DEVELOPMENT OF A LEARNING NETWORK MODEL FOR ENERGY CONSERVATION

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ABSTRACT

The objective of this research was to develop a learning network model for the establishment of energy conservation in an urban community.

The population consisted of the community leaders of 50 districts in Bangkok Metropolis Area. The sample group, 91 community leaders of Bang Sue District in Bangkok Metropolis was selected by purposive sampling technique based on the set criteria. These included willingness, time, devotion, participation, and cooperation to the network learning development process, acting as trainer, and sharing their knowledge received from the training course individually and group activity. In order to develop a learning network model, it needed to investigate the training needs, and develop the training course content, and it was implemented according to the invented concept Multi-level Management Linkage (MML) with 'Training of Trainer' (TOT) process integrated with Appreciate-Influence-Control (AIC), then it was evaluated by the invented PAMIE technique.

Results were as follows:

1. The participants in TOT for three levels from MML had posttest mean scores higher than pretest mean scores at highly statistically significant level of 0.01.

2. The AIC process results illustrated that participants were able to operate as trainers and facilitators for further training course level. Moreover, they developed project action plan for environment and energy conservation according to the shared vision obtained through brain storming at each training level. Brain storming included SWOT (Strength-Weakness-Opportunity-Threat) analysis based on project operation methods of Who, Whom, What, When, Where, Why, and How (6W1H).

3. Three Dimensional Evaluation (TDE) was used for evaluation of the participation in training courses and Four Dimensional Evaluation (FDE) or Round Dimensional Evaluation (RDE) was employed for qualifying trainees to be able to perform as trainers and facilitators. The results showed that all participants passed the 50% requirement, based on TDE and FDE.

4. Participatory Performance, Assessment, Monitoring, Evaluation, and Impact (PAMEI) technique was used as the tool for the ultimate phase of evaluation of participants in the three levels as trainers for energy conservation. Some participants joined public minded activities, such as community knowledge giving, school training, and public knowledge giving. The highest electricity reduction achieved was 95%, and the highest pipe water reduction was 80%.

5. The learning network was established and the administrative committee was elected after the training process was used for evaluation. Some 55 participants were qualified as trainers and educators, and 36 participants were qualified as facilitators and educators.

Recommendations for further research: the prototype of a learning network model that should be implemented in other districts in the Bangkok Metropolis in order to encourage communities to minimize energy consumption and maximize benefits of energy utilization. Moreover this learning model can be adapted for implementation with other learning networks, such as environment and natural resources. in order to improve environment quality.

KEY WORDS: DEVELOPMENT / LEARNING NETWORK MODEL / ENERGY CONSERVATION

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การพัฒนารูปแบบเครือข่ายการเรียนรู้สำหรับการอนุรักษ์พลังงาน (DEVELOPMENT OF A LEARNING NETWORK MODEL FOR ENERGY CONSERVATION)

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คณะกรรมการควบคุมวิทยานิพนธ์ : รัชชานนท์ ศุภพงศ์พิเชฐ พบ.ด., จิรพล สินธุนาวา Ph.D.,วิลเลี่ยม รอสส์ Ph.D.

บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อ ศึกษาการพัฒนารูปแบบเครือข่ายการเรียนรู้สำหรับการอนุรักษ์พลังงาน เพื่อเป็นต้นแบบสำหรับการอนุรักษ์พลังงาน

ประชากรเป้าหมายของการวิจัยครั้งนี้ได้แก่ผู้นำชุมชน ของกรุงเทพมหานครทั้ง 50 เขต การสุ่มตัวอย่างใช้วิธีการสุ่มแบบเฉพาะเจาะจง โดยการกำหนดเกณฑ์ในการคัดเลือกผู้นำชุมชนซึ่งประกอบด้วย ความเต็มใจ การเสียสละเวลา การอุทิศตน การมีส่วนร่วม และการให้ความร่วมมือในกระบวนการพัฒนาเครือข่ายการเรียนรู้ ในการปฏิบัติตนเป็นวิทยากรและแบ่งปันความรู้ที่ได้รับจากการฝึกอบรมทั้งส่วนบุคคล และกิจกรรมกลุ่ม เพื่อให้การพัฒนารูปแบบเครือข่ายการเรียนรู้ประสบความสำเร็จ นั้นจำเป็น สำรวจความต้องการ พัฒนาหลักสูตรและดำเนินการฝึกอบรมตามแนวคิดที่ประดิษฐ์คือการบริหารจัดการโดยการเชื่อมโยงอย่างเป็นเครือข่าย Multi-level Management Linkage (MML) ด้วยวิธีการสร้างวิทยากร‘Training of Trainer’ (TOT) ซึ่งบูรณาการด้วยวิธีการประชุมเชิงปฏิบัติการอย่างมีส่วนร่วม Appreciate-Influence-Control (AIC) กลุ่มตัวอย่าง เป็นผู้นำชุมชนจำนวน 91 คนของเขตบางซื่อ กรุงเทพมหานคร

ผลการวิจัย สามารถสรุปได้ดังต่อไปนี้

1. การอบรมเพื่อสร้างวิทยากร (TOT) ด้วยแนวคิดที่ประดิษฐ์ขึ้นคือการบริหารจัดการ โดยการเชื่อมโยงอย่างเป็นเครือข่าย (MML) จากการวิจัยพบว่าคะแนนเฉลี่ยหลังฝึกอบรมทั้ง สามระดับสูงกว่าก่อนฝึกอบรมอย่างมีนัยสำคัญทางสถิติอย่างสูงที่ระดับ 0.01

2. ผลจากการประชุมเชิงปฏิบัติการอย่างมีส่วนร่วม (AIC) พบว่า ผู้เข้าร่วมการฝึกอบรมสามารถดำเนินการจัดตั้งคณะวิทยากรเพื่อบริหารจัดการและดำเนินการจัดอบรมในระดับต่อไป และได้แผนปฏิบัติการเพื่อดำเนินการเกี่ยวกับการอนุรักษ์สิ่งแวดล้อม และพลังงาน ตามวิสัยทัศน์ที่ร่วมกันกำหนด ซึ่งได้จากการระดมสมองโดยนำเทคนิค SWOT (Strength-Weakness-Opportunity-Threat) analysis มาบูรณาการ ตามแนวคิด การบริหารโครงการด้วย Who, Whom, What, When, Where, Why, and How (6W1H)

3. ผล การประเมินสามมิติที่ประดิษฐ์ขึ้นนำมาใช้ประเมินการมีส่วนร่วมในการฝึกอบรม และการประเมินสี่มิติ หรือการประเมินรอบด้านที่ประดิษฐ์ขึ้นนำมาใช้ประเมินการปฏิบัติตนเป็นวิทยากรของผู้เข้ารับการฝึกอบรม พบว่าทุกคนผ่านเกณฑ์การเป็นวิทยากรกระบวนการ (facilitators)

4. มีการจัดตั้งเครือข่ายการเรียนรู้สำหรับการอนุรักษ์พลังงานและสิ่งแวดล้อมในเขตบางซื่อ และมีการเลือกตั้งคณะกรรมการบริหารหลังจากกระบวนการฝึกอบรมเสร็จสิ้นตามแนวคิด MML และจากการประเมินตลอดทั้งกระบวนการด้วยเทคนิคที่ประดิษฐ์ขึ้นคือ Participatory Performance, Assessment, Monitoring, Evaluation, and Impact (PAMEI) พบว่า ผู้เข้ารับการฝึกอบรม จำนวน 55 คนที่ผ่านเกณฑ์การเป็น วิทยากร และผู้ให้ความรู้ จำนวน 36 คนที่ผ่านเกณฑ์การเป็น วิทยากรกระบวนการ และ ผู้ให้ความรู้

ข้อเสนอแนะที่เป็นผลจากการวิจัยมีดังนี้คือ ควรนำต้นแบบไปใช้ในการสร้างเครือข่ายการเรียนรู้สำหรับการอนุรักษ์พลังงานในเขตอื่นๆของกรุงเทพฯ เพื่อให้เกิดการประหยัดพลังงานด้วยการใช้พลังงานให้เกิดประโยชน์สูงสุด นอกจากนี้รูปแบบนี้สามารถปรับใช้ในการดำเนินการอนุรักษ์สิ่งแวดล้อมและทรัพยากรธรรมชาติเพื่อปรับปรุงคุณภาพสิ่งแวดล้อมให้ดีขึ้น

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LIST OF ABBREVIATIONS

AFMEYF: Austrian Federal Ministry for Environment, Youth and Family

AIC: Appreciation-Influence-Control

BASNEC: Bang Sue District Learning Network for Energy and Environment Conservation

CEI: Central Europe Initiative

CLC: Community Level Center

ECF: Energy Conservation Promotion Fund

ECP Act: Energy Conservation Promotion Act of 1992

EE: Environmental Education

EGAT: Energy Generation Authority of Thailand

FDE: Four Dimensional Evaluation

FGD: Focus Group Discussion

GHG: Green House Gas

IEA: The International Energy Agency

LDCs: Least Developed Countries

LND: Learning Network Development

MEA: Metropolitan Electricity Authority

MML: Multi-level Management Linkage

NEPO: National Energy Policy Office

NEPC Act: National Energy Policy Council Act of 1992

OECD: Organization for Economic Cooperation and Development

OPEC: Organization of Petroleum Exporting Countries

PAME: Participatory Assessment, Monitoring and Evaluation

PAMEI: Participatory Attendance, Assessment, Monitoring, Evaluation, and Impact

PAR: Participatory Action Research

PEA: Provincial Electricity Authority

PRA: Participatory Rural Appraisal

LIST OF ABBREVIATIONS (cont.)

RDE: Round Dimensional Evaluation

SLC: Subdistrict Level Center

SWOT: Strength-Weakness-Opportunity-Threat Analysis

TDE: Three Dimensional Evaluation

TOT: Training of Trainer

UNFCCC: UN Framework Convention on Climate Change

6W1H: Who, Whom, What, When, Where, Why, and How

CHAPTER 1
INTRODUCTION

1.1 Rationale and Justification

By the year 2003, both industrialized and developing countries were aware of global warming—one of the major environmental crises affecting the planet. Thailand has also paid attention to this issue as well ever since the government became a member of the UN Framework Convention on Climate Change (UNFCCC). The United Nations Parties to the Convention were seeking to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, through an emphasis on sharing the responsibility to decrease greenhouse gases, particularly in the developed countries. These areas were primarily responsible for historic and current emissions and must take the lead to combat climate change (McMichael, Haines, Slooff, and Kovate,1996).

As for Bangkok, Thailand's largest city, about one tenth of the country's population (approximately 6,400,000 in the year 2000) lives here, according to the National Statistic Office. However, because of numerous unregistered residents, it was estimated that there are actually 10 million people, or one sixth of Thailand's population, living in the city. For this reason, if a learning network project could be built for energy conservation and implemented through the aforementioned project, then there would be a vast amount of natural resources saved through environmental protection, with national money saved simultaneously. There was a high rate of population migration in and out of Bangkok because of better education, job opportunities, and entertainment. The increasing population was due to the development of infrastructures such as road networks, real estate developments and land value, and public policy, as well as an advancing economy that resulted in

expansion into the surrounding areas (UN, 2002; and Bangkok Metropolitan Administration & UNEP, 2001).

As such, there are numerous activities operating in Bangkok. It has been recognized as the center of different functions, such as politics, administration, education, history, culture and economy, for more than 200 years. High energy consumption within the capital would be unavoidable due to the rapid rise in the number of factories. During the years 1997-2000, the number of factories amounted to 21,026 and the capital invested equaled 261,428 million baht, with the factories employing 608,088 workers. As a result of the economic crisis and the Bangkok Comprehensive Plan (1999), factories in Bangkok were more likely to be small-scale factories. Nevertheless, the city has been undergoing rapid urbanization and industrialization since 1960 (Bangkok Metropolitan Administration & UNEP, 2001).

The rapid rise in population caused an increase in community numbers. The Bangkok Metropolitan Administration (BMA) defined communities into 5 categories: slum community, suburb community, real estate community, urban community and housing community. In 2000, there were a total of 1,596 communities in Bangkok, and there was a trend that communities in the city were increasing every year. The population in communities totaled 1.26 million and households numbered 310,490 and 256,489 houses (Bangkok Metropolitan Administration & UNEP, 2001).

The rapid development of Bangkok has led to various environmental problems and created environmental degradation in all aspects, such as air pollution, water pollution, noise pollution, solid and hazardous wastes problems and land subsidence. The sources of air pollution came from both mobile, such as vehicles for transportation, and non-mobile sources, such as crematoriums and factories that caused significant nuisance and pollution. From vehicular registration statistics, it was found in the year 2000 that the number of vehicles registered in Bangkok was 4.5 million, which was an increase of 113 percent from 1991, compared to 20 million for the whole country. These large numbers of vehicles and traffic congestion have caused severe impact on air quality in Bangkok. The resulting greenhouse gases such as carbon dioxide increased as well, in addition the gases that resulted from the charcoal

burned as energy for electrical generation. Greenhouse gas was the major cause of global warming or climate change (UNEP, 1993 and UNEP/GEMS, 1992).

Energy was a crucial fundamental production factor; a sufficient supply of energy to meet the demand in various economic activities was essential to develop the international competitiveness of the country. Electrical consumption in Bangkok was about 35.30 percent of the total consumption of the country. The highest figure of electricity consumption is from the industrial sector, which was 38.77 percent of the total electricity consumption Bangkok in 2000. The other figures included 34.23 percent from business, 21.42 percent from residential and 5.57 percent from other sectors (NEPO, 2001; and Bangkok Metropolitan Administration & UNEP, 2001).

Fuel consumption of Bangkok in 2000 was 12,219.44 million liters, which was 35.3 percent of the total consumption of Thailand. It was composed of diesel (29.49 percent), aviation fuel (26.83 percent), fuel oil (20.74 percent), unleaded gasoline (20.0 percent), liquid petroleum gas (2.69 percent), and illuminating and kerosene (0.24 percent) (Bureau of Fuel and Oil, Department of Commercial Registration, Ministry of Commerce, 2000).

For this reason, if we could decrease the rate of combustion of transportation via the mass transit systems instead of personal transit methods as well as control the huge population (one sixth of total national population) in Bangkok, this could help decrease electrical consumption, mitigate air pollution, and alleviate the greenhouse effect.

In order to solve, prevent and mitigate all these problems, the integration of environmental education and information technology seems to be one of the most appropriate measures to build the network of learning for energy conservation. Thailand also had faced global warming as well as environmental degradation due to greenhouse gas emission caused by deforestation, energy production, consumption and agriculture. The country would need to develop a learning network linkage of energy conservation to alleviate the above mentioned environmental problems. The most important thing would be to raise the public awareness so that the integration of the environmental education process through the learning network linkage could be established. In addition, the lifelong education concept could be an essential and

effective strategy to accomplish energy conservation to alleviate global warming in order to reach sustainable development, which is the ultimate goal of the human race. Lifelong environmental education would be an essential means to this result, which would be done via the adult learning concept through different approaches, such as Participatory Action Research (PAR), Participatory Rural Appraisal (PRA) (Opp, R., 1997), Appreciate-Influence-Control Process (AIC), PAME (Food and Agriculture Organization of the United Nations Rome, 1990) and training of trainers (TOT).

All these approaches would be integrated to develop the learning network linkages, which, once established, could be an appropriate and valuable technique to achieve environmental education, knowledge and an understanding of development, positive attitudes and values, and raising responsibility, awareness and consciousness. It was expected that the developed integration approaches or holistic approach expressed in this research could contribute to the dissemination of knowledge, understanding, awareness, and finally the establishment of learning networks in the studied area.

To develop the effective learning network establishment, especially in a giant city like Bangkok, a prototype of learning network would need to be established, which would be done by initiating an appropriate district as a case study to develop the network. Bang Sue District was selected to be developed as a prototype for the network learning establishment via the invented integration approaches or holistic approaches. A preliminary survey was done for a few districts such as Phranakorn, Dusit, and Bang Sue in order to select the most appropriate district for trying out the research concepts and principle of Multi-level Management Linkage (MML) concept with a “training of trainer” (TOT) process. The set criteria included community leader competency, willingness, and availability of time for participating in training courses and practicing as a trainer, as well as administrating or running after the learning network established. The major process used was the TOT process, with MML concept applied as a multiplier effect in order to accelerate public consciousness of energy conservation to alleviate global warming, especially within communities in Bangkok. The TOT concept was a process that developed trainers by applying the concepts of education for adults and the lifelong education process, particularly

participatory training the community leader to be a trainer, which would be another effective means to multiply the number of informal educators or community educators. Moreover, the beginning point in the Ninth National Social and Economic Development Plan concepts and strategies along with the enhancement of knowledge and leadership for change management support this. Collaborative networks involving all development partners should be supported and enhanced to create a learning society, with the interactive learning network, through community participation, becoming an important approach. Besides this, activities could be arranged among communities, such as energy conservation, reduction of greenhouse emission by using the mass transportation systems instead of private cars, waste recycling and changing daily lifestyle patterns to become more sustainable (Isarawatana, 2000; Office of the National Education Commission,1997; National Economic and Social development Board Office of The Prime Minister, 2002; Sripahol & Seniwong na Ayuttaya, 1997; Kamchaturat, P., 1987; AAEE, 2001, and Division of Technology, Industry and Economics, 2001).

The expected results from the above mentioned processes and implementations, the prototype model for development of a learning network establishment for energy conservation to alleviate global warming, would be the model for the remaining 49 Districts of Bangkok, including Phra Nakhon, Dusit, Nong Chok, Bang Rak, Bang Khen, Bang Kapi, Patumwan, Pom Prap Sattru Phai, Phra Khanong, Min Buri, Lat Krabang, Yan Nawa, Samphanthawong, Phaya Thai, Thon Buri, Bangkok Yai, Huai Khwang, Khlong San, Taling Chan, Bangkok Noi, Bang Khun Thian, Phasi Charoen, Nong Khaem, Rat Burana, Bang Phlat, Din Daeng, Bueng Kum, Sathon, Chatuchak, Bang Kho Laem, Prawet, Khlong Toei, Suan Luang, Chom Thong, Don Mueang, Ratchathewi, Lat Phrao, Watthana, Bang Khae, Lak Si, Sai Mai, Kanna Yao, Saphan Sung, Wang Thong Lang, Khlong Samwa, Bang Na, Thawi Watthana, Thung Khru and Bang Bon, as presented in Figure 1, which can be used for learning network establishment as well.

Even though a number of researchers had studied the development of a learning network model, no research process proposed had been done by investigating the influencing factors that facilitated and accelerated the learning network

establishment via a “Training of Trainer” process with the integration of participatory training means, such as the AIC technique, under the operation of an invented MML concept through a holistic approach like in this research. In order to confirm the effectiveness of the prototype learning network development, it was evaluated by a created integration PAMEI technique.

The study would result in the achievement of an effective model and the implementation to develop and establish the learning network for energy conservation, which would be applied as a prototype to other districts in Bangkok or even other communities in the rural areas as well, including the modified integrated Participatory, Assessment, Monitoring, Evaluation, and Impact (PAMEI) technique, the invented Three Dimensional Evaluation (TDE) for the participatory training of participants, and the invented Four or Round Dimensional Evaluation (FDE or RDE) with both qualitative and quantitative approaches for qualification of training the trainer performance. All the techniques developed from this study could be used as effective tools for others’ evaluation of training programs.

1.2 Objective of the Study

The objective of this study was to develop the model learning network for the establishment of energy conservation in the urban community, by taking Bang Sue District, Bangkok as a pilot case for the study.

1.3 Scope of the Study

In developing a learning network in the Bangkok metropolitan area for energy conservation to alleviate global warming where in this study, the Bang Sue District was selected for commencing the development of a prototype network learning establishment via the invented integration approach or holistic approach, because its policy, administrators, officers and the readiness of community were favorable facilitators.

1.4 Research Questions

1.4.1 Would the invented concept of MML and TOT process be able to develop and establish a learning network for energy conservation among community leaders who participated in this research operation?

1.4.2 What factors would be required for developing a learning network establishment for energy conservation?

1.4.3 How would the invented techniques of PAMEI, TDE, and FDE or RDE be used to implement and evaluate the learning network model establishment effectively and successfully?

1.5 Contribution of the Study

There are different contributions of this study, as follows:

1.5.1 The invented concept of MML and TOT process would be used to develop and establish the learning network for energy conservation among community leaders and community people in the Bang Sue District.

1.5.2 The discovered factors from this study, which were required for the development of learning network establishment for energy conservation, could be used as essential components for concentrating in the process of learning network development.

1.5.3 The invented techniques such as PAMEI, TDE, and FDE (or RDE) would be used to implement and evaluate the other learning network model establishment effectively and successfully.

1.5.4 This invented concept of MML and TOT process would be used as a prototype to develop and establish the learning network for energy conservation.

1.6 Operational Definitions of Variables

1.6.1 **Leadership** was used to refer to the attributes of the leader, such as public mindedness, devotion, voluntary commitment, responsible, bird's-eye view visions, leadership skills, and motivation, all of which would be used for inducing members to participate in and pursue energy conservation to alleviate global warming.

1.6.2 **Training of Trainer (TOT)** was used to refer to the participatory training course that was held to develop the trainer in energy conservation, via AIC technique of brain storming to enable practice as a trainer and community educator for energy conservation for people in the community

1.6.3 **AIC Techniques** (Appreciation, Influence, Control technique) was used to refer to a participatory workshop-based technique that encouraged stakeholders to consider the social, political, and cultural factors along with technical and economic aspects that influenced a given project or policy. AIC helped workshop participants identify a common purpose or shared vision, encouraged them to recognize the range of stakeholders relevant to that purpose, and created an enabling forum for stakeholders to pursue that purpose collaboratively. Activities focused on building appreciation through listening, influenced through dialogue, and controlled through action. The SWOT (Strength-Weakness-Opportunity-Threat) analysis was applied in the implementation of the brain storming process used for identifying the previous, existing, and future situations of energy conservation in the participants' communities.

1.6.4 **Multi-level Management Linkage (MML)** was used to refer to an invented continuous process, by using the multiplying effect with the various levels of the TOT program to train the community leader to be a trainer and an educator on energy conservation, through the integrating with the participatory training approach and AIC technique.

1.6.5 **Environmental Perspectives** was used to refer to the community leaders that had different dimensions of existing environmental states, such as water resources, agricultural development, forestry, land-use planning, energy conservation, waste recycling, global warming, impacts of pollution and so on.

1.6.6 **Knowledge** was used to refer to information and understanding about the environment, natural resources, lifelong education, energy conservation, learning

network development, and sustainable development that were remembered, recalled and recognized by anyone.

1.6.7 **Awareness** was used to refer to people perceiving, accepting and recognizing their obligation and responsibility to do activities in order to conserve energy to prevent global warming.

1.6.8 **Participation** was used to refer to the feelings, opinions, or consciousness to participate in TOT process and **Ba**ng **S**ue District Learning **N**etwork for **E**nergy and Environment **C**onservation (BASNEC), established for members to be a trainer, educator, or facilitator for network activities for public interest.

1.6.9 **Learning Network** was used to refer to an individual, and/or groups, and/or communities or organizations that had relationships to collaborate, share, exchange and discuss issues with each other regularly through the central learning organization, as well as to manage learning for members and be used as core of knowledge exchange among them with the same shared vision and commitment.

1.6.10 **Development of Learning Network Model** was used to refer to the method to construct and improve the learning network in order to change network community levels for individuals to be able to manage learning continuously and to arrange for network members to have enough knowledge, understanding, and awareness to participate and practice.

1.6.12 **Energy Conservation** was used to refer to using energy with economization and the highest efficiency.

1.6.13 **Participatory Attendance, Assessment, Monitoring, Evaluation, and Impact (PAMEI)**

PAMEI was a technique invented by the research for this study because it was an effective means to evaluate the trainee after training. To accomplish the learning network development for energy conservation, trainer performance of participants would be evaluated. Particularly, most participants were willing to share their responsibility to public by expressing their capability to perform as a trainer and participate in activities held by the Bang Sue District Learning Network for Energy and Environment Conservation, which was established by all the trainees of the training course arranged by this study. They also participated thoroughly and regularly as members of the learning network, which was established by themselves in all phases and activities, including participatory attendance, participatory assessment,

participatory monitoring, participatory evaluation, and sharing the responsibility to create an impact upon society with their own public-mindedness, in harmony with the objectives of the learning network.

Definitions of PAMEI technique

Participatory Performance (P) is a mean to observe and examine the participant performance in the training course of MML techniques in two phases: firstly during the period of participation in the training course and secondly as trainer performing after training was received, by expressing their capability as a facilitator, educator and trainer individually or collectively with the network or other groups in the community and other societies.

Participatory Assessment (A) is a method for determining, from the participant point of view: what activities are needed and can be supported; they have identified the right problem and right solutions via using the application of Appreciate-Influence-Control Process (AIC) with integration of the SWOT analysis technique for seek a shared vision to set plan and project to implement to accomplish the objectives of environment and energy conservation.

Participatory Monitoring (M) is a systematic recording and periodic analysis of information that has been chosen and recorded by participants with the help of researcher team, with the main purpose being to provide information during the life of the project, so that adjustments and/or modifications can be made if necessary.

Participatory Evaluation (E) is an opportunity for both researcher team and participants to stop and reflect on the past in order to make decisions about the future. Participants are encouraged and supported by researcher team to take responsibility and control of planning what is to be evaluated, how the evaluation will be done, carrying out the evaluation, and analyzing information and presenting evaluation results, since the participants already intuitively and informally evaluate, in light of their own individual and/or group, the objectives. The evaluation was done by employing the invented Three Dimensional Evaluation (TDE) for the training course achievement and Invented Four Dimensional Evaluation (FDE) or Round Dimensional Evaluation (RDE) techniques for trainer performances of participants.

Participatory Impact (I) is an activity to be practiced by participants, in order to perform as trainers or for participation in training courses to provide knowledge for different groups or institutes in the communities on the issue of energy conservation and network development process, including getting the community people to participate in activities such as meetings held in the community for giving knowledge about environment and energy conservation and taking part in a campaign of electricity and pipe water use reduction.

1.7 Conceptual Framework

The learning network establishment would be developed by using the "Training of Trainer" process with the Multi-level Management Linkage (MML) via the invented integration approach or holistic approach in this research. Accordingly, the Bang Sue District would be the "Learning Network Center" and 2 subdistricts (2 zones for Bang Sue District) would be the "Learning Network of Subdistrict Center Level" and the 50 communities (Zone 1 was composed of 27 communities, and Zone 2 was composed of 23 communities) would be the "Learning Network of Community Center Level" as well. After the training course was finished and the evaluation process completed for each level, the first level trainees would become trainers for second level trainees, and the second level trainees would be the third level trainers and so on until finally the learning network would be established, as demonstrated in Figure 1: Multi-level Management Linkage (MML) of Learning Network Establishment. As stated, the learning network will be established in the Bang Sue District after the research has been developed by using "Training of Trainer" process with the Multi-level Management Linkage (MML) concept via the invented integration approach or holistic approach. Afterwards, most people in this district will gain knowledge on energy conservation.

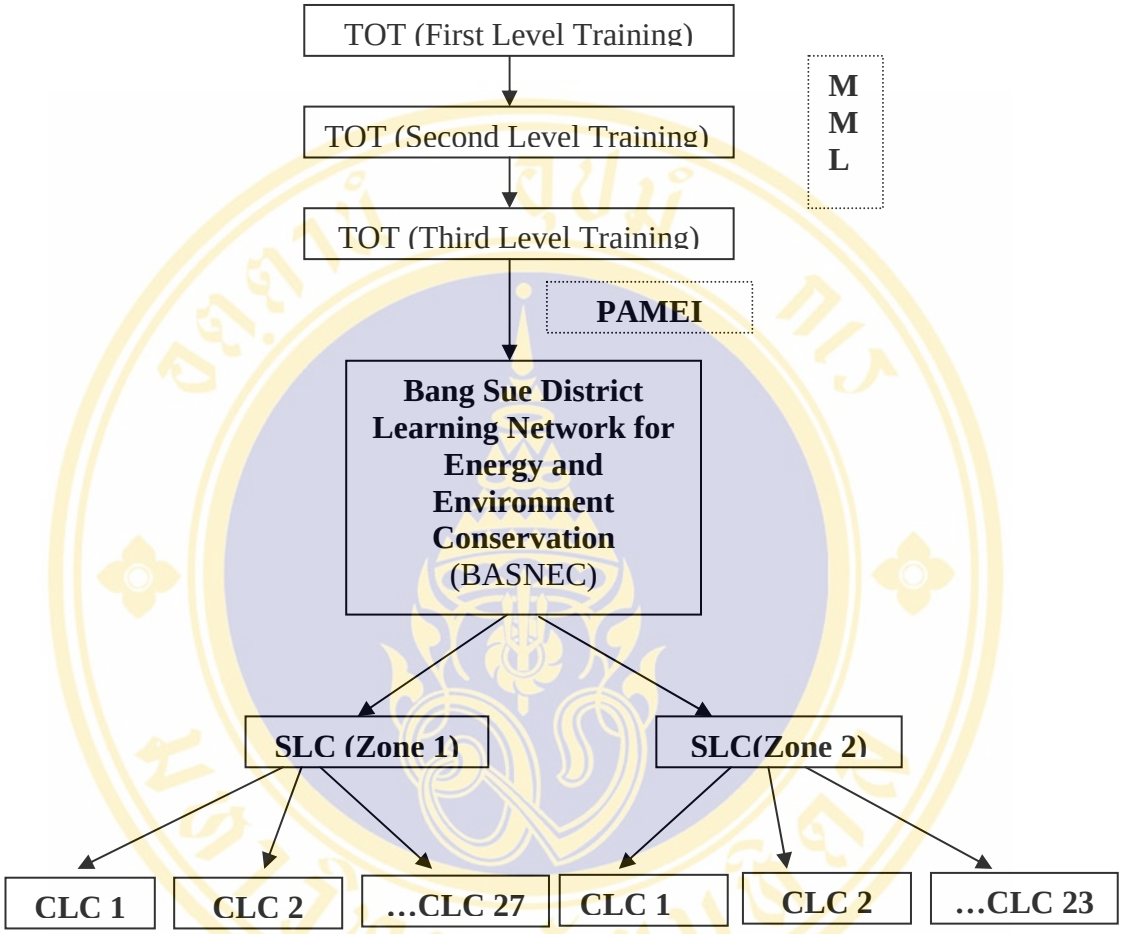


Figure 1 Multi-level Management Linkage (MML) of Learning Network Establishment

NB: SLC=Subdistrict Level Center, CLC=Community Level Center

CHAPTER 2
LITERATURE REVIEW

In this study, a literature review would be done on the related issues relevant to the development of a learning network system (model) for energy conservation, which included the following issues:

- ⊙ Energy
- ⊙ Environmental Education
- ⊙ Community Participation
- ⊙ Learning Network Model Development

During the 21st century, it was expected that the major energies such as petroleum, natural gas, and charcoal would have a shortage in the 21st-22nd centuries, with the environmental impact from these fossil fuels impacting the world (International Labor Organization, 1993; and Wongwaisayawan, 1993). In order to alleviate the energy shortage and decrease the environmental impact due to fossil fuel consumption as well as wait for the appropriate technology to develop the clean renewable energy for substitution, the environmental education process seems to be the only means that would truly help. Environmental education would let people keep up with environmental problems, and introducing the concept of sustainable development through a lifelong education process. This could be further helped by developing a learning network as the center for providing knowledge and understanding, as well as raising awareness, consciousness, and responsibility for environmental and natural resources conservation. In order to accomplish the learning network, an effective model for developing and sustaining the established network was needed. Therefore, this research tried implementation with the invented MML concept and the TOT process, integrated with different tools and techniques such as AIC, SWOT Analysis, focus group discussion, PRA, PAMEI, TDE, and FDE, all of

which were based on the participation of the community leaders as the target group of this study.

2.1 Energy

At present in the year 2003, the world was faced with decreasing fossil energy, such as oil and gas, which were the major sources of the most important global energy. Therefore, there had been various attempts to search for other prospects of sustainable energy to support the 21st century development of all countries, both industrialized and developing. Energy production from fossil fuel was the principal pressure for degradation of the environment in the industrial world and promises to add to myriad problems in the developing world as well.

Fossil-fuel combustion accounted in the late 1990s for 89 percent of the commercial energy consumption in USA and 80 percent of total energy used worldwide (Bodansky, 1991; Weisel, and Kelly, 1991; and Hollander, 1990). The worldwide fossil-fuel emission of the green house gas (GHG) carbon dioxide (CO_2) had been estimated at over 20 billion metric tones (mt) annually. The International Energy Agency (IEA) expected world primary energy demand to increase with an annual growth rate of around 2 percent, reaching 50 percent above the levels of the 1990s by the second decade of the 21st century (Ferrier, 1996, and 1997; IEA, 1996). They also forecasted that 90 percent of that energy would still be supplied by fossil fuels in that decade. It was to be expected that energy-driven CO_2 emission would increase in about the same proportions. The IEA further expected that the largest developing countries (China and India) would have a greater increase in CO_2 emissions than the already industrialized nations of the Organization for Economic Cooperation and Development (OECD). While control of the emissions of pollutants, such as sulfur dioxide (SO_2) and carbon fine particles, was being established in many countries, there remains a debate over further reductions. Even in the face of optimistic energy-efficiency scenarios, Anderson (1995) expected that the growth of demand from developing countries would result in a net growth of world fossil-fuel consumption into the 21st century.

Nevertheless, there was growing consensus in scientific circles that anthrogenic sources of the GHGs as another environmental pressure (carbon dioxide, methane, chlorofluorocarbons (CFCs), nitrous oxide, etc.) were contributing to climate change worldwide (NAS, 1991; Rosen, & Glasser, 1992; Steen, 1994; and CEI, 1999). Of these, CO_2 and nitrous oxide (N_2O) emissions form fuel combustion. The documented rise in global average temperatures was now undisputed. The annual increase in atmospheric CO_2 and the other gases had been recorded and long been unquestioned. The theoretical understanding of the mechanisms of interaction with thermal radiation, whereby heat was held by the gases in upper atmospheres, was unchallenged. Whereas the atmospheric physic issues of counterbalancing effects (e.g., cloud cover) and dynamics of atmospheric and oceanic circulations had not been fully resolved, there had been increasing scientific agreement that the prospects of global warming resulting from human activities was real, with fossil-fuel combustion a major contributor. In the face of these findings, there was still not a concrete effort by industrial nations to take strong measures to reduce GHGs emissions worldwide (New York Times, 1997). Nonetheless, in view of these prospects, there had been a call to “decarbonize the world economy” (Goldemberg, 1996).

However, for the prospects of long-term exhaustibility of fossil resources and their present uneven geographic distribution, the industrial world had already experienced the implications of the latter in the second half of the 20th century. The energy crisis of the 1970s was simply about distribution in the supplies of oil for the industrial nations who were, and still have been, heavily dependent on oil imports. It was expected that the USA, which had a major share of the world market, would have to import over two thirds of its oil in the first decade after the turn of the century, as its domestic production continued to decline. Other oil-importing industrial countries, such as Western Europe, were apt to fall into greater dependence on imports, with North Sea production declining into the second decade of the 21st century and limited prospects in future for import from Eastern Europe. Japan would have to compete with a growing demand by China for oil supplies, which might still be dependent on production in the Far East (IEA, 1995).

There were numerous countries of different continents establishing cooperation at policy and plan level to manage the transport system to diminish the GHGs emission such as Central European Initiative (CEI). Countries had initiated cooperation through sustainability objectives and reducing environmental pollution and health hazardous caused by transportation, which were key challenges for environment and transport policies in Europe. There was also fruitful cooperation of UNEP and AFMEYF (Austrian Federal Ministry for Environment, Youth and Family, the OECD (Organization for Economic Co-operation and Development), elaborated by TRAFICO (Transport Planning under the Project Management of UNEP, OECD, and FMEYF).

By the second decade of the 21st century, it was expected that the Organization of Petroleum Exporting Countries (OPEC) would be supplying 50 percent or more of the world oil market, at a rate of 50 million barrels per day or greater (IEA, 1996). However, this would be technically feasible only if they had made the investments necessary for production capacity, because energy must be taken for accessing goods, services and information essential for economic and social development. In addition, transportation in all its many forms needed fossil-fueled energy. It played an essential role in the economies of all countries, industrialized or developing, and therefore was of critical importance for virtually all industries and activities (UNPEP, 2000).

The Johannesburg Summit, billed as the biggest-ever United Nations conference, brought together 104 heads of State and government. A total of 191 countries participated in the Summit besides the European Commission and Palestine. The United Nations issued 21,340 accreditation passes, including more than 9,000 to delegations, over 8,000 to major groups and more than 4,000 to media (UN, 2002). At the Johannesburg Declaration, committing themselves to build a humane, equitable and caring global society cognizant of the need for human dignity for all, the heads of state and government assumed a collective responsibility to advance and strengthen the interdependent and mutually reinforcing pillars of sustainable development -- economic development, social development and environmental protection -- at the local, national, regional and global levels.

According to the Declaration, the world leaders would continue to pay special attention to the development needs of small-island developing states and the least developed countries. The leaders agreed that in pursuit of their legitimate activities, the private sector had a duty to contribute to the evolution of equitable and sustainable communities and societies. They also agreed that there was a need for that sector to enforce corporate accountability within a transparent and stable regulatory environment. Describing the 1992 Rio Summit as a significant milestone that had set a new agenda for sustainable development, they reaffirmed their commitment to Agenda 21 and the Rio Declaration. Between Rio and Johannesburg, the Monterrey Conference on Financing for Development and the Doha Ministerial Conference had defined a comprehensive vision for the future of humanity (UN, 2002).

It was accepted that energy would be an essential factor for living creatures on this planet to survive. For the past two-three centuries since the industrial revolution, fossil fuel had been a major part of energy sources. More than 1 billion people living in the industrialized countries consumed about 54 percent of the world's total energy supply, while around 5 billion people in developing and transition economies consumed the remaining 46 percent (UNEP, 2002).

With the further thrusts toward development, large demands for fossil fuels could be expected, unless alternative energy technologies become available. Technological innovations would most likely emanate from research and development (R&D) established by the industrial countries, and the focus for assessing the prospects for these developments would accordingly be there, in the USA, Europe, and Japan (Cassedy, 2000).

In recent years, advocates from the industrialized world promoted the use of renewable resources (such as biomass of hydropower) or inexhaustible resources (such as solar energy or wind power) as the solution to the development dilemmas of the Third World. Some had even proposed that such resources be the chief means of powering the developing world, in order that it did repeat the despoliation that had accompanied industrialization of Northern nations. The technical, financial, and institutional barriers to alternative technologies made widespread non-fossil development quite uncertain in the developed world as well as in the LDCs (Least

Developed Countries). The developing nations had already indicated their impatience with unproven solutions and had escalated their use of fossil fuels as their financing and development programs had permitted (Cassedy, 2000).

Nevertheless, energy was essential to maintain life because every form of life and all societies required a constant input of energy. In every ecosystem, the sun provided that energy. The first transfer of energy occurred during photosynthesis, when plants converted light energy into chemical energy in the production of food. The energy sources most commonly used by industrialized nations were fossil fuels: oil, coal, and natural gas, which supplied about 90 percent of the world's commercial trade energy. Fossil fuels were formed hundreds of millions of years ago and the rate of formation of fossil fuels was so slow that no significant amount of fossil fuels would be formed over the course of human history. They were an accumulation of energy-rich organic molecules produced by organisms as a result of photosynthesis over millions of years (Enger, & Smith, 1998).

The energy could be divided into two types: renewable or non-renewable energy, depending on formation time. Non-renewable energy means it had to taken a long time to produce such fossil fuels, and renewable energy refers to energy sources that take a short time to renew or produce such as solar energy, wind energy, and biomass energy (Auken, 2002). In theory they could meet humanity's energy needs many times over, and would do so cleanly, but it was unclear how quickly they could be developed. It was estimated the share of the world's energy supplies in the second half of this century ranged from about 20 percent to over 50 percent (Lean, 2002). Two billion people still depended on biomass fuels, such as firewood, crop wastes and dung for cooking and warmth. Gathering them was often massively time-consuming, backbreaking work, while burning them created the world's deadliest air pollution: every year more than 2 million people die from breathing the cocktail of chemicals given off when they burned (UNEP, 2002 and Lean, 2002).

In 1991, Thailand adopted a nation-wide master plan for energy conservation to address a number of concerns, including environment and peak-load management concerns. Much of the reform since then had been driven by the National Energy Policy Council Act of 1992 (NEPC Act) and the Energy Conservation Promotion Act

of 1992 (the ECP Act). In the current situation relating to energy conservation in Thailand, the organizations involved in energy conservation in Thailand and their mandate resulted from the NEPC and ECP Acts. The Energy Conservation Promotion Fund (ECF) was established by the ECP Act, but the Energy Conservation Promotion or ENCON Program resulted from the ECP Act. Other energy conservation programs were undertaken by the Energy Generation Authority of Thailand (EGAT), The Metropolitan Electricity Authority (MEA) and The Provincial Electricity Authority (PEA). Therefore, the Awareness Program with the objective to disseminate information to persons directly concerned with the ENCON program – comprising facility owners, persons responsible for energy consumption of the facilities, and manufactures of equipment, machinery and materials contributing to energy conservation – were pertinent to the concept of environmental education for sustainable development.

2.2 Environmental Education

Environmental education is a learning process that increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action (UNESCO, 1978), including developing people to understand that they have a relationship with the environment and that whatever they do affects it. This education is there to help create consciences within people and stimulate them into responsible behavior by using the technology of education to develop the quality of the environment (Stapp & Dorothy. 1981; Schmieder & Allen, 1977; Chunkao, 1993 and Veeravatnanond, 1996).

Moreover, environmental education enhances critical thinking, problem-solving, and effective decision-making skills, and teaches individuals to weigh various sides of an environmental issue to make informed and responsible decisions. Environmental education does not advocate a particular viewpoint or course of action but needs to be approached with a holistic view (EPA, 2002).

Even though different campaigns had been implemented to motivate people to have more knowledge and understanding about energy conservation, people are still ignorant because they received superficial knowledge, especially through the various media such as television and radio. There is no effective renewable energy to substitute fossil fuels due to deficiencies in the technology for generating renewable energy.

Therefore, the environmental education process seems to be the tool for keeping up with the fossil fuel depletion, by using the TOT process to raise awareness and consciousness so people could conserve energy. It is a process designed to increase learning of the target groups so that they can change their performance in certain issues. Their learning may be a change of some attitude, knowledge, skill, and behavior. However, there has been different training courses held but these were effective only in certain levels. Most of the training was implemented but it was not monitored and evaluated after training courses were completed for a certain period. In other words, the majority of training courses were normally designed by one-level training, as various studies and researches that were done have shown (InWent-DSE-ZEL, 2002; Ob-Ay, 2003; Nonprarest, 2001; and Nakthae, 1998).

In order to solve the problem of discontinuity and to accomplish sustainable energy conservation, the development of a learning network model for energy conservation with the invented MML concept and the TOT technique by using AIC based on the participatory brainstorming operation with the application of SWOT Analysis technique was introduced, used in this research to establish the prototype learning network to meet the needs of energy conservation in order to achieve sustainable development. Furthermore, this study also invented the evaluation techniques for assessing the results, outcome, and impact of the implementation with the participatory evaluation techniques TDE, FDE, and PAMEI.

The design in this study was an MML concept, by using training of trainers (TOT) with participation of participants who were the community leaders in every step of implementation. It was a process of developing competencies by integrating knowledge during training processes with methods such as a learner-centered education and informal education for adults or lifelong education approach. This led to

a change of sustainable development, since the community people were the major factor to initiate and implement things by themselves with their own responsibilities and willingness (Quinn, 1996; and Srinivasan, 1990).

Environmental education emphasized the interdisciplinary integration of the subject matter and problem solving, including issue-based learning experiences, team teaching, learner-centered instruction, constructivist approaches and self-directed learning as core principles, including challenges of environment and economy that require understanding of the interdependence of the environment, economy, communications and technology. Therefore, government agencies and other responsible organizations for natural resources management must operate with progressive knowledge, sharing information and expertise and managing knowledge in a way that integrates information from a broad range of fields. The environmental education perspectives could be concluded in Table 1 (NAAEE, 2001; Gorman, 1999; and Murphy, 1999). Those planned in the new paradigm need to use new technology to meet environmental and economic challenges by having the requisite cognitive and scientific skills to manage the nation’s natural resources effectively (Conway, 1991; and NAAEE, 2001). The perspective of environmental education on the development of learning network for energy conservation in this research had principles, goals, and process as summarized in Table 1.

Table 1 Perspective on Environmental Education of This Research

Principles	Goals	Processes
1. Study the environment with a holistic view, both nature and human invented through integration of multidisciplinary approach. 2. Develop an understanding of the environment from bottom up, at local level to global level, from past to present and future. 3. Develop experience with environmental planning, decision making, and accepting the actual results, including environmental leaders. 4. Create people of all ages who are concerned about the environment and pass this concern onto others. 5. Develop analytical and critical thinking, systematically find solutions to problems, act locally, think globally 6. Develop and restore the quality of the environment for sustainability, and develop social life at all levels of family, community, up to national and global levels.	To develop people in order to have the following attributes: 1. Possess knowledge, understanding, awareness, and the skills to make decisions to participate in as well as solve environmental problems through the appropriate method. 2. Able to integrate natural resources, environmental situations knowledge with culture. 3. Be responsible towards the environment and the conservation of it in order for humans to live with nature harmoniously.	1. Use formal, non-formal, and informal education, integrated with lifelong education for people of all ages. 2. Emphasize the relationship between society and environment. 3. Training of trainers for environmental issue for community leader 4. Emphasize hands-on experience in out doors, and learning to solve problems through learner-oriented, participatory training with brain storming concept. 5. Arrange group activities by various media such as slides, movies, videotapes, field work, and establishing the learning center. 6. Cooperate to arrange activities among institutes, community, organization both government and non government organization. 7. Assess the outcomes of various techniques in order to see the real image and performance of the learners.

2.3 Community Participation

The community participation level in all countries in the world was introduced as an important function of the environmental and natural resources management concept, which would strengthen international and regional collaboration with the technological information system, thus supporting the rapid success of global protection to accomplish the sustainable human development.

Participation is a strategy for sustainable development to achieving full and effective community participation in development activities. It is a difficult job and much depends on the way members of communities are approached by field staff, developers, extension workers, or consultants (Srinivasan, 1990). Additionally, Thailand established the 2nd development strategies in the Ninth National Economic and Social Development Plan (B.E.2545-2549), which proposed sustainable urbanization. This should be done through developing the potential of human resources, strengthening the community and promoting the participation of the people in society in terms of sustainable development integration (National Economic and Social development Board Office of The Prime Minister, 2003).

The participation in all phases of this study was introduced as a main idea of MML concept and different techniques were employed for implementation and evaluation based on participatory approaches for all steps of implementing, such as PRA, and PAMEI, including the participatory evaluation techniques TDE and FDE were also employed as well. The participation was a form of ‘bottom-up’ or ‘grassroots’ development adopted by national governments, development agencies and NGOs wishing to improve the effectiveness of their development efforts during nineteenth century in order to be a substitute of centralized ‘top-down’ or ‘blueprint’ approaches of development. Therefore, this new shift in thinking has been characterized by the increasing use of the concept of ‘participation and a number of complementary notions such as ‘local organization’ and community-based’ initiatives, in addition to the rise of myriad of methodological approaches of development research such as ‘Participatory Rural Appraisal (PRA)’ and ‘stakeholder analysis’ listening to the voices of local people in the process of development was thought to

facilitate the emergence of more effective, efficient and responsive interventions. At the same time, local actors, through their active participation would be ‘empowered’ to guide and sustain their own development. The local people’s knowledge can be used to improve the effectiveness and efficiency of development. Furthermore, placing people at the center of development and giving them power to influence development decisions is an empowering process which would ultimately lead to people’s self-development.

In the aspect of community participation, there are various studies such as the one by Rawang (2001) who researched community-cultures based environmental education with a case study for the World Culture Heritage of Ayutthaya Historic City that emphasized culture-based aspects. The national and regional levels have also realized the importance of community participation so there have been different studies done in Asian cities about human settlements and community participation on forest plantation, water supply, and sanitation (United Nations Centre for Human Settlements (Habitat) Community Development Programme for Asia, 1998; Food and Agriculture Organization of the United Nations Rome, 1990; and Srinivasan, 1990).

It can be concluded that community participation is an important approach to introducing the success of various sustainable development, but it is the most essential concept to keep up with the environmental problem solving, so learning network establishing was also introduced. Therefore, the researcher was interested to study an effective methodology and process that can accelerate the establishment of learning networks through community participation (Kaoykaewpring, Suwannapong, and Choochart, 1994; and Srinivasan, 1990).

The grassroots people are accepted as being the most important, as they are the fundamental users of natural resources and environment. Therefore, environmental education concept was integrated into the newly invented concept of MML. The methods of evaluation and monitoring of TDE, FDE and PAMEI were successful in this study, since the trainees or participants could perform as trainers in their community to give knowledge to people in different communities and students.

The community leaders who were participants then trainers should able to express their intentions through building a shared vision together about energy and

environment conservation, by establishing a learning network to perform the activities and sharing their received knowledge in order to make the network into a living and dynamic learning organization. The network would be based on environmental education processes, because it would be a comprehensive process for helping people, teachers, communities, and students understand the environment in order to create awareness, consciousness, and responsibilities, and integrate them with the qualities of empowerment, self-discipline, flexibility and ethical behavior.

The community participation has different criteria according to their social structure, culture, and location. In 1970s, in the United State, there were a variety of studies done on the community participation such as eight levels of citizen control over initiatives or 'ladder of participation', and participation researches were based on the nature of the relationship between researchers and farmers, and were described as contractual, consultative, collaborative and supporting farmers'. Other workers in agriculture have also used a four-tier definition of participation that related different types of participation to the power and scope of interaction between different players. More recently, other attempts to characterize type of community participation was concluded as real community participation in term of requiring local people to take ownership of development activities. The real participation of community members in any project or activity is considered by participation concept. Participation could be used as strategy for sustainable development. The essential concepts of community participation are the free or cheap labor or raw material donating, cost-sharing, contractual obligation, planning, operation, decision-making, problem-solving, monitoring, and evaluation. It was called in term of PAME (Participatory Assessment, Monitoring and Evaluation) (Sirivansan, 1990; and FAO, 1990).

This study emphasized community leaders as a target group because the leaders are important people. They can lead and introduce any idea or activity, which will be accepted by the community member easier. Therefore a competent leader is an essential factor to distribute the knowledge of energy conservation and learning network development. Leaders need good interpersonal skills, a high level of self-awareness, and ability to develop and adapt plans when circumstances change. There were numerous studies which found that the community leader was an important

factor of success for a learning network formation. This was relevant to for the learning network establishing of Bang Sue District, because a leader was a person who had the ability to lead, motivate and persuade the other people to act willingly (Makasiranonth, 1999; Quinn, 1996; and Kiechel, 1994).

The implementation was done under the participatory training with principles of MML, AIC, PRA, and PAME, including the invented PAMEI, TDE, and FDE evaluation techniques by being confident in the ability of the community to be interested and energetic to receive knowledge on energy conservation, emphasizing the utilization of a community's strength to solve problems by using the high capability of community leaders. Nevertheless, giving importance to knowledge gained from real situations in everyday life when the PRA was implemented, the community people still lacked a way to practice energy economization, particularly in their everyday use of electrical appliances. The research design was formed from a participatory concept so it would let them have a major part in the process. This led them to cooperate in the campaign, after the leaders persuaded them to join the competition of most decreased daily life energy usage.

2.4 Learning Network Development

For learning network development, there were different studies done. Suwaree Sripoona (2000) studied the learning network development for biodiversity conservation, Shutima Saengngern (2002) studied learning networks of resources and environmental management for self-reliance, and Korbkarn Photchanachai (1993) studied learning network and management of community forests. All these studies were illustrated in terms of suggestions in the possibility of factors that influenced the network development. No study is verified with the new system approach of introducing new innovation techniques to explain the effective means to accomplish the formation of a learning network. This study tried to search for the technique and evaluation methods to verify the efficiency and effectiveness of invented processes, including the influencing factors for sustainable network learning development. Moreover, it lacked evidence to demonstrate what type of process would be effective

in developing a learning network. Therefore, it needs an experimental try to get the guidelines for network learning development as prototype of sustainable learning.

At the moment, there is still no precedence for any principles of learning network development with systemic approaches or any study undertaken. Therefore the researcher tried to develop a learning network by inventing the TOT with MML concept, including inventing the 3 evaluating techniques of Three Dimensional Evaluation (TDE) Technique, Four Dimensional Evaluation (FDE) or Round Dimensional Evaluation (RDE) Technique and Participatory Performance, Assessment, Monitoring, Evaluation and Impact (PAMEI) for implementation in this study. In previous studies, there was a learning network development through the existing learning network, such as Sripoona, and Saeng-Ngern.

Most of the studies created a learning network on different disciplines, especially through the information technology aspect, or internet on-line network having computers as tools of access. In addition, it was studied at a distance by comparing the means via internet channel and the conventional approach. This educational network is growing exponentially.

Learning and adapting were keys to individual success and network survival. Therefore, participatory training by MML principles would be an effective means to support the strength of a person (a member of a learning network), including building their competence and empowering them to face and overcome the other aspects of problems in their lives. This is also consistent with the concept by Senge (1990), who stated “real learning gets to the heart of what it means to be human. Through learning we became able to do things we never could and extended our capacity to be part of generative process of life,” and is also proposed by the research of Sripoona.

Learning in this study meant participatory learning through participatory training with the invented MML concepts. It needed to be accelerated learning in order to supplement the ability of individuals to learn more and receive information in less time, as well as to increase learner retention through the many varied techniques of accelerated learning. Accelerated learning techniques engage all parts of the brain in the learning process in conjunction with both conscious and subconscious mental functions. This ensures that every means of learning and acquisition was utilized as

simultaneously and fully as possible. It had also proved to be very effective in building innovation, imagination and creativity into the learning process that was consistent with the concept of Marquardt (1996).

In addition, participatory learning used in this study also included action learning as one of the most valuable instruments or methods of organizational learning, because it involved working on real problems and focusing and actually implementing solutions. It provided a well-tested method on accelerating learning, which enables people to learn better and to handle difficult situations more effectively. It was used as a systematic process that was pertinent to the studies of Revans (1980) and Marquardt (1996). It increased learning in an organization or network so that the organization or network could more effectively respond to change.

Therefore, the participatory learning used in this research should be the most effective when examining and observing the organization or network in term of adult learning approach by demonstrating and practicing of people participation in the training process and it was increased by reflecting from experience so the participants learnt critically when they were able to question the assumptions on which actions were based and they learnt when they received accurate feedback from others and form results of their problem solving actions. They were most challenged when they worked on unfamiliar problems in unfamiliar situations -- this was where the greatest learning might occur. It was most effective when the learners were examining the organizational system as a whole like as concept of Marquardt (1996).

A community learning network is a place where an individual can develop his own learning capacity. This creates new ideas and a broader perspective. (Senge, 1990: 2) An organization will make learning convenient for its members and continuously develop the system of learning and stimulate its members to use their own abilities. (Pedler 1991) When mistakes or successes occur, there will be an opportunity for the organization’s members to discuss and analyze the outcome, which becomes a learning experience for all. This is the reason why the entire country would benefit if there were learning networks all throughout the land; it would stimulate grass-root people to do better and be more knowledgeable

Learning is accomplished by the organizational system as a whole, almost as if the organization was a single brain or shared vision (Marquardt, 1996). If learning network will achieve the goal and target, it needs the unitization of the members to participate in the network activities.

The objective or goal or target is also an essential factor of every organization and network to accomplish sustainable development through the shared vision of members, because objectives are like a compass of the organization and network, with the vision like a tiller for members. Therefore, the organization or network must set clear objectives or aims that all members can take part to set together; subsequently they must search a shared vision to bring the organization or network toward reaching the objectives or goal. The ultimate goal of a learning network of energy conservation is sustainable development.

Shared vision is a shared picture for every participant of the future. It provides members of an organization with the stars to steer by. Therefore, it is a viable function to accomplish and sustain learning network maintenance when there is a truly shared, genuine vision, and people are inclined to excel and learn, not because they are forced to do so, but because they sincerely desire it. Instead of being exclusively a personal vision of a charismatic leader, it could be a shared picture for everyone of the future. Such a shared vision fosters heartfelt commitment by people throughout the organization or network to seek to improve, to learn, so that the vision can be accomplished (Marquardt, 1996).

A shared vision is valuable for the learning organization or network since it provides a focus and energy for learning. While adaptive learning is possible without a shared vision, generative learning occurs only when people are striving to accomplish something that matters deeply to them. (Senge, 1990; and Marquardt, 1996).

The concept of training of trainers in participatory techniques is employed for community participation, as a strategy for sustainable development of learning network establishment for energy conservation. This is done through various projects such as forestry conservation in order to broaden the learners' vision. The participatory approach—often known as learner-centered—has evolved over the past decade as a means of helping learners take greater control of their lives and their

environment by developing their skills in problem-solving and resource management (Srinivasan, 1990; and Kaoykaewpring, Suwannapong, and Choochart, 1994). It is integrated with PAME technique, AIC, and PRA, in addition the invented technique such as PAMIE, TDE, FDE, and the invented MML of TOT were also included in this study.

Additionally, if they are able to establish a learning network by themselves to sustain their activities continuously, it might be said that participatory training of MML employed in this study was successful and relevant to the principle of environmental education: environmental problem solving, promoting environmental knowledge and enhancing the public value, consciousness, awareness, and skill development in order to be able to take responsibility for environmental protection appropriately and effectively (UNESCO-ACEID, 1997; and NAAEE, 2001). Community leaders with lofty objectives or aims will compel new ways of thinking and acting. It provides a tiller to keep a learning process on course when stresses develop so the powerful, generative learning will still occur because they are truly committed to accomplishing goals that matter deeply to them. With a shared vision and values, they more readily question their established ways of thinking and their deeply held views, due to their participatory training received from this research design. Moreover, the shared vision will guide strategic thinking and planning for the organization and network.

Therefore, the implementation of this study should emphasize participation of the people from all walks of life and efficient resources utilization in the frame of participatory approach. The participation is an essential factor to support the success of a sustainable learning network development. The AIC technique implemented was a participatory training process and learner centered approach. These are relevant to different researchers such as Promboot and Pornseema, 1997; and Srinivasan, 1990). The AIC process was used as participatory activities that would motivate participants to do brain storming and to create a shared vision with SWOT Analysis, to search the existing strengths and weaknesses of their community and to use opportunities to accelerate the shared vision that they had in the training of trainer course so as to accomplish a learning network development for energy conservation. Therefore the

participatory learning or learner-centered learning that was introduced in this study would be an essential factor for a learning network development.

Getting quality training results is a long-term goal, not a blueprint, to develop and sustain. Implementing total quality management requires practical and continuous leadership to accomplish any administration (Swift, Ross, and Omachonu, 1998), particularly the learning network development for energy conservation. Establishing the prototype of a learning network is a more complicated system to form. It requires numerous factors to develop and construct new learning techniques.

CHAPTER 3

RESEARCH METHODOLOGY

To study the development of a learning network model for energy conservation: application to Bang Sue District, Bangkok, and the research design was divided into 6 phases as follows:

- The Proposed Model of Learning Network Establishment
- Population and Sample
- Research Design
- Research Instruments
- Assessment of the Effectiveness of the Instrument
- Data Collection
- Data Analysis

3.1 The Proposed Model of Learning Network Establishment

The concept of this research was the development of a learning network establishment in Bang Sue District, as a prototype of a learning network for energy conservation for other Districts in Bangkok Metropolis. Focus group discussions were made for community leaders to examine the need of training of trainers (TOT) to assist other districts to hold a center of learning network. The model was confirmed by implementation based on the MML concept by using TOT with the AIC technique integrated with the SWOT Analysis in order to set project for energy conservation of each group in accordance with project operation concept of Who, Whom, What, When, Where, Why, and How (6W1H) in order to accomplish the development of learning network model for energy conservation by establishing the “Bang Sue District Learning Network for Energy and Environment Conservation (BASNEC)” with the research design illustrated in figure 2.

3.2 Population and Sample

To develop the learning network system for energy conservation, the population used consisted of community leaders in the Districts Bang Sue, who participated in training of trainers with the invented MML concept. The population of community leaders was sampled by a purposive technique, but the sample group was done through purposive sampling with at least 30 persons for each of the three levels of MML training concept. There were 50 districts in Bangkok Metropolis Area. Each district was composed of numerous communities. In this study the Bang Sue District was selected as sample group for prototype of learning network development for energy conservation due to appropriateness leader capability from survey studies. The name of 50 districts, population, and households are presented in Table 2.

Table 2 Population & Households in Authorized District Areas, Bangkok

Code	*District*	Population	Households
1	Phra Nakhon	80,134	18,512
2	Dusit	151,942	28,826
3	Nong Chok	98,056	28,603
4	Bang Rak	59,891	23,148
5	Bang Khen	173,774	70,062
6	Bang Kapi	144,608	67,559
7	Patumwan	97,082	24,697
8	Pom Prap Sattru Phai	73,183	18,220
9	Phra Khanong	100,844	33,248
10	Min Buri	106,557	35,415
11	Lat Krabang	122,076	42,753
12	Yan Nawa	93,303	39,404
13	Samphanthawong	37,181	13,194
14	Phaya Thai	93,975	27,787
15	Thon Buri	179,162	41,474
16	Bangkok Yai	86,959	26,633
17	Huai Khwang	79,281	31,241
18	Khlong San	109,570	28,047
19	Taling Chan	101,828	30,541
20	Bangkok Noi	154,584	42,966
21	Bang Khun Thian	114,331	42,185
22	Phasi Charoen	139,782	41,879
23	Nong Khaem	116,477	40,805
24	Rat Burana	97,328	31,585
25	Bang Phlat	118,844	35,841
26	Din Daeng	161,450	46,607

Table 2 Population & Households in Authorized District Areas, Bangkok (Continued)

27	Bueng Kum	138,518	46,626
28	Sathon	108,529	32,122
29	Bang Sue	159,618	45,519
30	Chatuchak	171,405	72,119
31	Bang Kho Laem	115,871	33,363
32	Prawet	126,462	44,599
33	Khlong Toei	136,213	52,815
34	Suan Luang	113,612	41,437
35	Chom Thong	173,338	54,479
36	Don Mueang	151,860	53,121
37	Ratchathewi	146,324	27,049
38	Lat Phrao	109,897	38,520
39	Watthana	81,706	41,250
40	Bang Khae	177,965	64,845
41	Lak Si	119,779	42,701
42	Sai Mai	150,118	60,988
43	Kanna Yao	79,825	26,486
44	Saphan Sung	75,541	23,711
45	Wang Thong Lang	110,128	44,755
46	Khlong Samwa	103,784	38,589
47	Bang Na	100,864	40,519
48	Thawi Watthana	55,945	22,891
49	Thung Khru	93,920	35,757
50	Bang Bon	80,602	36,878
	Total	5,774,026	1,932,371

Source : Adapted from www.dola.go.th, updated on February 2002

3.2.1 Sample Group of Community Leaders

The sample group of community leaders the Districts Bang Sue for training of trainer purpose was sampled by purposive techniques, with at least 30 persons for each training course.

3.3 Research Design

3.3.1 Process of for Training of trainer for Community Leaders and Learning Achievement of Participants

The process of training was comprised of six steps.

1. Selecting community leaders to be trained
   (The criteria for selecting the community leaders were willingness, time, devotion, and public mindedness from the focus groups discussion)
2. Training the community leaders to be a trainer by using training of trainer (TOT) course.
3. Community leader who passed the trainer course would have two obligations.
   3.1 To be the person who transferred knowledge to the community people.
   3.2 To be the trainer for other community leaders in further TOT Course holding.
4. The AIC technique was employed for the participatory training process of brain storming, to consider the past and present existing environmental problems in communities, such as waste accumulation, waste disposal in rivers, waste recycling, and energy conservation behavior such as electrical appliance and pipe water consumption, as well as searching for a shared future vision of the environment, natural resources, and energy conservation methods. To achieve the sustainable energy and pipe water consumption behavior, the SWOT Analysis technique was employed in order to set project for energy conservation of each group in accordance with project operation concept of Who, Whom, What, When, Where, Why, and How (6W1H). The TDE was employed for evaluation of participants' intention of training participation. FDE or RDE was employed for primary evaluation of participants practicing as trainers for the further training course holding.
5. After three levels of TOT course was done, the knowledge achievement test was tested for comparison of difference between pretest mean score and posttest mean scores of the participants of three levels. Finally, the learning network would have been established at the district level.
6. Invented PAMEI technique was employed for evaluation of efficiency and effectiveness of administration and operation of the committee and members of learning network establishment for energy conservation, including trainer performances by giving knowledge to public, schools, and community.

3.3.2 Research Implementation

In this study, the training of trainer process would start via the Bang Sue District as a Training Center. Thirty community leaders who were certified by the setting criteria were selected to be the first group of trainees for “Training of trainer Course.” After training was done, they would be evaluated by the invented process of the research. Subsequently, the certified first group would be the trainers for the second group of community leaders. The training course would be repeated again by the first level participants as a steering committee. The third course of training would be held in the similar manner and the second level participants would operate the course as a steering committee as well. After the training process was finished, the trained community leaders had to have two major roles and obligations: be a trainer and a facilitator for other community leaders in the same district or different districts in Bangkok, and an educator for household members of their communities by transferring energy conservation concepts and knowledge, understanding, attitudes, practices, and behaviors (Figure 2, Research Design). Step of implementation were as follows:

3.3.2.1 Training Need Assessment

FGD technique was employed for training needs assessment for training of trainer on energy conservation through invented training process that was Multi-level Management Linkage (MML) of Learning Network Establishment as presented in figure 1.

3.3.2.2 Development of Training of Trainer Course

Training of trainer course was developed by emphasizing three content aspects: leaning network development process, training of trainer, and energy conservation knowledge of daily life activities that can lead to maximum profit and minimum cost of electricity consumption.

3.3.2.3 Preparation for the 1st Training Program

The PRA technique was employed for studying the existing state of energy conservation in communities of 2 zones and simultaneously, setting criteria for selection of participatory training participants. Thirty community leaders were recruited as participants according to the following criteria.

1) Criteria for selection of participatory training participant. The set criteria included willingness, time, devotion, participation, and cooperation to the network learning development process, acting as trainer, and sharing their knowledge received from the training course individually and group activity.

2) The thirty community leaders were recruited as participants would be informed by researcher directly and by the community leader who joined in holding focus group discussions.

In order to accomplish the goal of training, the course was arranged according to the following concepts:

1. TOT course was arranged for making the community leaders to be trainers and educators with abilities to transfer their knowledge, understanding, awareness, and consciousness of energy conservation to other districts and people inside and outside communities in Bangkok Metropolis.
2. A variety of concepts and evaluation techniques were invent to implement for developing a sustainable learning network in Bangkok Metropolis such as MML concept, TDE, FDE or RDE, and PAMEI techniques.
3. The systematic operation of three level training courses were prepared for training the participants to be able to perform as trainer, facilitator and educator for energy conservation via invented Multi-level Management Linkage (MML) with

'Training of Trainer' (TOT) process integrated with Appreciate-Influence-Control (AIC). Moreover, they would be able to develop an action plan and projects for environment and energy conservation according to the shared vision obtained through brain storming at each training level. Brain storming included SWOT (Strength-Weakness-Opportunity-Threat) analysis based on project operation methods of Who, Whom, What, When, Where, Why, and How (6W1H).

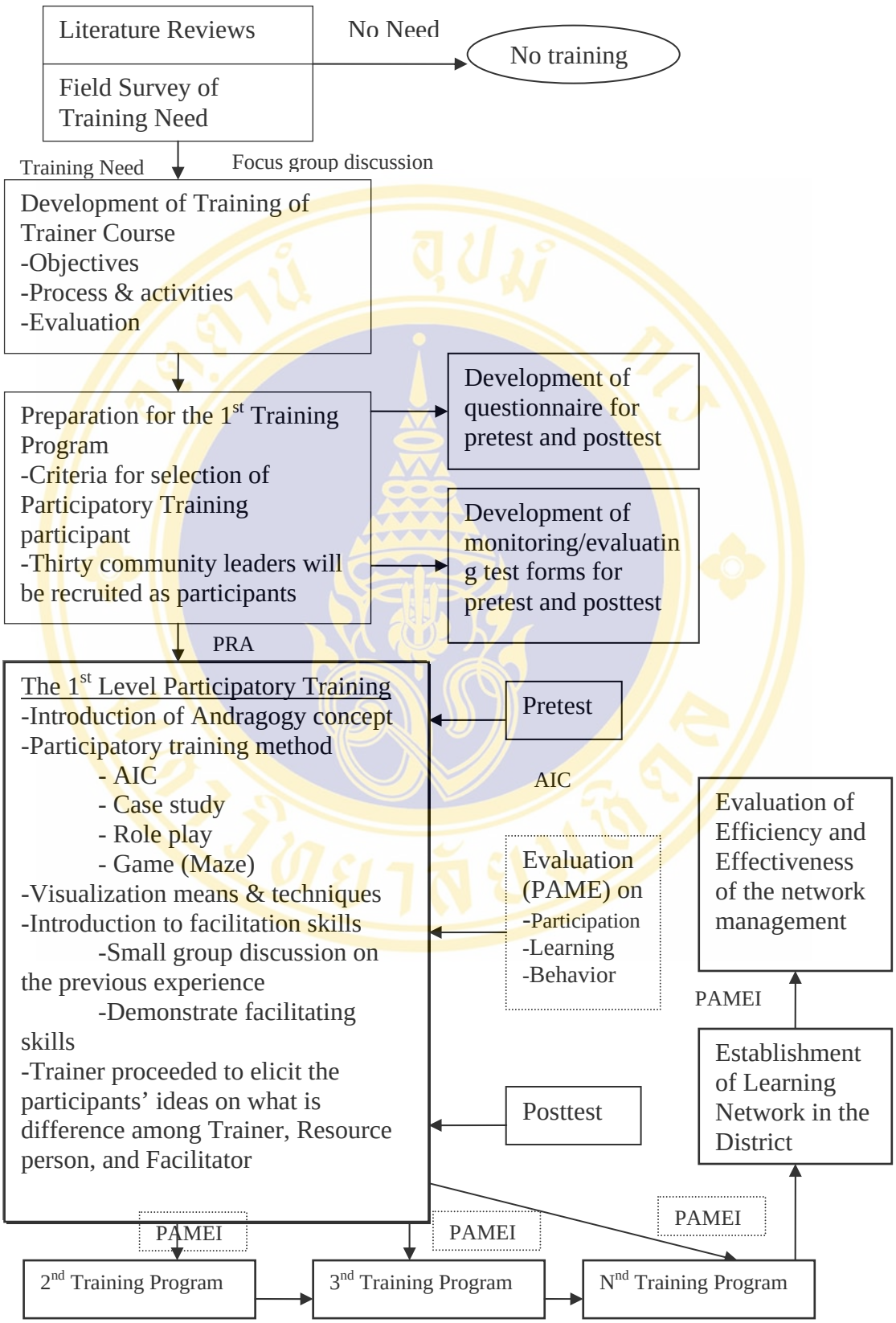
4. The learning network center was established for energy conservation by the participants by selecting the committee for operation to sustain the network.
5. After training received, the participants should be able to introduce knowledge, understanding, awareness, and consciousness of energy conservation to community people by motivating them to participate in energy conservation campaign, and they should also able to perform as educators, trainers and facilitators.

3.3.2.4 Implementation of Training of Trainer Course

After the focus group discussion and PRA were implemented, the objectives, process and activities were prepared, including the evaluation form and contents for training. The TOT course was implemented at three levels according to the research design of MML concept by following the research design in figure 2.

3.3.2.5 PAMEI Evaluation Technique

This new invented technique of evaluation was PAMEI technique was introduced for evaluation of MML development of a learning network for energy conservation by using participatory performance, participatory assessment, monitoring, evaluation, and impact.



3.3.3 Techniques and Method Employed in This Research

There were 8 techniques employed in this study: PAME (Participatory Assessment, Monitoring and Evaluation), Focus Group Discussions (FGD), Appreciate-Influence-Control Process (AIC),Participatory Rural Appraisal (PRA), Invented Participatory Performance, Assessment, Monitoring, Evaluation, and Impact (PAMEI), Invented Three Dimensional Evaluation (TDE) Technique, Invented Four Dimensional Evaluation (FDE) or Round Dimensional Evaluation (RDE) Technique, and a method of invented Multi-Level Management Linkage(MML) approach.

3.3.4 Process of TOT

The process of training was a multiplier technique. The training course was planned in three steps, as follows:

1. The researcher held a training of trainer course for 30 community leaders in the first level.

2. The trainees of the first level who were certified would be the trainers and facilitators for the second level training course.

3. The trainees of the second level who were certified would be the trainers and facilitators operating for the third level as well.

All three groups would be evaluated for qualification of trainers by doing self-report forms and self-evaluation forms at least twice after training. They would be evaluated by members in small group activities during the course, and their trainers with PAMEI technique by using the invented three dimensional evaluation and round dimensional evaluation technique.

3.4 Research Instruments

The various instruments used in this study were as follows:

3.4.1 Focus Group Discussion (FGD)

The research instruments for focus group discussion were as follows:

Videotape recorder, laptop computer, tape recorder, paper and pen, camera, tapes, videotapes and discussion guideline

3.4.2 TOT

The research instruments for TOT were as follows:

Flipchart, maker per, cards, overhead projector, transparent sheet, case study, whiteboard, ribbon for games, bell or buzzer, videotape recorder, laptop computer, tape recorder, paper and pen, camera, tapes, videotapes, questionnaire for knowledge test, form of three dimensional Evaluation, form of three dimensional Evaluation, and handbook of training.

3.5 Evaluation of the Instrument

3.5.1 Questionnaire for achieving training performance on learning network system of energy conservation.

The training assessment was formulated by considering the objectives of the training, the implementation process, and the contents. The knowledge and understanding of energy conservation, TOT, and learning network development (LND) were divided as follows:

1) The general information of community leaders.

2) The knowledge, understanding, attitude, belief, and practice of energy conservation, TOT, and LND, where questions were 30 close-ended items. The answers composed of Know, Don't Know, and Not Sure. Every correct answer got 1 point; incorrect ones got 0 points, and not sure meant 0 points

- The knowledge, understanding, attitude, belief, and practice tests were commented by the thesis advisors, experts in training of trainer technique, experts in energy conservation, and learning network development experts. Afterwards, the tests were improved, ready for testing.

- The test was tried out with 30 community leaders in the District of Phra Nakhon. Authorization was asked from the Dean of the Social Sciences and Humanities Faculty, Mahidol University, for cooperation in trying out the questionnaire. Afterwards the knowledge assessment test was analyzed by individual questions with the 27% high-group, low-group technique in order to find the difficulty level.

3.5.2 Questionnaire for the model of learning network system on energy conservation

The interview questions would be tried out with a sample population of 30. This sample group was not the real sample group. The interview questions would then be analyzed, as detailed below.

1). Evaluation of the effectiveness of the knowledge assessment of energy conservation, training of trainer, and network development

For the knowledge assessment on energy conservation, training of trainer, and network development, 1 point would be given for the right answer and 0 for the wrong answer. Each respondent's marks will then be totaled. Then each item would be analyzed to find the difficulty level and discrimination power and reliability value

1.1) Difficulty level and discrimination power could be found by using the 27% Technique as shown in the formula below:

$$\text{Difficulty level (p)} = \frac{P_H + P_L}{2n}$$

$$\text{Discrimination Power (n)} = \frac{P_H - P_L}{n}$$

Where

n = The number of all the respondents in the high or low groups

P_H = The number of all the respondents giving the right answers in the high group

P_L = The number of all the respondents giving the right answers in the lower group

In selecting questions, the researcher would choose questions with a difficulty level between 0.2 – 0.8 and with a discrimination power of at least 0.2 to become the real test questions.

1.2) The test questions that passed the criteria for both the difficulty level and discrimination power would then be tested for reliability. Reliability was done by determining the alpha coefficient (α-coefficient), the value of which was 0.85.

The Kuder-Richardson 20 formula was used for testing internal consistency, as follows (Sproull, 1988):

$$r_{tt} = \frac{n}{n-1}\left\{\frac{1-\sum pq}{s^2}\right\}$$

Where

r_{tt} = Reliability value of the test

n = The number of tests

p = Proportion of the respondents giving the right answers

q = Proportion of the respondents giving the wrong answers or 1-p

s^2 = The variance of sample scores

2) Questionnaire Construction for Knowledge Achievement from Training

The constructed interviewing forms were used as instruments for this study. The researcher studied from texts and related research papers in order to set the research scope. It was composed of 4 sections as follows:

Part 1 Question on General information, such as age, marital status, occupation, education level, position in the community and income.

Part 2 Questions on knowledge and understanding about energy conservation

Part 3 Questions on knowledge and understanding about learning network development

Part 4 Questions on knowledge and understanding about arrangement of training of trainer course

3.6 Data Collection

3.6.1 Focus group and PAME would take 2 months at least.

1) Focus group Discussion

The researcher would contact the administrator of Bang Sue District in order to inform and ask for cooperation on research implementation, including describing the research of objectives and the benefit for people in the Bang Sue District to obtain research participation. Afterwards, the appointment was made for focus group discussions, to assess the need of training of trainer for the topic of energy conservation to prevent global warming.

The data collection was done as follows:

1.1). Information from focus group discussions came from observations during the discussion, notes, both videotape and tape-record. They were summarized and content analysis was done.

1.2) Information about knowledge, attitudes, learning assessment, and participating assessment were collected by testing the sample group with questionnaires and observation forms that were created beforehand; these were given before and after the training.

2) PAMEI, AIC, and PRA were employed through the whole process of the research.

3.6.2 Training of Trainer

The major process used was the TOT process, based on the Multi-level Management Linkage (MML) concept. This would be applied as a multiplier effect in order to accelerate public consciousness of urban communities for energy conservation to alleviate the global warming, especially those in Bangkok, through implementing by the TOT process. The TOT concept was a process that instructs the trainer in the education for adult learning in terms of a lifelong education process, particularly in training community leaders to be a trainer and as an expected effective means to multiply the informal educator or community educator.

The one group pretest-posttest design was employed for assessment the training achievement after training.

3.7 Data Analysis

3.7.1 Qualitative Analysis

The various qualitative approaches were employed for this study, such as FGD, PRA, PAME, AIC, and invented PAMEI techniques.

3.7.2 Statistics Used for Data Analysis

1) One Group Pretest-Posttest Design, t-test, and One-way ANOVA Analysis were employed for training achievement. The pretest and posttest scores were used, and the differences were found for the mean ($\overline{X}$), variance (S^2), standard deviation (S), percentage, frequency, and the significant level using the Paired-Sample t test by SPSS program version 11.

2) For the One Group Pretest-Posttest Design, t-test was employed for calculation, as follows:

$$t = \frac{\sum D}{\sqrt{\frac{n\sum D^2 - (\sum D)^2}{n-1}}}$$

$\sum D$ = Total sum of the difference between average scores of pre-test and posttest

$\sum D^2$ = Total sum of the difference between average scores of pretest and posttest, squared

D = The difference between scores of pretest and posttest of each sample

n = Total number of community leaders

CHAPTER 4
RESULTS

To study the development of a learning network model for energy conservation, the research results were implemented through 8 phases, as follows:

- Focus Group Discussion
- Development of Training Course
- Participatory Rural Appraisal (PRA)
- Appreciation -Influence-Control Process (AIC)
- Pretest and Posttest For Multi-level Management Linkage (MML)
- Participant to be Qualified as Trainer
- Participatory Attendance, Assessment, Monitoring, Evaluation, Impact (PAMEI)
- Learning Network Model Development for Energy Conservation in Bang Sue District as prototype.

4.1 Focus Group Discussion

The development of a learning network model for energy conservation by arranging TOT course needs the basic techniques of Focus Group Discussion (FGD) to determine the training need of the target group, which included the community leaders of 49 communities in Bang Sue District. This district contains only one Subdistrict, which was divided into 2 zones. The President of the community leaders in Zone 1 was Mr. Somkiat U-Paeuk, leader of Chantharakasem Community, and the President of community leader in Zone 2 was Mr. Thongchai Petch-Ampai, leader of Yimprayoonpatana Community. The FGD was arranged to hold on March 13, 2003 at Wat Soi Thong, Bang Sue Subdistrict, Bang Sue District, Bangkok at the community meeting place of Zone 2.

The focus group discussion was held at the meeting of both zone 1 and 2 on 13 March 2003. For zone 2, the location was at Wat Soi Thong, Bangsue district at 6p.m.-7.45 p.m. and for zone 1, it was at Tuek Daeng Multi-purpose Building at 8 p.m.-9.45 p.m. The results of the focus group discussions were as follows:

It can be concluded that participants of both zones had a desire to participate for the course of training of trainer for "The Development of A Learning Network Model for Energy Conservation" for community leaders in Bang Sue District because of the following reasons:

1. Their opinion about this topic was that it was a useful course for self-development and for development of community people.
2. The model of training can be applied to other topics that are introduced for knowledge transferring.
3. The method of training would empower the community leaders to increase their potential as a leader, as well as information communicable abilities and knowledge transferring.
4. It would be a good training course, and the chance to learn it at other places would be slim.
5. The participants would have a good chance to be trained as trainers.
6. The participants could use the knowledge gained, such as energy conservation, in daily life.
7. The participants would be able to share their knowledge to their families and communities.
8. They realized that it is an essential learning process to maximize the highest profit of energy consumption and to minimize the family cost; moreover, it is an excellent means to assist the country to safely budget for buying energy from abroad.
9. The participants would gain knowledge about the process of training, learning network building, and energy conservation from an academic person who had a lot of experience in these topics.
10. It would be a good chance for participants to learn to evaluate the new invention of TDE and FDE or RDE.
11. It provided the opportunity to work systemically with other people.

12. The course has direct usefulness to trainees, communities, and the nation as a whole.
13. They expected that it would increase their knowledge, understanding, awareness, and consciousness to take responsibility and to participate in energy conservation campaigns.
14. They were willing to receive the training for 5 days at 6.00 pm to 10.00 pm.

4.2 Development of Training Course

In the development of training course, a curriculum was needed to be developed, including arrangements for the place, budget, personnel, materials and equipment, including all types of recording equipment such as cameras, video recorders, digital voice recorders, and laptops.

4.2.1 The Curriculum Development

There was development of the training curriculum by taking the information received from participants from the FGD about the content and activities in the "Development of a Learning Network Model for Energy Conservation" into consideration, in order to set the structure and issues of the curriculum. The qualified experts were requested to assist in examining and approving the developed curriculum so that it could be tried out.

The content of the developed training curriculum was composed of a learning network development process, training of trainers based on MML concept, Concept of environmental educatuion with the lifelong education process, Concept and principle of sustainable development, and energy conservation with knowledge for daily life activities that could lead to maximum profits and minimum costs of electricity consumption.

4.2.2 The training course was arranged as the following topics:

1. Energy conservation

2. TOT based on invented MML concept

3.Concept of environmental educatuion with the lifelong education process

4. Concept and principle of sustainable development

5. Concept and principle of LND

4.2.3 Implementation of Training of Trainer Course

After the focus group discussion and PRA were implemented the objectives, process and activities were prepared, including the evaluation form and contents for training.

1) Objectives

1.1) To hold TOT course for creating the community leaders to be the trainers and educators to transfer their knowledge, understanding, awareness, and consciousness of energy conservation to other districts, other people inside and outside communities in Bangkok Metropolis by using

1.2) Invent the technique of network sustainable development in Bangkok Metropolis.

1.3) To let participants have a chance to be train as trainer, facilitator and educator for energy conservation via invented Multi-level Management Linkage (MML). Resulting, the model of this learning network establishment for energy conservation would be called as MML integrated with AIC, SWOT, Analysis and project proposed with 6W1H.

1.4) Participants are able to introduce the knowledge, understanding, awareness, and consciousness of energy conservation to community people by motivation the them to participate in practice the energy conservation campaign.

2) Behavioral Objectives

After training, the participants will have the following abilities:

2.1) Ability to explain the technique of TOT.

2.2) Ability to be a trainer to transfer understanding, awareness, and consciousness of energy conservation to others in training course.

2.3) Ability to be an educator to transfer understanding, awareness, and consciousness of energy conservation to other persons in community.

2.4) Ability to explain Multi-level Management Linkage (MML) concept and TOT concept.

2.5) Ability to explain about Multi-level Management Linkage (MML) process and TOT process.

2.6) Ability to arrange about Multi-level Management Linkage (MML) process and TOT process.

2.7) Ability to implement about Multi-level Management Linkage (MML) process and TOT process.

2.8) Ability to persuade the other persons to participate in energy conservation in their daily lives activities.

2.9) Ability to explain situation and benefits of "Development of Learning Network Model for Energy Conservation" correctly.

2.10) Ability to explain the techniques and forms of "Development of Learning Network Model for Energy Conservation"

2.11) Ability to practice of energy conservation in their daily lives activities as prototypes for other persons.

2.12) Ability to motivate the community people to participate in energy conservation campaign.

3) Process & activities

The pretest was done before the training process was started. The process and activities were arranged as following sessions:

Session 1: Overview of Concept of training of trainer through the Introduction of Environmental Education (EE) concept, Multi-level Management Linkage (MML), and Andragogy concept and adult education principle and

Session 2: To develop the knowledge, understanding and awareness

raising of energy conservation via issues of importance of energy, maximization benefits of energy consumptions, and impact of energy consumption.

Session 3: AIC will be employed as technique for searching alternative of sustainable energy conservation.

Session 4: To establish the participation of energy conservation by invented Multi-level Management Linkage (MML) of training of trainer.

Session 5: Developing of Environmental Education Trainer (EET)

Session 6: Role playing as trainer.

Session 7: Propose the model of Learning Network for Energy Conservation.

Session 8: Learning network establishment concept via the games of weaving the network (CEDPA, 1999).

Session 9: Formulate and Maintaining and sustaining Network (CEDPA, 1999).

Session 10: Sustaining network (CEDPA, 1999).

The posttest was tested at the end of this session.

3.3 Evaluation

The evaluation was employed during the training course after every session by PAME technique via the self-evaluated, group-evaluated, and trainer-valuated.

4.3 Participatory Rural Appraisal (PRA)

Before training was held, the PRA was implemented to analyze the existing community situation on energy conservation, through the participation of people in the community, outsiders, the researcher, developer, and academics. The developer, researcher, and academics played the role of assistant or consultant, to suggest techniques that could be used more quickly, properly, and correctly for community analysis.

From the PRA in some communities, it was found that most people accepted the importance of energy conservation through maximizing the profit and

economizing the energy consumption. They would start to implement the means of saving the energy consumption in daily life activities. They were willing to participate in a campaign that would be held in January and February 2004 for energy conservation, by comparing the bill payment and making percentage calculations to measure the decreases.

4.4 Appreciation -Influence-Control Process (AIC)

Process of AIC

The process of Appreciation-Influence-Control (AIC) is a method in which group members will participate in a certain system in the form of a workshop, which will let the people think-analyze-decide during brain storming of past and present situations, and createa shared vision for the learning network development for energy conservation for future.

The results of the three levels of training courses during the brain storming process were used to propose projects to implement in the communities, in order to be actively participated in by the participants of the three groups. The training process was implemented by using the integration of AIC technique and SWOT Analysis based on project operation methods of Who, Whom, What, When, Where, Why, and How (6W1H).

4.5 Pretest and Posttest for Multi-level Management Linkage (MML)

The training courses of all three levels were held according to the invented concept of MML via TOT course. The process was implemented by using the application of AIC process and SWOT Analysis technique. One group pretest-posttest design was employed for determination the training achievement of all three levels of TOT according to MML concept. The results of general information of three levels groups illustrated in table 3.

4.5.1 Training for the First Level, Second Level, and Third Level

General Information of Three Sample Groups

Three sample groups consisted of 30, 30, and 31 community leaders from various communities in Bang Sue District who had never received training in a "training of trainer" program for "The Development of a Learning Network Model for Energy Conservation". The findings were revealed as follows:

Gender

There were 16 males and 14 females in the first level, 13 males and 17 females in the second level, and 9 males and 22 females in the third level.

Age

Most of the people (12 in total) were 51-60 years old, followed by those with ages between 41 -50 years old (7 people). Seven people were aged more than 60 years while the remaining 4 people were aged less than or equal to 40 years in the first level group. In the second, most people (14 people) were 51-60 years old, followed by 9 people with ages between 41 - 50 and years, while 5 people were less than or equal to 40 years old while the remaining 2 people were aged more than 60 years. In the third level, 10 people were aged 51-60 years, followed by 10 people aged more than 60 years, 9 people with ages between 41-50 and years, 6 people who were less than or equal to 40 years, and the remaining 2 people were aged more than 60 years old.

Marital Status

In the first level group, most people (20 people) were married, followed by singles (9 people), while the remaining person was a widow. In the second level, most (24 people) were married, while 3 were single and 3 were widowed. In the third level, most (20 people) were married, 7 people were single, and 4 people were widowed.

Education Level

The majority of the group (17 people) graduated with secondary school/high school level, followed by 5 people with primary school level, 4 people diploma or equivalence, 3 people who had a degree higher than a bachelor's, and 1 person who possessed a bachelor degree in the first level group. In the second level, the majority of the group (14 people) graduated with secondary school/high school

level, followed by 7 people with primary school level, 5 people with bachelor's degree, 3 people with a diploma or equivalent, and 1 person who possessed higher than bachelor's degree. In the third level, the majority of the group (13 people) graduated with primary school level, 11 people with secondary school/high school level, followed by 5 people who held a bachelor's degree, and 2 people with diploma or equivalent.

Monthly Income

The majority of the first level (15 people) had monthly income between 5,000-10,000 Baht, followed by <5,000 Baht, while the rest (3 people) were in the range of income between 10,001 - 15,000 Baht, 15,001-20,000 Bah, and > 20,000 Baht. In the second level, the majority of the group (9 people) had monthly income between 5,000-10,000 Baht, followed by 7 people with 10,001-15,000 Baht, 6 people with <5,000 Baht, 5 people with > 20,000 Baht, and 3 people with income between 15,001-20,000 Baht. In the third level, the majority of the group (13 people) had monthly income between 5,000-10,000 Baht, followed by 11 people with monthly income between <5,000 Baht, while 4 people were in the range of income between 15,001-20,000, 2 people with > 20,000 Baht, and l person with 10, 001-15,000 Baht.

Present Position in Community

Most people in group 1 were part of committees, followed by 6 who were secretaries, 5 people who were presidents, 4 who were vice presidents and 2 were treasurers. In the second level, most people in the group (10 people) were in committees, followed by 3 people who were presidents, 2 people who were secretaries and 2 people who were vice presidents. In the third level, the majority of the group (11 people) were part of the committee, 3 people were presidents, 3 were secretaries, 3 were treasurers, and 2 were vice presidents. The details are shown in Table 3.

Table 3 General Information of the Participants of Three Levels

General Information	No. of Participants (%)		
	First Level (n=30)	Second Level (n=30)	Third Level (n=31)
Gender			
Male	16 (53.3)	13 (43.3)	9 (29.0)
Female	14 (46.7)	17 (56.7)	22 (71.0)
Age (year)			
≤40	4 (13.3)	5 (16.7)	6 (19.4)
41-50	7 (23.3)	9 (30.0)	7 (22.5)
51-60	12 (40.0)	14 (47.6)	10 (32.3)
> 60	7 (23.3)	2 (6.7)	8 (25.8)
Marital Status			
Single	9 (30.0)	3 (10.0)	7 (22.6)
Marriage	20 (66.7)	24 (80.0)	20 (64.5)
Widow	1 (3.3)	3 (10.0)	4 (12.9)
Education Level			
Primary School	5 (16.7)	7 (23.3)	13 (41.9)
Secondary School/High School	17 (56.7)	14 (46.7)	11 (35.5)
Diploma or Equivalence	4 (13.3)	3 (10.0)	2 (6.5)
Bachelor	1 (3.3)	5 (16.7)	5 (16.1)
Higher than Bachelor	3 (10.0)	1 (3.3)	- (0.0)
Monthly Income (Baht)			
<5,000	6 (20.0)	6 (20.0)	11 (35.5)
5,000-10,000	15 (50.0)	9 (30.0)	13 (41.9)
10,001-15,000	3 (10.0)	7 (23.3)	1 (3.2)
15,001-20,000	3 (10.0)	3 (10.0)	4 (12.9)
> 20,000	3 (10.0)	5 (16.7)	2 (6.5)
Present Position in Community			
President	5 (16.7)	3 (10.0)	3 (9.7)
Vice President	4 (13.3)	2 (6.7)	2 (6.4)
Secretary	6 (20.0)	2 (6.7)	3 (9.7)
Treasurer	2 (6.7)	1 (3.3)	3 (9.7)
Committee	8 (26.7)	10 (33.3)	11 (35.5)
Others	5 (17.6)	12 (40.0)	9 (29.0)

4.5.2 Pretest and Posttest for Multi-level Management Linkage (MML)

A one group pretest-posttest design was employed to determine the training achievement of all three levels of TOT according to the MML concept. The results of the general information test of the three levels groups are illustrated in Table 3. Learning achievement test of the first, the second and the third level training courses are presented in table 4. It could be seen that posttest mean scores of each level were higher than those of the pretest at highly statistically significant level of 0.01 ($p<.001$). Therefore, it indicated that the participants understood and gained more knowledge about LND, TOT, and EC because the content, which was given in a five-day training course and composed of the process of learning network development, training of trainer, and energy conservation, including the concept of environmental education, environment, and sustainable development.

Table 4 Achievement of the Pretest-Posttest of the Participants of three Levels

Experimental Group	Level	Number (n)	Mean	S.D.	S.E.	t
Pretest	First	30	18.23	3.21	.59	8.921*
Posttest			23.12	2.70	.49	
Pretest	Second	30	20.70	3.84	.70	8.190*
Posttest			24.90	2.29	.42	
Pretest	Third	31	18.97	3.06	.55	6.799*
Posttest			22.00	2.51	.45	

* P< .001

4.5.3 Results of Three Dimensional Evaluation of the Participants of Threes Level Training

The invented TDE was employed for determining the congruence of three aspects of evaluation: self-evaluation, group-evaluation, and trainer-evaluation, by using One-way ANOVA Analysis to investigate the mean scores difference of three

group. The results of One-way ANOVA Analysis had shown that there were no differences in the mean scores of three levels (Table 5). Moreover the mean scores of TDE were used to qualify the training participation of the participants during the training course in each level, by using the criteria of evaluation as follows: the mean scores of less than 1.5 (50%) need improvement, mean scores between 1.5-2.39 (50%-79.9%) it was at satisfactory level, and the score was equivalent to 2.40 (80.0%) or higher, it was at good level. However, the primary qualified trainer must express his ability to perform as a trainer in the training course held at further levels. The results of the mean scores for TDE of participant performance evaluations in these three levels of training courses are presented in Tables 6, 7 and 8

Table 5 Three Dimensional Evaluation of the Participants of Three Levels

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
The First Level					
Between Group	.050	2	.025	.443	.643
Within Group	4.944	87	.057		
Total	4.994	89			
The Second Level					
Between Group	.028	2	.014	.215	.807
Within Group	5.664	87	.065		
Total	5.692	89			
The Third Level					
Between Group	.042	2	.021	.315	.730
Within Group	5.813	87	.067		
Total	5.855	89			

$P < .05$

Table 6 Mean Scores of Three Dimensional Evaluation of the participants in the First Level Training

Participant No.	Self-Evaluation	Group-Evaluation	Trainer-Evaluation	Three Dimensional Evaluation
1	2.06	2.19	2.06	2.10*
2	2.56	2.69	2.76	2.67**
3	2.75	2.68	2.82	2.75**
4	2.29	2.78	2.76	2.61**
5	2.26	2.49	2.53	2.43**
6	2.56	2.45	2.61	2.54**
7	2.47	2.48	2.55	2.50**
8	2.65	2.56	2.72	2.64**
9	2.65	2.10	2.47	2.41**
10	2.12	2.20	2.25	2.19*
11	2.65	2.72	2.67	2.68**
12	2.47	2.47	2.57	2.50**
13	2.78	2.82	2.82	2.81**
14	2.24	2.34	2.29	2.29*
15	2.82	2.73	2.71	2.75**
16	2.62	2.51	2.53	2.55**
17	2.47	2.61	2.53	2.54**
18	2.88	2.51	2.53	2.64**
19	2.71	2.68	2.71	2.70**
20	2.65	2.58	2.65	2.63**
21	2.76	2.59	2.65	2.67**
22	2.59	2.37	2.71	2.56**
23	2.42	2.56	2.62	2.53**
24	2.45	2.56	2.47	2.49**
25	2.03	2.09	2.12	2.08*
26	2.12	2.19	2.18	2.16*
27	2.06	2.09	2.06	2.07*
28	2.12	2.18	2.24	2.18*
29	2.46	2.36	2.47	2.43**
30	2.18	2.06	2.18	2.14*
Total	73.85	73.64	75.24	74.24
Mean	2.46	2.45	2.52	2.47

* satisfactory level
** good level

Table 7 Mean Scores of Three Dimensional Evaluation of the participants in the Second Level Training

Participant No.	Self-Evaluation	Group-Evaluation	Trainer-Evaluation	Three Dimensional Evaluation
1	2.53	2.6	2.9	2.79**
2	2.12	2.26	2.4	2.26*
3	2.94	2.99	2.82	2.92**
4	3.00	2.56	3.00	2.85**
5	2.12	2.21	2.12	2.15*
6	2.12	2.60	2.06	2.26*
7	2.65	2.61	2.82	2.69**
8	2.68	2.75	2.72	2.81**
9	2.59	2.52	2.68	2.60**
10	2.18	2.1	2.21	2.16*
11	2.47	2.43	2.48	2.46**
12	2.33	2.01	2.2	2.18*
13	1.88	2.25	1.94	2.02*
14	2.71	2,.66	2.71	2.67**
15	2.26	2.29	2.29	2.28*
16	2.4	2.58	2.53	2.81**
17	2.47	2.78	2.59	2.61**
18	2.25	2.20	2.05	2.06*
19	2.58	2.60	2.53	2.57**
20	2.04	2.20	2.15	1.99*
21	2.54	2.53	2.62	2.56**
22	2.53	2.58	2.47	2.53**
23	2.56	2.52	2.59	2.66**
24	2.06	2.22	2.29	2.19*
25	2.24	2.38	2.18	2.26*
26	2.66	2.51	2.65	2.61**
27	2.26	2.18	2.36	2.47**
28	2.29	2.38	2.25	2.31*
29	2.45	2 54	2.42	2.47**
30	2.56	2. 5	2.61	2.56**
Total	72.47	74.44	73.64	73.76
Mean	2.41	2.48	2.45	2.45

* satisfactory level
** good level

Table 8 Mean Scores of Three Dimensional Evaluation of the participants in the Third Level Training

Participant No.	Self-Evaluation	Group-Evaluation	Trainer-Evaluation	Three Dimensional Evaluation
1	2.06	2.19	2.06	2.10*
2	3.00	2.69	2.76	2.82**
3	3.00	2.58	2.82	2.80**
4	2.29	2.78	2.76	2.61**
5	2.66	2.49	2.54	2.56**
6	2.57	2.54	2.60	2.57**
7	2.47	2.68	3.00	2.72**
8	2.65	2.86	3.00	2.84**
9	2.58	2.69	2.71	2.66**
10	2.78	2.69	3.00	2.82**
11	2.65	2.82	3.00	2.82**
12	2.74	2.87	3.00	2.87**
13	2.85	2.82	2.82	2.83**
14	2.24	3.00	3.00	2.75**
15	3.00	2.74	2.65	2.79**
16	2.82	2.43	1.59	2.28*
17	2.88	2.51	2.53	2.64**
18	2.71	2.68	2.71	2.70**
19	2.56	2.18	2.88	2.54**
20	2.61	2.59	2.71	2.64**
21	2.59	2.37	2.71	2.55**
22	2.87	2.56	2.82	2.75**
23	2.51	2.54	2.47	2.51**
24	2.61	2.58	2.47	2.55**
25	2.81	2.77	2.69	2.76**
26	2.67	2.66	2.72	2.68**
27	2.85	2.87	2.77	2.83**
28	2.54	2.48	2.61	2.54**
29	2.61	2.71	2.64	2.65**
30	2.06	2.19	2.06	2.10*
31	2.58	2.45	2.56	2.53**
Total	72.47	74.44	73.64	73.76
Mean	2.57	2.54	2.60	2.57

* satisfactory level
** good level

4.6 Evaluation of Participant Performance as Trainer

1) The Qualification of the First Level Trainer

A trainer evaluation form was employed to qualify each person for the first level participants (self-evaluation), participants of the second level (audience-evaluation), small group members during training processes (group-evaluation), professional trainers (trainer-evaluation), and by using Four Dimensional Evaluation (FDE) or Round Dimensional Evaluation (RDE). Participants in the first level would perform as trainers and facilitators in the second level. The results presented in Table 9 illustrated that 20 persons or 66.67% of participants or trainees of the first level were able to perform as trainers, by using the criteria of evaluation as follows: the mean scores of less than 1.5 (50%) need improvement, mean scores between 1.5-2.39 (50%-79.9%) it was at satisfactory level, and the score was equivalent to 2.40 (80.0%) or higher, it was at good level.

Table 9 Mean Scores of FDE of the First Level Trainers

Person No.	Audience - Evaluation	Self-Evaluation	Group-Evaluation	Trainer-Evaluation	Four Dimensional Evaluation
1	2.67	2.78	2.85	2.81	2.78
2	2.64	2.74	2.67	2.72	2.69
3	2.87	2.77	2.82	2.85	2.83
4	2.56	2.58	2.6	2.72	2.62
5	2.95	2.89	2.95	2.81	2.90
6	2.66	2.74	2.74	2.71	2.72
7	2.79	2.83	2.87	2.92	2.86
8	2.93	2.92	2.9	2.85	2.90
9	2.66	2.67	2.68	2.67	2.67
10	2.78	2.69	2.78	2.78	2.76
11	2.35	2.56	2.46	2.65	2.51
12	2.65	2.53	2.64	2.51	2.58
13	2.34	2.33	2.13	2.23	2.26
14	2.56	261	2.78	2.49	2.61
15	2.81	2.74	2.58	2.61	2.69
16	2.59	2.47	2.70	2.64	2.60
17	2.56	2.45	2.61	2.69	2.58
18	2.34	2.44	2.39	2.53	2.43
19	2.29	2.61	2.31	2.40	2.41
20	2.20	2.51	2.24	2.37	2.33
Total	52.20	52.86	52.70	52.96	52.68
Mean	2.61	2.64	2.64	2.65	2.63

* satisfactory level

** good level

2) The Qualification of the Second Level Trainers

A trainer evaluation form was employed to qualify each person for first level participants (self-evaluation), participants of the second level (audience-evaluation), small group members during training processes (group-evaluation), professional trainers (trainer-evaluation), and by using Four Dimensional Evaluation (FDE) or Round Dimensional Evaluation (RDE). Participants in the second level would perform as trainers and facilitators in the third level. The results presented in Table 10 illustrated that there were 16 persons or 53.33% of participants who were able to perform as trainers, by using the criteria of evaluation as follows: the mean scores of was equivalent to total mean scores 2.67 or higher would be graded at satisfactory level for qualifying as trainer performance.

Table 10 Mean Scores of FDE of the Second Level Trainers

Person No.	Audience - Evaluation	Self-Evaluation	Group-Evaluation	Trainer-Evaluation	Four Dimensional Evaluation
1	2.64	2.56	2.61	2.59	2.60
2	2.88	2.94	2.97	2.87	2.92
3	2.91	2.87	2.89	2.95	2.91
4	2.87	2.77	2.75	2.65	2.76
5	2.77	2.67	2.81	2.69	2.74
6	2.55	2.65	2.57	2.64	2.61
7	2.98	2.85	2.94	2.93	2.93
8	2.54	2.59	2.61	2.65	2.60
9	2.66	2.76	2.81	2.79	2.76
10	2.45	2.36	2.48	2.31	2.40
11	2.71	2.42	2.53	2.61	2.57
12	2.44	2.06	2.63	2.46	2.40
13	2.71	2.54	2.65	2.57	2.62
14	2.45	2.51	2.54	2.63	2.53
15	2.48	2.64	2.60	2.53	2.56
16	2.61	2.57	2.64	2.72	2.64
Total	42.65	41.76	43.03	42.59	42.51
Mean	2.66	2.61	2.69	2.66	2.67*

* satisfactory level

** good level

3) The Qualification of the Third Level Trainers

A trainer evaluation form was employed to qualify each person for first level

participants (self-evaluation), participants of the second level (audience-evaluation), small group members during training processes (group-evaluation), professional trainers (trainer-evaluation), and by using Four Dimensional Evaluation (FDE) or Round Dimensional Evaluation (RDE). Participants in the third level would perform as trainers and facilitators in a further level. The results presented in table 11 illustrated that there were 19 persons or 61.29 % of participants or trainees who were able to perform as trainers , by using the criteria of evaluation as follows: the mean scores of less than 1.5 (50%) need improvement, mean scores between 1.5-2.39 (50%-79.9%) it was at satisfactory level, and the score was equivalent to 2.40 (80.0%) or higher, it was at good level.

Table 11 Mean Scores of FDE of the Third Level Trainers

Person No.	Audience - Evaluation	Self-Evaluation	Group-Evaluation	Trainer-Evaluation	Four Dimensional Evaluation
1	2.35	2.56	2.65	2.46	2.51
2	2.64	2.51	2.65	2.53	2.58
3	2.49	2.61	2.78	2.56	2.61
4	2.65	2.54	2.71	2.57	2.62
5	2.46	2.54	2.541	2.62	2.54
6	2.55	2.65	2.57	2.64	2.60
7	2.45	2.36	2.33	2.45	2.40
8	2.59	2.52	2.65	2.64	2.60
9	2.39	2.38	2.40	2.53	2.43
10	2.46	2.35	2.47	2.32	2.40
11	2.70	2.44	2.53	2.60	2.57
12	2.61	2.70	2.57	2.61	2.62
13	2.84	2.78	2.75	2.67	2.76
14	2.80	2.70	2.62	2.62	2.69
15	2.55	2.61	2.60	2.63	2.560
16	2.62	2.59	2.63	2.70	2.64
17	2.30	2.33	2.17	2.23	2.26
18	2.96	2.87	2.94	2.93	2.92
19	2.56	2.52	2.34	2.30	2.43
Total	48.97	48.56	48.90	48.61	48.76
Mean	2.45	2.428	2.45	2.43	2.44

* satisfactory level

** good level

Twenty participants of the first level practiced as trainers in the second level training course, while the rest were practicing as facilitators. Sixteen participants of the second level practiced as trainers in the third level training course, and the rest practiced as facilitators. It was indicated that there were no differences of mean scores among the four evaluations (self-evaluation, group-evaluation, trainer-evaluation, and audience-evaluation) of participants at both levels that practiced as trainer in the training courses. However, for the third level, 19 participants practiced by performing as trainers and facilitators in the community and school training sessions held. The results of trainer performance of each level with FDE evaluation are shown in Table 12.

Table 12 Four Dimensional Evaluation of the Participants of Threes Level Training

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
The First Level					
Between Group	.017	3	.006	.146	.932
Within Group	2.971	76	.039		
Total	2.988	79			
The Second Level					
Between Group	.054	3	.018	.551	.649
Within Group	1.949	60	.032		
Total	2.002	63			
The Third Level					
Between Group	.014	3	.005	.175	.913
Within Group	1.869	71	.0216		
Total	1.882	74			

$P < .05$

4.7 Participatory, Assessment, Monitoring, Evaluation, and Impact (PAMEI)

The invented PAMEI technique was employed in order to evaluate the trainee performance and the impact after the training course of each level, and after the three courses were finished. It was implemented by observing trainees and by interviewing neighbors in the community. The basic concept of PAMEI encouraged and supported the participants taking control of decisions that affected their environment, as well as building courage and commitment to take part in other decisions. The insiders or community people also developed important contacts with those outside their community so they could seek advice on their own. Sustainability was more likely to be achieved because insiders develop the skills and continue to do so even after outsiders leave.

The process was divided into fives phases, as follows:

4.7.1 Participatory Performance (observation by trainees and researcher by using a systematic approach composed of practice by oneself and performing as a trainer or educator)

4.7.2 Participatory Assessment is a method for determining, from the insiders point of view, what activities are needed and can be supported; they have identified the right problem and right solutions via using the application of Appreciation - Influence-Control Process (AIC) and Participatory Rural Appraisal (PRA) by outsiders as facilitators with the objectives of energy conservation. The results of the three groups were presented already in previous sections.

4.7.3 Participatory Monitoring is a systematic recording and periodic analysis of information that has been chosen and recorded by insiders with the help of outsiders, with the main purpose being to provide information during the life of the project, so that adjustments and/or modifications can be made if necessary. The training course of this study was done by using the observation and PAMEI. After each group had finished, the community leaders of each group held meetings to give knowledge to community people. After the training in the second level was completed by the participants of the first level, the second level joined the Committee of

Examinatng and Monitoring the Administration of Public Knowledge, which was given at Taopoon Metropolitan Police Station. This was done by holding public relations for the 'Bang Sue District Learning Network for Energy and Environment Conservation' (BASNEC) in front of Taopoon Metropolitan Police Station and lecturing about energy conservation and electrical appliance utilization on 4 December 2003, which was Thai Environment Day.

4.7.4 Participatory Evaluation is an opportunity for both outsiders and insiders to stop and reflect on the past in order to make decisions about the future. Insiders are encouraged and supported by outsiders to take responsibility and control of planning what is to be evaluated, how the evaluation will be done, carrying out the evaluation, and analyzing information and presenting evaluation results, since the insiders already intuitively and informally evaluate, in light of their own individual and/or group, the objectives. The TDE and FED were employed for evaluation, in terms of participation from members while training course holding and after training. The results were presented in Tables 5,6, 7, 8, 9, 10, 11, and 12.

4.7.5 Participatory Impact

The participatory impact was divied into 2 patterns, individual performance and group performance. The impact can be classified into 2 categories as follows:

4.7.5.1 Trainer Performance for public mind service such as giving knowledge to communities, schools, and the public.

The impact of training of the trainer for each level could be observed by the performance of the trainer, as mentioned above. Besides their performance as trainers and educators in their own communities, they would also perform as trainers according to the invented MML approach of this research design. They were able to perform as trainers to give knowledge for the public on 4 December 2003, which was Thai Environment Day, and to the students of two schools in Bang Sue District: Chang-Ahas Umrung School and Wat Liab Rach Bumrung School. The 55 participants were qualified as trainers and educators, and 36 participants were qualified as facilitators and educators by using PAMIE technique. Nevertheless, the rest of 36 facilitators and educators are also able to qualified as trainers afterwrad because the BASNEC members have performed as trainer further.

4.7.5.2 Reduction of Electricity and Pipe Water Consumption

The obvious impacts of energy conservation would consist of outputs that are the measurable results of activities. In this study, these would be the electrical consumption and pipe water consumption, which would be seen by measuring the percentage of reduction in energy and pipe water consumption of households in the community. Therefore, the researcher held a campaign after the training course was completed at the end of 31 January 2004, holding a competition for the highest percentage of reduction in both electrical and pipe water consumption by collecting the utility bills to find the winner. The results are presented in Table 13.

The results of the top ten competitors showed that most of them could reduce the electrical and pipe water consumption by more than 50 percent, when compared with the prior month, before they received knowledge from the trainers.

Table 13 Percentage of the Top Ten Electrical and Pipe Water Reduction of the Competitors

Competitor	Electrical Reduction (%)	Pipe water Reduction (%)
1	95.5	80.5
2	82.4	75.6
3	73.2	72.1
4	70.8	70.7
5	69.7	68.5
6	68.8	65.2
7	67.5	61.9
8	66.1	59.7
9	65.5	55.4
10	61.9	53.3

4.8 Learning Network Model Development for Energy Conservation in Bang Sue District as prototype

The learning network development of this research was a systematic approach that used an invented MML approach, PAMIE techniques, AIC, FCD, PRA, and an invented evaluation technique of TDE and FDE. After each training course was completed, the research and dissertation advisor encouraged the people to establish a learning network for each level. Finally, 3 groups agreed to join together to become

the ‘Bang Sue District Learning Network for Energy and Environment Conservation’ on 4 December 2003, as a prototype. The participants of the 3 groups also agreed to unite and elect a new committee, which was composed of members from all three groups. Mr. Sunan Saensri was elected as president through voting from all participants in that day.

CHAPTER 5
DISCUSSION

The importance of a learning network had been realized since the information technology developed progressively, with it done through the internet channel. There had been a lot of theories and concepts introduced, such as re-engineering, reforming education, life-wide education and lifelong education. Most organizations, both private and government sectors, realized that developing and improving the total quality management (TQM) in all aspects, including environmental management, could be done through the participatory training process.

The environmental education process had also integrated the participatory training approach as a means to educate people about the environment in different aspects to diverse target groups, in order to increase knowledge, and raise awareness to support long-term environmental security and accomplish sustainable development as the highest ultimate development. Moreover, it associated challenges, developed the necessary skills and expertise to address the challenges and fostered attitudes, motivations and commitment to make informed decisions and take responsible action. Additionally, it enhanced critical thinking, problem-solving and effective decision-making skills. Therefore, the demand for environmental management knowledge in order to seek the effective model continued to grow in the response of international agencies, including at the regional, country and local level.

Therefore, this study emphasized the development of a learning network model for energy conservation because of two mains essential factors. Firstly, there was a report that in 2000, Bangkokians consumed 35.0 percent of energy, more than a third of the total country consumption; and secondly, community leaders played very important roles in convincing the people to pursue different activities in the communities. Bang Sue District was used according to the research design, since the

preliminary survey results indicated that most leaders in this district had willingness and high attention and intention to participate in this Multi-level Management Linkage (MML) training of trainer course. This research design needed high attention, intention and participation continuously through the concept of development learning network. They had to a member of a learning network organization and they had to perform as trainers for other districts in the Bangkok Metropolis or other areas of the country as well. The results were discussed as follows:

5.1 Summary

The research results illustrated that most of the leaders in this district had high capabilities, responsibility and intentions to be trainers for their district and other districts with the sincere devotion to establish a learning network in all three levels (groups) of participants. Besides, they were also linked together into the Bang Sue District Learning Network for Energy and Environment Conservation (BASNEC) that was established on the 4th of December 2003 at Bang Sue District, where they elected the president of the club. Mr. Sunan Saensri was elected as the first president of the network. 55 participants were qualified as trainers and educators, and 36 participants were qualified as facilitators and educators. Moreover, they also performed as trainers according to the invented MML approach of this research design. They were able to perform as trainers to give knowledge for public on 4 December 2003, which was the Thai Environment Day at front of Taopoon Metropolitan Police Station by lecturing on energy conservation and electrical appliance and pipe water conservation means, to the students of two schools in Bang Sue District that were Chang-Ahas Umrung School, and Wat Liab Rach Bumrung School.

5.2 Discussion

Discussions would be held during the whole process of developing a learning network model for energy conservation, in order to answer the following research questions:

5.2.1 Research Question 1

Would the invented concept of MML and TOT process be able to develop and establish a learning network for energy conservation among community leaders who participated in this research operation?

The research results were able to clearly answer this question: the “Bang Sue District Learning Network for Energy and Environment Conservation (BASNEC)” was established on the 4th of December 2003.

The obvious impacts of energy conservation in another aspect was the measurable results of electrical consumption and pipe water consumption effectiveness, by measuring the percentage of reduction of consumption in households in the community. The BASNEC committees held a campaign after the training course to hold a competition for the highest percentage reduction of both electrical consumption and pipe water consumption, by collecting the bills to calculate and select the winner. The winner of the contest had a 95.5% reduction for electrical consumption and 80.5% for water pipe consumption reduction. The results presented in table 20.

5.2.2 Research Question 2

What factors would be required for developing a learning network establishment for energy conservation?

The participation in all phases of this study was introduced as a main concept of MML, and different techniques were employed for implementation and evaluation based on participatory approaches such as PRA, PAMEI, including the TDE and FDE techniques. The participation was a form of ‘bottom-up’ or ‘grassroots’ development adopted by national governments, development agencies and NGOs wishing to improve the effectiveness of their development efforts during the recent times, in order to be a substitute of centralized ‘top-down’ or ‘blueprint’ approaches of development. Therefore, this new shift in thinking had been characterized by

increasing use of the concept of ‘participation’ and a number of complementary notions such as ‘local organization’ and community-based initiatives. This was in addition to the rise of a myriad of methodological approaches of development research, such as ‘Participatory Rural Appraisal (PRA)’ and ‘stakeholder analysis.’ Listening to the voices of local people in the process of development was thought to facilitate the emergence of more effective, efficient and responsive interventions. At the same time, local actors, through their active participation would be ‘empowered’ to guide and sustain their own development. The local people’s knowledge could steer development interventions to improve their effectiveness and efficiency. Furthermore, placing people at the center of development and giving them power to influence development decisions would be an empowering process which should ultimately lead to people’s self-development.

From the study, it could be concluded that there were 9 essential factors to facilitate the development and establishment of learning network. These were as follows:

1) Learning Network Members

A network was established and developed by the participation of different groups of people, such as academics, and developers, who stimulated the group, through a capable leader who had high competence to collaborate, including having skills in strategy development. The uniformity committee would result in enthusiastic learning and preaching members. Furthermore, the internal and external scholar, academics and responsible people in different organizations, both in government and private sectors, would act as supporters, facilitators, developers, network consultants and organization leaders at all levels: local, regional, and national. Networks where people were engaged more or less depended on structural management and the activity of each network. Networks should create the concept of human development by letting people seize the principle of living together with all creatures in nature with equality and love, and freedom to share ideas by practicing together or separately in some issues without influencing or commanding. They used meetings to exchange experiences and find cooperation in learning. Conclusions were made by voting liberally, including respecting the way of thinking of others and the different cultures

and traditions of each group. Members were a component of a network, whether it was a learning network or other types of networks, because they were the people who perform activities to accomplish the objectives and goals of the organizations or networks. Moreover a learning network would not occur without the people as an active force.

This study emphasized community leaders as a target group because the leaders were vital, as they would lead and introduce any idea or activity, which would be accepted by the community members easier. A competent leader was an essential factor to distribute knowledge of energy conservation and learning network development. Leaders needed good interpersonal skills, a high level of self-awareness, ability to develop and adapt those plans when circumstances change. There were numerous studies that found that community leader was an important factor of success for a learning network formation. This was applicable to for the learning network establishing of Bang Sue District, as a leader had the ability to lead, motivate and persuade the other people to act willingly.

2) Community Network

A network consists of diverse individuals or groups of people who implemented activities systemically and continuously by functioning as a committee or organization in order to delegate work to members. They needed to have obvious roles and responsibilities buoyed by high spirits to work for a group, organization, or network. It might be distributed in a variety of communities, but how far depended on the preparedness of the network to extend. The most critical factors for sustaining network organization were administration, management, and cooperation among network members, other organizations, and networks. The network committee was elected through voting. It was composed of a president, vice president, secretary, treasurer and president of numerous departments in keeping this sort of activity, which was implemented. In addition, the other positions, such as the delegation of communities, were included. There were activities that involved allocating responsibility and defining the rules and regulations and term of working. It was

found that a successful network should have a strong network organization with the high competence of a leader and committee who have good intentions for devotion of public activities.

3) Objective of Community Network

A network, group and organization had to have similar objectives, goals, or targets. Therefore, the objectives or goals or target must be comprehensible and possible to achieve. It would become a center for members to share their ideas to plan, act and monitor, and evaluate activities to achieve their target through a shared vision.

The objective or goal was also an essential factor of every organization and network to accomplish sustainable development through the shared vision of members, because objectives were like a compass of the organization and network, with the vision like a tiller for members. Therefore, the organization or network must set clear objectives or aims that all members could take part to collaborate together in the network activities; subsequently they had to search a shared vision to bring the organization or network toward reaching the objectives or goal. The ultimate goal of a learning network of energy conservation was sustainable development. The grassroots people were accepted as being the most important part, as they were the fundamental users of natural resources and environment. Therefore, environmental education concept was introduced to be integrated into the newly invented concept of MML as well. The methods of evaluation and monitoring of TDE, FDE and PAMEI were used successfully in this study since the trainees or participants were able to perform as trainers in the Bang Sue District area by giving knowledge to people in different communities and students in the schools.

The establishment of BASNEC was a shared vision because for every participant of the future. It provided members of an organization with the stars to steer by. As a result, it was a viable function to accomplish and sustain learning network maintenance when there was a truly shared vision, and people were inclined to excel and learn, not because they were forced to do so, but because they sincerely desired to

do it. Instead of being exclusively a personal vision of a charismatic leader, it was a picture shared by everyone for the better future for the environment and natural resources for their next generations. Such a shared vision fostered heartfelt commitment by people throughout the organization or network to improve and learn, so that the vision could be accomplished by their participation and collaboration in the energy and environment conservation activities.

4) Learning as a Key of Success

The success of network implementation depended on the capability of learning management in order to increase the potential of members. There was emphasis on learning from actual practice in order to be useful in real life situations. The culture and indigenous wisdom connected with modern knowledge concurring to the local network situation in order to develop society, economy and environment

Learning and adapting were keys to individual success and network survival. Therefore, participatory training by MML principles would be an effective means to support the strength of a person (a member of a learning network), including building their competence and empowering them to face and overcome the other aspects of problems in their lives. This is also consistent with the concept by Senge, P. M. (1990), who stated “real learning gets to the heart of what it means to be human. Through learning we became able to do things we never could and extended our capacity to be part of generative process of life”.

Learning in this study meant participatory learning through participatory training with the invented MML concepts. It needed to be accelerated learning in order to supplement the ability of individuals to learn more knowledge and receive the information in less time, as well as to increase learner retention through the many varied techniques of accelerated learning. Accelerated learning techniques engage all parts of the brain in the learning process in conjunction with both conscious and subconscious mental functions. This ensures that every means of learning and acquisition was utilized as simultaneously and fully as possible. It had also proved to

be very effective in building innovation, imagination and creativity into the learning process.

Moreover, the participatory learning through MML was collective learning that generated or created learning types of organizations or networks. In this study, these were integrated by techniques of AIC process (which is a participatory training, brain storming, and creative approach and challenged for unfamiliar problem solving by simulating).

In addition, participatory learning in this study also included action learning as one of the most valuable instruments or methods of organizational learning because it involved working on real problems, and focusing and actually implementing solutions. It provided a well-tested method on accelerating learning which enabled people to learn better and to handle difficult situations more effectively. It increased learning in an organization or network so that the organization or network could more effectively respond to change.

Therefore, the participatory learning used in this research was the most effective when examining and observing the organization or network in terms of adult learning approach. Participation in the training process was increased so the participants learned when they were able to question the assumptions on which actions were based, and when they received accurate feedback from others and from the results of their problem-solving actions. They were most challenged when they worked on unfamiliar problems in unfamiliar situations--this was where the greatest learning might occur. It was most effective when the learners were examining the organizational system.

The TOT design used in this study would provide several skills for participants, such as performing as trainers by giving knowledge to students in the schools and community people in the Bang Sue District. It made participants become active partners in the learning process and also provided a viable solution for dealing with issues of leadership and teamwork.

There was also need to hold activities in the learning process for practice in reaching the goal of the learning network. This was also an important subcomponent of any types of networks or learning networks, since if there were no activities for members to act or work together, there would be no development at all. The cooperated activity would lead to learning among members, giving them a chance to share their experiences, discuss and do brain storming for effective implementation of activity, solve the problems and receive the benefits together. There were prior studies having similar evidence of using activities as practice for cooperation and collaboration of the success of network establishment.

5) Community Linkages

Network implementation had to use linkage to connect collaboration among individuals, groups, organization, external sectors activities and learning. The linkage of networks with various sources included funding, academia, action plan definition, projects, and study tours. The resulting creation brought trust and respect to the leaders in the implementation, administration and outcome of networks. Cooperation led to success and achievement of objectives, goals and targets. The linkage caused cooperation among networks, organizations and others extensively, and as a result the network developed national policies further. However, the essential factor of linkage was creating collaborations with friends for sustainable social, economic, environment and life quality development. To develop any type of network, one of the chief factors was linkage of different stakeholders to assist, cooperate, and connect in order to maintain and sustain the network established.

6) The Effective Two-way Communication

A network within an organization gathers numerous members or people for participation, share ideas for planning, and practicing activities together, so it would need unambiguous two-way communication, with the sender and receiver employing diverse channels. Effective communication would lead to the creation of a learning network development process, including developing the capabilities of members into

high competence people. This was consistent with the studies by Office of National Committee Village and Urban Community Fund, Office of Prime Minister (2003: 15).

7) Regulation and Agreement

There were a lot of people working together as members of the network; it needed the regulations and agreements in order to implement projects harmoniously to accomplish shared objectives and targets together. Because the members have diverse experiences, they had various ideas that must be built into a unique system of network. Therefore, the regulations and agreements need to be clearly defined for work performance in order to drive the objectives and goals successfully. It would eliminate the influence of some members in the group, solving the problem of inequality, thus becoming transparent.

8) Systems Approach

The MML concept was invented for implementation of a learning network establishment, under the basic principle of participatory training through the AIC technique with the integration of SWOT Analysis technique. The establishment of a learning network would be sustainable, which needed a system approach with systematic administration, planning, and implementation. The most critical factor was to think systemically to initiate, improve, maintain, develop and sustain a learning network. It needed skills (disciplines) of network learning.

There were at least six skills (or disciplines, as Peter Senge refers to them) needed to initiate and maximize organizational learning or network learning: system thinking, mental models, personal, team learning, shared vision, and two way communication. It required the creative exploration of subtle issues, a deep listening to one another and suspension of one's own views. The discipline of dialogue involved learning how to reorganize the patterns of interaction in teams that promoted or undermined learning. For example, the patterns of defensiveness were often deeply ingrained in how a group of people or an organization operates. Dialogue was the critical medium for connecting, inventing and coordinating learning and action in the workplace.

9) Participation of Community Members

Participation was a strategy for sustainable development to achieving full and effective community participation in any development activities. It was a difficult job and much depended on the way members of communities were approached by field staff, developers, extension workers, or consultants. Thailand established the second development strategy in the Ninth National Economic and Social Development Plan (B.E.2545-2549), which was proposed to accomplish sustainable urbanization. It should be done through developing the potential of human resources, strengthening the community and promoting the participation of the people in society in terms of sustainable development integration.

The implementation of this research was harmonious with different studies on the concept of participation. The implementation of this study emphasized on participation of people from all walks of life and efficient resource utilization in the frame of a participatory approach. The participation was an essential factor to support the success of a sustainable learning network development. The AIC technique was a participatory training process and learner centered approach.

Community participation was an important approach to introduce the success of various sustainable developments, but the most essential concept to keep up with the environment was problem solving, so a learning network establishment was also introduced. Therefore, the researcher was interested in studying the effective concepts, methodology and process that could accelerate the establishment of a learning network through community participation, which was congruent to the second development strategy in The Ninth national Economic and Social Development Plan (B.E.2545-2549). It should be done through developing the potential of human resources, strengthening the community and promoting the participation of people in terms of sustainable development integration. In addition, it was in accordance with concepts of community participation for a strategy of sustainable development. The concepts included a spirit of self-help with labor contribution, cost sharing, contractual obligation and community decision making with their agreement of genuine

commitment and widespread support by the community as a whole, and the continuity of participatory community education through participatory training approach.

The concept of training of trainers in participatory techniques was popularly used for community participation and as a strategy for sustainable development of a learning network for energy conservation through various projects such as environmental conservation in order to broaden the learners' vision. Participatory approach—often known as learner-centered—had evolved over the past decade as a means of helping learners take greater control of their lives and their environment by developing their skills in problem-solving and resources management.

It could be concluded that the success of this research in developing a learning network model for energy conservation came from the fact that the research design and implementation were perfect matches with the systemic approach. The research design used the MML concept and different participatory techniques such as focus group discussion, PRA, AIC (participatory training approach), as well as inventing PAMEI, TDE and FDE techniques to verify the formation of a learning network. Community leaders were defined as a target group since they had good capabilities and energy to devote to their own communities and public service as trainers and educators, and to participate as members in learning network, BASNEC, since a learning network was considered as a core center for the successful future of all types of organizations and networks. The core subsystem of the learning organization was learning, and this dimension permeated the other four subsystems. Learning took places at the individual, group and organizational levels. The skills of system thinking, mental model, personal mastery, team learning, shared vision and dialogue were necessary to maximize organizational learning.

Therefore, to accomplish sustainable network learning, all the above 9 factors were required as a conceptual framework for implementation.

5.2.3 Research Question 3

How would the invented techniques of PAMEI, TDE, and FDE or RDE be used to implement and evaluate the learning network model establishment effectively and successfully?

It was seen from this study that after the first training course was complete, a learning network was established on November 8, 2003 with the name BASNEC. In this study, the researcher was an outsider who motivated community leaders to participate on energy conservation training in order to be a trainer and educator.

Getting training quality results was a long-term goal, not a blueprint, to be developed and sustained. Implementing total quality management required practical and continuous leadership to accomplish any administration, particularly the learning network development for energy conservation, because establishing the prototype of a learning network was a more complicated system to form. It required numerous factors to develop. To develop and establish the new learning network was a difficult job but to sustain it was more difficult.

Therefore, after the training courses finished, the participants who were community leaders realized the importance of establishing a learning network for energy and environmental conservation in the Bang Sue District, in order to transfer and sustain the knowledge received to other people, to accomplish the goal of sustainable development that needed to start promptly. In addition they realized that to conserve energy and environment, it was not only their own money that would be saved from electricity and water pipe expenditures but national money for buying energy from abroad. They had expressed their responsibilities for global environment as well.

At present, there were no precedence learning network development with systemic approaches or even if any study had been tried out. Therefore the researcher tried to develop a learning network by inventing the TOT with MML concept, including inventing the 3 evaluating techniques of Three Dimensional Evaluation

(TDE) Technique, Four Dimensional Evaluation (FDE) or Round Dimensional Evaluation (RDE) Technique and Participatory Performance, Assessment, Monitoring, Evaluation and Impact (PAMEI) for evaluation of implementation in the whole process of this study.

Therefore, it could be concluded that the success of a learning network development and formation came true when the researcher acted as the stimulator and activator for trainees who had a high level of competency of leadership. It was congruent to the concept that competency possesses both knowledge and behavioral capability to act appropriately, as the design in this study was training of trainers with participation in every step of implementation. It was a process of developing competencies by integrating knowledge during training processes with methods such as a learner-centered education and informal education for adults or lifelong education approach. This led to a change of sustainable development, since the community people were the major factor in initiating and implementing activities by themselves.

The community leaders in Bang Sue District established a learning network to sustain their activities continuously. It might be said that the participatory training of MML used in this study was consistent with the principle of environmental education for environmental problem solving, promoting environmental knowledge and enhancing the public value, consciousness, awareness, and skill development in order to be able to take responsibility for environmental protection appropriately and effectively. Community leaders with lofty objectives or aims would compel new ways of thinking and acting by providing a tiller to keep the learning process on course. They more readily questioned their established ways of thinking and their deeply held views, due to their participatory training received from this research design. The shared vision would be a strategic thinking and planning guide for the organization and network.

For the shared vision of the community leaders who were the participants in this study, it could be concluded that they wished to conserve natural resources through their daily activities by economizing electricity and pipe water usage. They

established a learning network, BASNEC, with the objective to distribute knowledge received from training to people and students by starting at the boundary of Bang Sue District. Their shared vision was built through the participatory training process with the aim of environmental education to develop literate citizens who could compete in the global economy and possessed the skills, knowledge and inclinations to make well-informed choices and exercise the rights and responsibilities of members. The shared vision was essential for a successful organization and network, whether it was a learning organization or network.

The community leaders who became trainers expressed their intentions through building a solid foundation of shared vision together about energy and environment conservation, by establishing a learning network to perform the activities together and sharing their received knowledge in order to make the network into a living and dynamic learning organization. The network would be based on environmental education processes, because it would be a comprehensive process for helping people, teachers, communities, and students understand the environment in order to create awareness, consciousness, and responsibilities, and integrate them with the qualities of empowerment, self-discipline, flexibility and ethical behavior. It emphasized the interdisciplinary integration of the subject matter and problem solving, including issue-based learning experiences, team teaching, learner-centered instruction, constructivist approaches and self-directed learning as core principles, including challenges of environment and economy that required understanding of the interdependence of the environment, economy, communications and technology.

Therefore, government agencies and other responsible organizations for natural resources management had to operate with progressive knowledge, sharing information and expertise and managing knowledge in a way that integrated information from a broad range of fields. Those who planned in the new paradigm, needed to use new technology to meet environment and economic challenges by having the requisite knowledge and scientific skills to manage the nation’s natural resources effectively.

The critical factor to initiate or lead a learning network formation was the establishment of BASNEC, which had need for highly competent leaders with a real comprehension of the type of commitment required to build such a learning network. Nevertheless, it demanded the shared vision of the leader and members as presented in the 10 small groups implemented according to the AIC process, all of which had a shared vision of energy and environment conservation. This shared vision emerged from the personal vision of the participants in all three levels of training activities on AIC implementation. It was not only about their personal self-interest; in fact, participant's personal visions usually included dimensions that concerned family, organization, community and even the world because after they gained knowledge participatory learning through the participatory training in this research. They realized the essential part of energy and environment conservation was to participate and perform as trainers to accomplish sustainable development. It was a process of stimulating participation by starting off with a stimulant for thinking and expressing those thoughts in pictures or symbols that communicated a message about future expectations, as per the issue of energy and environment conservation discussed. They used the SWOT Analysis techniques to seek a shared vision and commitment together in order to set a project for energy conservation in each group, in accordance with project operation concepts of Who, Whom, What, When, Where, Why, and How (6W1H).

CHAPTER 6
CONCLUSIONS AND RECOMMENDATIONS

This study was for the development of a learning network model for energy conservation: application to Bang Sue District, Bangkok in order to create trainers and educators with a multiplying effect for transferring knowledge about energy conservation. This would be done through the process of training trainers for community leaders in Bang Sue District. The training needs assessment was done using the FGD technique for implementation. The PRA was employed in order to identify the existing problems of energy conservation in daily life activities, such as electricity appliance and pipe water utilization, including other existing environmental problems in the community. It was found that most of the community leaders in the Bang Sue District had high capabilities to be trainers and educators. Therefore, the MML concept was proposed based on the training of trainers, and the participatory training approach was introduced to be implemented. During the training, courses were operated with participatory assessment, monitoring, and evaluation done by PAMEI, PAME, TDE, and FDE. The pretest and posttest were used in each training course. Besides, the process of learning network needs not only time but also an effective system approach.

6.1 Conclusions

A learning network is one of the most effective methods for knowledge transfer, especially since the community participation channel would be an excellent strategy for an environmental education process (such as energy conservation) to alleviate global warming. It is a global problem that needs the whole population to collaborate in a harmonizing way, since an environmental problem is the responsibility of every person in the world.

At present, there are international attempts of various sectors to solve the environmental problem, which have been met with some success. However, the environmental education approach seems to be the most successful strategy to conquer and keep up with problems, because it is a powerful outlet via all systems of learning, such as formal, non-formal, and informal education approaches. This is particularly true of the lifelong education concept due to its essential style of learning, because it can take place any time and place. Additionally, the current rapid information technology is providing and facilitating the process. Simultaneously, when it is integrated with the environmental education process, it will accelerate and disseminate information unlimitedly.

Therefore, in order to extensively disseminate the knowledge, understanding, and awareness to people with environmental education concept by establishing the learning network with regarding to the competency of the community leaders. The systemic approach was introduced by holding the multi-level management linkage with the integration of training of the trainer, brain storming process with AIC technique, and participatory training process. This increases people's knowledge and awareness about the environment and associated challenges, develops the necessary skills and expertise to address the challenges, and fosters attitudes, motivations, and commitments to make informed decisions and take responsible action after the whole system approach in this study. It was obviously seen from the success of the learning network establishment by the participants (community leaders) of three levels training course linking together into the Bang Sue District Learning Network for Energy and Environment Conservation (BASNEC) on the 4th of December 2003 at Bang Sue District. Moreover, it can be concluded that to establish and sustain the learning network, it required 9 essential factors that are man or people, organization or committee, objective or goal or target, learning process, linkage or connection, communication, regulation and agreement, system approach, and participation because this research implementation needs the participation of community leaders and community people to participate in the whole process, including the educational institutes, private organization, and governmental sectors to collaborate as well. This study is there to help create consciences within people and stimulate them into

responsible behavior by decreasing the energy consumption since the BASNEC committees held a campaign after the training course to hold a competition for the highest percentage reduction of both electrical consumption and pipe water consumption, by collecting the bills to calculate and select the winner. The winner of the contest had a 95.5% reduction for electrical consumption and 80.5% for water pipe consumption reduction. Nevertheless the effectiveness of the MML concept with the TOT implementation is proved by the evaluation with TDE, FDE or RDE, and PAMEI methods.

The impacts are obviously seen that since the trainees or participants were able to perform as trainers and facilitators in the Bang Sue District area by giving knowledge to people in different communities and students in the schools such as Chang-Akad Amrung Primary School, and Wat Liab Primary School, Bang Sue District, Bangkok.

Therefore, a learning network is an effective learning process through employing the lifelong education concept in developing a person's abilities and changes a person's awareness, attitude, and beliefs, getting him to take responsibility for nature and environment of his surroundings through collaborating among people and groups of certain communities, including sharing their knowledge with each other. Since learning is a process that develops a person's abilities and changes a person's view of his surroundings. It is a powerful process of change: from ignorance to knowledge; from not knowing how to do something to being competent enough to do so under the ultimate goal of learning is to be able to modify and adopt various sources of information for the benefit of oneself and one's community.

In order to solve the global environmental problem, it must be implemented successfully. The learning network establishment was an excellent concept for energy conservation to alleviate global warming, especially in developing a prototype of learning by lifelong education for adults in urban places like the Bangkok Metropolis.

The prototype of learning network establishment had been established in Bang Sue District, and it will be a guideline model for the rest of the 49 Districts of Bangkok so that the decrease of energy consumption and pollution decrement will occur. Finally, it would lead to sustainable development, which is the ultimate goal of the research because these are evidently proved by the research results as follows:

1. The participants in TOT for three levels from MML had posttest mean scores higher than pretest mean scores at highly statistically significant level of 0.01.

2. The AIC process results illustrated that participants were able to operate as trainers and facilitators for further training course level. Moreover, they developed project action plan for environment and energy conservation according to the shared vision obtained through brain storming at each training level. Brain storming included SWOT (Strength-Weakness-Opportunity-Threat) analysis based on project operation methods of Who, Whom, What, When, Where, Why, and How (6W1H).

3. Three Dimensional Evaluation (TDE) was used for evaluation of the participation in training courses and Four Dimensional Evaluation (FDE) or Round Dimensional Evaluation (RDE) was employed for qualifying trainees to be able to perform as trainers and facilitators. The results showed that all participants passed the 50% requirement, based on TDE and FDE.

4. Participatory Performance, Assessment, Monitoring, Evaluation, and Impact (PAMEI) technique was used as the tool for the ultimate phase of evaluation of participants in the three levels as trainers for energy conservation. Some participants joined public minded activities, such as community knowledge giving, school training, and public knowledge giving. The highest electricity reduction achieved was 95%, and the highest pipe water reduction was 80%.

5. The learning network was established and the administrative committee was elected after the training process was used for evaluation. Some 55 participants were qualified as trainers and educators, and 36 participants were qualified as facilitators and educators.

6.2 Recommendations

6.2.1 Recommendations for the Research

From the research results, the following recommendations are made:

1) In order to succeed in learning development, there is a need to understand the existing situation of the energy conservation of communities, including the culture and life style, particularly the leader's competency.

2) There is a need to cooperate with government officers and advisors in order to have convenience for research implementation.

3) The researcher must prepare free time, place, budget, equipment, materials and learning content before implementation, as well as having assistants, training arrangements, videotape recorders, photographers, and facilitators for AIC process.

4) The researcher should be a motivator in order to encourage, communicate, and challenge the trainees, and simultaneously build the learning atmosphere to be friendly and welcoming.

6.2.2 Recommendations for Further Research

In order to reach the highest benefit from this study, the following areas of research are suggested:

1). The prototype of learning network model should be implemented in other districts in the Bangkok Metropolis in order to accelerate the conservation of energy and maximize the benefits of energy utilization.

2) There should be research that applied building a learning network of environmental and natural resources conservation.

3) This learning model can be adapted to be implemented for other learning networks and problem solving, such as poverty and health care, with the training of trainers used for vocational training in order to improve quality of life.

4) There should be research on the verification of this learning model in order to search which components of the learning network development plays the most influence in this model, by using the LISREL Model.

In order to reach the sustainable development with the environmental education process via the informal education, the invented MML technique should be used as a concept for giving knowledge and raising awareness of all people to conserve their natural resources and environment by introducing for the rest of all community leaders in other districts in Bangkok. It can be immediately implemented without waiting for the modern technology to produce the substitute energy such as solar energy, hydro energy, wind energy or other clean energy. It can be promptly done as soon as possible with the different channels of education as formal, informal, non-formal and lifelong through the advance and wide information technology support. Ecologists teach us that for survival, nature is very conservative in its use of energy. Hopefully, this thesis will go same way towards directing we humans towards a more conservative and conservationist approach as well.

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