistant Professor of Engineering at Messiah College, Grantham, PA. He received his B.S.E.E. from Rutgers University and M.S.E.E. from Purdue University, West Lafayette, IN. Since 1990 Mr. Erikson has been interested in and has been promoting the concept of Appropriate Technology through general education and engineering courses. He has worked in Kenya, Bolivia, and Venezuela.

ROBERT A. KILMER

Robert Kilmer is currently Associate Professor of Business Information Systems at Messiah College. He received his BS in Mathematics from Indiana University of Pennsylvania, MS in Operations Research from the Naval PostGraduate School, and Ph.D in Industrial Engineering from the University of Pittsburgh, Pittsburgh PA. Since 1994 Dr Kilmer has participated in a variety of research projects emphasizing multi-disciplinary approaches to solving complex business and engineering problems.