

Detailed description of Best Practices/Success Stories from selected local governments in Cambodia, Indonesia, the Philippines, Thailand and Vietnam.

EU-Project "Partnership for Democratic Local Governance in South-East Asia"

Note: on average 60pages per BP description (including graphics, photos).
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Country:	Thailand
Reported by:	Mr.Apiyut Sriyapan
Name of Local Government:	Muangklang municipality
Type of Local Government:	Municipality
BP Theme:	Low carbon city
Thematic Theme:	3

A. Description of the best practice model

- What is the content of the best practice model? What are the innovative elements?

Muangklang municipality aims to achieve knowledge-based and balanced urban development, with sound awareness, understanding, and participation of the people. Therefore, Muangklang municipality seeks for a comprehensive way to remain clean and green, low-emitting, and environmental friendly, along with its basic duty and responsibility as a "municipality" for appropriate development and optimal modernization.

Talking about best practice model, Muangklang municipality has implemented a number of interventions to solve urban problems in a complete and synergistic way. All interventions are striving forward under the 4 guiding strategies;

1) City of Trees



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- 2) City of Waste Minimization
- 3) City of Energy Efficiency
- 4) City of Sustainable Consumption.

Each intervention under the four strategies is not a total solution to a problem. In fact, one intervention is more or less related to other interventions. Taking a systematic look at all the best practice, one can see the relationship among them and synergistic effects do exist.

A short-list of interventions is shown here before getting down to the details.

1) City of trees

- Promotion of planting trees around town
- Turn trash into trees
- Increase the green area
- Motivating the people to plant trees

2) City of waste minimization

- **Solid waste management**

- Set up a municipal waste separating center
- Collecting market's organic waste
- Animal farm in town
- Reduce, Reuse, Recycle
- Landfill management
- School recycling program
- Missing bins

- **Water quality management**

- River conservation
- Grease trap
- E.M.
- Stakeholder collaboration
- PR
- River monitoring program
- Dredging
- Waterway resurrection

3) City of energy efficiency

- Office building improvement



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- Energy saving campaign
- Fuel saving campaign
- Renovation of public water system
- ISO 14001
- Traffic control and re-design
- NGV bus
- Non-motorized route
- Reduced truck trips to the landfill
- Bio-gas and alternative fuel production
- Compost, E.M. and bio-gas

4) City of sustainable consumption

- Urban agriculture
- Backyard organic vegetable
- City of rice
- Rabbit, goat, and pig and their manure
- EM and Compost
- Slaughterhouse waste
- Black gold

And moreover,

5) Quality of life promotion

- Making merit in the river
- Municipal sports complex and recreational area
- Cultural conservation & Promotion

Now let us go into details.



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1) City of Trees

Promotion of planting trees around town

More and more trees are being planted. Muangklang Municipality possesses green space per head at above average level compared to other towns and cities in Thailand yet the work is still in progress. **At present, there are 6,456 perennial trees in municipal area and the number of tree is increasing at 5-10% per year.**

Knowing how good trees are to human's living quality, the municipality is not only planting trees on public soil but also planting trees on any possible, permitted private property in order to have green area as a carbon sink, as much as possible.

By the way, all seedlings and organic fertilizers are locally produced in Muangklang municipality facility.



Figure 1 Planting trees on roadsides



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Turn trash into trees

In general, a vacant space in or around municipal area can possibly be a dumping spot; some may throw household trash, construction waste, green waste like trimmed branches, etc. and it is not unusual to see a heap of trash in a vacant space.

Hence any empty space in the municipality area is planted with trees. Planting various kind of tree helps increase green area and, at the same time, prevent trash dumping; it makes people think twice before doing so. Eventually, not only good looking it becomes, but it also keeps the city clean and green, and helps top soil conservation.

The increase of trees not only decorates the town but also help absorb carbon dioxide for photosynthesis. Therefore, the trees help in air purification.



Figure 2 Tree planting in weeded vacant urban area



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Increase the green area

The strategies to increase green area are as follow;

1) Land use administration. The master plan of municipal land use exists and only intensified reinforcement of land use is needed. It is a preventive measure in order to have an organized urbanization.

2) "Trees anywhere"; the municipality urges every house, school, and temple with available space to plant trees.

3) "Replace trash by trees"; the municipality planted some ornamental trees on the roadsides where the planted trees control weeds and also reduce littering along the roadsides.

4) A long-term planning; a number of trees to be planted each year is designated with consideration of appropriate variety and method to maximize the success.

5) Collaboration; the municipality gives out young trees for anyone to plant. Local children are hired to produce seedlings in their free time for their own income and instill the concept of green in their mind.

6) Find urban civil space; continuously the municipality has tried to possess an amount of land for public use in order that in a long run, the green area for recreation and sports will be increased.



Figure 3 More urban public spaces become green



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Motivating the people to plant trees

To be successful in this campaign, motivating the public general to give a hand is essential. Public participation is the key that cannot be ignored, no matter how hard the task is.

The municipality has tried to;

1) Enhance quality and practically useful green area development; to convince the people on intention and commitment. So the people can see that the municipal efforts have good results.

2) Enhance people's participation; from the beginning to the administration of the green area

3) Find more optional green; to find the most appropriate green area usage such as urban agriculture, edible plants, etc.

4) Share benefit to all stakeholders; to share the benefit from the green area as much as possible.



Figure 4 Planting trees as a common public activity



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2) City of Waste Minimization

2.1) Solid Waste management

Set up a municipal waste separating center

Everyday, tons of municipal waste is generated, filling up the landfill pit out of town. Simple waste separation in prior to landfill can reduce more than half of the amount of daily waste to the landfill. This effort is taking place at the municipality service compound.

Instead of investing a large amount of money for a modern waste management building with sophisticated separation system, electronic control, mechanical tools, plus a wastewater treatment section in it, a low-cost, simple "conveyer belt" is set up in the middle of Muangklang municipality service compound.

The belt is 14 meters long set in tilted position on a 4 by 24 meters concrete ground, with a peripheral trench and a simple roof. It can handle 6-8 tons of waste per day (equivalent to 3 trucks). The waste enters the belt at the lower end and moves toward the higher end, where it drops into the trunk of a truck.

All daily garbage collected by the municipal trucks goes on the belt at the lower end. While moving, the recyclable, organic and degradable waste are picked out by a number of belt workers standing on both sides of the belt and the rest of it goes into a truck, heading for municipal landfill. This process totally reduces daily disposal volume and number of truck-trips to the pit.



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Figure 5 Waste separations on a belt



Figure 6 Some are picked out and the rest goes to landfill



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Simply saying, there are 5 trucks of municipal waste every day. Due to man-hour limitation, 3 out of 5 trucks can come to the belt. From 3 trucks, after the separating process at the belt, 90% goes to the land fill and 10% is separated. Out of this 10-% part, most of it is perishable waste that can be used in compost production. Some 17% is recyclable so it is sold and part of the income pays back to workers as daily wage and some as their incentive.

To look at it as a bigger picture, the separating center is the hub, small but vital, to other waste-minimization related activities. The center takes in municipal solid waste and transform majority of it into starting materials where other 'value-added' products begin. Finally, almost every bit of waste collected here becomes valuable, income-generating, or practically useful products.

Collecting market's organic waste

Municipal market, or fresh market, is a simple open-air market with lots of local vendors. At the municipal market, fresh commodities e.g. fresh meat, fruits and vegetables, are daily brought in early in the mornings.

Those fruits and vegetables are not packaged like those in western supermarkets. They come direct from the wholesale market. Retail vendors at municipal market have to peel off the outer part of some certain vegetables, discard the disqualified fruits or damaged part of fruits. Some shops prepare fruits by peeling them off and cut into slices before packing a ready-to-eat set.

Moreover, talking about food shops, all food shops have to cook. In preparation of the cooking, fresh vegetable is sorted, cut, and sliced. Lots of unused vegetable is discarded. Moreover, after the end of day, there is always leftover or discarded food to throw away every day. These shops create a large amount of fresh waste every day.



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Figure 7 Fruit peels from fresh market

On-site waste management takes place here by the collaboration of vendors of Muangklang municipal market in gathering all the waste. After the market ends each day, lots of collected waste is given to the municipal collector who transports this waste to the separating center. Most of it can be used instantly in the making of E.M. (effective micro organism) concentrate and feeding to the animals. (The latter 2 processes will be explained later)

Animal farm in town

There are tons of green wastes each day, for example, discarded fruit and vegetable from the market, mowed grass from offices' lawns in town, trimmed leaf on municipal street sides or garden are, cut branches from houses. The mentioned material makes perfect feed for some animals kept in the waste separating center compound.

-Rabbit

This cute animal eats a lot of green stuff each day! Rabbit can feed on any kind of human-rejected green vegetable, either discarded before displaying on shelf, before cooking, or after the day ends. Rabbits live in a large group, that's why they can take in lots of green



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waste per day. Moreover, they are good at reproduction, being matured after 4 months only, and yields lots of offspring. In a well-confined space, the rabbits are ready to take care of municipal green stuff.

-Cow

Cows grazing on the ground might be difficult to find nowadays around town. Anyway, cows can eat tons of discarded fruits, fruit peels, mowed grass, and even trimmed leaf. A lot of such waste comes into the municipal compound every day.

-Goat

Goat is a universal eater. Goat eats various kinds of food, or almost all organic stuff, just like or even better than cows.



Figure 8 Goats feed on most organics

-Pig

Indigenous pigs are kept in a pen and fed with fruit, vegetable, and leftover food.



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Figure 9 Pigs are 'living mills' mincing tons of green waste daily



Figure 10 And the mills keep growing in number



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Figure 11 Goat manure is useful

Furthermore, the excrements of these animals are also made use! Cow drops can be used for fuel (mixed with grease collected from grease traps), and bio-gas production. Rabbit and goat drops in granule shape is a good and ready-to-use fertilizer. Pig’s drop is on the pen’s ground laid with straw, which is turned over every day by the pigs’ behavior in a way that the drop and the straw are mixed together. On top of that, E.M. is added to help decompose the mixture. This makes excellent fertilizer the fruit farmer cannot resist.

Comprehensive waste minimization scheme

It is very important to see the links among the interventions of waste minimization in Muangklang municipality (some elements are not yet described so far).

The community generates various kinds of waste, publicly or individually. Each type of waste goes through interventions or processes and eventually turns beneficial, cost-reducing, or income-generating. In conclusion, at the end of the lines, waste becomes valuable in Muangklang municipality.

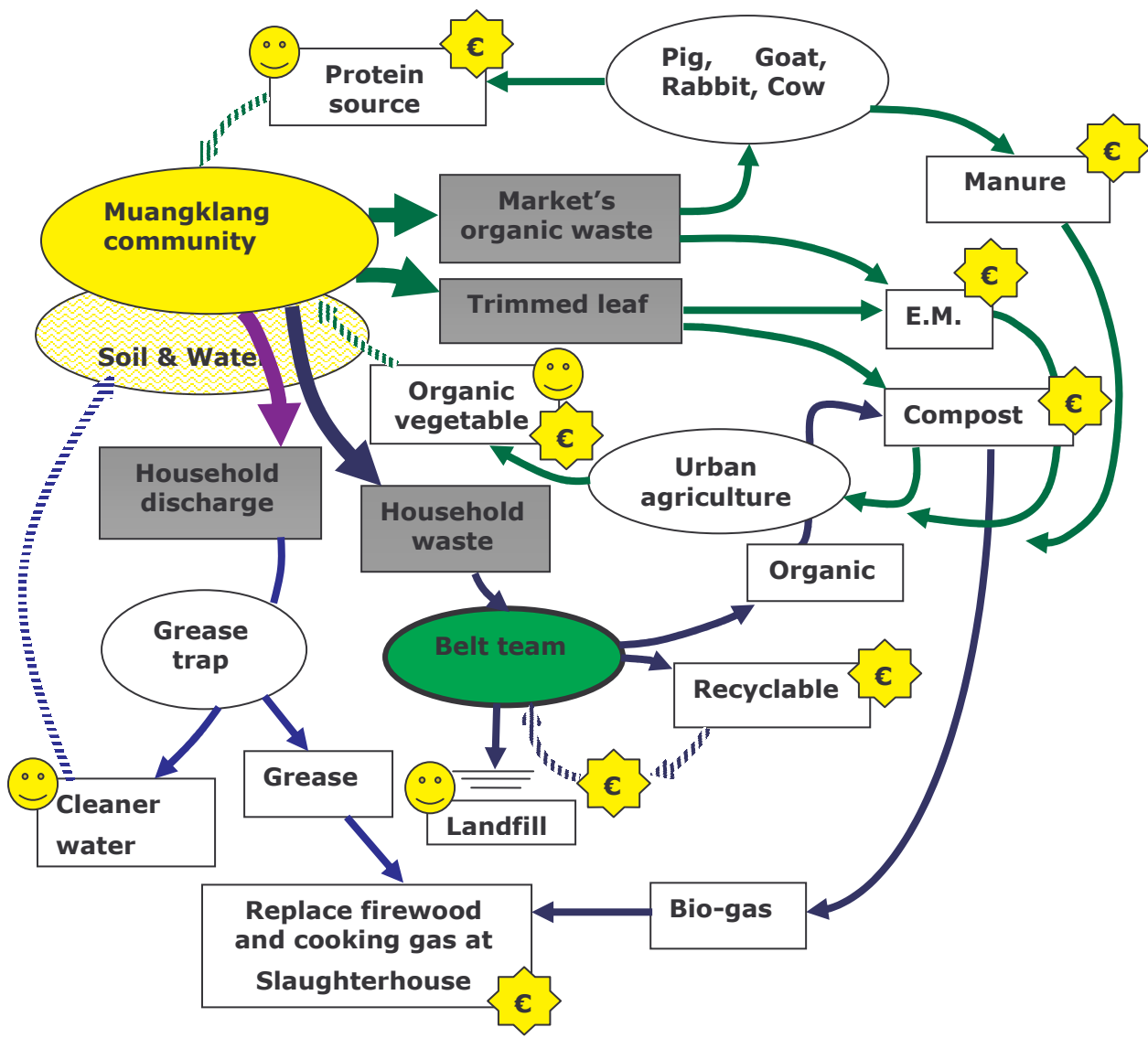


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Muangklang's Best Practice of Waste Minimization



= income/cost reduction
 = benefit



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Reduce, Reuse, Recycle

This green idea is being promoted through various media e.g. local radio, leaflet, website, school, etc. At municipal level, these three methods are being conducted. For a large-scale example, organic waste is being used for value-added intervention, for example, organic waste goes to compost, market green waste goes to the demonstrative farm, etc. Recyclable waste is separated and becomes eventually recycled. Daily waste disposal to municipal landfill is being reduced.

Landfill management

Municipal landfill is owned by Muangklang Municipality and there are more local authorities using this landfill by paying annual disposal charge to the municipality.

One reason why to raise the disposal charge, it is a signal to the users to think about reducing their waste, otherwise, the payment becomes higher and higher. The increased income from this particular part will be spent at the belt to augment the capacity of waste separation so that all 5 trucks per day can go on the belt (instead of only 3 due to limited man-hour)

The charge is currently as shown below;

1. Governmental organizations	670 B./ton*
2. Local private organizations	
First 50 ton	500 B./ton
50.1-100 tons	550 B./ton
100.1 tons or above	600 B./ton
3. Other private organizations	
First 50 ton	550 B./ton
50.1-100 tons	600 B./ton
100.1 tons or above	650 B./ton

Remarks;

*since June 1st, 2010

Moreover, the pit is well managed to show the visitors who come for solid waste management study tour. The pit has to be well maintained and look fairly organized at all times, resulting in increased orderliness, cleanliness, and its efficiency.



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Figure 12 Muangklang's municipal landfill



Figure 13 Muangklang's municipal landfill



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School recycling program

Not only the municipality but school boys and girls are sharing hands on solid waste management program.

Trainers are sent from Muangklang municipality to participating schools to educate and demonstrate students and teachers how to separate school waste. Participating schools are encouraged to separate recyclable wastes and sell them to buyers for income generation.

Moreover, to encourage and support this environmental friendly practice of the local schools, the municipality pays additionally 1 Baht on top of each kilogram of recyclable wastes sold.

This measure effectively reduces amount of solid waste on site.



Figure 14 Participating students with their separated trash



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Missing bins

The more bins, the more trash. This belief could be true. The municipality reduces the number of trash bins in public places especially residential area in hope that people be more responsible, think twice before littering, or even before that, think twice before generating waste.

Instead of finding more and more bins endlessly and ending up with overloaded, smelly, unpleasant bins, the municipality cut down the number of trash bin and asked the residents to properly lay their trash bags in front of their house and the bags are collected punctually.

However, routine trash collections punctuality is enhanced making sure that no trash bags and bins are left or overloaded and create nuisance.

2.2 Water quality management

River conservation

Prasae River flows through the town to the Gulf of Thailand. It becomes one of the town’s symbols because it has been a vital part of town in every way.

In early days, the transportation was by sea and the river was the essential links from the town to various remote destinations, for example, Bangkok. Moreover, commuting within the town and around, mainly relied on the river since they commuted by boat.

After the land transportation became more popular a few decades ago, along with the construction of roads and introduction of cars and trucks, the river has played less and less important roles to serve the town. Eventually, it became sewer taking sewage from communities along its banks, causing it polluted and shallower.

The present Mayer of Muangklang municipality, since his inauguration in 2001, has been working on conservation measures of the river consistently with not only the outside institutions but also the local communities in order to have the clean river back in shape.



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Rehabilitation of the river is one of his first few urgent missions. There are strategies as follow;



Figure 15 River conservation consists of various interventions



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Strategy 1) Partnership and participation promotion

By identifying stakeholders of the river, conservation groups can be formed up and periodic meetings take place among them to discuss on existing problems of the river. The output goes into short and long term plan of the municipality.

Strategy 2) Awareness building through media

A radio channel and a gazette are established to propagate the message of why and how to rehabilitate the river. More activities took place as well, such as promotion of youth camps on conservation topics or an establishment of river monitoring program.

Strategy 3) River conservation & income generation

To balance the river conservation and the income generated from such activity was a key to success. People cannot concentrate much on environmental issue before their basic needs is fulfilled. Local residents along the river are encouraged to make a living but in an environmental friendly way. For example, eco-tourism is promoted. Those who have boats can make additional money by boating people out for river sightseeing. Fishermen are encouraged to try coastal aquaculture e.g. floating fish cages for their additional income.

Strategy 4) Appropriate technology

For sustainable river conservation, a fixed but simple household appliance has been introduced; a grease trap. This also applies for restaurants to make sure that sewer from communities is, to some degree, cleaner before it reaches the river. All new houses are obliged to install a grease trap before it can be officially registered.

Besides, effective micro organism concentrate is added into the drainage in the municipal area so that the discharged is partly treated before it reaches the river.

Water quality monitoring is blended into school activities. Students are trained to do simple monitoring work to sharpen their science knowledge and to create awareness on river conservation. The schools turned in water quality monitoring reports consistently.

Strategy 5) Networking

Along the river, there are a few more neighboring local authorities who can become alliance for the river conservation. Besides local



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authorities, private companies and factories located around Muangklang and this watershed are requested to join into the network where they can share their own resources for the river conservation.

To look into some details of the strategies mentioned above, here are some more information of prominent elements;

Grease trap

The Prasae River has been taking sewage from houses, shops and markets since the municipality is located along its banks. Besides the dirty and muddy water, the daily discharge is full of organic compound from human activities. This definitely goes beyond carrying capacity of the river causing the river’s water quality degraded.

In order to reduce massive organic load, the municipality introduced “Grease trap” to new houses and buildings. To abide with the municipal regulation, the grease trap must be equipped to the newly built houses and buildings along the river. Some participating existing houses and shops also join in for the sake of the river conservation.



Figure 16 Grease trap installed under a washing sink



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Figure 17 A grease trap outside of a house



Figure 18 Grease collection simply by hand-scoop



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The installation of grease traps can greatly reduce grease and oil load in the river. Participants can clearly see how much grease and oil they had been dumping into the river by seeing the trapped grease.

It's better to be seen than spoken, this practice immediately generates awareness of how residents are unintentionally harming the river. The trapped grease is collected by the municipal staff and then used as supplementary fuel at the municipality slaughterhouse.



Figure 19 Trapped grease is used as additional fuel at slaughterhouse



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E.M.

Effective micro organism (E.M.) has been well known in Thailand for many years because of its universal benefit.

Particularly, E.M. helps reduce organic matters very effectively. In practice, an amount of E.M. concentrate (in liquid form) is simply diluted and applied in order to reduce smell in a very fast and effective action. This biological cleaner is far less expensive than chemical cleaning agent on the supermarket's shelf, and certainly more environmental friendly.

E.M. was initially in use for water quality improvement in Prasae River. At present, E.M. concentrate, locally produced from municipal garbage and organic waste, is being added into the drainage at different locations across town daily. This micro organism effectively reduces excessive nutrients in the sewage, treating it even before it reaches the river.



Figure 20 E.M. treats sewage before it finally goes to the river



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Stakeholder collaboration

Establishment of Prasae River Conservation Group consists of all stakeholders in the city. Then a number of meetings among the members of this group took place to discuss the problem and how to solve as well as proposing some activities into municipality's 3-year development plan.

Moreover, the municipality seeks collaboration and shares information with other local authorities located along Prasae River to form a network for river conservation.

PR

The municipality continuously promotes both the river conservation to the local residents and eco-tourism programs in Prasae River to visitors including boat trip, fire flies watching, a home stay, etc.

Furthermore, it publishes a gazette namely "Rak Nam Prasae" or Love Prasae River and distribute monthly and also establishes a local radio channel to share the river conservation information to the people

River monitoring program

A very effective way to conserve the river in a long run is to train young residents into river inspectors.

By using a proven ecological and biological based method, students are intensively trained to assess basic information of the river such as pH, DO, temperature, velocity, color, odor, and biological traits including any existing animals found on site. A systematic training series took place and monitoring continued after the training sessions, responsible by the schools along the river. This forms up a large effective network to monitor water quality and the information gained is consistently published in local printed matters.

Moreover, since they learned how to monitor the quality of the river, their mind has been planted with awareness to conserve the river.



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Figure 21 Students in training to use equipment



Figure 22 Students are sampling water in the river



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Dredging

Dredging Prasae River has finally become necessary after the river has been getting shallower by receiving sewage from the communities, bringing sand, clay, and silt washed down from the road surface. The shallower river allows less water recirculation in the river, causing poorer water quality.



Figure 23 The river is being dredged

Waterway resurrection

After years and years of land transportation development i.e. road construction and motorized land transport's popularity, an obvious change nowadays is that commuting by boat has been forgotten.

In the past, many towns in Thailand, large or small, had plenty of waterways uses as roads. And people at that time went around by rowing boat. At present, the river serves as municipal discharge.



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Muangklang municipality brings back an old fashion commuting method i.e. by boat, by improving piers and related facilities and promoting boat tour to see tourist attractions along Prasae River. The boat tour not only generates income to the boat owners but also increases people’s awareness on river conservation; the more they touch it, the more they feel it.

For example, a boat trip program is shown here.

Route:	Muangklang-Prasae
Passenger:	6 passengers/boat
Fare:	100 B./passenger
Duration of a trip:	1 hour 20 minutes
Duration of round trip:	3 hours
Passenger limit:	120 persons per group per time
Attractions:	Ton Pho pier, Mangrove and local livelihood Crane and waterfowls Prince Chumphon Ket Udomsak statue Prasae M.V. battle ship Sommuttithep Thapanaram temple Marine turtle conservation center at Koh Mun Nai island (optional/ to make contact in advance) Night sightseeing for firefly (optional)

Moreover, some water transports are promoted such as a free boat ride from the downtown pier to the new recreational and sports center so people go there to do daily exercise in the evening via boat rather than driving a car or riding a motorcycle there. Clearly, this promotion of water transport greatly helps reduce private car use.



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3) City of Energy Efficiency

Office building improvement

At the municipality office building, professional electricians were hired to investigate the building and came up with possible energy saving measures. For instance, replacing old light bulbs with energy-saving ones, adding reflectors at all lighting points, using string switch at each lighting point for local control, etc. These measures can reduce electricity consumption and the action raises the awareness of officers in energy conservation.

In particular, the municipality aims to be the model of energy conservation by collecting data of electricity bills and organizing training with pre-test. The training aims to increase knowledge of the participant. Not only the municipal officers, but the training also expands to a number of schools in the municipality area so that children can learn about energy conservation.

Last but not least, the municipal office can always be shown as a demonstrative building in energy conservation theme.



Figure 24 Municipality office building



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Energy saving campaign

Municipal offices attend this program and all staff are encouraged to reduce their electricity bill payment (a year's accumulative) by these measures;

- 1) Educate, propagate, and make them aware of the energy saving campaign by putting a sticker onto each switch so they can read it each time they use it.
- 2) Separate on-off lighting switch as much as possible so the lights are turned on locally, only where necessary.
- 3) Designated air conditioner operating time is 09.00-11.30 h in the morning and 13.30-16.00 h in the afternoon.
- 4) Monthly air conditioner filters clean up
- 5) Check up air conditioner units every 6 months
- 6) Replacement of defective electric devices
- 7) Only one water boiler is allowed on one office floor

Fuel saving campaign

A campaign on reducing fuel used in the municipal affairs was aimed to cut down fuel cost and to be a model on this issue.

The process started by announcing the policy to staff and set up mutual objectives. They huddled up to plan and manage the vehicle use in daily activities, increased car use efficiency, and monitored the plan. The goal was to reduce greenhouse gases from fossil fuel combustion.

Renovation of public water system

In order to produce enough tap water for household use and to reduce the energy consumed in the production process, the municipality improved the production system.

The public water work staff was re-educated and all equipment was checked up. Regular maintenance of equipment was then emphasized. Moreover, a new water tower was constructed to increase water pressure yet reduce electricity cost for pumping. After a year, it was found that the electricity consumption (unit per cubic meter of water produced) reduced satisfyingly.



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ISO 14001

Aiming to develop better working attitude of the municipal officers and to improve the efficiency of Muangklang municipality's service, the introduction of a standard for energy and environment management took place in 2001.

The introduction of ISO 14001 was a whole new start for the municipal staff to improve their way of working and thinking, focusing on energy and environmental conservation as a common goal, which benefit not only to them but the public in general.

The process has made the staff work more versatile and work with more teamwork spirit. They consistently sit together to talk, revise, analyze, discuss, monitor, and improve their work results and this enables better working ability, eventually resulting in the better change of service.

It can be assumed that the result of this standard not only takes effect individually but also publicly. The ISO 14001 is certified by Thailand Institute of Scientific and Technological Research.



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Traffic control and re-design

The town has been here since a hundred years ago. Any old town faces one common problem; traffic congestion due to narrow streets.

In Muangklang municipality as well, traffic problem has been getting worse and worse by the increase of vehicles in town. Without good management, not only the traffic congestion takes place but also unnecessary fuel becomes wasted, and unnecessary greenhouse gases are generated. After all, it causes air pollution, noise pollution, and nuisance to urban residents.

To be proactive, Muangklang municipality has taken actions to control the urban traffic by reinforcing traffic rules and regulations, for example, restriction of non-parking area, one-way street, or even adding more regulations, and redesigning some routes.

All these effort is to make traffic flow better, particularly in rush hours. The better traffic reduces the fuel waste, the air pollution, and residents' stress.

NGV bus

In a small town like Muangklang, with its century-old town's layout and its population increasing, it is not unusual to find traffic congestion in rush hour.

In general, people who can afford would not wait to have a private car or a motorcycle, or even both, for their daily living. The more congested it becomes, the more private cars or motorcycles people own. The number of private vehicle has been definitely increasing and that spells trouble for such a small town.

Moreover, what comes after the traffic congestion is the waste of fuel and at the same time, the air pollution from exhaust pipes. Hence, quality of life is definitely affected.

A very practical solution to solve traffic congestion problem is a public transport in and around the municipal area. Muangklang municipality then promotes free-of-charge public transport for the residents. Instead of using private cars in and around the town,



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Thailand Environment Institute



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compressed natural gas (Natural Gas Vehicle: NGV) public buses in a conservative tram-like appearance are running around offering in free-of-charge service. This initiative helps reduce daily traffic problem, air pollution, total fossil fuel combustion and greenhouse gases generation, and finally improves the quality of life of the people.

In 2003, Thailand Environment Institute (TEI) invited Muangklang municipality to participate in a program call Cities for Climate Change Program (CCP) by Local Government for Sustainability institute (ICLEI). The program aimed that every city understands the human activities that contribute a big part of climate change problem i.e. electricity consumption and fuel combustion for land transport. It aimed that all cities collaborate in mitigating the situation.

At the beginning, the municipality counted the number of vehicles in the municipal area and calculated the Carbon dioxide gas generated from those vehicles. Then a projection of number of vehicles in the future was made in order to predict how much Carbon dioxide gas would be generated. The model made us realize how the city's growth can harm our planet. Therefore, mitigating measures have to be initiated to start reducing the gas that harms us in the near future.

Using a public transport by an NGV bus was one of the measures Muangklang selected. Initial target groups were the elderly who go to do some exercise at the sports complex and the students who go to school. The additional benefit is the increased safety and decreased daily expense. The operation time was from 5 to 7 in the morning and from 4 to 6 in the evening every day except Sunday. Then the schedule for students was launched. After some evaluation, Muangklang municipality aims to expand the service area to a larger coverage.

The bus also provides service to visiting groups to Muangklang occasionally.



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Figure 25 Muangklang NGV public bus in action



Figure 26 Muangklang NGV public bus in a special event



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Non-motorized route

Not only in and around town, the service plan goes beyond that. Since the new municipal sports complex is located a little out of town, the Mayor launched an idea of new service.

Aiming the new municipal sports complex to be very green, it takes a green route to reach there to make it a complete green lifestyle. Hence, the NGV buses also provide free round-trip service from town to the sports complex each day in the evening. People can leave their cars and motorcycles back at home and take the bus to do exercise.

Besides, after having dredged the river, it was found possible that there is a boat service from town to the sports complex as another option. Embarkation is at one of the renovated pier in the middle of town. Riding boat to the sports complex sounds classic, and it is surely a green idea since it helps reduce car use.

On top of that, no addition parking lot will be constructed at the sports complex. To support the use of NGV buses and boats, car park will be merely limited. There will be no expansion of the parking lot.



Figure 27 Non-motorized route promotion



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Bio-gas and alternative fuel production

At the municipal waste separation ground, recyclable trash is picked out as well as green, organic waste. The latter is used for compost production.

The by-product of compost production is inflammable gas called methane. Methane from the compost production provides enough bio-gas to serve the needs of the municipal slaughterhouse that operates daily (actually at night). The use of bio-gas greatly reduces the firewood use.

In addition, grease and oil collected from a number of restaurants in town by grease traps can simply be regularly used as substitution fuel to the gas as well.



Figure 28 A bio-gas production tank



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Compost, E.M. and bio-gas

Organic waste is daily separated from the conveyer belt and used in the production of compost.

To produce compost, EM is also used in the process. With locally produced EM, the compost is truly low-cost and can be sold to farmers at a low price, or be used in municipal plant plots across town.

Moreover, bio-gas collected from the compost pit is daily used in the municipal slaughter as main fuel source. This method reduces the municipality's fuel cost while generating supplementary income to the municipality.

Energy efficiency is an issue which cannot be missed. Instead of using firewood, cooking gas, and chemical fertilizer, with hidden environmental cost such as transportation from the source, the use of locally produced bio-gas, grease fuel, compost, and EM can be a very good example for energy efficiency practice.



Figure 29 A compost production pit with ventilator and drainage ducts



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Reduced truck trips to the landfill

Solid waste management scheme mentioned before (the belt) is also a way of energy minimization.

According to the objective of waste management, less waste means the reduced number of trips of the truck to landfill and of those around the town for trash collection. For example, before the use of belt for municipal waste separation, it took 3 truck trips to the landfill. But after the use of the belt, the number of truck trips becomes only once a day.

Consequently, fewer truck trips means less fossil fuel combusted and much less greenhouse gasses are generated.



Figure 30 Municipal truck being loaded from the belt



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4) City of Sustainable Consumption

Urban agriculture

In the past, with limited communication and transportation system, each house, village, or small town seemed to be comprehensively self-reliable. They ate what they planted or caught and later traded their excessive produce with the neighbouring towns.

At present, the development leads us toward a totally different way of life; the life that aims to work and work for the sake of money, whilst everything else in life is to be paid for. The comprehensive, productive livelihood is replaced by money-oriented lifestyle where everyone aims to a higher income by any means. Eventually, instead of a self-reliance community that work for food, we work for money and totally depend on others to live our lives.

Moreover, the present urbanization pushes green area away from town and productive agriculture land is replaced by housing developments, roads, and factories. Products we consume in daily life is produced elsewhere and transported to our town, including the rice we eat, the vegetable we cook, the fruit we enjoy.



Figure 31 Paddy field; being replaced by city expansion



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The urban agriculture idea tries to bring back a productive society where people can produce for their own living e.g. as a town, we plant something to eat, not to sell to other towns. The rice is from the paddy field, the fish is from the river, the vegetable is from the backyard, the fruit is from our next door village.

In this regards, we need less transportation to bring in everything. But we try to produce as many necessary things as possible for our living.

Backyard organic vegetable

In a small scale, municipal workers plant some common vegetable around the workplace by using only locally produced compost and EM as fertilizers. The vegetable is then collected and packed for sale to generate their supplementary income. It is now well-received and regularly sold at local markets.

Normally, organic vegetable is a little hard to find and sold at higher price, but this does not happen in Muangklang. The residents can always find organic vegetable grown locally at a friendly price, making it popular with the local.



Figure 32 Vegetable planted by municipal workers



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City of rice

Despite lots of commercial entrepreneurs, business companies, and shops, Muangklang seems to have its root on the rice field.

In Thailand, it has been common that location names take after its natural, topographical, or human use characteristics. Many names of place in Muangklang are exactly related to the rice farmer’s way of life and due to the topography, Muangklang is the land for rice farming indeed.

The Mayer initiates the idea that Muangklang should be able to produce more rice and enough rice to feed its population. This idea is being promoted through activities and it just fits the environmental friendly concept to consume local products.

Moreover, the Mayer states that Muangklang aims to be rather productive than consumptive; ‘Why do we have to buy rice if we can sufficiently produce some on our own’.



Figure 33 Muangklang used to grow rice extensively



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Rabbit, goat, and pig and their manure

People can learn to grow their own food to achieve the food security. Backyard farm idea comes to our mind when thinking about it. In Muangklang municipality operation ground, a demonstration farm is there.

With abundance of thrown-away fresh vegetable given from municipal market, some animals e.g. rabbit, goat, cow, and pig are raised and fed by this vegetable. In addition, pigs, being fed with the same vegetable and green stuff, are raised in a shallow earthen pit and the bottom is paved with rice straws. Moreover, cows are raised in a field and feed on grass, and fed with additional trimmed leave from the municipal landscape service.

Talking about their manure, rabbits and goats drop dry, nutritious granules and cows drop massive manure daily. These can be used as organic fertilizer in plant plots. Besides, the mixture of pigs' drop and straw, daily over-turned by pig's behaviour, decomposes, while daily conditioning with EM makes perfect fertilizer for fruit farmers. The pit pig fertilizer can never meet the demand at present; it is widely used in fruit plantation.



Figure 34 Pig's manure bagged for sale



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E.M. and Compost

The local production of E.M. and compost is one of the proofs of self-reliance vision.

Instead of buying fertilizers or chemicals needed for cleansing or planting from outside suppliers, the residents have alternative source for locally produced, less expensive fertilizer. This supports the urban agriculture program so well. Actually, it is not possible without the locally produced fertilizers.

Slaughterhouse waste

Each night, operation at the slaughterhouse leaves behind fresh waste. Instead of carrying these several-kilogram bags of waste to the municipal landfill on the day after, all this fresh organic waste is simply buried in a proper way around the slaughterhouse, in hope that it decomposes and becomes nutrient source for the soil later.

By this means, a lot of waste is on-site reduced. And that means some kilogram less waste each day to the municipal landfill.

Black gold

Black gold is not gold. It is not black either. It's worms' excretion.

An exotic type of earthworm is kept in several buckets while it decomposes cows' manure mixed with leaf and straw. New manure, leaf, and straw are added every 3 months for the earthworm to feed on.

To moisten the mixture (habitat of the earthworms), some water is added on top of the mixture every day. And this water adding is the way to collect the product which is not the worm but its excretion; the dripping from buckets' bottom outlet is collected then bottled, labelled, and sold as earthworm liquid fertilizer. This is quite popular with ornamental plant lovers.



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However, there are more aspects to look at Muangklang’s best practice. Besides the four policies aiming to be a livable city, Muangklang municipality is working toward the happiness of its residents. Therefore, in Muangklang, not only physical development, but also mental and spiritual developments are taking place.



Figure 35 Stacks holding earthworms to collect "black gold"



Figure 36 Earthworms



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5) Quality of life promotion

Muangklang is where the river conservation activities and people's way of life can find their crossroad.

For better understanding, in Thailand, "Tham Boon" or making merit is a very common activity going along the Thai way of life. To celebrate an occasion of either a single family or a community together, "Tham Boon" ceremony can be held at home or in a temple.

"Tham Boon" at home, it can be seen as a daily activity when residents stand in front of their house with freshly cooked or preserved foods and wait for monks to pass by. The monks pass through villages to receive the offering from local communities and return to temple.

"Tham Boon" at temples, occasional celebration or ritual take place here for either a single family or the whole local community. The temples serve for civil assembly. Community members join in and help fulfill the religious and social value.

In general, the ceremony at the temple consists of religious part such as offering food to the monks, paying homage to the Buddha image; and social activity part such as donating money to public benefit, etc. Besides, the fun part is the cultural and traditional activities such as music, dance show, games, procession, and stage performance.

"Tham Boon" in the river

A few years ago, Muangklang municipality had just finished renovating an important boat pier when an idea about having a ceremony to celebrate the new pier and the town came up. It was not only to celebrate but to enhance the importance of the river. Prasae River conservation is the key issue for the people to realize after having joined the ceremony.

Muangklang municipality combines the ceremony and the conservation of the river wisely by organizing all those mentioned above activities in the river.



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In the day time, the highlight is the graceful procession led by Buddha images and revered monks on boats. After that there are also games and fun competitions in the river such as kid’s kayak race, boat race. In the evening, there are stage performances. All shows and dances are performed in the middle of the river. A floating stage is set on a sizable barge for the people to watch performances from the banks. People from Muangklang and other towns come and join the cerebation in the river and feel the life of it.

Not only the municipality who prepares the shows but also Muangklang communities participate in various kinds of activities and shows as well. After all, they can realize the importance and their ownership of the river. The more important point is that without the clean river, there is no ceremony like this. On top of that, it is obvious that if the river is not well maintained, or water quality is not good enough, the ceremony is not possible.

River conservation and people’s way of life then can really find their co-existence.



Figure 37 Annual river procession in the city of Muangklang



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Municipal sports complex and recreational area

A piece of land, twenty-one-hectare, located a few kilometers from the downtown has been developed into a sports compound for general public.

Instead of investing in construction works, a big amount of budget was spent, with unanimous consent of the municipal council, to possess a piece of land in the outskirts area and developed into a sports compound. Knowing the good intention for the residents of Muangklang, a couple who had a piece of land adjacent to it donated the land for the municipality to merge with the first piece.

There is a soccer field, basketball courts, petongue courts, safety playground, exercise facility, and all these among green perennial trees. This is considered a new recreational venue for everyone to come and enjoy.

A kind reminding, there is round trip NGV bus service and boat service for everyone from downtown to the sport complex.



Figure 38 Muangklang sport complex



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Cultural conservation & Promotion

To ensure the brighter future, Muangklang instills its people and young people the awareness of its root.

History is revived through different methods. For example, renovation of boat pier and its importance is stated, talks and printed matters telling old stories of Muangklang, integration of local history into school curriculum, etc.

Recently, the old police station of Muangklang in downtown area has been renovated and converted into a Historical Hall in a very classic, conservative look and local architecture features.

Moreover, the annual festivity in the middle of the Prasae River encourages people to join in and then realize the importance of the river and to participate more in the river conservation.



Figure 39 Auspicious ceremony in the annual festivity



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- Why has the model been developed, which problems or shortcomings were it supposed to address, what are the objectives of the model?

Poor water quality in Prasae River

Muangklang is a town in Rayong Province, eastern Thailand. Originally, the town was settled upriver from the present location. For centuries, it has expanded down along the Prasae (a.k.a. Krasae) river closer to the mouth of the river in order for a better connection to the sea and has grown continuously. Finally, the town moved to the present location 100 years ago. Nowadays, the downtown area is on both sides of the river a few kilometers from the sea.

The growth of town brought not only communities but also its waste. For years, all community wastes had ended up in the river, slowly causing it polluted. Moreover, it became shallower as well. The shallower river meant less water circulation. And less water circulation worsens water quality.

In addition, because of the modern way of life with land transport, the river seems to reduce its width, together with its social significance. People turned their back to the river greeting civilization incoming from the national highway and left the river blackened and dirty. All river-related ways of life seem to gradually diminish.

The river which passes through the town used to provide foods for the local. They caught fish, crab, and prawn from the river but later this way of life changed due to the degradation of water quality. The aquatic animals seemed to disappear.

Solid waste constraint

Over 20 tons of solid waste is generated daily in Muangklang town. It was the municipal landfill where all this ends up every day. The handling cost is 1 Baht per kilogram of waste. That means every day, 20,000 Baht was spent by Muangklang municipality on the waste handling.



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Moreover, the landfill site covers only 12.8 hectares and the life span is estimated 3-5 years only. Definitely, the more waste the shorter service of the landfill site. What comes after that is the investment of a fairly large amount of money to develop a new landfill, plus the risk of being strongly objected by the local community of that time against the development of a piece of land into a landfill site.

Not only Muangklang municipality is using this landfill site, but there are also more local authorities and private companies whose waste is dumped in here. The list of users is as follow;

1. Na Yai Arm Municipality
2. Na Yai Arm Tambon Administration Organization
3. Ban Na Municipality
4. Thung Kwai Kin Municipality
5. Pak Nam Prasae Municipality
6. Thung Kwai Kin Tambon Administration Organization
7. Nam Pen Tambon Administration Organization
8. Klong Poon Tambon Administration Organization
9. Grohe's manufacturing plant
10. Para Eastern company
11. Mr.Prasert Reungboonsong's manufacturing plant
12. Ms.Atchara Paesukcheun's manufacturing plant
13. F&C company limited
14. Apina Industry company limited
15. Teo Ching Lee store
16. Suchin store
17. Grand Rubber company limited
18. Mr. Pongpot Wongsim
19. T.K. Furtech company limited
20. Greenwood company limited



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- Which results have been achieved? How relevant are they for the living situation of the people in this municipality? Status of finalization of the model.

Muangklang municipality has implemented a number of interventions to solve urban problems in a comprehensive and synergistic way; output from one intervention can be input for another one, or one activity in one intervention can support another intervention. Thus, talking about the results achieved, the results have to be considered in a more holistic way, to see relations among them.

Again, results of Muangklang municipality model can be elaborated under the before-said 4 guiding strategies;

1) City of Trees

More trees and green area

Having visited Muangklang, one cannot deny that it looks clean and green. From the entrance of town; the intersection on Highway number 3, to the back side of municipal area, Muangklang is filled with plants and trees.

In particular, between 2001 and 2007, Muangklang municipality planted **14,179 trees**. These trees can absorb **550 tons of carbon dioxide per year**.

Moreover, driven by intense promotion and campaign to make Muangklang a green city, not only the municipality is doing the job, private companies, schools, civil societies are doing the same job; planting trees. The tree planting is now taking place at all occasions.

A point that cannot be missed, Muangklang Municipality has green space per head at above average level compared to other towns and cities in Thailand, that is **15.77 meter square per capital** (as of June 2010)



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2) City of Waste Minimization

Waste reduced

It is fairly difficult to see the result of waste minimization, because a lot of waste is missing!

Due to data collection, the amount of waste seems to reduce over years. The table below shows a good trend of the past 7 years.

Fiscal year (October to September each year)	Total collected waste by trucks of 12 months (kg)
2004	7,714,832
2005	7,659,018
2006	7,462,795
2007	7,538,552
2008	7,147,650
2009	6,058,140
2010(Oct'09-Jun'10)	4,860,469

Table 1 Municipal waste collected by municipal trucks in each fiscal year

In 2004, there were **7,714,832** kilograms of waste (total of 1 year) collected by the municipal trucks from municipal area. The effort on waste management has shown a good result because the amount of waste collected by the trucks has been reducing.

In 2009, there were only **6,058,140** kilograms of waste. This shows the improvement of onsite waste management which strikes at the right point i.e. to reduce at the source of waste generation.

The effort on waste management eventually expands the service life of sanitary landfill of the municipality because less waste is filling up the pit each day. This ensures the longer service life of the landfill.

Waste reused and recycled

Incoming trucks loaded with municipal waste are very welcome here in the municipal waste separating center. The belt in an open-air shelter is waiting with a team to separate all the unloaded into organic waste and recyclable waste. Then the rest goes to landfill.



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Due to the data collection (March and April 2009), it could be assumed that the daily municipal waste consists of 83% organic waste. This amount of separated organic waste is totally used in the making of compost instead of being disposed in the landfill.

The table below shows the data of what comes out of the separating belt each month of the first 2 quarters of 2010.

Month-Year	Organic (kg)	Recyclable (kg)	Plastic (kg)
Jan 2010	13,185	5,282.9	1,714.5
Feb 2010	12,497	2,418.6	1,185.0
Mar 2010	13,053	2,639.0	1,184.0
Apr 2010	8,899	1,964.1	655.0
May 2010	8,569	3,034.4	2,342.0
Jun 2010	7,695	2,718.8	2,358.0
Total	63,898	18,057.8	9,738.5

Table 2 Amount of organic, recyclable, and plastic waste separate from the belt each month (to be further used and for sale)

Market waste makes money

Municipal market serves food to feed everyone in town. The increasing population definitely increases food and waste in the market. It is quite difficult to control this natural growth but there is a way to make things work out; convert the waste to money!

Every day, municipal collector collects thrown-away fresh market waste i.e. part of fresh vegetables, damage fruits, and leftover food. This organic mass is transported to the municipal compound and made into compost, E.M., or fed to animals.

Instead of dumping market waste, this amount of daily organic waste is making money. The table shows the data of the first 2 quarters of 2010.



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Month-Year	Fruit & vegetable (kg)	Food waste (kg)
Jan 2010	14,874	8,509
Feb 2010	13,591	8,018
Mar 2010	15,219	8,968
Apr 2010	14,839	8,612
May 2010	15,331	8,967
Jun 2010	14,909	8,633
Total	88,763	51,707

Table 3 Municipal market waste; fresh fruit, vegetable, and food waste (becomes value-added instead of being disposed)

School recycling program works out

Not only the municipality but school boys and girls are sharing hands on solid waste management program. This learning process is taking effect. The more waste separation they can do the more recycle they can sell. That comes along with more income.

A very clear output measurement is the amount of recyclable waste, and income. Data collection can encourage the students to do more and more waste management. This idea finally reaches their homes. Waste minimization and separation take place in a wider range.

So far, a number of schools have participated in the program. Here is the list.

1. Klang Wittayasathavorn school
2. Wat Saranart Thammaram school
3. Wat Pho Thong school
4. Wat Plong Chang Peuk school
5. Rung Napa Pittaya school

The participating students from participating schools have been working on solid waste management to pick out recyclable waste in school and the collected is sold. In addition to this sale, the



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municipality also pays additional 1 B. per 1 kg of recyclable waste sold in order to encourage the participants of the program.

For the past few years, the accumulative amount of recyclable waste is fluctuating depending on students' academic schedule yet it has been good enough, taking into account that it is students' effort.

This nearly 30 tons of waste from just seven-month period has been recycled, instead of wasted in the landfill pit. In addition, the disposal to landfill decreases as the money in the pocket increases.

Participating schools	Recyclable waste collected (Dec 07 - June 2010) (kg)
Klang Wittayasathavorn school	6,096.80
Wat Saranart Thammaram school	7,957.79
Wat Pho Thong school	4,333.30
Wat Plong Chang Peuk school	6,571.00
Rung Napa Pittaya school	3,677.10
Total	28,635.99

Table 4 Amount of recyclable waste collected from December 2007 to June 2010

Water quality improved

In Prasae River, water quality has now improved. It has been made possible by different interventions working together. For example,

- **grease traps** hold organic load off the river,
- **liquid E.M.** treats sewage before it reaches the river,
- **dredging** improves water circulation in the river,
- **monitoring** raise awareness of the young and witness,
- **the festivity** makes everyone realize the importance of the river
- **promotion of more boat trips** in the river makes residents, realize the importance of the river as transportation route
- **promotion of eco-tourism** in the river makes visitors, and the residents, realize the importance of the river as tourist attraction



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Now that the water quality has improved, the very simple evidence is the sighting of fish in the river. In the past, aquatic animals were so abundant. Then the animal population was reduced by the poorer quality of water. Now it has come back. People living along the river said they witness more fish in the river.

Those who live near the river and some who catch fish and prawn from the river confirm that they can see better water quality and can catch more animals these days.

In addition, thanks to the work of river monitoring units from different local schools, they are trained and providing good monitoring efforts to the river. The reports confirm the sighting of more fish and convince that the water is getting better over time.

Below is the number of 'monitoring agents' contributing to the improvement process.

Students become river inspectors

One after another, the training of water quality monitoring expands the networking of river conservation. Students get knowledge and hand-on experience in each training course. The number of participating students is shown in the table.

Year	No. of participating schools	No. of participating students
2008	13	131
2009	14	148
2010	18	180

Table 5 Number of participating schools and students in the river monitoring program from 2008 to 2010



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Grease trap is working well

After the grease trap was introduced in order to reduce organic load, particularly grease and oil, flowing into the river, the amount of grease that was collected has been increasing over time. Amount of grease and oil recently collected from grease traps can be shown in the table below.

Month-Year	Grease collected (kg)
Oct 2009	978
Nov 2009	774
Dec 2009	746
Jan 2010	463
Feb 2010	886
Mar 2010	1,888
Apr 2010	1,465
May 2010	1,269
Jun 2010	755

Table 6 Recent grease collected from grease traps in Muangklang

So far, there are **1,188 grease traps** in Muangklang municipality (2006 up to July 2010) which are installed in houses, gas stations, restaurants, and the likely source of grease and oil.

Due to the new regulation of Muangklang municipality, a new house must install a new grease trap before they come and register at the office. The confirmation of grease trap is requested in form of photograph. The recent number of traps installed in new houses can be shown below.

Fiscal year	No. of new registered house which installs grease traps
2006	296
2007	118
2008	106
2009	211
2010	71

Table 7 Number of new house with grease traps installed



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Waterway resurrection

Muangklang municipality initiates water transport system improvement by renovating boat piers and relevant facility such as river embankment, and by promoting boat tour to see tourist attractions along Prasae River. The boat tour not only generates income to the boat owners but also increases people's awareness on water quality conservation.

There are now **14 boats (7-seaters) and 6 barges (50 passengers)** providing service for visitors. Number of visitors goes up and down due to the weather but in average, there are roughly 500 visitors per month.

Moreover, a free boat ride from the downtown pier to the municipal's new recreational and sports complex is becoming more and more popular.

Annual festivity

Muangklang municipality combines the common Thai ceremony as a way of life and the conservation of the river wisely by organizing it in the river. This measure has made great impact to local residents' mind because the Buddha ceremony is spiritually meaningful to the Thai. The unique and creative way of celebration plus the entertaining programs make people happy and they cannot wait to give a hand for the next year's ceremony. But while waiting before that, why not help conserving the river.

As a result, people can realize the importance and also their ownership of the river. At least, the common perception is that without the clean river, spectacular ceremony like this is impossible. River conservation and people's way of life then co-exist.



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3) City of Energy Efficiency

Greenhouse gas emission reduction

As of 2004, Muangklang municipality, due to the collaboration through TEI – Thailand Environment Institute, with ICLEI – Local Governments for Sustainability, has had a commitment to reduce greenhouse gases emission. Its data collection showed that the municipality and communities' activity emitted 87,194 tons of carbon dioxide in 2000 and could be more in the coming years.

The municipality aimed to reduce the emission of this greenhouse gas 20% from municipal's activity and 3% from community's activity. That accounted for several tons of carbon dioxide to reduce by these means;

- **Energy conservation in the office (22 tons/year)**
 - Change to high efficiency air conditioners
 - Installing light reflectors and using high efficiency light bulbs, including high efficiency ballasts
 - Renovation of a small meeting room to use in case of under 12 attendees, instead of larger meeting room
- **Municipal vehicle fuel cut down (16 tons/years)**
 - Check up all vehicles' engine
 - Plan for efficient use
- **Efficient electricity consumption for public lighting (65 tons/years)**
 - Change to high efficiency light bulbs in sporting grounds
 - Remove unnecessary lighting points
 - Installing solar cell as energy source for warning light at junctions
- **Efficient water work system (136 tons/years)**
 - Construction of high water tower to increase pressure and reduce pumping
- **Waste minimization**
 - Waste management schemes in municipal offices (4 tons/years), schools, and communities (572 tons/years)



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- Waste separation at municipal ground
- Use organic waste to produce E.M.
- **Green area**
 - Planting in urban area and planting mangrove (550 tons/years)
 - Find more free space for sporting ground and park

Energy conservation and ISO 14001

Aiming to develop better working attitude of the municipal officer and to improve the efficiency of Muangklang municipality's service, the introduction of a standard for energy and environment management **ISO 14001** took place in 2001. This includes the saving of electricity in the office as mentioned, and saving the petrol used by municipal vehicles with clear figures. Reducing truck trips to the landfill from 3 to 1 trip per day is one of the best examples.

It can be assumed that the result of this standard not only takes effect individually but the idea is also carried home and shared in a wider coverage. Service quality of the municipality has improved can be one of the results.

New public water system

The new tower was constructed to increase water pressure but reduce electricity cost for pumping. After a year, it was found that the electricity consumption (unit per cubic meter of water produced) reduced accordingly.

The electricity consumed per cubic meter of water produced was between **0.35 – 0.45 in 2003** and after the introduction of program, it became **less than 0.30 month over month in 2004**.

Traffic control and NGV bus

To be proactive, Muangklang municipality has taken actions to control the urban traffic by reinforcing traffic rules and regulations, adding more regulation, and redesigning some routes. All these effort



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is to make traffic flow better, particularly in rush hours. The better traffic reduces the fuel waste, the air pollution, and residents' stress.

In addition, instead of using private cars in and around the town, compressed natural gas (Natural Gas Vehicle: NGV) public buses are offering in free-of-charge service to Muangklang residents during rush hours. This initiative helps reduce traffic problem, air pollution, total fossil fuel consumption and greenhouse gases produced daily, **claiming 33 kilogram of carbon/vehicle/day**, and finally improves the quality of life of the people.

Bio-gas and alternative fuel production

Methane from the compost production provides enough bio-gas to serve the needs of the municipal slaughterhouse that operates daily, completely replacing conventional fuel (firewood). In addition, grease and oil collected from a number of restaurants in town by grease traps can simply be regularly used as substitution fuel to the gas as well.

4) City of Sustainable Consumption

Urban agriculture and city of rice

Normally, organic vegetable is a little hard to find and sold at higher price, but this does not happen in Muangklang. Thanks to the EM and compost, organic vegetables locally produced are available on market. The residents can always find organic vegetable grown locally at a friendly price.

Moreover, the Mayor initiates the idea that Muangklang should be able to produce more rice and should be able to produce enough rice to feed its population. The promotion on rice farming is taking place. Rice farmers feel more secure and confident to stay on track and keep growing rice.

Locally produced fertilizers

Availability of locally produced fertilizing agents such as EM, compost, green manure, animal manure, and black gold makes sure that the urban agriculture is making a go.



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- Description of the municipality/local government unit: population, size, location, legal position in the respective state structure, human and financial resources, specific political, social, cultural and economic character/framework.

Muangklang Municipality

First of all, Muangklang Municipality is 14.5 square kilometer with 13 communities in it. As of December 2008, the population was 17,197 and there were 3,309 households. It is 269 kilometers from Bangkok by the eastern highway.

It is located near the sea. It is a plain with hilly area on the east-west direction with Prasae River flowing through the heart of town into the Gulf of Thailand. On the east side of the river is agriculture area and on the west side is hilly and filled with communities, commercial area, governmental units, factories, and so on.

Muangklang's climate is tropical with all year round sea breeze. It's rather warm and cooler near the sea. Rainy season comes in May and lasts through October. In average, it rains 128.8 days per year and average rainfall is 1,638.12 mm per year (1995-1999) The average temperature is 28.91 degree Celsius (max 38.16, min 15.96) The population in Muangklang municipality is 17,254 with 8,230 male and 9,024 female.

- Which costs had to be covered for the implementation of the project? Who paid for it?

It was not the money that matters, but how to make use of it that matters.

If taking a closer look, each practice of Muangklang municipality best practice is not a huge investment at all. For example, people think about large incinerator, a large building, or an enormous landfill pit to handle the growing city's waste. Instead of that, in the middle of



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Muangklang town, a simple belt with comprehensive management and value-adding process takes the role. Income generating activities also contribute in self-support.

Most of the best practice schemes spend annual budget in a wise way. In case the available budget is not enough, private companies in the vicinity sometimes contribute in terms of budget and materials; for example, Apina Industry Company, National Starch and Chemical Company. Rayong province also give a hand into conservation programs for example, the support of grease traps for Muangklang municipality to install in houses.

Moreover, they help support the printing of gazette, the monitoring program, the annual festivity, etc. in return of their corporate social responsibility.

What cannot be missed when talking about cost is “time” to spend on finding ways to solve the problem and on doing all the work. The Mayer has spent a lot of his working and personal time thinking hard and working hard for all these years.

- Which specific technical expertise was necessary to design and implement the model? Who supplied it?

Most work explained above depends on existing knowledge, local wisdom, and people’s participation and is brought into practice by the initiation of the Mayer. Yet, it has been possible by trial-and-error learning process, with a strong will to make it better.



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B. Methodology in the design and implementation of the best practice model

- Brief description of the design process of the model (who drafted the first paper, who was involved?)

The present Mayor of Muangklang Municipality, Mr.Somchai Chariyacharoen, initially aimed to bring the river back to life and conserve the identity of town which had been closely related to Prasae River by first saving this river from pollution. This conservation effort was where the whole story began.

To bring back clean water in the river, Mr.Somchai looked into various methods. Then, more measures were initiated toward the primary goal; river rehabilitation. Finally, the result is now very satisfying. Muangklang has a clean river because of a number of programs. Today, his effort expands to a larger view that covers water, air, soil, waste, and standard of living problems. His ultimate goal is that Muangklang is a livable and pleasant town with enhanced quality of life.



Figure 40 The Mayer receiving visitors at the black gold stacks



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- Who initiated the model? Who were the driving forces and main actors?

The present Mayor, Mr.Somchai Chariyacharoen, aiming to create his town a truly sustainable and livable city, initiated one program after another to tackle urban environmental problems comprehensively, to use existing resource and potential, to short-cut bureaucratic friction, to emphasize simplicity but effectiveness, and ultimately to change from the consumerism way of life to a more productive and self-sufficient one for long-run sustainability.

- What has been the role and attitude of national authorities with regard to the model?

The 'Klang Model' has been known as an admirable development scheme. The Mayer's work has been propagated through various kinds of media nationwide. Now Muangklang municipality is the utmost learning centre of the eastern region with a large number of visitors who wish to learn from it.

It is not a surprise to say that Muangklang municipality has been awarded at times. Muangklang municipality won the prize of "Livable City 2004" from the Ministry of Natural Resource and Environment. In 2010, its project on bio-gas also won a prize from Department of Alternative Energy Development and Efficiency, Ministry of Energy due to its efficient application of bio-gas tanks.

- Brief description of the implementation process of the model: creation of legal and/or administrative conditions, qualification processes, stakeholders involved in the implementation, monitoring and evaluation.

The Mayer comes up with new ideas to cope with the problem and then get started from small scale at first. He has fairly practical thinking, so most of the projects can make a go. He has a number of team members who closely support him. The lesson learned and success make it easier for him to gain trust and support from either his municipal staff, the council, civil groups, private companies, or even general public.



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Moreover, he tries to assess and improve his work as time goes by, in order to increase efficiency of his particular work. This ensures that all his work is never wasted but gets improved after some time.

- How have civil society and population been involved?

Reflection

All good practices show good outcomes. Over time, Muangklang residents can see cleaner water in the river, improved means of public transport, locally produced organic vegetable, fertilizer, and compost, more and more green area comes in sight, visitors come to learn a lesson from the municipal learning center, and so forth.

All efforts show off their value and potential so that the residents realize what their better choices are.

Public participation

These initiations have proved to be well-received by communities. People can see common benefit and they give a hand. For example, market vendors collaborate in collecting discarded vegetable leaf, schools join in waste management program, and house owners install grease trap in their house.

Popularity

After several years' efforts, the Mayer proves to be the man for the job and gains more and more popularity with the people of Muangklang. The 3 consecutive election winnings showed that people agree for him to do more good work. This gives him more chance to create more projects and sharpen the existing ones to a higher efficiency as he wishes.


- Did the media play a role in the design and implementation of the model?

No, but instead, they propagate the messages around the country. After his inauguration in 2001, the Mayer worked hard and his efforts



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took effects. Then awards were given and he was better known, particularly, the unique way of leading Muangklang toward a sustainable city rather than a physically developed city.

Mr.Somchai Chariyacharoen has been interviewed and his initiatives and ideas have been propagated through international, national, and local newspaper, radio, and television channels.

“Klang Model” (a.k.a. Klaeng Model) was the name of his unique development scheme called by the media.

- Input from international, national and local experts, forms of communication and cooperation between them.

Many organizations have given hands to Muangklang municipality in order to improve its low carbon city campaign. Among them, Thailand Environment Institute (TEI) has continuously collaborated and assisted in different aspects. For example, the introduction of a greenhouse gas reduction program called Cities for Climate Change Program in 2003, the visitors from foreign countries at different occasions, etc.

Since the Mayer has been proactive and creative, the relation between the municipality and the outside institutions or experts is rather a collaborating one.

- Types of activities in the implementation of the model.

1) City of trees

- Promotion of planting trees around town
- Turn trash into trees
- Increase the green area
- Motivating the people to plant trees

2) City of waste minimization

• Solid waste management

- Set up a municipal waste separating center
- Collecting market’s organic waste
- Animal farm in town
- Promote 3 R; Reduce, Reuse, Recycle
- Landfill management



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- School recycling program
- Missing bins

- **Water quality management**

- River conservation
- Grease trap
- E.M.
- Stakeholder collaboration
- PR
- River monitoring program
- Dredging
- Waterway resurrection

3) City of energy efficiency

- Office building improvement
- Energy saving campaign
- Fuel saving campaign
- Renovation of public water system
- ISO 14001
- Traffic control and re-design
- NGV bus
- Non-motorized route
- Reduced truck trips to the landfill
- Bio-gas and alternative fuel production
- Compost, E.M. and bio-gas

4) City of sustainable consumption

- **Urban agriculture**
- Backyard organic vegetable
- City of rice
- Rabbit, goat, and pig and their manure
- EM and Compost
- Slaughterhouse waste
- Black gold

And moreover,

5) Quality of life promotion

- Making merit in the river
- Municipal sports complex and recreational area
- Cultural conservation & Promotion



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- Steering body and coordination mechanisms in the model.

ISO 14001 has been a tool to improve the overall working process and the service of Muangklang municipality since 2001. The tool can be considered a big change in the office for officer workers. They have learned to sit and work together, collect data and analyze problems, plan and implement, and evaluate the change before improving it again with continuous monitoring.

This ensures the quality of work and finally the quality of life of Muangklang people.

- Sequence of activities, vertical and horizontal logic and synergies.
- Documentation of activities, monitoring, reporting, updating of implementation plans.

C. Evaluation of the best practice model

- Will the model be sustainable?

Sustainability is ensured by these traits;

Self-reliance

In a small scale, the conveyer belt waste management staffs form up a team under close supervision by the Mayor. He designates this unit as a learning center. By selling its products such as compost, EM, recyclable material, locally grown organic vegetable, etc. this center is producing enough money to pay off its operation cost and has some for worker's incentive. Local authorities from around Thailand visit this learning center with an entry fee.

This self-reliance is very important to make a go for a long run.


Win-Win situation

In particular, the staff of waste separation on belt, the leading role of waste separation at the municipality level, is doing a good job. Municipal landfill is taking in less waste and providing longer



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service to Muangklang people, the municipality can save cost of truck trips to the landfill, the belt team who does the job gets some incentive from selling the recyclable on top of their wages. Everyone is happy.

Education to the young generation

The recyclable waste program is expanded to some local schools. Not only through teaching, but students are learning solid waste management by doing it. They see the results of decreased waste and increased income they generate. Volunteer trainers from the municipality go around schools to educate, demonstrate, and encourage students to do it. And the lessons are added to school's curriculum in hope that they carry on the concept as a lifetime attitude.

Public relation

The Mayer has been producing various types of public relation media, for example, local FM radio program, municipal website, announcement, events, and even face-to-face talks, to make sure people hear what have been done, and what will be done.

Furthermore, many interventions make themselves heard and seen. People understand better, like them and then give a hand to the municipality's projects.

- What have been the major success factors for the model?

The Mayer's vision and will

Against money-oriented urban development and administration, Mr.Somchai Chariyacharoen has proved money was not more important than other resources.


While most local governments complain about limited budget and keep waiting for more budgets in hands, Muangklang's Mayer takes lead forward aiming to the quality of life of his people and spends his time on how to make a go with the resource he has got.



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Finally, his most powerful driving force is the participation from the people who see the benefit publicly gained from his endless initiative and effort.

Public participation

One man cannot achieve this success without the participation of people around him. Showing his point of view, vision, and view is not enough for the Mayer to reach the finish line. He needs free-will participation and willingness to help.

In order to get them, he uses multiple methods to propagate the idea, point out the eventual outcome, show the way to do it, and do it. After some years, his effort has shown the success. His staffs know what he is doing and help as they can. Local private companies, local authorities also join in.

The most important is the people of Muangklang whose participation cannot be missed. They have seen what the Mayer has done over the past years and now wish to help him whatever they can because the Mayer has made them realized what the future will become. They are confident that they are following the right leader to the right direction.

- What have been the major obstacles and challenges for the design and implementation of the model?

The first challenge is the improved efficiency of each work he is doing. "How to do it better" is the biggest challenge. The Mayer spends some time to develop a project of his initiative, then after it has a product. The Mayer revises its efficiency and finds a way to improve it to a higher one.

Secondly, the legislation framework of governmental rules and regulations, in particular, regulations for the municipality to follow, is somehow difficult for a new initiative to make a move. However, there is always a way if thinking out of the box.

Thirdly, the trust of people is hard to gain than it seems. The Mayer takes years for the people and even his staff, to see what he is trying to do before they understand and collaborate.



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➤ Why do you judge the model as best practice?

The development of Muangklang is unique. Along with the growth, it tries to find its own root and put effort into capacity building of different communities and building relationship among them. These communities are important driving forces that the development really needs rather than such common development which relies on budget.

The cutting edge of the development is the Mayer, Mr.Somchai Chariyacharoen, together with his team. They are well trusted and have won the election for the 3rd time now. The success comes from this devoted leader who has faith and gets his hands on the new ideas he creates, many of which work successfully for the sake of people’s quality of life.

Strong participation and collaboration then come from the staff, the civil societies, the private sectors, and everyone in town. Large amount of budget or advance technology is not the first step to go forward here in Muangklang but the heart of the town is.

➤ Why do you believe that the model could be replicable in adapted forms in other municipalities and local government units (even in other countries)?

Waste reduction = Cost reduction = Income generation

It’s truly win-win situation of the municipality, the team, and Muangklang people. A small team of 42 workers are operating waste management schemes and they can save cost of the municipality whilst making enough money to pay their salary plus incentive. The team makes a living. The municipality saves cost and improves effectiveness. The people of Muangklang feel the charm of the Green City they live in.

Motivation

It’s better seen than heard. People can see improved situation, solved problems and better way of living. Any town residents would gladly adopt the proven measures once they have heard about Muangklang story.



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Least national-budget dependent

Learning more tactics of Muangklang, any municipality would feel eager to start their own projects without waiting for new budget allocation. Most of the best practices here in Muangklang are not costly at all.

Instead of ...

- ...a costly incinerator,
- ...a wastewater treatment plant,
- ...road expansion or fly-over,
- ...investing annual budget in constructing more buildings,
- ...dumping wastes,
- ...bringing in foods,
- ...getting more consumptive,

Muangklang ...

- ...uses the belt to deal with its waste.
- ...tackles the problem by using E.M. and grease traps.
- ...introduces NGV public bus.
- ...chooses to have more and more green area.
- ...finds a way to use them.
- ...urges its people to produce them.
- ...tries to be more productive.

So, national budget allocation is not the limit. What it takes is time and effort to adapt the proven measures to suit one's setting.

Institutionalize

The Mayor has passed trial and error part of the story and now put things together as proven methods. He tries to imbed these proven methods into institutions such as civil society, schools, and so on. He passes on his initiative to other people not through lectures but demonstrations, in hope that they, especially the young generation, could continue the best practices to make sure that Muangklang remains a liveable city forever.



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