

Visions and Solutions for Chiang Mai Green Development

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Abstract :

This paper describes pragmatic solutions how an urban city could pursue the path of achieving a nearly carbon-free future over the coming decade. The city of Chiang Mai, with about 0.6 million inhabitants, serves as the model. Chiang Mai is in a unique position to pave the way for environmentally friendly lifestyles and economies and to generate solutions that could serve as a model for other provinces, particularly in the northern region of Thailand.

1. Introduction:

The facts are undeniable that climate protection must begin in the cities. Large cities cover only about one percent of the Earth's surface. Yet they consume 75 percent of the world's energy, and they produce 80 percent of the world's greenhouse gas emission- carbon dioxide (CO₂) above all. And the cities are growing. Today, about half of the world's population lives in cities. By 2025, that figure is expected to reach 60 percent. Until now, bustling metropolises around the globe have thrived primarily on fossil fuels like natural gas, coal, and oil. Year after year, the burning of these fuels releases billions of tons of carbon dioxide into the atmosphere^[1].

1.1 What does green mean?

It means, quite simply, concern for life on earth. Not just concern for one's own family or friends, for a community or the whole human race, but concern for the process of life itself and everything that nurtures and sustains that process. One can only care for other people by caring for the earth.

Everything depends on this: our quality of life, our ability to serve others or to fulfill our own potential, the very capacity of the human race to survive. To be green means to have that understanding at the forefront of one's ideas and actions.

1.2 What is "Sustainability"?

Sustainability has many definitions but the basic principles and concepts remain constant: *balancing a growing economy, protection for the environment, and social responsibility, so they*

together lead to an improved quality of life for ourselves and future generations ^[2].

A sustainable society is one that lives within the self-perpetuating limits of its environment. That society is not a "no growth" society - it is, rather a society that recognizes the limits of growth and looks for alternative ways of growing.

1.3 Consumption, population, technology, resources

There is now abundant scientific evidence that humanity is living unsustainably. The overall driver of human impact on Earth systems is the consumption of biophysical resources. Human consumption can be divided into three key components: population numbers, levels of consumption (affluence), and impact per unit of resource use (which depends on the technology used). This has been expressed through an equation:

$$I = P \times A \times T$$

Where: I = Environmental impact,
P = Population,
A = Affluence,
T = Technology

Historically, humanity has responded to a demand for more resources by trying to increase *supply*. Sustainability, instead, applies *demand* management of all goods and services by promoting reduced consumption, using renewable resources where possible, and encouraging practices that minimize resource intensity while maximizing resource

productivity. Careful resource management is applied at many scales, but especially at the levels of economic sectors like agriculture, manufacturing and industry as well as to individual goods and services and the consumption patterns of households and individuals^{[3],[4]}.

1.4 Agenda 21

Agenda for the 21st Century (Agenda 21) sought to establish a concerted effort to educate people about the state of both environment and development, and to assist them to make decisions that lead to sustainability.

Secretary General of UNCED, Maurice Strong, summarized Agenda 21 as, a “*program of action for a sustainable future for the human family and a first step towards ensuring that the world will become a more just, secure and prosperous habitat for all humanity.*”^[4]

Agenda 21 called on all countries of the world to undertake a comprehensive process of planning and action to attain sustainability. In addition to global agenda, this document also detailed a role for cities and counties. Chapter 28 of Agenda 21 (known as Local Agenda 21) states: “*Local authorities construct, operate and maintain economic, social and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations, and ... as the level of government closest to the people, they play a vital role in educating, mobilizing and responding to the public to promote sustainable development*”^[4].

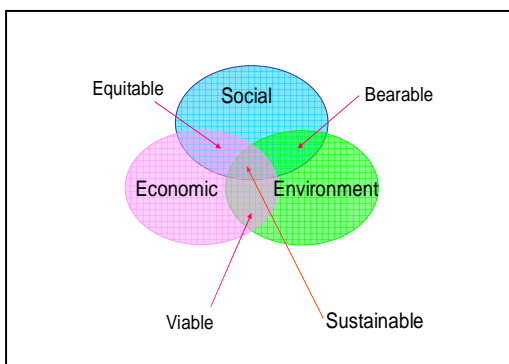


Fig. 1 The three pillars of sustainability^[5]

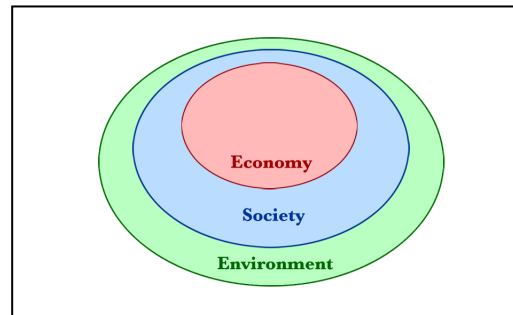


Fig. 2 Another representation of sustainability showing how both economy and society are constrained by environmental limits^[5]

1.5 Climate Change

Global climate change perhaps presents the nations of the world with a potentially unifying sustainability issue as the affects of significant changes in the world’s climate would impact us all. In December 1997, more than 150 nations adopted a historic agreement known as the Kyoto Climate Agreement to protect the earth’s atmosphere and climate. This climate agreement was established in Kyoto, Japan. For the first time, nations agreed to place legally binding limits to their emissions of heat trapping greenhouse gases. There were 38 industrial nations agreed to reduce their emissions of six greenhouse gases to 5% below the 1990 emission levels by the year 2012. A framework for climate change mitigation beyond 2012 was to be agreed in the 2009 United Nations Climate Change Conference, held in Denmark between 7-19 December 2009, commonly known as the Copenhagen Summit.

1.6 Declaration of the Sacred Earth Gathering of Spiritual Leaders at the UNCED Conference, Rio, 1992.

This is another important event which involved participation from not only politicians and scientists but also spiritual leaders.

The followings are excerpts from the Declaration:-

- *The planet Earth is in peril as never before. With arrogance and presumption, humankind has disobeyed the laws of the Creator which are manifest in the divine natural order.*

- *The crisis is global. It transcends all national, religious, cultural, social, political and economic boundaries. The ecological crisis is a symptom of the spiritual crisis of the human being, arising from ignorance. The responsibility of each human being today is to choose between the force of darkness and the force of light. We must therefore transform our attitudes and values, and adopt a renewed respect for the superior law of Divine Nature.*
- *Nature does not depend on human beings and their technology. It is human beings who depend on Nature for survival. Individuals and governments need to evolve “**Earth Ethics**” with a deep spiritual orientation or the Earth will cleanse itself of all destructive forces.*
- *We believe that the universe is sacred. We believe in the sanctity and integrity of all life and life forms. We affirm the principles of peace and non-violence in governing human behavior towards one another and all life.*
- *We view ecological disruption as violent intervention into the web of life. Genetic engineering threatens the very fabric of life. We urge all governments, scientists and industry to refrain from rushing blindly into genetic manipulation.*
- *We call upon all “**political leaders**” to keep a spiritual perspective when making decisions. All leaders must recognize the consequences of their actions for the coming generations.*
- *We call upon our “**Educations**” to motivate the people towards harmony with nature and peaceful coexistence with all living things. Our youth and children must be prepared to assume their responsibilities as citizens of tomorrow’s world.*
- *We call upon our “**brothers and sisters**” around the world to recognize and curtail the impulses of greed, consumerism, and disregard of natural laws. Our survival depends on developing the virtues of simple living and sufficiency, love and compassion with wisdom.*

- *We stress the importance of respecting all spiritual and cultural traditions. We stand for the preservation of the habitats and life-style of indigenous people and urge restraint from disrupting their communion with nature.*
- *The **World Community** must act speedily with vision and resolution to preserve the Earth, Nature and Humanity from disaster. **The time to act is now. Now or never**^[6].*

2. Making Chiang Mai’s Urban Area More Livable and Sustainable

To put sustainability into practice, improving the quality of Chiang Mai Urban life has become an urgent priority for the citizens of Chiang Mai and their local governments. The followings are some ways which various analysts have proposed to make Chiang Mai’s urban area more sustainable:

2.1 Economic Development and Population Regulation

- Maintain employment and plug money drains from local economies by setting up “buy local” programs, greatly improving energy efficiency, and instituting extensive recycling, reuse, and pollution prevention programs.
- Reduce population growth rates
- Reduce the flow of people from rural to the city areas by increasing investments and social services in rural areas.
- Recognize that increased urbanization and urban density is better than spreading people out over the countryside, which would destroy more of the country’s biodiversity. The primary problem is not urbanization, but our failure to make the city more sustainable and livable.

2.2 Land Use and Maintenance

- Encourage well-planned growth to conserve energy, water, land, and wildlife resources; to arrest destructive sprawls; to create more diverse and socially integrated communities; to promote smaller more affordable housing; and to take back the city areas from cars.

- Repair, modernize, and improve the resource use efficiency of existing infrastructures (streets, bridges, housing, water and sewer systems, and energy delivery systems).
- Stimulate the development of ecologically and economically sustainable new towns/or satellite towns
- Rely on comprehensive, regional ecological land use planning and control
- Adopt eco-city rezoning strategies to reshape the city, shrink urban sprawl, and establish ecologically healthy town and city centers.
- Give squatters legal title to land they have lived on, and provide them with support and low-cost loans to improve their communities.
- Plant large members of trees on unused lots and along streets to reduce air pollution and noise and to provide recreational areas and wildlife habitats.
- Establish greenbelts
- Restore degraded natural areas everywhere feasible.

2.3 Transportation

Discourage excessive dependence on motor vehicles with in city's urban areas. Do this by:

- Providing efficient bus service
- Building bike lanes
- Charging single occupant vehicles higher fees for tolls and parking
- Giving businesses tax write – offs for providing employees with transit passes instead of free parking spaces
- Providing tax incentives for individuals and business using car and van pooling or walking or cycling to work
- Establishing car – free zones in downtown areas, with mass transit systems carrying people to and from the edges of these zones

2.4 Improving Energy Efficiency

- Get more energy from locally available renewable resources
- Give tax rebates to businesses and individuals who use gas – sipping vehicles, and impose heavy taxes on those using gas guzzlers.

- Enact building codes that require new and existing buildings to be energy – efficient and responsive to climate.
- Retrofit public buildings to obtain all or most of their energy from renewable sources.

2.5 Water and Food

- Encourage water conservation by installing water meters in all public buildings and raising the price of water to reflect its true cost.
- Establish small neighborhood water – recycling plants.
- Enact building codes that require water conservation in new and existing building and businesses.
- Grow food (with emphasis on sustainable organic methods) in abandoned lots, community garden plots, small fruit – tree orchards, rooftop gardens, apartment window boxes, school yards, and some of the land in greenbelts.

2.6 Pollution and wastes

- Discourage businesses and industries that produce large quantities of pollution and that use large amounts of water or energy.
- Give tax breaks and other economic incentives to businesses that recycle and reuse resources and that emphasize pollution prevention.
- Enact and enforce strict noise control laws to reduce stress from rising levels of urban noise.
- Establish urban composting centers to convert yard and food wastes into soil conditioners and to convert the effluents and sludge from sewage treatment plants into fertilizers for use on parks, roadsides, flower gardens, and forests.
- Recycle or reuse at least 60 % (and ideally 80 %) of urban solid waste and some types of hazardous waste instead of burying it or burning it. Because solid wastes are concentrated in city, collection costs are lower – and recycling and reuse are more efficient – than in less densely populated areas.

3. Wholistic Engineering Approaches for Chiang Mai Green Development

Due to the increasing awareness of environmental, social and economic problems, some engineering and public agencies are becoming more open to new ideas known as wholistic engineering, and in some cases, going back to simple and “old” ways, also known as “traditional or local wisdom”, of doing things.

3.1 What is Wholistic Engineering?

The word “Wholistic” is derived from the word whole. In this context, “whole” means all of something, including all its component, elements or parts, a complete thing. “Wholistic” means relating to a complete and total system or organization of parts fitting or working together as one. A system, which may also exist within a whole system, includes a group of units or method of procedure so combined as to form a functioning whole and operating in unison : an organized whole.

“Engineering” means a science by which the resources and properties of matter and sources of energy are made useful to humankind in systems, structures, machines and products.^[7]

In order to design and implement sustainable solutions, a “whole system” or “integrated design” approach is needed. This requires design professionals, many of which are used to working only on their own little piece of the pictures, to become part of a team that requires the integration of many areas of expertise in order to achieve a sustainable design.

3.2 Relationships:

Wholistic Engineering is all about relationships. There are many challenges facing communities that involve cross-relationships between many kinds of complex components such as: laws and regulations, social concerns, politics, special interests, economic and environmental issues, science & technology, and resources. The implementation of a plan developed with a wholistic engineering management approach gains strength by concurrently evaluating all potential costs and benefits that may relate, either directly or indirectly, to the planned action.

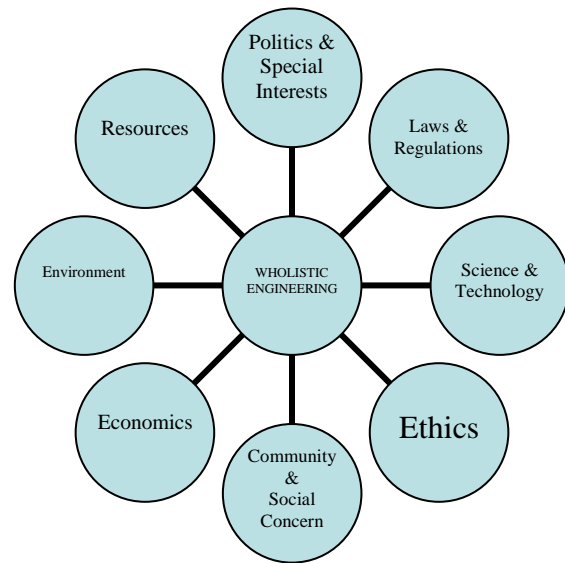


Fig. 3 Wholistic Engineering Approaches^[8].

3.3 “Changes” in Wholistic Engineering Approaches:

As society and human needs change and technology rapidly advanced, it is essential that cities, communities and their surrounding regions respond to and accommodate the evolution. Steps to accomplish this might include:^[8]

- View “changes” as “opportunities”, thereby making current problems beneficial, which leads to new and better solutions.
- Keep plans free and flexible within a creative framework, for example in terms of land use, systems of movement and services.
- Modify and improve plans when new technologies emerge or new opportunities present themselves
- Encourage freedom of choice and innovative design.
- Prepare a staged program for implementation, including provisions for necessary administrative unit, team members and personnel, legislation and capital funding.
- Launch an all-out drive to accomplish the first phase objectives.

3.4 Sustainable Solutions :

Design criteria in Wholistic Engineering must include the use of new and continually changing engineering systems and method in order to provide sustainable solutions that are needed for the future. A whole system design often requires many areas of expertise that are needed to complete the overall design.

The complication of rigid regulations and codes, and their related potential legal liabilities (for not following “the letter of the law”), inhibit the introduction of many sustainable alternatives. This also results in most of the engineering profession resorting to “cookbook” design solutions. This problem continues the use of environmentally incompatible designs and inhibits the development of new technologies that could provide for better solutions – for example, using costly 20th century technology in 21st century communities.

Individuals and firms that have been involved with sustainable designs are learning and developing systems that help to management and effectively integrate the efforts of a diverse multi-disciplinary design team. Engineers should be one in the team consisting of scientists, sociologists, economists, environmentalists, politicians, geologists, etc.

3.5 Leadership and Community Planning:

Leadership activates planning and action. What motives actions? Action is usually motivated by money, crisis and/or concern for future security. Effective planning reduces the financial burdens of operating in the crisis mode and provides for security of future conditions. This type of planning begins with leadership.

Many practical and simple strategies can be part of a cooperative “team” approach that encompasses different kinds of expertise within various public and private entities, along with the active participation of the general public. This requires tearing down the walls and building bridges between diverse interests.

This type of internal and external collaboration for public projects can result in better decisions, savings in time and money during project development, as well as avoiding costly lawsuits and appeals that are ever present

in today’s legal and political climate. Without this kind of leadership and integrated team approach, new plans will have limited use and will often only end up on the shelf.

3.6 Ethics :

Wholistic Engineering also embraces ethics as an important pillar for securing peace and sustainability. The main ingredients of an environmental ethic are caring about the planet-earth and all of its inhabitants, allowing unselfishness to control the immediate self – the interest that harms others, and living each day so as to leave the lightest possible footprints on the planet.

4. Case Study : River Restoration for Chiang Mai Green Development

Most of rivers and streams in the city of Chiang Mai originate in mountains located outside the city. Along with flowing waters, these rivers and streams are a “bridge” connecting the city and rural ecosystem serving as a passage way for wildlife and bio-diversity. The rivers and streams alleviate urban heat island effect through cooling and ventilation and play the role of ventilation opening to discharge pollutants.

In case of overcrowded city and towns, areas around these rivers are green resources that can be used as ecological parks and entertainment value.

4.1 Current Status and Problems

Despite the traditional belief and respect in the goddess of mother rivers (Pra Mae Kong Ka), all rivers and streams in Chiang Mai (and the whole country) have been poorly managed and treated. River systems have been dramatically altered by land use developments, urbanization, construction, channelization, pollution, encroachment, dams and reservoirs, etc. There has been a reduction in landscape quality, loss of wilderness areas, and aesthetic beauty of natural rivers has vanished. Some species of flora and fauna have disappeared; exotic species have invaded; and the functional characteristics of the river system have been disrupted. Moreover the headwater areas in upper watersheds which are the sources of our rivers and streams have been seriously degraded.

In response to the need to save our rivers and their environments, the members of the city of Chiang Mai and local communities partake their responsibilities in protecting and restoring their rivers and streams. This section describes the case study on the efforts directed to the application of wholistic engineering principles to the development of environmentally sensitive approaches and the role of civil society using indigenous knowledge for managing and restoring the Ping River and its headwaters' environment in Chiang Mai Province.

4.1.1 The Ping River Watershed

The Ping River, one of the 4 major tributaries of the Chao Phraya River, is a main river which provides water for livelihood to northern and central regions of Thailand. With the length of about 740 km., it joins the Chao Phraya River at Nakhonsawan Province and subsequently drains into the gulf of Thailand in southern area of Bangkok.

Chiang Mai is the home of forests and mountains where headwaters and streams originate and form the Upper Ping River Basin covering an area of about 22,000 km². The longitudinal course of the river through Chiang Mai Province is about 250 km. It passes through the provincial city, towns and villages which are residential areas of nearly one million population.

The crucial problems of the Ping River, as well as of other major rivers in Thailand, are diversified and complex. These include the lack of proper planning, administration and management within the fluvial hydrosystems; inadequate environmentally sensitive river engineering projects; deforestation on the mountains which causes severe watershed degradation, heavy soil erosion and deposition in the river channel ; improper land use; drainage of waste into the river which causes water pollution; and river encroachment. The river encroachment is the unscrupulous personal desire for land by encroachment into the river corridors and water body. This is evinced by filling with soil and other materials and by other practices such as planting some aqua species that cause siltation. At many spots, the width of the river consequently becomes smaller and smaller. In some areas the remaining width of the river is as small as 1/5 of the original width.

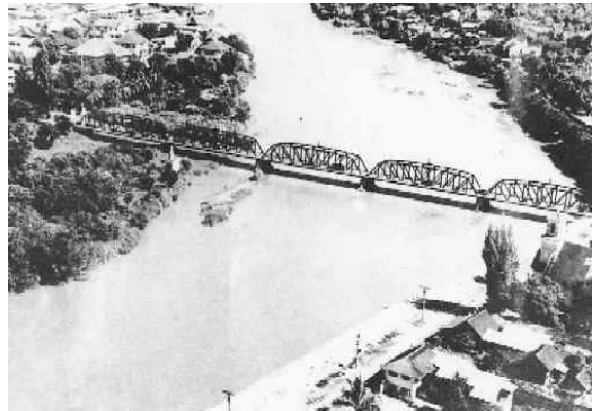


Fig. 4 Songkran Festival (Thai traditional New Year) celebrated in the Ping River, Chiang Mai, some 40 years ago. The river was clean, clear and aesthetically pleasant.

The encroachment, deposition and pollution problems have negatively affected the aquatic ecosystem and the biological resources of the river both quantitatively and qualitatively. The amount and quality of water have decreased drastically in the dry season, as have the numbers and types of plants and animals, some becoming extinct. The natural beauty and landscapes of the river are damaged and degraded. Natural, or to be more correctly, man-induced disasters such as flash floods and mudslides once rare in the area have now become annual occurrences.

4.2 River Engineering Practices.

Conventional river engineering works have become more intrusive, in terms of the scale of modifications as mechanization has increased our ability to modify rivers and their local environment. Any engineering work that modifies the river system has the potential to

cause instability and adversely affect the riverine environment. Attempts to impose an unnatural condition on a river can lead to major instability problems unless the river is heavily engineered. In turn, this can cause severe environmental degradation. The types of problems that can result may be illustrated by considering a range of engineering works on the Ping River and its tributaries as follows:-

1) Flood control and land drainage works have involved different combinations of dredging and straightening. Not only does this destroy river and bankside flora and habitats, but it adversely affects the local sediment transport regime of the river and promotes channel instability.

2) Straight channel alignment and geometrically homogeneity of cross-section have replaced the winding river with its charming and ecologically important contrast. Aesthetically pleasing features of the river have been lost.

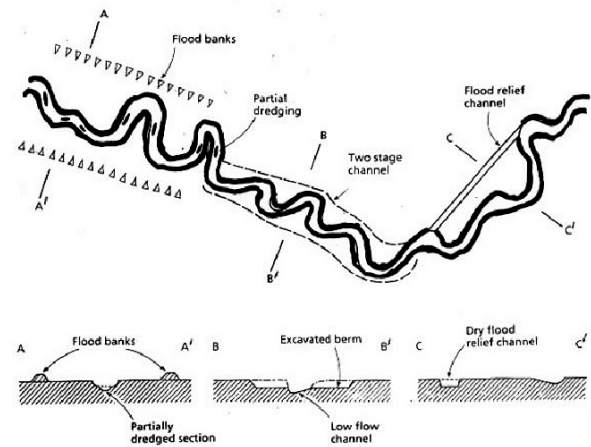
3) Dredging of the river lowers the bed level and the accompanying lower water levels in the dry season cause the groundwater table to be lower also. The capacity of the aquifers to serve agriculture is diminished. The coolness and the greenery of the lands alongside the river have been reduced.

4) Construction of bankside roads along the main river and its tributaries have caused severe erosion and sedimentation problems. Similar impacts are caused by road construction in the mountains and by many highland and upstream construction projects.

5) Bank revetments are mostly done with cement lining or concrete structures to prevent bank erosion. Inevitably this totally destroys the instream habitats of the natural flora and fauna. The river becomes canalized with little or no environmental value.

6) Reservoirs and dams have destabilized the river system by reducing flood flows and caused bed degradation for a considerable distance downstream. This also promotes a coarsening or armouring of the riverbed as finer material is eroded but not replenished from upstream. Eventually a state is reached when relatively little bed material transport occurs. The bed then becomes hardened as fines fill in the voids in the gravel framework and the bed is rendered relatively impermeable and unsuited for invertebrates and for fish spawning. In addition the width of the river is drastically reduced by

vegetation encroachment, mostly from exotic species e.g. *Mimosa Pigra* or giant sensitive plant, as annual flood flows no longer occur. The problem of water pollution is also intensified particularly in the dry season since the river flow is reduced and sometime a state is reached that there is no flow at all. Low flow also stimulates sedimentation of mud. Thus it is found that the riverbed in the Upper Ping region is often covered with mud instead of sand and gravel as there used to be. This renders the river unsuitable for recreational activities.



A – A' = Distant flood banks

B – B' = Two – stage channel (with excavated berm)

C – C' = Flood relief channel

Partial dredging = A limited central section of the river is dredged to increase channel cross-sectional area, particularly at shallow riffle sections. The undisturbed bed acts as a biological store of recolonizing species.

Fig. 5 Environmental sensitive options for flood alleviation schemes of the river.^[8]

4.3 The Role of Civil Society in Ping River Restoration

In response to the need to save the Ping River and its environment the members of local communities partake their responsibilities in protecting their river. The “Love Mae Ping River Group” was formed in 1992 and volunteered to clean up the river and to guard against waste disposal and any damage done to the river. The group has grown and expanded into various civic groups, for example, the Coordinating Committee for the Protection of the Ping River

Basin and Environment or CCPE. This local-based organization has been active and well-known in river restoration and green development. Its members consist of volunteers who are academics, teachers, students, monks and concerned citizens. Many programmes are set up for both short term and long term goals as follows:-

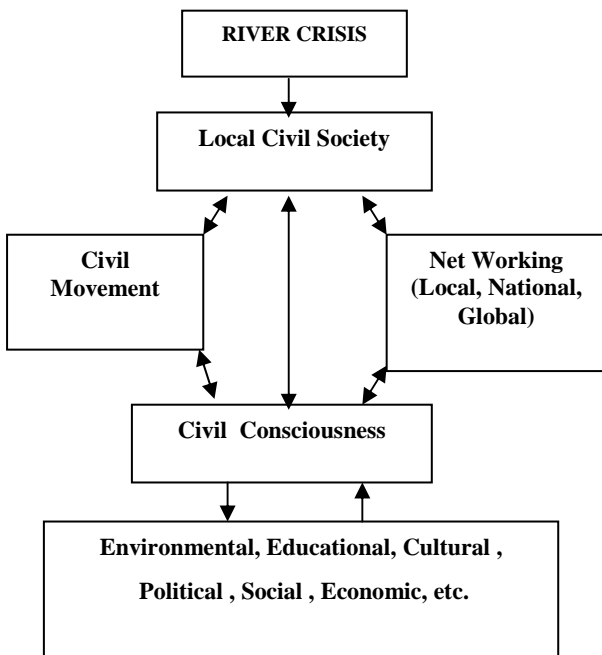


Fig. 6 Relationship and movement of the Chiang Mai civil society in restoring the river and its environment.

4.3.1 The Goals of Programmes:

- 1) To guard against the encroachment and the disposal of community waste into the Ping River.
- 2) To revive the aquatic ecosystem of the river.
- 3) To preserve the natural beauty of the Ping River.
- 4) To formulate preventive measures which effectively apply the community participation in the protection of the Ping River.
- 5) To set up good examples for other communities regarding the protection and maintenance of rivers and streams with emphasis on people participation.
- 6) To promote environmentally sensitive river engineering practices/projects.

- 7) To initiate the amendment of related Municipal Acts / laws / policies for the protection and conservation of the riverbanks, water quality and its flora and fauna.

4.3.2 Implementation of the Programmes

In order to solve the river problems, first of all, public consciousness has to be provoked. The CCPE tries to convert crisis into opportunity for river restoration. Since people - centred development is the development by people and for people. Therefore damages to the river, which are caused by the people, must be solved by the people themselves. The following steps and activities are made:-

Step 1: Awareness raising about the situation and problems

To educate and inform the public about the negative results of river encroachment and the pollution of their river which is caused by wastewater and disposal discharged from households, restaurants and hotels, the CCPE organizes the programmes to mobilize the local people such as town and district administrative officers, youth, teachers, government departments and civil groups including the mass media to be aware of the problems and to take further action.

Activities:

- River survey camps: to learn about the water resources, headwaters in the forest areas, landuse along the river, water pollution and role of youth in river monitoring and surveillance.
- Dialogue seminars: to provide the information on the importance of the river / water for our lives, the problems and effects, then encourage the local people to form groups to tackle the problems together.
- Boat Trips: to survey the quality of the water and analyze the situation, in this activity CCPE involves all sectors in the communities to join especially the mass media in order to distribute the information to the public on river environment as well as solicit comments from communities.
- Education and awareness campaigns.

Step 2: Development of knowledge and skill / River monitoring programme

After the public understands the situation and realizes the problems, they are encouraged to form groups to tackle the problems and take some action. Different volunteer groups for river protection are formed such as Ping River Preservation Volunteers Group, Love Mae Ping River Group and River Monitoring Group. The CCPE tries to empower the local people and provide them with more knowledge and skill as well as encourage them to involve more people in the programme and organize various kinds of activities to promote people participation in the process.

Activities:

- Training/ Workshops to check the quality of the water by using chemical test and biological method
- Launch guarding activities along the target locations by volunteers at a weekly/monthly basis to protect the river environment
- Field trips/ study tours in order to get the first hand experiences e.g. the process, strategy, implementation, impact, success and failure of other groups. Such programmes can expand the network and linkage at the same time
- Organize fish sanctuaries and aquatic organism conservation zones which are looked after by the local people

Step 3: Cooperation and Networking

To save the river effectively, cooperation among all concerned organizations and individuals is of utmost importance. The CCPE has its role as a coordinating agent between the civic groups and various government departments, e.g. the River Authority of the Harbour Department, the Land Department, the Irrigation Department and the Public Health Department as well as local administrative organizations at the village, tambol or sub-district, district and provincial levels. River Revival Committees are set up with full participation from various partners. Strong links and networks are created among towns, villages, volunteers, monasteries, schools, universities and mass media.

Activities:

- River watch networking
- River Revival Campaign
- Local Radio / Newspaper Campaign
- Amendment of Municipal acts / Laws / Policies
- Establishment of riverside parks
- River corridor registration

4.4 Results and impacts

- Towns and villages in response to the river crisis, have joined together with CCPE to study the problems and exchange information in order to convert crisis into opportunity for river revival.
- Town and village leaders have combined traditional methods of thinking and beliefs with modern values regarding conservation and passed these on to others. The traditional belief and respect in the goddess of mother river (Pra Mae Kong Ka), the indigenous wisdom such as the river life-prolonging ceremonies based upon local religious beliefs are used to raise awareness, create and strengthen the connection between people and their river.
- The non-fishing zones as well as aquatic organism conservation zones have been established by many villages. A committee in each village is set up to oversee the zones and make rules and establish clear and strict fines. The pressure of local social standards is also applied to ensure compliance.
- Funds have been set up, to support the carrying out of group activities on a continuous and sustainable basis.
- Changes in curriculum of local schools and universities.
- All sectors in the society are involved: homes / monasteries / schools / business / industry / mass media/ etc.
- Public river fronts and parks along the riversides as well as nature study centres are being established in many towns and villages

5. Concluding Remarks

The prospect and concluding remarks for green development for the city of Chiang Mai, and cities elsewhere can be summarized as follows :

- There are many good engineering and management practices used today throughout the world that are simple and proven techniques. These methods are typically based on local knowledge of both past successes and failures and on an intuitive understanding of what should be done to provide for a healthy future and green development.
- These types of economical and environmentally sound “common sense” approaches for solving problems, combined with today’s emerging technologies and computers, continue to gain importance as our need for sustainable solutions becomes more critical in order to meet our future needs.
- Ecological criteria are considered on equal footing with technical criteria. The engineering approach makes up only part of the information on which such processes should be based. The necessarily more diversified approach requires additional information from various areas of expertise, e.g. landscape architecture, economics, geology, biology, sociology and anthropology etc. The engineer, who would traditionally be in charge of projects, should find himself to be only one member of a team that includes economist, botanist, sociologist, geographer, and landscape architect etc.
- Research needs to be carried out to develop and define environmentally sensitive options for wholistic engineering management.
- Public participation is of utmost important. The role of civil society has to be recognized and supported as well.
- Any public decision making must be based on genuine facts and thorough understanding of the environmental system.
- To mobilize earth knowledge, there has to be a concerted effort by the common citizen, the universities and teachers in elementary schools, various industries,

the academies of science and the governments to address issues of earth education.

- In the biggest sense, “environmental education means learning to maintain” a balanced way of life.
- We need knowledge to care for ourselves, every part of the Earth and the life upon it, and all of the future generations as well.
- This means that education about the environment is of great importance to everyone. Scientific learning and technological progress are essential for improving the quality of life in the modern world. Still more important is the simple practice of getting to know and better appreciate our natural surroundings, and ourselves whether we are children or adults.
- If we have a true appreciation for others and resist acting out of ignorance we will take care of the Earth.

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