PROCEEDINGS

International Conference

of "Multidisciplinary Approaches on UN Sustainable Development Goals"

(UNSDGs 2016)

December 28th – 29th, 2016

Hotel Windsor Suites & Convention, Bangkok, Thailand



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The International Conference

of "Multidisciplinary Approaches on UN Sustainable Development Goals" (UNSDGs 2016)

December 28th – 29th, 2016 Hotel Windsor Suites & Convention, Bangkok, Thailand

Co-hosted by: - Nakhon Pathom Rajabhat University (NPRU), Thailand

- The Interdisciplinary Network of the Royal Society of Thailand (INRIT) under the Royal Patronage of HRH Princess Maha Chakri Sirindhorn
- Office of the Higher Education Commission (OHEC), Thailand
- Department of Medical Services, Ministry of Public Health, Thailand
- Faculty of Nursing, Prince of Songkla University, Thailand
- Faculty of Information Technology, King Mongkut's University of Technology North Bangkok, Thailand
- Faculty of Environment and Resource Studies, Mahidol University, Thailand
- The Royal Thai Army Medical Department, Thailand



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Number of Participants

No.	Nationality	Number of Participants
1	Thai	220
2	German	5
3	Indian	10
4	American	1
5	Chinese	8
6	Philippines	1
7	Japanese	3
8	Australian	1
9	Swiss	2
10	Russian	1
	Total	252

Summary of participants

Thai Participant	87.30%
Foreign Participant	12.70%

Number of Papers

No.	Country	Number of Papers
1	Thailand	107
2	Philippines	2
3	India	2
4	China	1
5	Japan	2
6	USA	1
7	Germany	4
	Total	119

Summary of Papers

Papers from Thailand 90%

Papers from other countries 10%



Message from President of Nakhon Pathom Rajabhat University

The International Conference of "Multidisciplinary Approaches on UN Sustainable Development Goals" (UNSDGs) is the first academic international conference of Nakhon Pathom Rajabhat University. On behalf of President of Nakhon Pathom Rajabhat University, I am delighted to host and co-hosted with 8 organizations including the Interdisciplinary Network of the Royal Society of Thailand under the Royal Patronage of HRH Princess Maha Chakri Sirindhorn, Office of the Higher Education Commission (OHEC), Faculty of Nursing, Prince of Songkla University, Faculty of Information Technology, King Mongkut's University of Technology North Bangkok, Department of Medical Services, Ministry of Public Health, Thailand, Faculty of Environment and Resource Studies, Mahidol University and the Royal Thai Army Medical Department.

The aims of UNSDGs is to provide a forum for academicians and professionals from various educational fields and with cross-disciplinary interests to network, share knowledge and engage in dialogue around the theme of fostering innovation and excellence in multidisciplinary approaches on UN sustainable development goals to end poverty, fight inequality and injustice, and tackle climate change by 2030. It is essential to bring together experts in various fields.

I would like to take this opportunity to express my sincere appreciation to Prof. Dr. med. Yongyudh Vajaradul, H.E. Ambassador Kamthorn Sithtichoti, Prof. Dr. rer. nat. Manfred Koch, – the plenary lecturers, Co-hosts, many distinguished international and Thai academicians that have presented their important research works, the Conference Organizing Committee and all supporters who have contributed their resources to the conference with a great determination. Last but not least, I would also like to thank the working team who delicate themselves to achieve the conference.

In conclusion, I am honor to express my heartfelt appreciation to all participants, especially those of you coming from abroad, for joining us and sharing your valuable experience and ideas and wish our visitors will enjoy the conference and have a very pleasant stay in Thailand.

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(Assistant Professor Somdej Ninlapan) President of Nakhon Pathom Rajabhat University





Message from Chairman of the Interdisciplinary Committee for Research and Development of the Office of the Royal Society of Thailand

On behalf of the Chairman of the Interdisciplinary Committee for Research and Development of the Office of the Royal Society of Thailand, we have co-worked with Nakhon Pathom Rajabhat University since 2011. Herewith the President of Nakhon Pathom Rajabhat University performs as a Chairman of Western Network of the Royal Society of Thailand.

Since then, we have cooperated for publishing Journal of Thai Interdisciplinary Research until now. And I am the Editor of Journal of Thai Interdisciplinary Research.

In the present, Journal of Thai Interdisciplinary Research is indexed in the tier 1 (Science and Technology) of TCI and ASEAN Citation Index (ACI).

Moreover, the conference is mainly hosted by Nakhon Pathom Rajabhat University and the Interdisciplinary Committee for Research and Development of the Office of the Royal Society of Thailand. The selected articles will be published on the Journal of Thai Interdisciplinary Research.

Finally, I would like to express the deep appreciation to plenary lectures, keynote speakers, all participants and working staffs whom devote themselves to this conference.

I further wish the International Conference of "Multidisciplinary Approaches on UN Sustainable Development Goals" (UNSDGs) to be a great success and wish all participants a pleasant stay in Thailand, to have extensive and successful academic exchanges on the importance of interdisciplinary research from the conference, and safe trip back home.

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(Professor Dr. med. Yongyudh Vajaradul, FRST) Chairman of the Royal Society of Thailand

Report speech by Dr. Ammarin Inyoo Vice President for Research Affair,

Nakhon Pathom Rajabhat University, Thailand at the Opening of the International Conference of "Multidisciplinary Approaches on UN Sustainable Development Goals" (UNSDGs) 28th December 2016 at the Hotel Windsor Suites & Convention, Bangkok, Thailand

Good morning, Mr. Prasit Pathumarak, Chairman of the University Council of Nakhon Pathom Rajabhat University, Assistant Professor Somdej Ninlapan, President of Nakhon Pathom Rajabhat University, Ms. Chadarat Singhadechakul, Director of International Cooperation Strategy and Acting Senior Advisor for Policy and Planning of the Office of Higher Education Commission (OHEC), Distinguished Delegates, Ladies and Gentlemen,

On behalf of President of Nakhon Pathom Rajabhat University, I would like to report you that:

The International Conference of "Multidisciplinary Approaches on UN Sustainable Development Goals" (UNSDGs) is co-hosted by 8 organizations including:

- (1) Nakhon Pathom Rajabhat University,
- (2) The Interdisciplinary Network of the Royal Society of Thailand under the Royal Patronage of Her Royal Highness Princess Maha Chakri Sirindhorn,
- (3) Office of the Higher Education Commission (OHEC),
- (4) Faculty of Nursing, Prince of Songkla University,
- (5) Faculty of Information Technology, King Mongkut's University of Technology North Bangkok,
- (6) Department of Medical Services, Ministry of Public Health,
- (7) Faculty of Environment and Resource Studies, Mahidol University and
- (8) The Royal Thai Army Medical Department, Thailand.

The aims of UNSDGs is to provide a forum for academicians and professionals from various educational fields and with cross-disciplinary interests to network, share knowledge and engage in dialogue around the theme of fostering innovation and excellence in multidisciplinary approaches on UN sustainable development goals to end poverty, fight inequality and injustice, and tackle climate change by 2030. It is essential to bring together experts in various fields.

The conference has 9 sessions, including:

- Session 1 : Pure and Applied Science
- Session 2 : Electrical Engineering and Technology
- Session 3 : Computer and Information Technology
- Session 4 : Multidisciplinary Health Sciences
- Session 5 : Humanities and Social Sciences
- Session 6 : ASEAN Studies
- Session 7 : Water Engineering, Groundwater Hydrology and Environmental Science
- Session 8 : Hospitality and Tourism Management
- Session 9 : The Interdisciplinary Research

All presentation papers have 119 papers, from Thailand 107 papers and from other countries 12 papers. There are more than 200 participants from 12 countries, including Thailand, China, Japan, India, Malaysia, Philippines, Pakistan, USA, Germany, Australia, Switzerland and Russia.

Thank you.

Dr. Ammarin Inyoo, Vice President for Research Affair, Nakhon Pathom Rajabhat University, Thailand

Organizing Committee

Chairman of UNSDGs

Assist. Prof. Somdej Ninlapan

Advisory Committees

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Assoc. Prof. Dr. Panitan Wattanayagorn

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- 1. H.E. Ambassador Kamthorn Sithtichoti
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- 1. Ms.Jintana Saeiaw
- 2. Ms.Ladda Khemnark
- 3. Ms. Pimonpan Saliew
- 4. Ms. Sirintra Prangpreampree

Thai Committees	41	persons
Foreign Committees	15	persons
Total	56	persons

List of Peer Review

Assoc. Prof. Dr. Aree Jampaklay	Mahidol University, Thailand
Assoc. Prof. Dr. Duangpun Singkarin	Mahidol University, Thailand
Assoc. Prof. Dr. Duangruedee Lasuka	Chiang Mai University, Thailand
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Dr. Thada Siththada	Nakhon Pathom Rajabhat University, Thailand



Conference Program

International Conference

of "Multidisciplinary Approaches on UN Sustainable Development Goals" (UNSDGs) December 28th – 29th, 2016

at the Hotel Windsor Suites & Convention, Bangkok, Thailand

Conference Program on December 28 th , 2016 (Day 1)			
Date/Time	Description		
08.30 - 09.00	Registration (Petch-Pailin Room, Fl. 11)		
09.00 - 09.15	Conference Opening		
	Report : Dr. Ammarin Inyoo,		
	Vice President for Research Affair, NPRU, Thailand		
	Welcome Speech : Mr. Prasit Pathumarak		
	President of the University Council, NPRU, Thailand	1	
	Opening Speech : Dr. Supat Jampathong,		
	Secretary General of the Office of Higher Education	Commission (OHEC)	
09.15 - 10.15	Plenary Lecture : Prof. Dr. med. Yongyudh Vajarad	lul,	
	Fellow of the Royal Society of Thailand and Chairma	an of the Interdisciplinary	
	Committee for Research and Development of the Ro	yal Society of Thailand	
	Topic : Interdisciplinary Research for Thailand 4.0		
10.15 - 11.15	Plenary Lecture : H.E. Ambassador Kamthorn Sithtichoti		
	Expert of the Interdisciplinary Committee for Research and Development, the office		
	of the Royal Society of Thailand		
	Topic: Sufficiency Economy Philosophy: A Practical Approach Toward the United		
	Nations Sustainable Development Goals		
11.15 - 12.15	5 - 12.15 Plenary Lecture : Prof. Dr. rer. nat. Manfred Koch,		
	University of Kassel, Germany		
	Topic : World Natural Hazards and Disaster Risk		
12.15 - 12.30	Presenting a Token of Appreciation and Commemorative Group Photo		
12.30 - 13.00	Lunch (Fl. G)		
13.00 - 14.00	Keynote Address / Presentation	For further information,	
14.00 - 15.00	Keynote Address / Presentation	please find out in the	
15.00 - 15.15	Coffee Break	presentation program.	
15.15 - 17.00	Presentation (continue)		
18.00 - 20.00	Welcome Dinner (Paetai Room Fl. 14)		

Conference Program on December 29 th , 2016 (Day 2)			
Date/Time	Description		
08.30 - 09.00	Registration (Ploy Room, Fl. 11)		
09.00 - 10.00	Keynote Address / Presentation	For further information,	
10.00 - 10.30	Presentation	please find out in the	
10.30 - 10.45	Coffee Break	presentation program.	
10.45 - 12.00	Presentation (continue)		
12.00 - 13.00	Lunch (Fl. G)		

Presentation Program

BOARD ROOM 1 (Fl. G)

Session: Pure and Applied Science

Session Chair: Assoc. Prof. Dr. Jakrapong Kaewkhao, Dr. Patarawagee Yasaka and Dr. Kitipun Boon-in

Dec 28 th , 2016		
Time	Code	Title
13.00 - 13.15	SCI 1	Sustainable Farm Models Using Sufficiency Economy Approach in Rice-based Farming Systems in Kamphaeng Phet Province by Suchanee Subsomboon and Benchaphun Ekasing
13.15 - 13.30	SCI 2	Malaria Risk Area Analysis from Environmental Factors in Surat Thani Province, Thailand by Sujaree Damsri and Kanyarat Noochum
13.30 - 13.45	SCI 3	CO ₂ -emission assessment of the concrete added crushed PET bottles waste by Nopagon Usahanunth and Pakpong Pochanart
13.45 - 14.00	SCI 4	Physical, Optical and Luminescence Properties of Zinc Aluminium Barium Borate Glasses Doped with Chromium Oxide by Patarawagee Yasaka, Pornnapha Mangthong, Suwimon Ruengsri and Jakrapong Kaewkhao
14.00 - 14.15	SCI 5	Effect of organic fertilizers on vitamin C, chlorophyll content and total phenolic compounds of Artemisia lactiflora. by Narin Taokaenchan, Pawinee Areesrisom, Varin Suton, Therdsak Thonnalak and Koblap Areesrisom
14.15 - 14.30	SCI 6	Facile synthesis of nanocrystalline wurtzite ZnO and its application for photocatalytic degradation of methyl orange and methomyl by Natkritta Boonprakob, Anchalee Masa-Ad and Paruchai Pongwan
14.30 - 14.45	SCI 7	Physical and Optical Properties of Ni ²⁺ ions in Borate glass by Yotsakit Ruangtaweep, Jakapong Kaewkhao, Sansanee Hansupho and Wimala Huaikrachao
14.45 - 15.00	SCI 8	Comparetive study of Luminescence and Optical Properties of Sm ³⁺ Doped Glasses with Different Hosts by Warawut Sa- Ardsin, Kitipun Boonin, Patarawagee Yasaka and Jakrapong Kaewkhao
15.00 - 15.15	SCI 9	Effect of mixed Ni-Cu in Soda Lime Silicate glasses by Nattapon Srisittipokakun, Anon Angnanon and Jakrapong Kaewkhao
15.15 - 15.30	SCI 10	Energy dispersive X-ray fluorescence analysis and physical properties of rutilated quartz by Suparat Tuscharoen, Pattamaporn Sookkasame, Amornrat Poomrapeeporn and Jakrapong Kaewkhao
15.30 - 15.45	SCI 11	Luminescence Properties of Pr ³⁺ -activated Lu ₂ O ₃ -CaO-SiO ₂ - B ₂ O ₃ Glasses by Keerati Kirdsiri, Benchaphorn Damdee and Jakrapong Kaewkhao
15.45 - 16.00	SCI 12	Investigation of Gamma-Ray Shielding Properties for Soils: Radioactive Waste disposal by Kittipong Siengsanoh, Suparat Tuscharoen, Pruittipol Limkitjaroenporn and Jakrapong Kaewkhao

BOARD ROOM 1 (Fl. G) Session: Pure and Applied Science

Session Chair: Assoc. Prof. Dr. Jakrapong Kaewkhao, Dr. Patarawagee Yasaka and Dr. Kitipun Boon-in Dec 28th 2016

Dec 28 , 2016			
Time	Code	Title	
16.00 - 16.15	SCI 13	Nitrate content Antioxidant and microbial safety of organic,	
		pesticide free and conventional vegetables in Nakhon Pathom	
		province, Thailand by Aumaporn Arlai and Chalida	
		Thakulsoonthon	
16.15 - 16.30	SCI 14	Physical and optical properties of Dy ³⁺ bismuth barium	
		borate glasses by Rungsan Ruamnikhom, Patarawagee	
		Yasaka and Jakrapong Kaewkhao	
16.30 - 16.45	SCI 15	Small - Scale Laboratory Development for Determination of	
		Ammonia-Nitrogen in Water Sample by Pimchana Hoktha	
		and Wuttichai Chinmueang	
16.45 - 17.00	SCI 16	Adoption of technologies by farmers producing bioethanol	
		crops in Thailand: Implications for achieving the energy	
		plan's goal by Wirawat Chaya and Shabbir Gheewala	
17.00 - 17.15	SCI 17	A Comparative Study of Forecasting Models for The Number	
		of Malaria's Patients in Phanom Districts, Surat Thani	
		Province by Sujaree Damsri and Ketsuda Maneewong	

BOARD ROOM 2 (Fl. G)				
Session: Electrical Engineering and Technology				
Session Chair: A	ssoc. Prof. Dr.	Piya Kovintavewat		
Dec 28 th , 2016				
Time	Code	Title		
13.00 - 14.00	Keynote	Prof. Dr. Pornchai Supnithi		
	Speaker	Topic: ''Effects of Ionospheric Irregularity on		
		Telecommunication and Aeronautical Technology''		
14.00 - 14.15	EET 1	The Occurrence of Passive Intermodulation and		
	1	Troubleshooting in Thailand Mobile Industry by Aditep		
	L	Chaisang and Sinchai Anantapreecha		
14.15 - 14.30	EET 2	Automatic Control of Synchronous Motor using PI Controller		
	I	for Improving Power Factor by Sittipong Pengpraderm,		
	L	Kreangsuk Kraikitrat and Somporn Ruangsinchaiwanich		
14.30 - 14.45	EET 3	Detection and Classification of Induction Motor Faults Using		
	1	Feed-Forward Backpropagation Network by Kreangsuk		
	l l	Kraikitrat, Sittipong Pengpraderm and Somporn		
	I	Ruangsinchaiwanich		
14.45 - 15.00	EET 4	Performance and evaluation of regular $(2, \rho)$ non-binary		
	I	LDPC codes over GF(q) based on Protograph design and a		
	1	new random construction method by Nut Tantibut, Ambar		
	1	Bajpai, Gan Srirutchataboon, Lunchakorn Wuttisittikulkij		
		and Piya Kovintavewat		
	1			

BOARD ROOM 2 (Fl. G)
Session: Electrical Engineering and Technology
Session Chair: Assoc. Prof. Dr. Piya Kovintavewat
Dec 28 th , 2016

Session Chan.	n:
Dec 28 th , 2016	

Dec 28 th , 2016		
Time	Code	Title
15.00 - 15.15	EET 5	Generation of bioenergy from cow manure using dual
		chamber microbial fuel cells by Chamath Dasun Yahampath
		Yahampath Arachchige Don and Patcharaporn Suwanvitaya
15.15 - 15.30	EET 6	Optimal allocation of multi-type FACTS Controllers for
		Optimal Power Flow using Hybrid PSO/SA by Suppakarn
		Chansareewittaya
15.30 - 15.45	EET 7	Effects of Ionospheric Irregularity on Telecommunication
		and Aeronautical Technology by Pornchai Supnithi,
		Phimmasone Thammavongsy and Somjai Klin-Nagam
15.45 - 16.00	EET 8	A Method to Mitigate an Insertion/Deletion Error in Bit-
		Patterned Media Recording Systems by Santi Koonkarnkhai
		and Piya Kovintavewat
16.00 - 16.15	EET 9	High Step-Up Push-Pull-Boost DC-DC Converter by
		Thawatchai Thongleam and Sombat Hathairattananon
16.15 - 16.30	EET 10	Intelligent monitoring Remote and Management System for
		PV Hybrid System by Rungphet Kongnok, Thanasin
		Boonnam and Boonyang Plangklang

BOARD ROOM 3 (Fl. G)		
Session: Computer and Information Technology		
Session Chair: F	Prof. Dr. Prabha	s Chongstitvatana, Assist. Prof. Dr. Suvimol Mukviboonchai
and Dr. Supoj He	engpraprohm	
Dec 28 th , 2016		
Time	Code	Title
13.00 - 14.00	Keynote	Prof. Dr. Prabhas Chongstitvatana
	Speaker	Topic: "Advances in Machine Learning"
14.00 - 14.15	COM 1	Extent of Implementation of ELMS and the Participation of STI General Santos City Senior High School Students by Adonis Solidarios Besa and Glenn Baladjay Fuentespina
14.15 - 14.30	COM 2	Preventive Maintenance System Development Project Management: A Case Study in Medium Scale Industrial Factory by Boonrad Boonradsamee and Watcharawalee Tangkuptanon
14.30 - 14.45	COM 3	The Prediction of Cultural Tourism Style in the Northern of Thailand by Pratya Nuankaew and Wongpanya Nuankaew
14.45 - 15.00	COM 4	Viral Video Development from Technology Determinism by Saha Puksirivongchai

AMPAWA 1 (Fl. 10)

Session: Computer and Information Technology

Session Chair: Prof. Dr. Prabhas Chongstitvatana, Assist. Prof. Dr. Suvimol Mukviboonchai and Dr. Supoj Hengpraprohm **Dec 29th. 2016**

Dec 29, 2010		
Time	Code	Title
9.00 - 10.00	Keynote	Dr. Panachit Kittipanya-ngam
	Speaker	Topic: "Big Data : Industry 4.0"
10.00 - 10.15	COM 5	Applying Decision Tree Technique to Filter Selected Customer
		Group for Financial Credit Approval by Uraiwan Inyaem
10.15 - 10.30	COM 6	The study guidelines for learning management of the STEM
		Education with Design Thinking Method to enhance
		Computer and ICT Literacy Skill in 21 th Century for
		undergraduates students by Charinthorn Aumgri
10.30 -10.45	COM 7	Development of Geographic Information System to Monitor
		Spread of Dengue Fever by Ketsarin Chawgien

AMPAWA 2 (Fl	. 10)	
Session: Multidisciplinary Health Sciences (Nursing)		
Session Chair: A	ssoc. Prof. Dr. S	Sunuttra Taboonpong and Mrs. Ruffel Joy C. Manalo
Dec 28 th , 2016		
Time	Code	Title
13.00 - 14.00	Keynote	Prof. Dr. Ramon Z Shaban
	Speaker	Topic: "Emerging infectious diseases and infectious control"
14.00 - 14.15	NUR 1	Diabetic Foot Care Knowledge and Its Related Factors
		Among Muslim Individuals with Type 2 Diabetes Mellitus in
		Indonesia by Estriana Murni Setiawati, Wipa Sae Sia and
		Luppana Kitrungrote
14.15 - 14.30	NUR 2	The Flood Safety Transferring Model for Bedridden Patients:
		A Case Study in Hat-Yai City Municipality by Jintana
		Damkliang, Praneed Songwathana, Wipa Sae-Sia, Chanon
		Kongkamol and Chotika Phuchaisiri
14.30 - 14.45	NUR 3	Development of a Transferring Tool Kit in Helping
		Vulnerable Individuals Affected by Floods for Village Health
		Volunteers by Najmah Lertariyapongkul, Wipa Sae Sia,
		Hathairat Sangchan and Praneed Songwathana
Dec 29 th , 2016		
Time	Code	Title
9.00 - 11.00	Panel	Assoc. Prof. Dr. Praneed Songwathana and
	Discussion	Prof. Dr. Ramon Z Shaban,
		Topic: "Experience in Research and Practice in
		Emergency and Disaster Nursing in SE Asia Pacific''
11.00 - 11.15	NUR 4	Factors Associated with Health Behavior in Food
		Consumption among Buddhist Monks in Trang Province by
		Siriporn Phithakphupha, Sukhumaphorn Sriwisit and Buppha
		Raksanam

AMPAWA 2 (Fl. 10)		
Session: Multidisciplinary Health Sciences (Nursing)		
Session Chair: A	ssoc. Prof. Dr. S	Sunuttra Taboonpong and Mrs. Ruffel Joy C. Manalo
Dec 29 th , 2016		
Time	Code	Title
11.15 - 11.30	NUR 5	Recognition of Stroke Signs and Symptoms among Stroke
		Victims and their Families by Jutarat Poopitukkul, Porntip
		Jokkrajai and Siriphan Ruangkhruawong
11.30 - 11.45	NUR 6	A Health Behavioral Modification Program for Overweight
		and Obese School-Age Children by Chitsirin Lailak, Chutikan
		Sangkam, Paweena Pan-In, Surangkanang Kheawhom,
		Atthaphol Rodkaew and Suwimol Tongkamkeaw
11.45 - 12.00	NUR 7	The Effects of Self-care Promoting program on Fall Prevention
		for Aging in Community by Pimsupa Chandanasotthi

AMPAWA 1 (Fl. 10)		
Session: Multidisciplinary Health Sciences (Medicine)		
Session Chair: Dr. Orapun Metadilogkul and Dr. Prasutr Thavornchaisit		
Dec 28 th , 2016		
Time	Code	Title
13.00 - 14.00	Keynote	Dr. Alexander V. Malygin
	Speaker	Topic : "TES-therapy based on the Scientific Discovery
		as a method for introduction into Multidisciplinary Medicine''
14.00 - 14.15	MED 1	Elderly health promotion with exercises to increase physical
		fitness and balance by Korakot Chansareewittaya, Araya
		Adultrakul, Utcharaporn Kamsrijai and Kanokthip
		Sawangjaithum
14.15 - 14.30	MED 2	Imprinted gene expression in human mesenchymal stem cells
		by Puttachart Pokathikorn, Suparat Wichitwiengrat,
		Sasiprapa Inongbopit, Kittima Iungprasertpol and Tatsanee
14.20 14.45	MED 2	Phermithal
14.30 - 14.45	MED 5	Comparison of the immunosuppressive capacity of
		mesenciryinal stem cens derived nom animotic fluid, animotic membrane and Wharton's jolly by Suparat Wightwighter
		Sasiprapa Thonghonit and Tatsanee Phermthai
14.45 - 15.00	MED 4	Effect of Stem cells Secretion Cytokines to Chondrocyte
14.45 - 15.00		Progenitor Cells by Supatra Klaymook and Tatsanee Phermithai
15.00 - 15.15	MED 5	No-Fault Patient Compensation for Medical Malpractice in
10100 10110		Thailand: Option or Not? by Prasutr Thawornchaisit and
		Archie A. Alexander
15.15 - 15.30	MED 6	Criminalizing Medical Practice: Overview by
		Prasutr Thawornchaisit and Archie A. Alexander
15.30 - 15.45	MED 7	Production of Mesenchymal Stromal Cells for Clinical
		Application by Patana Teng-Umnuay, Panurut Yanudom,
		Jettana Rongdet and Thantip Mitupatum

AMPAWA 1 (Fl. 10)		
Session: Multidisciplinary Health Sciences (Medicine)		
Session Chair: D	r. Orapun Metao	dilogkul and Dr. Prasutr Thavornchaisit
Dec 28 th , 2016		
Time	Code	Title
15.45 - 16.00	MED 8	Globalization of Health Care and Litigation by
		Archie A. Alexander and Prasutr Thawornchaisit
16.00 - 16.15	MED 9	Effects of Chelation Therapy in Patiens affected from Heavy
		Metal Toxicity from Gold Mining in Loei Province : Case
		study of Arsenic Toxicity by Sirichada Plengphanich, Pranee
		Limworawan and Ong-Ard Sirikulphisut

MORAKOT 1 (Fl. 12)		
Session: Humanities and Social Sciences		
Session Chair: Assist. Prof. Dr. Usa Noytim, Col. Artcha Boongrapu,		
Assist. Prof. Dr.	Piyaporn Tunn	eekul, Mr. Nupong Phusri and Ms. Duangjit Sukhapabsuk
Dec 28 th , 2016		
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13.00 - 13.15	HUM 1	Impact of social media on students' behavior and
		performance by Meena Laiphrakpam and Sayam
		Aroonsrimorakot
13.15 - 13.30	HUM 2	Addressing the Sustainable Development Goals of the United
		Nations through STEM Education for Buddhist Nuns in the
		Himalayan Region by Kat Lafever
13.30 - 13.45	HUM 3	The Influence of Cross-cultural Adjustment on Expatriate
		Performance: A Case Study on Chinese Expatriates in
		Thailand by Jingjie Liu
13.45 - 14.00	HUM 4	The Role of Employee Extraversion Personality on Job
		Performance: A Case Study of Financial Companies in China
		by Feiqian Zhang
14.00 - 14.15	HUM 5	The Effect of Corporate Social Responsibility on Employee
		Job Performance: A Case Study of Household Products
		Manufacturers in Southern China by Shuli Guo and Sasithorn
		Suwandee
14.15 - 14.30	HUM 6	Employee Promotion-based incentive scheme On
		Telecommunication Industry Case study of Chinese
		Telecommunication Companies by Zihui Wang and
14.00 14.45		Sasithorn Suwandee
14.30 - 14.45	HUM 7	The Vender Managed Inventory Knowledge Marketing
		Management for Thai Retailer-Based Brand Equity Model by
14.45 15.00		Pawinee Thongyam, Suthep Meearsa and Nuttakorn Karnkan
14.45 - 15.00	HUM 8	The representative of urban in "Nimitmarn" by Khobkun
15.00 15.15		Somboonwong
15.00 - 15.15	HUM 9	the implementation of pages and order programs in the
		herengeus of Conoral Sontos City by Adoria Doss and Clark
		barangays of General Santos City by Adonis Besa and Glenn
		ruentespina

MORAKOT 1 (Fl. 12) Session: Humanities and Social Sciences

Session Chair: Assist. Prof. Dr. Usa Noytim, Col. Artcha Boongrapu,

Assist. Prof. Dr. Piyaporn Tunneekul, Mr. Nupong Phusri and Ms. Duangjit Sukhapabsuk

Dec 28 th , 2016		
Time	Code	Title
15.15 - 15.30	HUM 10	The Moral Behaviors of Public Administration Program Loei
		Rajabhat University's Students Thailand by Kalaya
		Yotcamlue, Areerat Homprssert, Weeranaree Tiyaboot and
		Subanan Prarabudh
15.30 - 15.45	HUM 11	The Participation Prevention and Resolven the Impact of
		Mining for Citizen Folkway in Loei Province, Thailand by
		Kalaya Yotcamlue, Itsariyaphon Chaikularp and Teerawat
		Wongwarunyoo
15.45 - 16.00	HUM 12	Fluency or Accuracy for L2 Teaching by Duangjit Sukhapabsuk
16.00 - 16.15	HUM 13	An Error Analysis of English Paragraphs Written by English
		Education Major Students at Nakhon Pathom Rajabhat
		University by Jantra Prompan
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Dec 29 , 2016		
Time	Code	Title
9.00 - 10.00	Keynote	Assist. Prof. Dr. Apisak Pupipat
	Speaker	Topic: "Critical & Creative Thinking - Two Important
		Skills for Thai Learners and Their Teachers''
10.00 - 10.15	HUM 14	The Effectiveness of a Multimodal Approaches on Poetry
		Reading of EFL Students by Nupong Phusri
10.15 - 10.30	HUM 15	Tourism Driven by Community Spiritual Marketing by
		Jindapa Srisamran and Assist. Prof. Dr. Kamolthip Kamchai
10.30 -10.45	HUM 16	Sensation Seeking, Narcissism, Social Comparison and
		Online Social Networking Usage Behavior of Undergraduate
		Students at Kasetsart University by Chalermkwan Singhwee
10.45 - 11.00	HUM 17	Supplemental income from Plant Fruit Tree of Toddy Palm
		by Nichapat Boonyarat, Lakhana Damchoo and Pahkathip
		Khoonchai
11.00 - 11.15	HUM 18	The Learning Process of the Restoration of Indigenous
		Vegetables and Consumption of Indigenous Vegetables for
		local Health Communities: A case study Laembuavitaya
		School, Wattungnoy School and Watcokkema School,
		Nakhon Pathom Province by Piyanart Imdee

MORAKOT 2 (Fl. 12)

Session: Humanities and Social Sciences

Session Chair: H.E. Ambassador Kamthorn Sithtichoti, Dr. Thada Siththada, Mr. Sunhakrisana Boonchuay, Ms. Nareema Sangwiman, Ms. Lalana Pathomchaiwat and Ms. Ruja Sukpat

Dec 28 th , 2016		
Time	Code	Title
13.00 - 14.00	Keynote	Mr. Kavi Chongkittavorn
	Speaker	Topic: "The Stability of Thailand Creates the Stability of
		ASEAN''
14.00 - 14.15	AEC 1	Brand image and customers willing to pay a price premium for organic rice in Thailand by Chomaturod Kuajarern
14.15 - 14.30	AEC 2	Community skills development in the application of social capital to foster sustainable self-reliance when to be the Asean economic community: A case of Kanchanaburi province by Naratton Sritong, Pongpaiboon Silavalavet, Tong Boonrueng and Weerawat Udomtrap
14.30 - 14.45	AEC 3	The Feasibility of Cross-Border Cooperation between Non- Capital Cities in Asia: A Case Study of the Concept of Cross Border Cooperation between Busan and Fukuoka by Jonghyun Park and Masahiko Fujimura
14.45 - 15.00	AEC 4	The Impact of Job Rotation Adaptability: A Case Study of large enterprise in China and in Thailand by Chen Weifei
15.00 - 15.15	AEC 5	Indo-Bangladesh Enclave Exchange: A study on Dynamics of Emotions by Dulon Sarkar, Bikash Das, Piyal Roy, Sinor Lama and Utpal Barman
15.15 - 15.30	AEC 6	Teaching English vocabulary through ASEAN context by Lalana Pathomchaiwat
15.30 - 15.45	AEC 7	Constructing ASEAN identities through the lenses of Malaysian Woman's literary Works by Nareema Sangwiman
15.45 - 16.00	AEC 8	Reflections of Students' satisfaction with the learning management of English Education Curriculum under ASEAN Aspects by Lalana Pathomchaiwat
16.00 - 16.15	AEC 9	Preparation in Logistics and Production Planning for Crops Producing Cellulosic Ethanol in Thailand to become Leading Producer in ASEAN by Phongchayont Srisuwan

PLOY ROOM (Fl. 11)

Session: Water Engineering, Groundwater Hydrology and Environmental Science

Session Chair: Assoc. Prof. Dr. Tuantan Kitpaisalsakul, Assoc. Prof. Sayam Aroonsrimorakot and Assist. Prof. Dr. -Ing. Phatcharasak Arlai Dec 28th 2016

Dec 28 , 2016			
Time	Code	Title	
13.00 - 14.00	Keynote	Prof. Dr. rer. nat. Manfred Koch	
	Speaker	Topic: "Computation of the Irrigation Water	
		Demand in the Miandarband Plain, Iran, using FAO-	
		56- and Satellite-estimated Crop Coefficients''	
14.00 - 15.00	Keynote	Prof. Dr. Shinichi Onodera	
	Speaker	Topic: "Research Topic on the Hydrogeochemistry"	
15.00 - 15.15	ENV 1	Factor Affecting of Prediction of PM ₁₀ Concentrations in	
		Central Plain of Thailand by Phatarapon Vorapracha,	
		Rungruang Musiri and Pawena Preechayakul	
15.15 - 15.30	ENV 2	Hydrogeochemical Characteristics of Groundwater in	
		Upper Nam Phong Watershed by Pimchanok	
		Chartchonbot and Sarunya Promkotra	
15.30 - 15.45	ENV 3	A model for estimating rainfall from metrological	
		geostationary satellite data over southern China by	
		Phenphorn Nimnuan, Serm Janjai, Sumaman Buntoung,	
		Virulh Sayakanit, Jie Cao, Di Zhao, Ruowen Yang and	
		Junpeng Yuan	
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		Land Use Changes on the Runoff Coefficient in the	
		Prajinburi river basin, Thailand by Phatcharasak Arlai	
1.000 1.015		and Santhan Phodchasit	
16.00 - 16.15	ENV 5	Future Drought Characteristics over Thailand by Using	
		Bias Corrected Multi CMIP5 General Circulation Model	
		by Winai Chaowiwat, Orachorn Kamnoet and Sutat	
1615 1620			
16.15 - 16.30	ENV 6	Stable Isotope Analysis for Spatio-Temporal Runoff and	
		Groundwater Recharge Distribution in Inailand by	
16.20 16.45		Aksara Puunividnya and Jeerapong Laonamsai	
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16 45 17 00		Augligation of Course leaster Madeline to Dedict	
10.45 - 17.00	ENV 8	Application of Groundwater Modeling to Predict	
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		Garbaygan Plain, Iran by Majid Tale Semiromi and	
17.00 17.15			
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		whatuarband Plain, Iran, using FAU-50- and Satellite-	
		esumated Crop Coefficients by Monammad Zare and Monfred Keeh	
17 15 17 20		Manifed Kocn	
17.15 - 17.30	EINV IU	Analysis of the Biochemical Methane Potential (BMP) and Botch Booctor Studies of minory Studies from a Born Mill	
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Session Chair: Assoc. Prof. Dr. Tuantan Kitpaisalsakul, Assoc. Prof. Sayam Aroonsrimorakot				
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		Exhaust Gas Treatment System for Decentral Waste		
		Treatment in Emerging and Developing Countries by		
		Niro Akbary, Mohammad Aleysa and Souha Meriee		
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Dec 29 th , 2016				
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9.00 - 10.00	Keynote	Prof. Dr. Siriwat Wongsiri		
	Speaker	Topic: "Trends of the Interdisciplinary Research of		
		Thailand in the Next Twenty Years"		
10.00 - 10.15	ENV 12	Factors influencing willingness to pay for a municipal		
		waste collection fee in Songkhla, Thailand by Komwit		
		Siritorn		
10.15 - 10.30	ENV 13	Towards a low carbon tourism for sustainable		
		development by Sayam Aroonsrimorakot and Meena		
		Laiphrakpam		
10.30 - 10.45	ENV 14	Implementing Green supply chain management practices		
		in organizations in Thailand: A review in search for key		
		factors in GSCM implementation by Sayam		
		Aroonsrimorakot and Meena Laiphrakpam		
10.45 - 11.00	ENV 15	Economic Feasibility Study of Tune Up and Overhaul of		
		Bangkok Mass Transit Authority (BMTA) Private Bus		
		for Energy Saving and Pollution Reduction by Sayam		
11.00 11.15		Aroonsrimorakot and Meena Laiphrakpam		
11.00 - 11.15	ENV 16	Concentration of Heavy Metal in the Components of		
		Cyclophorus fulguratus and Hemiplecta distincta by		
11.15 11.00	ED 117.17	Sayam Aroonsrumorakot and Kantapat Kasıbut		
11.15 - 11.30	ENV I7	Concentration of Heavy Metal in the Components of		
		Golden apple snail (Pomacea canaliculata) and Pond snail		
		(Filopaludina martensi) by Sayam Aroonsrimorakot,		
11.20 11.45		Tongenana Sakulkiatpanya and Kantapat Kasibut		
11.30 - 11.45	ENV 18	Carbon Footprint of Faculty of Environment and		
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		Inailand in the year 2010- 2012 by Sayam		
11 45 12 00	ENIV 10	The Application of Tennin Extract from Plants to		
11.45 - 12.00	EINV 19	Paduce the Concentration of Argenia by Seven		
		Aroonsrimorakot Kantanat Kasibut Tongahana		
		Sakulkiatnanya and Niwooti Whangchai		
13.00 12.15	ENV 20	Effects of Zingiber officinals Possoo, avtracts in growth		
15.00 - 15.15	LINV ZU	media on nitrate and phosphate removals for growths		
		and accumulations by Inomoea aquatica Forsk by		
		Surattana Settacharnwit		
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		Abundance and Distribution of Land Snails in Chonburi,		
		Thailand : A Case Study of Hemiplecta sp. by		
	Thitimar Chongtaku, Sayam Aroonsrimorakot, Niwooti			
		Whangchai and Kitsanai Charoeniit		

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Session: Hospitality and Tourism Management		
Session Chair: Dr. Nipon Chuamuangphan		
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Time	Code	Title
13.00 - 14.00	Keynote	Dr. Zadok S. Lempert
	Speaker	Topic: "Medical Tourism : History and Trends"
14.00 - 14.15	HTM 1	An Analysis of Psychological Factors Influencing Tourist's Behaviors in Ecotourism Destinations by
14.15 14.20		Pitoon Amornwitthawat and Sangsan Phumsathan
14.15 - 14.30	HIM 2	brand perception, and purchase intention of OTOP products Thailand among Chinese tourists by Wei Zhao and Prasongsukarn Kriengsin
14.30 - 14.45	HTM 3	Reexamining India's Northeast regions tourism potential through its policy and economic cooperation between India and Thailand by Meena Laiphrakpam, Sayam Aroonsrimorakot and Rama Sanker Sharma Aribam
14.45 - 15.00	HTM 4	Social media apply and impact during vacation travel method :A case study of Millennials in Thailand by Chalida Techajirakul
15.00 - 15.15	HTM 5	Transformational or Transactional leadership which are suitable for hospitality business in Thailand. by Atichart Srikachornrat
15.15 - 15.30	HTM 6	The Agricultural Heritage Systems of Orchard Based on the Concept of Satoyama and Sufficiency Economy: Green Tourism Perspectives for Japan and Thailand by Amnaj Khaokhrueamuang
15.30 - 15.45	HTM 7	The Guideline for Tourism Promotion and Public Relation at Phra Pathom Chedi National Museum, Muang District, Nakhon Pathom Province by Tiranan Pratum

BOARD ROOM 4 (Fl. G) Session: Hospitality and Tourism Management

Session Chair: Dr. Nipon Chuamuangphan

Dec 28 th , 2016				
Time	Code	Title		
15.45 - 16.00	HTM 8	A Model of Wellness Tourism Management for Hot		
		Spring attractions in Thailand: A case study of Hot		
		springs in Taiwan by Pimchanok Mulmit		
16.00 - 16.15	HTM 9	Cultural Tourism for the Mon community in Thailand by		
		Nilubon Kongprem		
16.15 - 16.30	HTM 10	The Tourism Management in Cultural Tourism Adapted		
		from Chinese Music Wisdom of Bang Luang		
		Community, Banglane District, Nakhon Pathom		
		Province, Thailand by Nipon Chuamuangphan		

AMPAWA 3 (Fl. 10)				
Session: The Interdisciplinary Research				
Session Chair: Prof.	Dr. med. Yongy	udh Vajaradul, Gen. Dr. Vasu Chanarat and		
Dr. Waret Veerasai				
Dec 28 th , 2016				
Time	Code	Title		
13.00 - 14.00	Keynote	Dr. Monthip Sriratana Tabucanon		
	Speaker	Topic:"Watershed Based Adaptation to Climate		
	_	Change : the Case of the Sirindhorn International		
		Environmental Park and Its Vicinity"		
14.00 - 14.15	TIR 1	Feasibility study of the interdisciplinary research project		
		"The development plan for landmine affected areas along		
		Thai – Cambodian border in engineering, education, and		
		religion: case study in Chamrak Sub – district, Muang		
		District, Trad Province" by Vasu Chanarat and Sittikorn		
		Wongtanusilp		
14.15 - 14.30	TIR 2	Maize Supply Chain in Mae Chaem District, Chiang		
		Mai, Thailand by Nuzzree Watcharasakonpong and Poon		
		Thiengburanathum		
14.30 - 14.45	TIR 3	IoT for Interdisciplinary Research and Development by		
		Srisakdi Charmonman and Pornphisud Mongkhonvanit		
14.45 - 15.00	TIR 4	Customer purchase intention toward new energy		
		passenger vehicle: a case of China by Aoxue Yuan		
15.00 - 15.15	TIR 5	The Application of DEA Model to Evaluate Technical		
		Efficiency of Fire Agri-Supply Chain for Maize by		
		Nuzzree Watcharasakonpong and Poon Thiengburanathum		
15.15 - 15.30	TIR 6	Establishment of Thailand Interdisciplinary Institute by		
		Phunnudt Chaicom		

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Nitrate Content Antioxidant and Microbial Safety of Organic, Pesticide Free and Conventional Vegetables in Nakhon Pathom Province, Thailand Aumaporn Arlai and Chalida Thakulsoonthon	SCI	9
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Plenary Abstracts

Interdisciplinary Research for Thailand 4.0

Yongyudh Vajaradul^{1,*}

¹Fellow of the Royal Society of Thailand and Chairman of the Interdisciplinary Committee for Research and Development of the Office of the Royal Society of Thailand

Abstract

The world presently is facing more complex and adverse global challenges in various aspects ranging from the religious conflicts to civil war, poverty to food security, regular public- to emergency health management, water and environmental resource management to climate change, computer- to high end technology, sustainable tourism management, humanity and social problems. To holistic solve these global problems; it needs the interdisciplinary engagement among different scholars from various fields due to very complicate problems. Therefore the interdisciplinary approach now play important role in all research and development to solve the earlier mentioned global problems.

The above mentioned problems are not only challenged the world, but also Thailand. Therefore the Royal Society of Thailand set up and appointed the Interdisciplinary Committee for Research and Development (ICRD) to be the major agency for establishing the Interdisciplinary Networks among regional institutes and scholars/academicians. The committee has networked and built up 7 regional interdisciplinary networks all over Thailand, namely, (1) upper northern network, (2) lower northern network, (3) eastern network, (4) northeastern network, (5) central network, (6) southern network and (7) western network. In the near future, the committee plans to increase the number of regional networks to 10 regional networks. The interdisciplinary network aims to promote the interdisciplinary research (IDR) in order to solve the complicate national or regional problems in Thailand. Herewith, ICRD conducted many national activities, i.e., (1) proposed national IDR day which is marked the date of Her Royal Highness Princess Maha Chakri Sirindhorn Patronage bestow on the ICRD and regional networks - to the Royal Thai Government for recognizing the IDR in Thailand, (2) set up the Princess Maha Chakri Sirindhorn Congress in 2015 and (3) promote the IDR nationwide to solve the regional and national problems.

Keywords: interdisciplinary research, Thailand 4.0, interdisciplinary networks

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Sufficiency Economy Philosophy: a Practical Approach toward the United Nations Sustainable Development Goals

Kamthorn Sithtichoti^{1,*}

¹H.E. Ambassador and the Expert of the Interdisciplinary Committee for Research and Development, the office of the Royal Society of Thailand

Introductions: From Millennium Development Goals (MDGs) to Sustainable Development Goals (SDGs)

The Millennium Development Goals (MDGs), adopted in 2000, aimed at an array of issues that included slashing poverty, hunger, disease, gender inequality, and access to water and sanitation. The MDGs, which aimed to enhance people's standard of living composed of the following 8 goals:

- 1. Eradicate Extreme Poverty and Hunger;
- 2. Achieve Universal Primary Education;
- 3. Promote Gender Equality and Empower W0men;
- 4. Reduce Child Morality;
- 5. Improve Maternal Health;
- 6. Combat HIV/Aids, Malaria and Other Diseases;
- 7. Ensure Environmental Sustainability; and
- 8. A Global Partnership for Development.

Enormous progress has been made on the MDGs, in particularly, Thailand had a great achievement in the implementation of the MDGs during 2000-2015, showing the value of a unifying agenda underpinned by goals and targets. However, the indignity of poverty has not been ended for all. The Sustainable Development Goals (SDGs), also known as the new Global Goals, go much further than the MDGs. They address the root causes of poverty and the universal need for development that works for all people, and aim to achieve sustainable development.

2030 Agenda for Sustainable Development

The 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development were adopted by world leaders of 191 UN member Countries on 25 September 2015 at the Plenary Session of the 70 the UN General Assembly, held during the UN Sustainable Development Summit 2015, at UN Headquarter in New York. Over the next 14 years, with these new Goals that universally apply to all countries that mobilize efforts to end all forms of poverty, fight inequalities and tackle climate change while ensuring that no one is left behind.

The SDGs, consisting of 17 goals and 169 targets build on the success of MDGs and aim to go further to end all forms of poverty. The new goals are unique in that they call for actions from all countries-poor, rich and middle- income – to promote prosperity while protecting the planet. They recognize that ending poverty must go hand-in-hand with strategies that build economic growth and address a range of social needs including education, health, social protection and job opportunities, while tackling climate change and environmental protection.

The SDGs are as follows:

1. End poverty in all its forms everywhere;

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2. End hunger, achieve food security and improve nutrition and promote sustainable agriculture;

3. Ensure healthy lives and promote well-being for all ages;

4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all;

5. Achieve gender equality and empower all women and girls;

6. Ensure availability and sustainable management of water and sanitation for all;

7. Ensure access to affordable, reliable, sustainable and clean energy for all;

8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all;

9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;

10. Reduce inequality within and among countries;

11. Make cities and human settlements inclusive, safe, resilient and sustainable;

12. Ensure sustainable consumption and production patterns;

13. Take urgent action to combat climate change and its impacts;

14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development;

15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss;

16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels; and

17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

The adoption of the 2030 Agenda for Sustainable Development (2030 Agenda) at the UN Sustainable Development Summit 2015 was a milestone for mankind's pursuit of sustainable development. It is crucial for the 2030 Agenda to carry on the unfinished business of the MDGs especially poverty eradication. The 2030 Agenda must also combat widespread inequality, tackle climate change, and ensure sustainability, inclusive economic growth and a healthy environment. Most importantly, the 2030 Agenda must not leave anyone behind.

The implementation of the **SDGs** will be a crucial task for international community over the next 15 years. With 17 goals and 169 targets, achieving the **SDGs** will not be easy. Governments have the responsibility to lead but cannot take on this task alone. Implementing **the SDGs** will require a holistic approach which engages all stakeholders such as private sectors, civil societies, academia and media. The private sector is more engaged in the **SDGs** more than they were in the **MDGs** and will be especially instrumental in the global development efforts.

The voluntary and country-led follow-up and review of **the 2030 Agenda** will be as important as implementing **the SADGs**. It will help countries keep track of their progress. We will also need to learn from one another by sharing experiences, best practices and shortcomings.

Thailand's Views and Roles in the SDGs

Thailand reaffirmed her commitment to sustainable and people-centered development and in achieving **the SDGs.** For Thailand, our goal is to graduate from "*middle-income trap*" in accordance with our 20 years national strategy by utilizing the "*Pracharat*" **Policy** as the main driver, which is a form of financing for

development engaging partnership between **public**, **private sector**, banks and academic institutions to stimulate grass root economy for the well-being of all people. Thailand also attach particular importance to addressing such issues as the empowerment of women and vulnerable groups in society, health and **Universal Health Coverage (UHC)**, **integrated water resources management (IWRM)**, **disaster risk reduction(DRR)**, rule of law and human rights. Thailand will also fully engage in efforts to follow-up and review at all levels-national, regional and global.

Sufficiency Economy Philosophy (SEP)

Thailand has its own unique framework for sustainable development, which is called the **Sufficiency Economy Philosophy (SEP)** and it is based on more than four decades of development work, insight and observations by His Majesty King Bhumibol Adulyadej. While the philosophy was conceived by HM. the King in the mid-1970s, it was formalized in the wake of the 1977 Asian Financial Crisis and has since become the nation's guiding spirit.

From the beginning, sustainability has been at the centre of **SEP**, which is one reason it is now considered to have universal relevance and wide applications. Many of the principles underpinning **SEP** actually, evolved with issues of sustainability in Thailand- from water, forest and soil management to addressing concerns like poverty, hunger and universal healthcare in the global context, these challenges resonate in developing countries where it can be difficult to balance economic progress, environment protection and human needs.

It is important to note that **SEP** does not urge for a return to the past or for people to give up all their comforts, or for development that denies growth or free market mechanisms. It is not anti-globalization, anti-capitalism or insular. **The Philosophy** recommends simply that individuals, businesses and state agencies act virtuously and within their means, making informed and evidence-based decisions that take into account any and all potential repercussions. It also encourages transparency, integrity and good governance.

In 1998, HM. the King elaborated on the importance of **Moderation** as a corner stone of **SEP**. These days, developing a "**Moderation Mindset**" is of paramount importance given the world's increasingly stretched resources. **SEP** advocates finding the middle ground between necessity and luxury, tradition and modernization, as well as self-reliance and dependency. Across the globe, from now until 2030, **Moderation** in all facets of life will be crucial to achieving key **SDG** targets such as less wasteful consumption and production patterns, the curbing of fossil fuel usage, and the sustainable management of marine and terrestrial ecosystems.

The second pillar of **SEP** is **Reasonableness**, whereby we are asked to take into consideration the impact our actions and decisions we may have both on others and the world around us. In the context of sustainable development, it is easy to see how even small individual decisions we make each day are reasonable or not, as they either solve or create problems. But the same can be said of high-level policies formulated by companies or governments, who ultimately make decisions that impact sustainability on a much larger scale. Within the **2030 Agenda for Sustainable Development**, **reasonableness** has much practical application in combating climate change, promoting equality and justice, developing clean energy sources and cutting down on pollution.

Another pillar of **the Philosophy** is **prudence**, which is all above assessing potential risks, working methodically, achieving a level of competence and self-reliance before proceeding further, and taking care not to overreach one's capabilities. The kind of risk management advocated by the third pillar of **SEP** applies almost across the board on global issues of significance including health, food, water and energy security.

In broader terms, **SEP**'s focus on promoting human development through people-centered approach is very much in line with the **2030 Sustainable Development Agenda**. With a commitment to **"Leave No One Behind"** both **SEP** and

SDGs advocate taking a multi-stakeholders approach that involves all relevant actors, including communities and people directly impacted by decision-making.

SEP also emphasizes on cultivating sustainability mindsets in our younger generation. A unique aspect of **SEP** is that it also takes into account the value of local wisdom, culture and heritage.

SEP's greatest strength is how it can be applied to so many different areas of life, and by extension, to so many different **Sustainable Development Goals.** In Thailand, numerous businesses, communities, civil society organizations and individuals have improved their ability to contribute toward sustainability by following the principles of **SEP. The Philosophy** has also been successfully integrated into the constitution and the working plans of virtually every government agency.

SEP's principles have formed the basis of Thailand's 5 – year Economic and Social Development Plans since 2002, as well as the upcoming 20-year National Strategy Plan, is aimed at sustainable development issues in the kingdom. Referred to as the "6-6-4 plan", it consists of six areas of focus, six primary strategies, all of which are geared toward furthering the 2030 Agenda for Sustainable Development.

Thailand's 4.0, which is an economic model based on creativity, innovation and high-level services, reflects **SEP**'s focus on preparing for the future and is designed to transform the kingdom into a valued-based economy by reforming its most important existing industries (automotive, electronics, medical and wellness tourism, agriculture, biotechnology and food), scaling up the development of new sectors such as robotics, digital, aviation, logistics, biofuels and biochemical, and solidifying Thailand as a medical hub.

It should be noted that, the development approach based on **SEP** is not a **"Ready-Made Development Model or One-Size-Fits**–All **Model"**. On the Contrary, the approach has great relevance and wide applications for all peoples and sectors both the poor and affluent, developed and developing countries alike based on their societal and geographical conditions.

Keywords: Sufficiency Economy Philosophy, United Nations Sustainable Development Goals, Thailand 4.0

World Natural Hazards and Disaster Risk

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Abstract

Natural hazards across the world arise basically in the form of three families with major events as indicated: geophysical (earthquakes, volcanoes, mass-movements); meteorological/climatic (storms, tropical cyclones, droughts, extreme temperatures) and hydrological (floods, landslides, extreme waves). Each of these events may trigger further indirect perilous effects, such as tsunamis induced by large (sea) earthquakes. While there is no direct evidence of a substantial increase of the frequency and strength of geophysical hazards in recent decades, as these are triggered by long-term endogenous geological processes in the interior of the earth, the situation is different for the other two (meteorological and hydrological) hazard families, most likely due to climate change experienced over the last half century at different degrees over various regions across the earth.

A natural hazard must not necessarily end up in a (natural) disaster, the latter being somewhat an extreme ramification of the former, causing loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or other extreme environmental damage affecting a local society. In fact, an adverse hazardous event will not rise to the level of a disaster if it occurs in an area without vulnerable population. This is where the concept of disaster risk comes into play. Risk to a natural disaster is then in general some multiplicative combination of hazard-occurrence or exposure and vulnerability. It is clear that as a consequence of this definition, disaster risk is particularly high in densely populated areas with poor or not well-armed infrastructure to defend itself against the effects of a hazardous event. It is then of no surprise that the highest disaster risks are prevalent in underdeveloped countries with dense population or high population growth, all of which leading, in fact, to the perceived increases of disasters with more losses of life or economical losses in recent decades, even if the hazard exposure by itself may not have increased. Typical examples of this curious behavior are the damages wrecked by the numerous decadal earthquakes that have occurred in the Iranian-Caucasian region over the last half century, which go hand in hand with increased population growth during that time.

Further in agreement with the concept of vulnerability is the Asia-Pacific region which continues to be the world's most disaster-prone region. In fact, of the world's reported natural disasters between 2004 and 2013, about 41% occurred in the Asia-Pacific region, particularly, in south-east Asia. Moreover, disaster-induced deaths in the Asia-Pacific region rose more than three-fold over the past decade, i.e. up from only about 205,000 between 1994 and 2003 to 714,000 between 2004 and 2013, with an additional 1.5 billion people affected in their social and economic livelihood. Interestingly enough, this tremendous increase in casualties over the last decade can be attributed to only a handful of extreme disasters, including the 2004 Indian Ocean earthquake and tsunami, the 2005 Kashmir earthquake in Pakistan, the 2008 Sichuan earthquake in China and Cyclone Nargis in Myanmar and the recent, April 25, 2015 Nepal earthquake, with a death toll of about 9000.

Setting up appropriate risk mitigation management strategies presents an ongoing challenge for scientists and local authorities, as the former must take into account the nature of a natural disaster. Thus geological hazards, such as earthquakes and volcanic eruptions, which are nearly impossible to predict, require other emergency measures than meteorological and hydrological hazards which, in many cases, have some intrinsic lead times which could be wisely used to limit damages from the looming disaster. Typical examples of the latter are tsunami warning systems. Based on these statements, it becomes clear that an effective mitigation or reduction of the risk to natural disasters is achieved best by decreasing the vulnerability to such disasters by appropriate engineering measures which, in the case of earthquakes, means, for example, the application of modern earthquake engineering construction codes.

In year 2000, as part of its millennium goals, the United Nations created the UN Office for Disaster Risk Reduction (UNISDR), whose major objective is to set up a "conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development". Since that time, UNISDR has been instrumental in Disaster Risk Reduction (DRR), by trying to implement two frameworks of action: (1) the 2005-2015 Hyogo framework for action (HFA), which set out an ordered sequence of objectives (outcome, strategic goals and priorities) and, more recently, (2) the Sendai framework for Disaster Risk Reduction for the period 2015-2030, with the major goals of understanding disaster risk, strengthening disaster risk governance to manage disaster risk, investing in disaster risk reduction for resilience and enhancing disaster preparedness for effective response.

Keywords: natural hazards, exposure, vulnerability, natural disasters, risk, disaster risk reduction

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Session of Pure and Applied Science

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Malaria Risk Area Analysis from Environmental Factors in Surat Thani Province, Thailand

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Abstract

The objective of this study was to analyze Malaria risk area from the environmental factors in Surat Thani province. Data related to Malaria was collected from Surat Thani Provincial Health Office, Thai Meteorological Department and Department of Disease Control. Statistical results showed that the significant factor correlated with number of Malaria's patients was rainfall. 2,262.54 km² or 16.48% of the total areas in Surat Thani province were high risk which includes areas in Phanom, Wiphawade, Khririratnikhom and Ban ta khun. This study is useful to local disease control operation for Malaria prevention and control programme in accordance with the risk area situation.

Keywords: Malaria, Multiple correlation analysis, Geographic information system

1. Introduction

Malaria is a mosquito-borne infection that can be found in tropical climate. In Thailand, Malaria is a major health problem especially some province in the southern part. In 2012, WHO estimated that 207 million cases of Malaria occurred globally and 627000 deaths. Most deaths were in children under the age of five years. In 2013, there are 97 countries and territories with ongoing Malaria transmission, and 7 countries in the prevention [1].

From the collection data during 2004 - 2008 in Thailand, southern part is a region with a relatively high epidemic. Surat Thani province which located in the southern is an area of malaria transmission mainly vector disease caused by two major species of *Anopheles: Anopheles Dirus* and *Anopheles Minimus*. Although in Surat Thani province, there are many strategies to prevent and control as follow 1) vector control measures 2) anti-parasite measures 3) human prevention measures such as public relation, health education, and community participation but malaria was remain important problem for the people [2].

2. Research objectives

To analyze Malaria risk area from the environmental factors in Surat Thani province.

3. Materials and methods

3.1 Study area

The study area was Surat Thani province which is one of the 77 provinces in Thailand that consists of 19 districts 131 sub-districts. Surat Thani has an area about 13,726.05 square kilometers both on the mainland and islands combined which is the sixth biggest province of country [3].

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Figure 1 Map of Surat Thani province

3.2 Data collection

The study was conducted from October 2011 to September 2012. There are 2 database in this study: the attribute database which is the secondary data in Surat Thani province about the number of Malaria's patients was collected from Surat Thani Provincial Health Office and the spatial database which is the environmental factors: rainfall, altitude, distance from water source and distance from forest land was collected from Thai Meteorological Department and Department of Disease Control [4].

3.3 Data analysis

1) to analyze environmental factors which effect on number of Malaria's patients by multiple correlation analysis.

2) to classify the value of environmental factors into 4 levels according to the criteria for division of risk areas of the Department of Disease Control. If the value range of environmental factors is between $\overline{x} + s.D$. to $\overline{x} + 2s.D$, it will be classified to high risk level. If the value range of environmental factors is between $\overline{x} + s.D$. to $\overline{x} + s.D$, it will be classified to medium risk level. If the value range of environmental factors is between $\overline{x} - s.D$ to \overline{x} , it will be classified to low risk level. And if the value range of environmental factors is between $\overline{x} - 2s.D$ to $\overline{x} - s.D$, it will be classified to no risk level as shown in Table 2.

3) to define the risk area of Malaria and map Malaria risk area from each environmental factors by using Geographic information system.

4. Results and discussion

4.1 Results

Multiple correlation analysis

The statistical results of correlation analysis between environmental factors with the number of Malaria's patients showed that the significant factor correlate with the number of Malaria's patients in the same direction was rainfall as shown in Table 1.

Table 1 The relationship between environmental factors with number of Malaria's patients by multiple correlation

analysis		
Factors	Correlation coefficient (r)	P-value
rainfall	0.406	0.019^{*}
altitude	0.021	0.370
distance from water source	-0.029	0.330
distance from forest land	-0.067	0.280

* P-value < 0.05

Risk-based environmental factors stratification

To classify the value of environmental factors by using mean and standard deviation into 4 levels: high risk, medium risk, low risk and no risk as shown in Table 2.

Factors	Value	Risk level
	more than 231 millimeter	high risk
roinfall	164 – 231 millimeter	medium risk
Taiman	28 – 163 millimeter	low risk
	less than28 millimeter	no risk
	more than1,101 meter	high risk
altituda	725 – 1,101 meter	medium risk
attitude	348 – 724 meter	low risk
	less than349 meter	no risk
	less than 720 meter	high risk
distance from water source	721 – 924 meter	medium risk
distance from water source	925 – 1,129 meter	low risk
	more than 1,129meter	no risk
	less than751meter	high risk
distance from forest land	751 – 999 meter	medium risk
distance from forest faild	1,000 – 1,248meter	low risk
	more than1,248meter	no risk

Table 2 Risk-based environmental factors stratification of Malaria

Malaria risk area map from environmental factors mapped

We defined the risk area of Malaria in 4 levels and map Malaria risk area from each environmental factors by using Geographic information system as shown in Figure 2-6 and Table 3-7.

(1) Rainfall factor

Table 3 Risk area of Malaria from rainfall factor in Surat Tha
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Risk level	Area (km ²)	Percent
high risk	608.59	4.43
medium risk	9,643.06	70.25
low risk	3,474.09	25.31
no risk	0.31	0.002


Figure 2 Map of Malaria risk area from rainfall factor in Surat Thani

(2) Altitude factor

Table 4 Risk area of Malaria from altitude factor in Surat Thani

Risk level	Area (km ²)	Percent
high risk	70.22	0.51
medium risk	623.70	4.54
low risk	3,213.10	23.41
no risk	9,819.01	71.54



Figure 3 Map of Malaria risk area from altitude factor in Surat Thani

(3) Distance from water source factor

Risk level	Area (km ²)	
high risk	2,032.56	14.81
medium risk	9,331.83	67.99
low risk	2,296.97	16.73
no risk	64.69	0.47

Table 5 Risk area of Malaria from distance from water source factor in Surat Thani



Figure 4 Map of Malaria risk area from distance from water source factor in Surat Thani

(4) Distance from forest land factor

Table (6 Risk area o	f Mal	aria from	distance	from	forest	land	factor	in Su	rat Thani	i
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Risk level	Area (km ²)	Percent
high risk	8.92	0.07
medium risk	414.28	3.02
low risk	13,284.09	96.78
no risk	18.74	0.14



Figure 5 Map of Malaria risk area from distance from forest land factor in Surat Thani

(5) all factor

Table 7 Risk area of Malaria from all factor in Surat Thani

Risk level	Area (km ²)	Percent
high risk	2,262.54	16.48
medium risk	5,390.80	39.27
low risk	5,100.98	37.16
no risk	971.73	7.08



Figure 6 Map of Malaria risk area from all factor in Surat Thani

4.2 Discussion

The relationship study between the environmental factors with malaria by data collection found that rainfall associated with the number of malaria's patients. By multiple correlation analysis of the environmental factors shown that rainfall was positively correlated with the number of Malaria's patients at significant 0.05

level which related to the result to the study of Vichukorn *et al.* [5] who found that rainfall was correlated with the number of Malaria's patients at significant 0.05 level. Distance from water source hasn't been correlated at significant 0.05 level which related to the study of Phothong *et al.* [6] who found the distance from water source wasn't correlated with the number of Malaria's patients at significant 0.01 level [6]. The results from this study found that sum of high and medium risk area from all environmental factors in Surat Thani were 55.75% which related to define the control operation area of Malaria of Department of Disease Control [2] which using the data of number of Malaria's patients by transmission area were 52.96%.

5. Conclusions

The Geography information system for assessment of Malaria risk areas in Surat Thani by correlation analysis between environmental factors with number of Malaria patients in 2011 - 2012. Assessment of Malaria risk areas revealed that 16.48% of the total areas in Surat Thani province were at high risk; 39.27% of the total areas in Surat Thani province were at medium risk; 37.16% of the total areas in Surat Thani province were at low risk; 7.08% of the total areas in Surat Thani province were at no risk.

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References

- [1] WHO. World malaria report 2012. [Internet]. Geneva, Switzerland: World Health Organization; 2012 [cited 15 September 2016]. Available from: http://www.who.int/malaria/ publications/ world_ malaria_report_2012/en/
- [2] Surat Thani Vector-Borne Diseases Control Center. **The Operational Evaluation of Prevention and Control Vector-Borne Diseases.** Surat Thani: Surat Thani Vector-Borne Diseases Control Center; 2012.
- [3] Surat Thani Office. Surat Thani in Brief. Surat Thani: Surat Thani Office; 2007.
- [4] Bureau of Epidemiology. **Annual Surveillance Report**. Bangkok: The War Veterans Organization of Thailand Under Royal Patronage of His Majesty the King; 2008.
- [5] Vichukorn V, Bamrungphong V, Deemoon S. **GIS-Based Assessment of Malaria Risk Areas in Tak Province.** [dissertation]. Phitsanulok, Thailand: Naresuan University; 2009.
- [6] Phothong D, Thongbu T, Srisang W. Spatial Analysis of Malaria Risk in Phitsanulok Province Using Geographic Information System. [dissertation]. Phitsanulok, Thailand: Naresuan University; 2008.
- [7] Noochum K, Damsri S, Naowarat S. Mathematical Model of Malaria Transmission: Surat Thani Province. Surat Thani, Thailand: Suratthani Rajabhat University; 2014.

Nitrate content antioxidant and microbial safety of organic, pesticide free and conventional vegetables in Nakhon Pathom Province, Thailand

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Abstract

Presently, Thai has faced the health problems, e.g., cancer and food contamination. This has induced Thai turns to consume healthy foods, especially, organic natural products. However, the major problem of consumer is lack of knowledge on the nutrition and microbiology of organic natural products, e.g., fresh organic vegetables. The knowledge in Nakhon Pathom has been not yet investigated by any study before. The research aims to investigate the antioxidant, nitrate and food safety among 3 types of vegetables, e.g., (a) organic-, (b) pesticide free- and (c) conventional vegetables which are sale on markets in Muang, Nakhon Pathom. The investigation collected the different 3 types of vegetable samples in the markets in Muang, Nakhon Pathom during October 2010 till September 2011. The sampling collected 6 vegetables, namely, (a) pumpkin, (b) morning glory, (c) kale, (d) cowpea, (e) cabbage and (f) tomato. Each vegetable composed of 3 types, namely, organic, pesticide free- and conventional vegetables. In total, the investigation collected 18 samples. The study induced the analysis on vitamin c, beta-carotene, phenolic, nitrate, DPPH and microorganism safety. The results disclosed that the organic vegetable contained almost of all analyzed parameters significantly more than pesticide free and conventional vegetable samples. Meanwhile, the organic and pesticide free vegetable showed they are more micro-safety rather than conventional one.

Keywords: organic vegetables, pesticide free vegetables, conventional vegetables, antioxidant compound, microorganism

1. Introduction

Thai has faced the health problems from the Non-Communicable diseases (NCD), e.g., cancer, obese or food borne decease. A main influence factor of NCD is due to consuming unsafely food from the conventional vegetables which contains of lower nutrition gradient and more pesticide/chemical fertilization contamination [1]. From this situation, the Thai consumer turns his/her face to consume more safety fresh food rather than the processed food. From the literature reviews, there are international studies disclosed that organic vegetables contains of more antioxidant contents, namely, vitamin c, phenolic and antioxidant matter more than the conventional one [2-4]. This result conforms to the study in Thailand [5] which was conducted the investigation of comparing antioxidant capabilities between the organic- and conventional vegetables, namely, white cabbage, kale, morning glory, Chinese kale and cow pea in the Northern Thailand. The result showed the organic vegetable has more antioxidant capabilities more than the conventional one. Furthermore, the literatures showed that there are micro-contaminations, namely, E. Coli in the conventional vegetables [6], but the truth still be in doubt as the consumers were not know the date of local vegetables. All above mentioned studies, they have never been conducted in Nakhon Pathom Province, Thailand, before. Therefore Nakhon Pathom consumers do not know yet about the merit of consuming the organic or pesticide free vegetables. From this reason, the research project, thus, was to monitor the secondary compounds, DPPH and nitrate content including microorganism of food safety, in order to induce providing the merit of consuming organic or pesticide free vegetable.

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2. Materials and methods

2.1 Raw material

Certified organic, pesticide free and conventional vegetables were collected for 1 time per every month in a year (October 2010 till September 2011). The vegetables were collected from 4 main markets where these vegetables are available in Nakhon Pathom Province (Soi2 morning market, modern trade, Doi Kam shop and Patom mongkol market), Thailand. Ten kilograms per sampling lot of vegetables were transported and kept at 10 °C in polyethylene bag in a cool box to the laboratory. The aim of this sampling was to obtain a real set of samples that would be representative of the organic, pesticide free and conventional vegetables available in a year in Nakhon Pathom Province during the time of the study. From this sampling, 6 representative vegetables are pumpkin, morning glory, kale, cowpea, cabbage and tomato. Information upon sampling vegetables is present in Table 1.

2.2 Antioxidant and nitrate determination

The edible part of each vegetable was determined except pumpkin which the skin was peeled 80% according to the commonly consumed. Vitamin C content was analyzed according to AOAC 2000 standard [7] method. The beta-carotene, total phenolic content and DPPH assay were determined according to method of Nagata and Yamashi (1992), Singleton and Rossi (1965) and Brand-William (1995) [8-10] respectively. Nitrate content was conformed by using TMC-103 standard method for water and waste water analysis. The experiment was designed as completely randomized design with 3 treatments each vegetable, i.e., organic, pesticide free and conventional vegetables. The results reported as mean \pm SD with 3 replications. The mean differences were analyzed using ANOVA and Duncan's New Multiple Range Test [11]. The Differences were considered significant at *p* < 0.05.

2.3 Microbial analysis

The edible part of each vegetable was determined Total aerobic bacteria, yeast and mold according to [7]. *E.coli* and *Salmonella* sp. were monitored by [12] method. The results interpreted comparing with the criteria of microbiological quality and food contact containers Act (c.2) 28 September 2010 of the Department of Medical Sciences, Thailand.

3. Results and discussion

3.1 Antioxidant and nitrate content in organic, pesticide free and conventional vegetables

The comparisons of antioxidant and nitrate contents were shown in Figure 1 and 2. Vitamin C is a strong antioxidant property which has been reported that reduced the risk of cancer, coronary disease, inhibition of the LDL oxidation [13]. Vitamin C in the present monitoring as shown in Figure 1a found that all organic vegetables (pumpkin, morning glory, cowpea, kale, cabbage and tomato) having the highest quantity than those in pesticide free and conventional vegetables. This may be caused from the organic farming system is the holistic agriculture which focusing especially soil fertility and soil mineral utility. Furthermore, the plant cultivated from the organic system was stressed and produced more antioxidant compounds. The result was in accordant to [14] who reported that organic vegetables had higher vitamin C content than conventional one.

Beta-carotene is a primary source of vitamin A and also is the most abundant in plant. The amounts of beta-carotene in the samples ranged from 2 mg/g to 170 mg/g, are presented in Figure 1b. organic and pesticide free of Pumpkin (47 mg/g and 170 mg/g), morning glory (54 mg/g and 76 mg/g), cowpea(26 mg/g and 23 mg/g) and tomato(18 mg/g and 14 mg/g) contained the highest amounts of beta-carotene. Cabbage (2 mg/g in average value) has the lowest beta-carotene value.

The total phenolic content as shown in Figure 1c showed that non-significant value between organic, pesticide free and conventional pumpkin, kale, cabbage and tomato. Organic morning glory (1.52 mg/g) had total phenolic content higher than this in pesticide free (1mg/g) and conventional (0.8 mg/g). The result was conformed to [5] who argued that the highest content of total phenolic was found in organic morning glory. That total phenolic content was not in accordant to the result from cowpea which conventional cowpea had highest value than others.

DPPH is the radical scavenging assay to show the capability of antioxidant catch with a stable free radical (DPPH). The result showed in Figure 1d revealed that 4 organic and pesticide free vegetables (pumpkin,

morning glory, cabbage and tomato) had higher DPPH value than those in conventional. Whereas DPPH values of kale and cowpea had no different among organic, pesticide free and conventional. The data might be argued and conformed to [16] whom reported that vitamin C and secondary compounds content had higher in organic than convention vegetables, especially in morning glory [5].

Nitrate is the compound which metabolized from nitrogen fertilizer. It might be connected to be toxin and cancer in human and animal body [1]. Organic vegetables had lowest nitrate value especially in morning glory (50 mg/kg). Conventional kale had highest nitrate value (3400 mg/kg).

 Table 1 Organic, pesticide free and conventional vegetables available in Nakhon Pathom, Thailand during
 October 2010 to September 2011

Name		Periods (October 2010 to September 2011)										
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
Pumpkin	\checkmark								\checkmark		\checkmark	
Morning glory		\checkmark		\checkmark				\checkmark				
Cowpea			\checkmark					\checkmark			\checkmark	\checkmark
Kale		\checkmark		\checkmark						\checkmark		
Cabbage					\checkmark	\checkmark						
Tomato							\checkmark					\checkmark



Figure 1 Vitamin C (a), beta-carotene (b), total phenolic content (c) and DPPH (d) of organic, pesticide free and conventional of vegetables



Figure 2 Nitrate content of organic, pesticide free and conventional of vegetables

3.2 Microorganism in organic, pesticide free and conventional vegetables

The comparison of microorganism as shown in Table 2 revealed that *Salmonella* sp. was not detected in any kind of vegetables. Total aerobic bacteria of organic, pesticide free and conventional vegetables are almost in standard with exception of conventional cabbage had higher $(6.10 \times 10^6 \text{ cfu/g})$. Conventional kale and cabbage had yeast higher $(3.88 \times 10^5 \text{ cfu/g} \text{ and } 3.72 \times 10^6 \text{ cfu/g})$ than standard meanwhile organic morning glory and kale had highest incidence of mold (560 MPN mold/g and 508 MPN mold/g). *E.coli* contamination were found in all vegetables. The organic and pesticide free vegetables (Pumpkin, morning glory, cowpea and kale) were found *E. coli* <100 MPN/g, while all conventional vegetables were those detected. This result could be due to inadequate hygienic practices during cultivation, pre- and post-harvest handling or sporadic contamination in irrigation water [16]. However, no data concerning the quality of the water was obtained from the origin manufacturing. The data conform to [6] who reported that conventional salad vegetable had higher *E.coli* contamination than those organic vegetable.

Name	Туре	Total aerobic	yeast	mold	E. coli	Salmonella
		bacteria (cfu/g)	(cfu/g)	(MPN	(MPN	sp.
				mold/g)	/g)	
microbiological qua	ality and food contact	1×10^{6}	$1 x 10^{4}$	<500	<100	NF
contai	ners Act					
Pumpkin	organic	3.99×10^5	4.83×10^4	285	positive	NF
	pesticide free	4.25×10^5	4.96×10^5	268	positive	NF
	conventional	3.16×10^5	4.95×10^5	455	positive	NF
Morning glory	organic	6.33×10^5	4.73×10^4	560	positive	NF
	pesticide free	5.33×10^4	4.83×10^4	454	positive	NF
	conventional	5.37×10^5	5.73×10^4	370	positive	NF
Cowpea	organic	2.14×10^{6}	4.15×10^{5}	309	positive	NF
	pesticide free	2.14×10^5	5.02×10^5	183	positive	NF
	conventional	2.34×10^{5}	3.62×10^5	500	positive	NF
Kale	organic	3.85×10^5	5.14×10^4	508	positive	NF
	pesticide free	5.06×10^5	2.86×10^4	483	negative	NF
	conventional	6.67×10^5	3.88×10^5	654	positive	NF
Cabbage	organic	5.75×10^4	3.55×10^4	170	negative	NF
	pesticide free	4.70×10^5	3.60×10^3	135	negative	NF
	conventional	6.10×10^{6}	3.72×10^{6}	410	positive	NF
Tomato	organic	3.67×10^5	4.1×10^3	120	negative	NF
	pesticide free	4.15×10^5	1.56×10^3	227	positive	NF
	conventional	2.33×10^5	1.92×10^3	252	positive	NF

Table 2 Total aerobic bacteria, yeast, mold, E. coli and Salmonella sp. of vegetables

NF means not found

Positive means E.coli >100 MPN/g

Negative means E.coli <100 MPN/g

4. Conclusions

Base on this study, most organic vegetables available from Nakhon Pathom contain higher vitamin C content than conventional and pesticide free vegetables and exhibit potent antioxidant activity as assessed by DPPH, whereas, lowest nitrate content. Beta-carotene content in pesticide free trend higher than conventional vegetables, meanwhile the total polyphenol content in organic, pesticide free and conventional vegetables were not significant different. The result is the sampling vegetables which were available in the market, so the variation value of antioxidants and nitrate might arise from the variety of the plant, stage of ripening, place of cultivation, climate condition, fertilization, transportation, pre and post-harvest handling, sample preparation and methods of analysis. *Salmonella* sp. was not detected. The conventional vegetables had higher *E.coli*. than organic vegetables. The data can be used to be information to increase the consumption of organic and pesticide free in local community.

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References

- [1] Worthington V. Effect of agriculture methods on nutrition quality: a comparison of organic with conventional crops. Alter Therap Health Med. 1998; **4** (1): 58-69.
- [2] Divis J, Barta J, Hermanova V. Nitrogenous substances in potato 1(Solanum tuberosum L.) tubers produced under organic and conventional crop management. In: Niggli U, Leifert C, Alfoldi T, Luck L, Willer H, editors. Improving sustainability in organic and low input food production system. Proceedings of the 3rd International Congress of the European Integrated Project Quality low input food (QLIF). 2007, 276-9.
- [3] Aumaporn Arlai. **Organic food**. Nakhon Pathom: Faculty of Science and Technology Nakhon Pathom Rajabhat University. 2011.In Thai.
- [4] Meier-Ploeger A. Organic farming food quality and human health. NJF Seminar 15th. 2005; Reykjavík, Iceland.
- [5] Apichaya Prasoprattanachai. Antioxidant activities of organically –grown vegetable extracts. Chiang Mai: Maejo university. 2009. In Thai.
- [6] Oliveira M, Usall J, Vinas I, Anguera M, Gatius F, Abadias M. Microbiological quality of fresh lettuce from organic and conventional production. Food Micro. 2010; 27: 679-84
- [7] AOAC. Official methods of analysis.17th ed. Gaithersburg: Association of Official Analytical Chemists. 2000.
- [8] Nagata M, Yamashita I. Simple method for simultaneous determination of chlorophyll and carotenoids in tomato fruit. J Japan Soc Food Sci Tech. 1992; **39**: 925-28.
- [9] Singleton VL, Rossi JA. Colorimetry of total phenolic with phosphomolybdic phosphotungstic acid reagent. Amer Soc Enol Viti. 1965, 16 (3): 144-58.
- [10] Brand-Williams W, Cuvelier ME, Berset C. Use of a free radical method to evaluate antioxidant activity. Lebens Wis Tech/Food Sci Tech. 1995, 28: 25-30.
- [11] Cochran WC, Cox GM. Experimental Designs. New York : John Wiley & Sons, 1985.
- [12] FDA. Chapter 4 Escherichia coli and the coliform bacteria, chapter 5 Salmonella. In house method based on FDA bacteriological analytical manual. 8th ed [Internet]. c2001 [cited 2005 May 10]. Available from: <u>http://www.cfsan.fda.gov/~ebam/bam-4.html</u>
- [13] Osganian S K, Stampfer MJ, Rimm E, Spiegelman D, Hu FB, Manson JE, Willett WC. Vitamin C and risk of coronary heart disease in women. J Ameri Coll Cardio. 2003; 42 (2): 246-252.
- [14] Hoefkens C, Vandekinderen I, Demeulenaer B, Devloeghere F, Baert K, Sioen J, Dehenauw S, Verbeke W, Camp J. A literature – based comparison of nutrient and contaminant contents between organic and conventional vegetables and potatoes. British Food J. 2009; 111(10):1078-98.
- [15] Dangour AD, Lock K, Hayter A, Aikenhead A, Allen E, Uauy R, et al. Nutrition related health effects of organic foods: a systematic review. Amer J Cli Nutri. 2010; 92: 203-10.
- [16] Stevens M, Ashbolt N, Cunliffe D. Recommendations to change the use of coliforms as microbial indicators of drinking water quality. Canberra: Biotext Pty. 2003.



Session of Multidisciplinary Health Sciences (Nursing)

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Development of a Transferring Tool Kit to Assist Vulnerable Individuals Affected by Floods for Village Health Volunteers

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Abstract

The role of village health volunteers (VHVs) has been important in disaster preparedness since the demand of the care for those community members affected by disaster is increasing especially for vulnerable groups. In order to improve the ability to increase safety transfer of vulnerable individuals during disaster catastrophes, a training material or tool kit should be available for the VHVs. In July 2017, a developmental study was conducted in the South of Thailand to develop and evaluate the transferring tool kit for the VHVs to assist vulnerable individuals affected by floods. Three phases of development process were conducted. First, a focus group discussion and literature review was conducted to draft evident-based contents in relating to patient's transfer during flood disaster situation. Second, the content validity of the draft of transferring tool kit was examined by three experts. Third, the effectiveness of the transferring tool kit was tested for its feasibility with 6 VHVs working in Hat-Yai municipality. The results showed that the transferring tool kit was consisted of handbook, video, and pamphlet. The contents of this tool kit comprised three parts; assessment of the physical health of the vulnerable, safety procedures to prevent back injury of the VHVs, and skills/techniques of proper transferring. The 4 out of 6 (66.7%) VHVs indicated that the handbook was easy to be read and understandable and 5 out of 6 (83.3%) indicated that the video was easy to follow. The transferring tool kit is useful for the VHVs to follow to assist vulnerable individual during flood. Future study needs to test its effectiveness with a larger group of the VHVs.

Keywords: transferring tool kit, vulnerable individuals, village health volunteer, flood

1. Introduction

At present, natural disasters have usually occurred from any causes, such as climate change and global warming. The consequences of the natural disasters of ten yield tremendous effect to people both their lives and assets especially flood disaster that occurred during 2003-2013[1,2]. Effective transferring management would save lives of people living in a community. Based on the community-based disaster risk management model, evacuation of the vulnerable individuals including elders, disable people, pregnant women, and children is prioritized as the first group of people to be transferred [3,4]. A study in the United State of American shows that 66.5% of the disabled individuals did not plan to move out during the emergency situation [5]. In Thailand, an evidence shows that some vulnerable individuals still cannot leave themselves from flood disaster [6] because of their physical limitation. Therefore, they need help from other people.

Village Health Volunteer [VHV] is a key person who plays role and has a duty when facing with disasters. VHVs are responsible for all phases of disaster management including preparation phase, disaster phase, and recovery phase [7]. The role of the VHVs is to take care and help health care providers or people living in the community to evacuate vulnerable individuals living in the areas that they are responsible upon [8]. Most VHVs in Hat-Yai municipality, Thailand, are women and older women. Since their limitation of physical function, they are at high risk of back pain by lifting and transferring the vulnerable individuals. One study with 90 VHVs in Hat-Yai shows that 63% of VHVs complained back pain after lifting the individuals living in the community. They expressed that they did not have enough knowledge and skill in lifting and transferring the individuals [9].

Currently, there is no suitable guideline of lifting and transferring individuals during flooding disaster for the VHVs in Thailand; therefore, the purpose of this study was to conduct and test the efficacy of the transferring tool kit for the VHVs during flood disasters.

2. Objectives

To develop and evaluate the transferring tool kit for VHVs to assist vulnerable individuals affected by floods.

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3. Methods

Setting

The target population in this study was VHVs working in flood risk area, the South of Thailand. **Sample**

Samples of 6 VHVs working in Hat-Yai municipality were invited to test the efficacy of the transferring tool kit. They worked in the risk flood area. The inclusion criteria was less than 60 years old with no history of spinal bone disease, osteoporosis, or arthritis.

Study Protocol

There were three phases of developing study protocol of conducting this study. The first phase was a focus group discussion and literature review. In this first phase, the draft of evidence-based contents of lifting and transferring the vulnerable individuals during flood disaster was conducted. The searching was retrieved from science direct, CINAHL, Pubmed, and Google scholar. The transferring tool kit then composed of handbook, video, and pamphlet. The contents of all those materials were related to 1) assessment of the physical health of the vulnerable individual, 2) safety procedure to prevent back injury of the VHVs, and 3) skill/technique of proper transferring.

The second phase was validation and testing the reliability of the contents of the transferring tool kit. Three experts in flood victim management reviewed the contents of the materials of the transferring tool kit. The experts suggested to identify some contents in the handbook and pamphlet. The fonts of the handbook and pamphlet were suggested to be bigger that were easier to be read.

The third phase was testing the efficacy of the transferring tool kit. Six VHVs were asked to rate the possibility of applying this tool kit for lifting and transferring the vulnerable individuals using the Possibility of Using the Transferring Tool Kit Questionnaire developed by the researcher. This questionnaire consisted of 2 dimensions; the difficulty of using this tool kit and the possibility to apply this tool kit with the real situation. The response format was raging scale from 1-5, in which 1 was less possible to use this tool kit and 5 was the most possible to use this tool kit. The internal consistency of this questionnaire yielded a Cronbach's alpha coefficient of .89. The possibility of using the transferring tool kit was categorized into 3 levels as low (score 1.00-1.67), moderate (score 1.68-3.35) and high (score 3.36-5.00) [10].

Ethical consideration

Data were collected after receiving approval of the research proposal by the Ethic Committee, Faculty of Nursing, Prince of Songkla University, and also permission from the head of Hat-Yai municipality. Participants were described the purpose of the study and signed a Consent Form.

Data Analysis

Data were analyzed and presented using descriptive statistics: frequencies, percentage, mean, and standard deviations.

4. Results and discussion

All of the participants were female (100%). Most of them aged between 31-40 years old (50%) with the mean age of 39.3 years old (SD = 10.0). The majority of them were married (83.3%). Approximately half of them had received education at high school (50.0%) as well as having experience as VHV between 1-5 years (50.0%). The majority of them were Buddhism (83.3%).

Contents of the transferring tool kit

The transferring tool kit composed of handbook, video, and pamphlet. The contents of this tool kit were three sections: assessment of the physical health of the vulnerable individual, safety procedure to prevent back injury of the VHVs, and skill/technique of proper transferring. Table 1 illustrated the examples of each section's content.

Section	Example of contents		
1. Assessment of the physical health of the vulnerable	- Asses conscious, respiratory rate, or medical		
individual	equipment attached with the vulnerable individual		
	before lifting.		
2. Safety procedure to prevent back injury of the	- Don't bend your back while lifting.		
VHVs	- Keep the load close to the waist.		
	- Know your limit.		
3. Skill/technique of proper transferring	- Keep the load close to the body while lifting object		
	- Keep squat lifting posture by bending both knees		
	and keeping straight back		

Table 1 Example of contents of transferring tool kit handbook

The efficacy of the transferring tool kit

The efficacy of the transferring tool kit showed that the possibility of using this tool kit was at a high level (M = 4.10, SD = 0.30). Four (66.7%) VHVs indicated that the handbook was easy to be read and understandable and five of them (83.3%) indicated that the video was easy to be followed. However, (50%) VHVs indicated that the pamphlet was hard to be read because of too short contents and small pictures.

The results of this study indicates that the transferring tool kit to assist vulnerable flood victims. This high level of perception would be explained as followed. Firstly, the handbook was easy to be read because it had contents that were easy to be understood and the pictures were also easy to be visualized. It has suggested that promoting individual's learning process would be given through media and pictures [11,12]. Previous study also showed that VHVs had increased knowledge score after reading the handbook [13]. Secondly, video is another media that presents with motion and sound of corrected skill/technique of proper transferring. Motion and sound of the video would help the VHVs to learn quicker and enjoyably [11]. In the same way, VHVs have confidence when they practice transferring [12]. This finding was similar to a previous study that tested the effects of using video guided about deep-breathing exercise for patients' preparation before receiving general anesthesia. The patients reported that they could practice deep-breathing exercise by watching the video guided on deep-breathing exercise [14]. Thirdly, pamphlet is another media that provided brief contents of proper lifting and transferring technique. Previous study also found that additional using pamphlet significantly increased the mean knowledge score of the participants after participating in the teaching program [15]. However, the pamphlet should have clear contents and pictures [16].

5. Conclusions

The transferring tool kit in assisting vulnerable flood victims during flood disaster was possible to be used by the VHVs. Therefore, this transferring tool kit was useful for the VHVs to be used for transferring to assist vulnerable individual during flood events. Future study needs to test its effectiveness with a larger group of VHVs and revise the pamphlet to be clearer.

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References

- [1] Adelman DS, Legg TJ. **Disaster nursing: A handbook for practice**. Sudbury: Jones and Bartlett Publishers; 2009.
- [2] Meteorological Department. Flood [Internet]. 2014 [cited 12 Nov 2015]. Available from: http://www.tmd.go.th/info/info.php?FileID=70
- [3] Tomek M, Seidl M, Bucova G. Transport safety at evacuation for people with disabilities. Kontakt. 2014; 16 (3): 195-202.
- [4] World Health Organization. Venerable groups [Internet]. 2002 [cited 15 Nov 2015]. Available from: http://www.who.int/environmental_health_emergencies/vulnerable_groups/en/
- [5] Smith DL, Notaro SJ. Personal emergency preparedness for people with disabilities from the 2006-2007 behavioral risk factor surveillance system. **Disability and Health Journal.** 2009; **2** (2): 86-94.
- [6] Pongpisut J. Learning from Flood Experience 2011. **HSRI Forum**. 2012; **1**(4): 3-7.
- [7] Kamal A, Songwathana P, Sae Sia W. Knowledge and skills of emergency care during disaster for community health volunteers: A literature review. Nurse Media Journal of Nursing. 2009; 2 (2): 371-381.
- [8] Sangsurin P, Chatchavarnyangkul A, Pramuanjaroenkit C, Seesong N. Village health volunteer modern age handbook. Bangkok: The Federation of saving and credit cooperatives of Thailand; 2011.
- [9] Songwathana P, Sae-sia W, Kitrungrote L, Kongkamol C. Development of an Urban Network's Potential for Helping Groups of Flood-Susceptible Inhabitants: A Case Study of Had Yai. Thai Journal of Nursing Council. 2016; 31 (1): 56-59.
- [10] Srisatidnarakul B. The methodology in nursing research. Bangkok: U&I International; 2010.
- [11] Chaijaroen S. Instructional Design: Principles and Theories to practices. KonKean: Annaoffset; 2014.
- [12] Kanchana N. technique and teaching skill 1. Bangkok: Charansanitwong; 2010.
- [13] Anupunpisit V, Chitapong S, Sukjaroen N, Satayaprasert C. A Training Curriculum Development for Health Volunteer: Saensaeb Canal [Internet]. Nitibodee Sukjaroen; 2015 [cited 9 Nov 2015] Available from: http://www.researchgate.net/profile/Nitibodee_Sukjaroen/publication/245023041___/links/0deec51d 5971aad9a3000000.pdf

- [14] Boonchuduang S, Juthasantikul W, Chantarokorn A, Wasinwong W. Effects of using Video Guided about Deep-Breathing Exercise for Patient Preparation before Receiving General Anesthesia. Srinagarind Medical Journal. 2012; 27(2): 139-146.
- [15] Chuwong J, kongsakul P. Effects of Participatory Learning on Knowledge of Hypertension and Food Consumption of Hypertensive Elderly Patients in Elderly Club of Amphur Muang, Trang Province. Journal of Health Science Research. 2012; 6 (2): 30-37.
- [16] Wanhkaewheerun T. Lerning management. Tem printing, songkla; 2008.



Session of Multidisciplinary Health Sciences (Medicine)

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Elderly health promotion with exercises to increase physical fitness and balance

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Abstract

Increasing in numbers and proportions of the elderly populations indicate that more elderly people were reply on social welfare. More numbers of elderly care facilities are then required, especially for the elderly health resulting from chronic diseases and the risk of falls. In this study, different exercise models were used to promote the elderly health and aimed to increase their physical fitness: muscle strength, static balance, dynamic balance, flexibility, as well as cardio respiratory endurance. This study was conducted at Nang Lae district, Muang, Chiang Rai. Fifty-two elderly people who lived in the study area were participated. Participants were divided into three groups receiving three exercise models which consisted of elastic band exercise (EE), pole exercise (PE) and home exercise with water-filled bottles (HE). Five physical fitness tests including (1) 30 seconds chair stand (30 SCS) test for muscle strength (2) functional reach (FR) test for static balance (3) time up and go (TUG) test for dynamic balance (4) shoulder flexibility (SF) test for muscle flexibility, and (5) 6-minute walk test (6MWT) for cardio respiratory endurance were used to assess the participants, before and after receiving exercise models for 8 weeks. The results showed that all exercise models could significantly (p < 0.05) increase the elderly's muscle strength. The static and dynamic balances were significantly ($p \le 0.05$) enhanced by EE (both), and PE (dynamic balance). Increasing in cardio respiratory endurance was also observed in all groups. It could be concluded from the results that, all exercise models can increase elderly physical fitness. EE, especially, help promoting the elderly's balance both in dynamic and static movement thereby reducing elderly risk of falls. In addition, various elderly health risks were also decrease after receiving EE and PE models.

Keywords: elderly, exercise, physical fitness, balance

1. Introduction

Numbers of the elderly populations (defined as aged 60 and older) in Thailand is anticipated to increase from approximately 1.5 million to 10.7 million by 2015 or 16% of the total population [1]. By 2040, a projected 17 million Thai elderly population will account for more than a quarter of the population [2]. This increasing number is resulted from improved life expectancy in the elderly, which also associates to an increasing number of populations who are replied on social welfare [3]. The increasing dependency burden of ageing populations implies that the burden of support for older persons will become heavier. This includes health care costs and other social and economic supports. Health is a key concern for older people, since aging is associated with a decline in overall health. Exercise is well recognized to have many health benefits for the elderly such as optimizing cardiovascular functions [4], improving balance [5], and improving cognitive function [6]. However, because the elderly are generally less physically active than young adults and they are more susceptible to fatigue and injury, the exercise prescription for the elderly have many differences from young adults. The recommendation of exercise for the elderly should emphasize aerobic activities of low to moderate intensity, muscle-strengthening activity, and flexibility exercises, avoid heavy static-dynamic lifting, and allow for a slow, gradual adaptation period [7, 8]. Thus, using different kinds of exercise is more effective [9]. The health-related fitness (such as muscle strength, balance, flexibility, and respiratory endurance) was indicated as important factor for the elderly to perform their activities in daily living [10]. Some studies reported benefits of resistance exercise and aerobic exercise on improving fitness among elderly population [11, 12]. From our previous report [13], we applied the community participation to develop the exercise models which appropriate for elderly who lived in Nang Lae district, Muang, Chiang Rai. The developed exercise consisted of (1) elastic band exercise (EE) applied from [14], (2) pole exercise (PE) applied from [15], and (3) home exercise with water-filled bottles

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(HE) applied from [16]. Briefly, EE was the exercise model proposed for enhancing elastic progressive stretching and resistance. Inner tubes of bicycles were used instead of the commercial elastic band because of economical reason. A bamboo pole was used in PE model, proposed for enhancing balance and flexibility. In HE model, the water-filled (500 ml) bottles were used as economical equipment, proposed for simply promoting flexibility. Therefore, in this present study, these exercise models were selected to promote the elderly health. The objective of this study was to investigate the effect of selected exercise models on elderly health-related physical fitness. Duration of performing each exercise was 8 weeks, according to the relevant literatures which showed improvement in muscle strength and other physical performances in elderly after 8 weeks of strength training and exercise program [17, 18]. In addition, comparable between the effect of group-performing exercise (EE and PE) to individual-performing exercise (HE) on physical fitness was also observed. Five physical fitness tests including (1) 30 seconds chair stand (30 SCS) test for muscle strength (2) functional reach (FR) test for static balance (the body's ability to maintain a stationary position with control while performing a task) (3) time up and go (TUG) test for dynamic balance (the body's ability to balance while in motion or switching between positions) (4) shoulder flexibility (SF) test for muscle flexibility, and (5) 6-minute walk test (6MWT) for cardio respiratory endurance were used to assess the participants, before and after receiving exercise models for 8 weeks.

2. Materials and methods

2.1 Participants

This study was approved by the Research Ethics Board at the Mae Fah Luang University. Participants were recruited by announcements at community activities and municipality. Inclusion criteria consisted of being elderly people (60 years of age and older) who lived in the study area (Nang Lae district, Muang, Chiang Rai), having no self- reported musculoskeletal, neurological, or sensory deficits that may affect balance, having normal or corrected–to-normal vision and talking, living without relying on other people's support, walking with or without an assistive device, and being willing to attend throughout the end of the study. One hundred and seven persons were assessed for eligibility. Fifty-five persons were excluded because they did not meet the inclusion criteria: they were not interested, and they were unable to attend the post-test. Fifty-two eligible elderly people were from 3 villages, so we randomly selected each village to receive one of each three exercise models. We divided them into 3 groups receiving the elastic band exercise (EE), the pole exercise (PE), and home exercise with water-filled bottles (HE). All groups received individual exercise model for 8 weeks. Participants in each EE, and PE groups performed their exercises together at the community parks. While in HE group, participants were asked to do exercise at home or places of their convenience independently using waterfilled bottles, recorded their exercise activity in the provided record book and they were followed up by researchers via telephone.

2.2 Exercise models

Before starting each exercise model, routine body warm-up was required for 5-10 minutes.

Elastic band exercise (EE) [14] One session of EE comprised of 10 postures (Figure 1). During the first two weeks, participants were trained to perform each posture for 6 to 8 times, 3 sessions per day, 2 days per week. Next four weeks (3^{rd} to 6^{th} week), participants performed each posture for 8 to 12 times, 2 sessions per day, 2 days per week. At last two weeks (7^{th} to 8^{th} week), participants performed each posture for 15 to 18 times, 1 session per day, 2 days per week.

Pole exercise (PE) [15] One session of PE comprised of 12 postures (Figure 2). Participants were trained to perform each posture for 16 times, 1 session per day, 2 days per week, for 8 weeks.

Home exercise with water-filled bottles (HE) [16] One session of HE comprised of 2 postures : first, rising to a full standing position and then sit back down again and second, lifting water bottles in the up –and-down, front-and-behind direction while sitting on a chair with a backrest (Figure 3). Participants performed each posture for 10 times, 5 session per day, 2 days per week, for 8 weeks.

2.3 Physical Fitness Testing

Five physical fitness tests including (1) 30 seconds chair stand (30 SCS) test (2) functional reach (FR) test (3) time up and go (TUG) test (4) shoulder flexibility (SF) test, and (5) 6-minute walk test (6MWT) were used to assess the participants (52 eligible elderly people who were assigned to preform each exercises), before and after receiving each exercise models for 8 weeks.

30 seconds chair stand (30 SCS) test [19] was used to test the leg strength and endurance. In 30 SCS test, the individual participant was set to sit in the middle of the chair, place his hands on the opposite shoulder crossed at the wrists and keep his feet flat on the floor. Assessment was by counting the number of times that the

participant came "rise to a full standing position and then sit back down again" within 30 seconds. The number of completed chair stands in 30 seconds was recommended. Standard numbers for 30 SCS test was 8. Below standard numbers was identified as those participants who are at risk.

Functional reach test (FR) test [19] was used to measure a static balance as well as ability to maintain balance during a functional task. In FR test, a tape measure was placed on the wall, parallel to the floor, at the height of the acromion of individual participant's dominant arm. The participant was asked to stand with the feet a comfortable distance apart, make a fist, and forward flex the dominant arm to approximately 90 degrees. Then, the participant was asked to "reach forward as far as possible without taking a step or touching the wall". Assessment was by measuring the distance between the start and end point, the head of the metacarpal of the third finger was used as the reference point. Below average distance was associated with predictive of falls in older adults. Standard distance for FR test was 25 cm. Below standard distance was identified as those participants who are at risk.

Time up and go (TUG) test [20] was used to assess the functional mobility (a dynamic balance). The TUG test began by having the individual participant sit back in a standard arm chair and identified a line 3 meters or 10 feet away on the floor using a piece of tape or other marker. The participant was set to wear his regular footwear and able to use a walking aid if needed. The participant was asked to "stand up from a chair without using armrests, walk to the line on the floor as quickly as possible without running, turn around, walk back to the chair at his normal place and sit down again without using armrests". Assessment was by measuring the time the participant has sat back down. Standard time for TUG test was 10 seconds. Above standard time was identified as those participants who are at risk.

6 Minute walk test (6MWT) [19] was used to detect a functional aerobic capacity (a cardio respiratory endurance). The 6MW test required a-flat and hard surface-50 yards (45.7 meters)-walkway and the participant was asked to walk around the walkway as far as possible in a period of 6 minutes. He or she was allowed to self-pace and rest as needed as they traverse back and forth along a marked walkway. Assessment was by measuring the total distance the participant was able to walk. Standard total distance for 6MWT was 319.9 m. Below standard total distance was identified as those participants who are at risk.

Shoulder flexibility (*SF*) *test* [19] was used to test the flexibility of the shoulder join. The SF test was a simple flexibility test to determine if the hands can be brought together behind the back. This test was done by having the participant in the standing position, placing one hand behind the head and back over the shoulder, and reaching as far as possible down the middle of his back, his palm touching his body and the fingers directed downwards. Placed the other arm behind his back, palm facing outward and fingers upward and reached up as far as possible attempting to touch the fingers of each hand. Reverse the procedure and repeat with the opposite shoulder. Assessment was by measuring the minimum distance between hands. Standard distance for SF test was 22 cm. (or - 22.00 cm.). Above standard distance was identified as those participants who are at risk.

2.4 Statistical analysis

All data were coded on Excel file. Descriptive statistics was used to describe characterizations of participants. The paired t-test was used for comparison of pre- and post- test. A *P* value lower than 0.05, was considered statistically significant ($p \le 0.05$). To perform the analysis, the SPSS (Windows, ver 15.0) was used.



Figure 1 Elastic band exercise (EE) (created by authors)



Figure 2 Pole exercise (PE) (created by authors)



Figure 3 Home exercise with water-filled bottles (HE) (created by authors)

3. Results and discussion

Participants

A description of 52 eligible participants' characteristics (who were enrolled in this study and were assigned to preform each exercise) is provided in Table 1. The mean age \pm S.D. of the participants was 70.4 \pm 0.98 years (range, 69-72 years), and most were women.

 Table 1 Participant characteristics

Group	EE	PE	HE
_	(n=19)	(n=22)	(n=11)
Age (years)	71 ± 6.4	71.5 ± 6.1	69.3 ± 7.2
Sex (male/female)	4 / 15	6 / 16	4 / 7
BMI (kg/m ²)	22.7 ± 3.7	22.8 ± 3.7	21.7 ± 4.2

Note: values are mean \pm S.D. for continuous variables and number for categorical variable. EE: elastic band exercise, PE: pole exercise, HE: home exercise with water-filled bottles

Physical Fitness Testing

The physical fitness tests results of participants in three experimental groups (EE: elastic band exercise, PE: pole exercise, HE: home exercise with water-filled bottles), before and after receiving each exercise models for 8 weeks were summarized in Table 2.

Table 2 Summary of physical fitness tests results (mean±S.D.) for the three experimental groups							
Maggurag	Test	FE	DE				

Measures	Test	EE		P	E	HE		
		Pre	Post	Pre	Post	Pre	Post	
Muscle strength	30 SCS (numbers)	10.5 ± 2.5	16.1±3.4*	13.6 ± 2.4	14.9 ± 3.5*	12.9 ± 2.4	$15.8 \pm 4.9*$	
Static balance	FR (cm)	25.0 ± 5.7	30.7 ± 6.3*	23.1 ± 6.2	24.7 ± 7.8	31.9 ± 9.3	27.9 ± 10	
Dynamic balance	TUG (sec)	9.11 ± 2.7	7.74 ± 2.1*	9.32 ± 2.1	7.86±1.7*	9.45 ± 1.9	9.00 ± 3.1	
Cardio respiratory endurance	6MWT (m)	428 ± 62.7	441 ± 49.9	432 ± 57.7	458 ± 90.1	442 ± 97.4	429 ± 104	
Shoulder flexibility	SF (cm)	-7.66 ± 10.1	-6.58 ± 11.3	-6.73 ± 11.7	-11.3 ± 14.8	-14.9 ± 15.0	-19.2 ± 17.7	

Note: values are mean \pm S.D. for pretesting and posttesting measurements. EE: elastic band exercise, PE: pole exercise, HE: home exercise with water-filled bottles. 30 SCS : 30 seconds chair stand, FR : functional reach test, TUG: time up and go test, 6MWT : 6-minute walk test, and SF: shoulder flexibility test. *Statistically significant (p \leq 0.05)

The results showed that EE significantly ($p \le 0.05$) increased the elderly's leg muscle strength (30 SCS; 10.5 ± 2.5 , 16.1 ± 3.4), static balance (FRT; 25.0 ± 5.7 , 30.7 ± 6.3), and dynamic balance (TUG; 9.11 ± 2.7 , 7.74 \pm 2.1). Increasing in cardio respiratory endurance (6MWT; 428 \pm 62.7, 441 \pm 49.9) and shoulder flexibility (SF: decreasing in minimum distance between hands from 7.66 \pm 10.1 to 6.58 \pm 11.3 cm.) were also observed, although no significantly difference was found. These results related to the findings of a previous study indicating that elastic band exercise improved leg muscular strength, balance ability, and positively influenced whole body function such as cardiovascular endurance and upper body flexibility [10]. In addition, PE significantly (p ≤ 0.05) increased the leg muscle strength (30 SCS; 13.6 \pm 2.4, 14.9 \pm 3.5), and the dynamic balance (TUG; 9.32 ± 2.1 , 7.86 ± 1.7). Improving on static balance (FRT; 23.1 ± 6.2 , 24.7 ± 7.8) and cardio respiratory endurance (6MWT; 432 ± 57.7, 458 ± 90.1) were found but no significantly difference. However, the shoulder flexibility was declined (SF: increasing in minimum distance between hands from 6.73 ± 11.7 to 11.3 ± 14.8 cm.). From the results, it might be indicated that pole exercise involved physical activity moving the whole body with a pole, continuous movement could promote the movement of whole body muscle thereby enhancing elderly's muscle strength and balance, especially the dynamic balance. These results agree with a previous study showing that good muscle strength of lower limbs was crucial for proper body balance [21]. On the other hand, HE significantly (p \leq 0.05) enhanced only the leg muscle strength (30 SCS; 12.9 \pm 2.4, 15.8 \pm 4.9), while better in the dynamic balance (TUG; 9.45 ± 1.9 , 9.00 ± 3.1) was observed. Nevertheless, the static balance (FRT; 31.9 ± 9.3 , 27.9 ± 10), the cardio respiratory endurance (6MWT; 442 ± 97.4 , 429 ± 104), and the shoulder flexibility (SF: increasing in minimum distance between hands from 14.9 ± 15.0 to 19.2 ± 17.7 cm.) were decreased. The results could be explained that participants in HE group did not strictly perform the

exercise program, since they did the exercise at their individual place (home). The provided record books for recording their exercise activity at home showed that no participants could completely perform the exercise until the end of the program (8 weeks). These results also demonstrated that group-performing exercise (EE and PE) improved better physical fitness in the elderly compared to individual-performing exercise (HE). It was because physical activities created opportunities of social interaction, cooperation with others, sharing experiences, and receiving the encouragement of peers [22]. For further study, the performance of HE group can be improved by the motivation of group-based exercise. Moreover, regular physical activity could also be suggested to them to maintain their physical fitness and their ability to live without relying on other people's support [23].

The percentage of physical fitness improvements from pre- and post- testing for all three groups was provided in Figure 4. EE group had the greatest increase in all physical fitness (53.0%, 22.6%, 14.1%, 15.0%, and 3.08% for muscle strength, static balance, shoulder flexibility, cardio respiratory endurance, and dynamic balance, respectively), followed by PE group which could improve in almost physical fitness, except for the shoulder flexibility, while HE group could help only in muscle strength and dynamic balance. Muscular strength, static and dynamic balances and flexibility contributed to the ability to prevent falls in elderly [24]. After 8-weeks receiving exercise models, participants in all exercise models groups significantly improved their physical fitness. Three exercise models; EE, PE, and HE used in this study were presented as parts of stretching and resistance, balancing and flexibility exercise. It was known that exercise could play an important role in reducing the risk of falls and it was not surprising that there was no single types of exercise or training program that standed out alone a being effective [9]. EE; as a type of stretching and resistance exercises, provided greater improving of all physical fitness (Table 2) than the other two exercise models. These results related to the findings of a previous study indicating that stretching and resistance exercises could improve static and dynamic balance of elderly adults [25]. This was because stretching increased muscle mass, strength and independence in activities of daily living [8]. Enhancing of strength led to improve the static balance in the elderly persons and increasing in balance resulted in greater tolerance of instability and increased resistance to muscle fatigue [5]. Using elastic band in EE was not only to enhance strength but also to provide as resistance training. Resistance exercise increased the rate of muscle protein synthesis and contributed to improved muscle strength in elderly men and women aged 76 years and older [26]. These results agree with a previous study showing that resistance exercise was effective at enhancing the lower extremity muscle strength and balance ability [27]. Aging decreased exercise capacity and the cardiac responses to exercise, but resistance training led to improve blood pressure and cardiovascular health [28, 29]. PE represented an example of balance training in this study. It could also been showed that balance training could reduce the risk of falling through reducing the base of support and movement of the centre of gravity [30]. HE could be a simple exercise that elderly could perform by themselves at home to promote their flexibility and activity living. It was supported by [22] that regular physical activity including flexibility training and a dynamic lifestlye could help to improve the physical fitness in aging people.

A clear picture of change in decreasing numbers of participant who were at risk level was provided in Figure 5. Of interest, numbers of participant who were at risk level (according to standard score or assessment of each physical fitness test, mentioned in the method) decreased after receiving EE and PE, while HE did not showed any change in decreasing numbers. These results indicated that participants in EE, and PE groups improved their health after the receiving the exercises. EE showed the highest decrease in numbers of participants who were at risk in almost physical fitness; muscle strength (100%), dynamic balance (75%), cardio respiratory endurance (50%) and static balance (40%). PE could help decreasing numbers of participants who were at risk in shoulder flexibility (100%), dynamic balance (60%), and static balance (56.25%). HE could not decrease in numbers of participants who were at risk in all physical fitness. It should be noted that percentage of change was defined as the ability of exercise models to reduce the number of participants who were at risk level, calculated by numbers of participant at risk level after receiving the exercise model, divided by numbers of participant who were assessed to be at risk level before receiving the exercise models and multiplied by 100. Therefore, 100% referred that after receiving the exercise models, no participant was assessed to be at risk level, while 0% might referred that the particular exercise were unable to reduce the numbers or the numbers were not change.





Figure 4 Percentage of change [(posttesting-pretesting \times 100) / pretesting)] on improving physical fitnesses after receiving three exercise models (EE, PE, and HE). Significant (p \leq 0.05) baseline to posttest changes indicated by asterisk (*) above bar.



Figure 5 Percentage of change on decreasing number of participants who are at risk level, achieving by physical fitness tests, after receiving three exercise models (EE, PE, and HE).

4. Conclusions

All exercise models could significantly ($p \le 0.05$) increase the elderly's muscle strength. The static and dynamic balances was significantly ($p \le 0.05$) enhanced by EE, while PE could significantly ($p \le 0.05$) improve

only the dynamic balance. Increasing in cardio respiratory endurance was also observed in EE and PE groups, but no significantly differences were found. The shoulder flexibility was better in EE group although no significantly difference was not found. It should be noted from the findings of this study that all exercise models can increase elderly physical fitness. EE, especially, help promoting the elderly's balance both in dynamic and static movement, thereby reducing elderly risk of falls. In addition, using the elastic band (in EE) was easy, economical and safe to use by individual. Various elderly health risks were also decrease after receiving EE and PE models as well. On the other hand, since we did not control for place to perform the exercise, and the ability of the exercise method itself was not compared, so place of performing the exercise could become an external factor. For further study, this type of study could be scaled-up to be introduced in the larger older population, not only in Nang Lae district.

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References

- Knodel J, Teerawichitchainan B, Prachuabmoh V, Pothisiri W. The Situation of Thailand's Older Population. An update based on the 2014 Survey of Older Persons in Thailand. Population Studies Center Research Report 15-847; October 2015. 1-104.
- [2] Worldbank.org [Internet] [cited 18 May 2017]. Available from: http://www.worldbank.org/en/country
- [3] Foundation For Older Persons' Development. **Situation of the Thai Elderly (Population situations)** [Internet] [cited 18 October 2016]. Available from: http://fopdev.or.th/situation-of-the-thai-elderly-population-situations
- [4] Vigorito C, Giallaur F. Effects of exercise on cardiovascular performance in the elderly. **Front Physiol.** 2014; **5**: 1-8.
- [5] Lee IH, Park SY, Balance Improvement by Strength Training for the Elderly. J. Phys. Ther. Sci. 2013; 25: 1591–1593.
- [6] Smith PJ, Blumenthal JA, Hoffman BM, Cooper H, Strauman TA, Welsh-Bohmer K, Browndyke JN, Sherwood A. Aerobic exercise and neurocognitive performance: a meta-analytic review of randomized controlled trials. **Psychosom Med.** 2010; **72**(3):239-252.
- [7] Nelson ME, Rejeski WJ, Blair SN, Duncan PW, Judge JO, King AC, Macera CA, Castaneda-Sceppa C. Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. Circulation. 2007; 116 (9): 1094-1105.
- [8] American College of Sports Medicine Position Stand: Exercise and physical activity for older adults. Med Sci Sports Exerc. 1998, 30: 992–1008.
- [9] Wan M, Wong RY. Benefits of exercise in the elderly. CGS Journal of CME. 2014; 4(1): 5-8.
- [10] Lee HC, Lee ML, Kim SR. Effect of exercise performance by elderly women on balance ability and muscle function. J. Phys. Ther. Sci. 2015; 27 (4): 989–992.
- [11] Kim CS, Park IH, Kim MW. Effects of exercise using thera band on body compositions blood pressure and physical fitness in the elderly woman. J Muscle Joint Health. 2007;14(2):158-68.
- [12] Park IR, Effects of 12 weeks aerobic exercise on health-related physical fitness and bone density in elderly. J Sport Leis Stud, 2004; 22: 459–469.
- [13] Sawangjaithum K, Chansareewittaya K, Adultrakul A, Kamsrijai U. Development of appropriated exercise model for elderly combining community participation. Proceeding of the 5th National and international conference on sustainable community development "The future of development towards stability, prosperity and sustainability in the ASEAN community"; 2015 Dec 24-25; Knon Kaen, Thailand. p. 638-44
- [14] Nippita S, Jitpaiboon N. The study on exercise program using 2 types of elastic band for physical fitness for the elder. Ministry of Health: October 2007. 1-62.
- [15] Division of Physical activity and health promotion, Department of Health, Ministry of Health. The physical fitness test for activity of daily livings in the elderly. Nonthaburi: The War Veterans Organization of Thailand Publishing. 2005. 1-41.
- [16] Hara T, Shimada T. Effects of Exercise on the Improvement of the Physical Functions of the Elderly. **Phys Ther.** 2007;**19:** 15-26.
- [17] Hunter GR, Treuth MS, Weinsier RL, Kekes-Szabo T, Kell SH, Roth DL, Nicholson C. The effects of strength conditioning on older women's ability to perform daily tasks. J Am Geriatr Soc. 1995;43(7): 756-60.

- [18] Eyigor S, Karapolat H, Durmaz B. Effects of a group-based exercise program on the physical performance, muscle strength and quality of life in older women. Arch Gerontol Geriatr, 2007; 45(3): 259-71.
- [19] Samahito S. **Sports Authority of Thailand Physical Fitness Test for Elderly**. Sport science. Department of Physical Education, Ministry of Tourism and Sports. 2013.
- [20] Podsiadlo D, Richardson S. The timed 'Up and Go' Test: a Test of Basic Functional Mobility for Frail Elderly Persons. J Am Geriatr Soc. 1991; 39: 142-148.
- [21] Karinkanta S, Heinonen A, Sievänen H, Uusi-Rasi K, Kannus P. Factors predicting dynamic balance and quality of life in home-dwelling elderly women. J Gerontol. 2005; 51(2): 116-21.
- [22] Battaglia G, Bellafiore M, Alesi M, Paoli A, Bianco A, Palma A. Effects of an adapted physical activity program on psychophysical health in elderly women. **Clin Interv Aging.** 2016; **11**:1009–1015.
- [23] Mandle EM. Health promotion thoughout the life span. 7th ed. Canada: Mosby Elsevier. 2010.
- [24] Reed-jones RJ, Dorgo S, Hitchings, Bader JO. Vision and agility training in community dwelling older adults: incorporating visual training into programs for fall prevention. Gait Posture. 2012; 35: 585-589.
- [25] Yu W, An C, Kang H. Effects of resistance exercise using Thera-band on balance of elderly adults: A randomized controlled trial. J. Phys. Ther. Sci. 2013; 25: 1471–1473.
- [26] Yarasheski KE. Exercise, Aging, and Muscle Protein Metabolism. J Gerontol. 2003; 58 (10): 918–922.
- [27] Hirase T, Inokuchi S, Matsusaka N, Nakahara K, Okita M. Effects of a resistance training program performed with an interocclusal splint for community-dwelling older adults: a randomized controlled trial. J. Phys. Ther. Sci. 2016; 28: 1499–1504.
- [28] Molmen HE, Wisloff U, Aamot IL Stoylen A, Ingul CB. Aerobic interval training compensates age related decline in cardiac function. Scand Cardiovasc J. 2012; 46(3): 163–71.
- [29] Williams MA, Stewart KJ. Impact of strength and resistance training on cardiovascular disease risk factors and outcomes in older adults. Clin Geriatr Med. 2009; 25(4): 703–14.
- [30] Gillespie LD, Robertson MC, Gillespie WJ, Lamb SE, Gates S, Cumming RG, Rowe BH. Interventions for preventing falls in older people living in the community. Cochrane Database Syst Rev. 2012; (12)9: CD007146.



Session of ASEAN Studies

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Community Skills Development in the Application of Social Capital to Foster Sustainable Self-relianceWhen to be the ASEAN Economic Community: A Case Study of Kanchanaburi Province

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Abstract

The research on the social skill development in applying social capital for sustainable self-reliance when entering the AEC, a case study of Kanchanaburi Province has 4 objectives: 1. to study and assess social capital for sustainable self-reliance when entering the AEC in Kanchanaburi Province 2. to study the preparation of the people in 13 Kanchanaburi's districts to cope with the coming change 3. to promote sustainable skills or competency in sustainable self-reliance when entering the AEC in Kanchanaburi and 4. to support the community in preparing in application of social capital in their community to many kinds of goods and products by selling to 10 AEC countries tourists for raising income or taking a chance from the coming change for economic strength of the community. The research instruments were questionnaires with validity and reliability, the data were collected from the population of 390 subjects in 13 Kanchanaburi's districts during 27 January – 30 April 2016. The 13 village meetings were held on 1 – 30 May 2016. The workshop training programs were provided for the people to develop their social capital skill according to the 13 pilot projects selected, 4 programs for each project, in June – September 2016. The academic exhibition, shows and sale of community products were held provincially on 5 October 2016 at the front yard of Kanchanaburi Town Hall. The data were then analyzed by computerized application in terms of frequency distribution, percentage, mean and standard deviation.

The findings were according to the objectives:

1. The results of the study and assessment of the social capital for sustainable self-reliance: the factor of the human aspect found as moderate overall ($\bar{x} = 2.31$). The main factor of their culture found in 34.44% of the subjects believed in luck.

2. The 41.11% of the subjects informed that the people in the community prepared themselves to cope with the coming changes when entering the AEC by applying the Sufficiency Economy Philosophy principles to their living.

3. The process of improving skills or competence of the community for sustainable self-reliance when entering the AEC: the meeting of the people from 13 villages was held to analyze the SWOT, the 13 pilot projects for social capital application and the activities of the projects were performed in 4 months' time.

4. The process of supporting the community to be prepared for increasing income or taking a chance on the coming change for the economic strength of the community: academic exhibition, shows and community product sale provincially on 5 October 2016; the coordination with the Bank for Agriculture and Agricultural Cooperatives, Kanchanaburi; the products sold at the community product center; and the coordination with the Community Development Office, Kanchanaburi to sell the community products at the OTOP Center, Kanchanaburi.

Keywords: social capital, social skill, ASEAN Economic Community, sustainable self-reliance

1. Introduction

Kanchanaburi is a province in the western Thailand. Most of the people in this province are rather poor, they worked hard in their farms and got very low income, some of them had to work in the factory with bad quality of lives. Ortherwise, in every community in Kanchanaburi has social capital, such as local wisdom, interesting culture, appropriate resources and environment for adapting to be many kinds of charming goods and many products for tourists, in this way, the people in 13 Kanchanaburi's districts were lack of good chance to aware of the value of social capital in their community and the means to make many goods and products from the social capital for higher money from the tourists from 10 AEC countries, they were 1. Thailand, 2. Myanmar, 3. Laos 4. Philippines, 5. Cambodia, 6. Vietnam, 7. Brunei 8. Singapore, 9. Malaysia and 10.

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Indonesia. The researcher had worked in Kanchanaburi Rajabhat University [8] for a long time and wanted to support the people in 13 Kanchanaburi's districts in developing their skill in the application of social capital for foster sustainable self-reliance when enter to be a part of the ASEAN Economic Countries: AEC.

2. Objectives

2.1 to study and assess social capital for sustainable self-reliance when entering to AEC, in Kanchanaburi Province.

2.2 to study the preparation of the people in 13 Kanchanaburi's districts to cope with the coming change

2.3 to promote sustainable skills or competency in sustainable self-reliance when cutering the AEC, in Kanchanaburi Province.

2.4 to support the community in preparing in application of social capital in their communities to many kinds of goods and products by selling to 10 AEC countries tourists for raising income or taking a chance from the coming change for economic strength of the community.

3. Methods

The research instruments were questionnaires with validity and reliability. The research steps were: -

Steps 1: to study and assess social capital in 13 Kanchanaburi's districts, the questionnaires were used for collecting the data from the population of 390 subjects during 27 January - 30 April 2016, and analize the data by computer in terms of frequency distribution, percentage, mean and standard deviation.

Steps 2: to select 13 pilot projects from each district on 1-30 May 2016 by letting the people to participate in 13 district meetings.

Steps 3: to manage 13 training programs for the people by developing their social capital skill according to 13 their pilot projects in June-September 2016.

Steps 4: to let the people and community leaders from 13 Kanchanaburi's districts study visit at the SUPPORT Arts and Crafts international Centre of Thailand (Public Organization), Ayutthaya Province on 26 August 2016 for getting more vision and wanted to make their charming goods and many kind of products from social capital.

Steps 5: to prepare provincially exhibition, show and sale the 13 Kanchanaburi's districts goods and products by letting people and community leaders participate on 4 October 2016 at the meeting room of the Community Development office, Kanchanaburi.

Steps 6: to manage the academic exhibitions, shows and sale of 13 districts goods and products on 5 October 2016 at the front yard of Kanchanaburi Town hall.

Steps 7: to promote the 13 districts goods and products by developing participative network with many organizations and OTOP Center, Kanchanaburi.

4. Results and discussion

Kachanaburi consist of 13 districts, they were 1. Muang, 2. Tha munag, 3. Tha Maka, 4. Panom Thuan 5. Huay Krachao, 6. Lao Kwan, 7. Nong Plue 8. Bo phloy, 9. Sri Sawat, 10. Dan Makham Tia, 11. Sai Yok, 12. Thong Phaphum and 13. Sangkhla Buri District.

Self-reliance or self-help theory had explained about the ultimate goals of this theory to help people to stand on their own feet [14] were the most important objective of this research by applying the social capital in their community.

Mitchel [15] explained about social networks theory in many concepts, especially, the social network can make the sense of community empowerment process in the urban situation and the people in the community will get the sense of belonging The results and discussions of this research were very interesting, they were: -

4.1 The results of the study and assessment of the social capital for sustainable self-reliance: the factor of the human aspect was found moderate overall ($\bar{x} = 2.31$) that consistent to Fauri et.al [5], Fransis Fukuyama [7], Field [6], Carol [2], Coleman [3], Putnam [11] and Naratton Sritong [9] who explained that human aspect was the most important of social capital because the human could manage themselves in learning, thinking and coordinating, especially in applying social capital for sustainable self-reliance.

The factor of cultures, the research found that 81.11% of the subjects believed that clothing was handed down respectively generation to generation, 48.33 % informed that the cultural change caused by western trend and 53.61% informed that the influencing pattern of receiving the outsiders' culture was clothing culture that did not consistent to Community Development Department [4] who explained that every person have a sense of honour of the people, they are free without any influence from others, and did not accordance with the description of Naratton Sritong [10] who explained about the value of community culture and to provide unique to the community.

Thiwaporn Sriworakul was perceived to be a local scholar and specialist by 48.33% of the subjects. She was a food preservation expert in Kanchanaburi's Muang District. 34.72 % of the subjects informed that the

local wisdom used to take as career and increase their income was preservation and food proceeding for sale that accordance with Sunya Sunyaviwat [12] who explained about economic strength in the community by the Sufficiency Economy Philosophy, be aware of self-reliance principles, honesty and moral in thinking and doing every activities in the way of life and accordance with Naratton Sritong [10] who explained about the pattern of self-reliance community economy empowerment consisted of 3 aspects, they were aspect 1) supportive factors with 8 concepts: they were 1. to apply the Sufficiency Economy Philosophy for way of life 2. to inform information useful to daily life 3. to build cooperative network 4. to learn the new thing and to build interested groups, 5. to use appropriate social capital in the community economy development. Aspect 2) the process of participation of building self-reliance community economy empowerment pattern in Kanchanburi were: the people in the village realized their roles in the village, so they attended the meeting regularly to raise their problems, cause of problems finding the resolution, take part in problem solving and monitoring and assessing the activities to make conclusion for other resolutions and aspect 3) there is the appropriate pattern of self-reliance community economy empowerment in Kanchanburi.

4.2 The research found that 41.11% of the subjects informed that the people in the community were prepared to cope with the coming change when entering the AEC by applying the Sufficiency Economy Philosophy principles that consistent to Apichai Pantasen (ed). [1] who explained about Thai's way of life in helping people in the village can live together with happiness for a long time.

4.3 The finding of this research were the process of improving skill of the community for sustainable self-reliance when entering the AEC were the meeting of the people from 13 Kanchanaburi's districts for analyzing SWOT and set up pilot projects to develop people skill for social capital application and the activities of the projects that consistent to Teerapatra Aagpachaisawat, [13] who explained about the 5 steps of participative principles in the villages which can make people get sense of belonging their villages.

4.4 The research found that the process of supporting the community to be prepared for increasing income or taking a chance on the coming change for the economic strength by studying and assessing social capital, select pilot project to develop the people's skill in application of social capital in their communities to be the sharming goods and products and sale them to the 10 AEC countries tourists for getting more income for high quality of lives. of the community by academic exhibition, shows and community products sale and the coordination with many government organizations and non-government organizations that consistent with Community Development Department, [4] who explained about the means of self-reliance community empowerment.

5. Conclusions

In 13 Kanchanaubri's districts have various of social capital. The research wanted to show the social skills in development and applying social capital for sustainable self-reliance in 13 Kanchanaburi's districts when entering the AEC, The preparation to cope with the coming change and to support the community in preparing for raising income or taking a change from the coming change for economic strength in 13 Kanchanaburi's districts and the researchers suggested that for the further work to the interested researcher that he should study about means to develop participation network for promoting OTOP products: case study in Kanchanaburi Province.

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Some interesting figures during research process:

Figure 1 The data were collected from the population of 390 subjects in 13 Kanchanaburi's districts, 27 January -30 April 2016

Source: Naratton Sritong, the chief of the researchers.



Figure 2 The village meeting was held to SWOT analyze and select a pilot project for each village on 1-30 May 2016

Source: Naratton Sritong, the chief of the researchers.



Figure 3 The workshop training programs were provided for the people to develop their social capital skill according to the 13 pilot projects selected in June-September 2016.

Source: Naratton Sritong, the chief of the researchers.



Figure 4 The study visit was provided for the people and community leaders at the SUPPORT Arts and Crafts International Centre of Thailand (Public Organization), Ayutthaya Province on 26 August 2016.

Source: Naratton Sritong, the chief of the researchers.



Figure 5 Some community products from 13 Kanchanaburi's districts were held provincially on 5 October 2016 at the front yard of Kanchanaburi Town Hall.

Source: Naratton Sritong, the chief of the researchers.



Figure 6 The academic exhibition, shows and sale of community products were held provincially on 5 October 2016 at the front yard of Kanchanaburi Town Hall.

Source: Naratton Sritong, the chief of the researchers.

- [1] Apichai Pantasen. (ed.). Looked behind to the Sufficiency Economy in the next decade (2013-2022). Bangkok: Research Supporting Fund Office; 2012.
- [2] Carol, T.F. Social capital local capacity building and poverty reductions. Manila: ASEAN Development Bank; 2001.
- [3] Coleman, J. Social capital in the creation of human capital. American Journal of sociology. 1988; 94 (Supplement). 95-120.
- [4] Community Development Department. Community meeting for planning. Bangkok: author; 2004.
- [5] Fauri, Wernet & Netting. **CASES in macro social work practice**. 3rd ed. United States of America. Pearson Education: 2008.
- [6] Field, J. Social capital. London: Rutledge; 2003.
- [7] Fukuyama, F. Trust: The social virtues and the creation of prosperity. London: Penguin; 1995.
- [8] Kanchanaburi Rajabhat University. Core Kanchanaburi tourising plan. Kanchanaburi: author. 2009.
- [9] Naratton Sritong. Process of community empowerment creation for sustainable self-reliance in Kcnahanaburi: Bangkok: Odian Store; 2015.
- [10] Naratton Sritong. The pattern of self-reliance community economic empowerment in Kanchanaburi. Kanchanaburi: Kanchanaburi Rajabhat University: 2015.
- [11] Putnam, R. The prosperous community social capital and public life. American Prospect. 1993; (13): 35-42.
- [12] Sunya Sunyaviwat. Managemental community. Bangkok: Ammy Trading: 1998.
- [13] Teerapatra Aagpachaisawat. Community study. Bankok; Chulalongkorn University; 2011.
- [14] United Nation. Administration of rural development in ASEAN countries. New York: Author; 1983.
- [15] Mitchel., J.C. Social network in urban situation. Manchester: Manchester University Press. 1896.



Session of The Interdisciplinary Research

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The Application of DEA Model to Evaluate Technical Efficiency of Burned Agri-Supply Chain for Maize.

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Abstract

This paper aims to measure the technical efficiency (TE) for maize production in Mae Chaem District, Chiang Mai, Thailand and to explain estimated TE by farmer characteristics. Two Stage Data Envelopment Analysis was employed to estimate farmer score of technical efficiency (TE) both of constant return to scale (CRS) and variable return to scale (VRS) were applied to the study based on input oriented, a relative efficiency index in production. Then, Tobit regression model was used to clarify the variation in technical efficiency scores by determining major farmer's characteristics as an element factors behind. A total 103 Maize farms or 103 were selected for the study dividing into 2 groups by 52 farms were a non-burn farm and 51 farms were burned farm. The result showed that group1 has more average efficiency result show that majority of both of farmer group were operated with increasing return to scale. Tobit regression result shows that farm's characteristics such as farm experience, burn, family size have statistically significantly affected by 0.53, -7.2 and 1.36 percent to technical efficiency under constant return to scale, the technical efficiency under variable return to scale was influenced by farm experience and family size by 0.61 and 1.10 percent respectively.

Keywords: non-parametric, Data Envelopment Analysis, Tobit Analysis, technical efficiency, farmer characteristics

1. Introduction

Haze becoming a serious problem in northern of Thailand since 2007, The haze seasoning begun from March to May every year. In 2015, Northern part of Thailand has 15,950 times of hotspots. Chiang Mai has a significant share of 2,119 times of hotspot in the haze problem [1] and more than 319 hotspots in Mae Chaem district [2]. There are many causes of hotspot including agriculture waste burning, crop preparation, forest's fire and etc. Maize was alleged as the cause of haze problem from burning agriculture waste and pre-land planting. Since maize has a huge involve as the main occupation and allegation in causing of haze problem. It's very important to find out if the burned farms and non-burned-farm are working efficiently or not as a big research question. This study points out the source of inefficiencies of crop maize production in Mae Chaem district which the result can offer a big context in determining policies and might guide as a decision supporting tools to figured out the maize-haze solution for the future.

2. Materials and methods

A two stage Data Envelopment Analysis was applied into this study. For the first stage, the technical efficiency of maize producer was measured by DEA program DEAP2.1. For the second stage, explanatory variables which were assumed to affect the technical efficiency were estimated by Tobit Regression Analysis.

2.1 Data and Variables.

The maize farmer producer is call decision making unit (DMU). The number of DMUs is expected to be larger than the product of number of input and output in order to discriminate [3] effectively between efficient DMUs. However, the sample size should be at least 2 or 3 times larger than the sum of the number of inputs and output. This study has the sum of inputs number and output number is precisely 5. Therefore, 15 farms should be minimum sample size according to suggestion [4]. A sample size of 103 farm households randomly selected in the study area based on cross sectional data 2014/15 crop the variable burn identified 52 and 51 farms for non-burning group and burning group respectively. In addition, burning refers to the using of burn into land preparing before planting maize. This study employed one output and four inputs in the efficiency estimation. The output is maize yield per 0.16 hectare. The four inputs include seed quantity, labor cost, chemical-pesticide

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(1)

cost, and fertilizer cost. Table 3 shows the descriptive statistics of the inputs and output while table 4 shows descriptive statistic of farm's characteristic in the study. Technical efficiency value was calculated by DEAP2.1 suggested by Tim Coelli [5] which result in two type of technical efficiency both of CRS and VRS assumption. Then, the Tobit Regression was used to find out causes of inefficiencies. The explanatory variables such as Farm Experience, Farm Size, Family Size, and Burn were selected for independent variables and were estimated by econometric software named STATA 12.

2.2 Data Envelopment Analysis and Literature Review.

There are two ways to measure the production efficiency including parametric and non-parametric method. The non-parametric method was initiated by Farrell in 1957. Data envelopment analysis is non-parametric based on the use of linear programing techniques that can be estimated efficiency and inefficiency from an observed data. An input oriented data envelopment analysis was employed under the assumption of a constant return to scale (CRS) and variable return to scale (VRS) to minimize inputs use of decision-making units (DMUs) which can maintain the current level of maize yield. Then a scale efficiency will be assessed the scale efficiency each DMUs. The linear programing model for constant return to scale used in this study were as follow Coelli [6] as seen in equation 1 and 2.

_{θ,λ} θ,

Subject to

 $\begin{aligned} -y_i + Y\lambda &\ge 0\\ \theta x_i - X\lambda &\ge 0\\ \lambda &\ge \mathbf{0} \end{aligned}$

_{θ,λ} θ,

Subject to

$$\begin{aligned} -y_i + Y\lambda &\geq 0\\ \theta x_i - X\lambda &\geq 0\\ \text{N1}/\lambda &= 1\\ \lambda &\geq 0 \end{aligned} \tag{2}$$

From the statement of introduction, based on the research question that "Does the maize production in research area good or bad?" and "How the maize productivity situation is". The consequence of burning agriculture affects to people in Chiang Mai. Recently report indicated that maize is highly implicated to Mae Chaem's farmers. There are many suggestions to farmer such as terminate maize production, avoiding burn agriculture process. This is study concern maize as part of farmer's life. The question can answer by measure current efficiency in maize production. The degree of inefficiency in resource utilization give alternative aspect to analysis whether if the farmer cannot change the crop and still planting maize. Efficiency analysis considers as an identifying tool.

Efficiency analyses are a convenience for integrate efficiency describing exogenous variable [7]. In the previous studies, there are many studied indicated farm experience has positive relation to technical efficiency such as Endras Geta [8], Ogunniyi [9], Kane [10], Yusuf [11] state that "the variable farm experience showing that farmer with greater farming experience will have better management skills and higher efficiency. Thus, the increasing of farm experience could increasing technical efficiency. The positive relationship between farm experience and technical efficiency was also founded by Parikh [12] conducted the studies on Pakistan farmer. After 1 year later, Coelli [6] and Battese [13] was found the same result in Indian farmer. In the contrast, Ajibefun [14], Seyoum [15], Amaza and Maurice [16], Wakili [17] and Karimov [7] found that the older farm was more inefficient, these were conducted in Nigeria. A Farmer's age and experience still discuss in efficiency measurement literature now a day.

Family size had been mostly reported with negative relation with farmer technical efficiency by Okike [18] in the other words, a larger family size causing technical inefficient on a farmer. Yusuf [11] found that family size has a negative influence on technical efficiency. Ogunniyi [9] reported that family size was a negative influence and statistically significant on technical efficiency under a constant return to scale. Geta [8] considered this factor in the model and also found a negative relation but not significant. However, Ingram [19]
and Pender [20] reported that more densely household could enable them to increase crop production. In the other word, they found a positive relationship between family size and technical efficiency.

Farm size in previous studies was found both of negative and positive relationship with technical effciency. In case of negative relationship. In 1994, Ingram [19] found the smaller farm were operated more efficiency than larger farm in Sub-Sahara Africa. According to Pender [20] farm size was negatively affected on farmer's technical efficiency in Ugunda. 5 years later, Brambilla [21] conducted the study in Zambia, results show small farm tend to be efficient more. Although, there are positive relationship between farm size and technical efficiency reported in the study, Budak [22] found that farm size was positively associated with technical efficiency, the study conducted in Turkey. In a similar way, Sharma Leung, et al.[23], Geta [8], Tipi [24], Bagi [25] confirm the same result in their study.

2.3 Scale Efficiency (SE)

Scale efficiency value explains when the use of inputs and increased proportionally, the productivity will increase proportionally as much as they used. For example, if any DMU has an efficient on scale efficiency when the increase of input used for 10% the productivity of that DMU will be increase at 10%. This calls the constant return to scale or "CRS" if DMU can increase their productivity more than 10% after using 10% of input. DMU will be "increasing return to scale or "IRS" but in the other way, if the DMUs can produce the productivity less than 10% after using 10% of input, thus the DMU will be decreasing return to scale or "DRS". Scale Efficiency can obtain from following equation 3; Dhungana et al.[26]

$$SE = \frac{TE_{crs}}{TEvrs}$$
(3)

2.4 Tobit Analysis Model.

The Tobit model was purposed in 1958 by James Tobin, the model was known as censored or truncated regression models. Since the technical efficiency score are range between 0.00-1.00, Maddala [27] states that the estimation with the ordinary least squares (OLS) regression on DEA score or one sided Tobit regression will affect by biased parameter since the OLS assume a normal distribution and homoscedastic variable. Hence, this study applied the two-limit Tobit regression to explore the source of efficiency score and explanatory variables such as farm experience, Farm size, Burn Process, and Family size. The two-limit Tobit regression can define as; [28] in equation 4 and application in equation 5

$$y_{i}^{*} = \beta_{0} + ? \sum \beta_{m} X_{jm} + \mu_{i}$$

$$y_{i} = 1$$

$$y_{j}^{*} \begin{cases} if \ y_{i}^{*} \leq 0 \\ if \ 0 < y_{i}^{*} \leq 1 \\ if \ y_{i}^{*} \geq 1 \end{cases}$$

$$0 \qquad (4)$$

$$y_i^* = \beta_0 + \beta_1 Fexp + \beta_2 Fsize + \beta_3 Burn + \beta_4 Famsize + \mu_i$$
(5)

2.5 Marginal Effect

For the two-limit Tobit model, regression coefficients cannot infer such a traditional regression coefficient which gives a degree of marginal effects of change in the explanatory variables on expected value of dependent variable.

3. Results and discussion

3.1 Descriptive statistic result in the study.

1) The summary of variable in this study.

The summary of statistics of variable for the production frontier estimation is presented on table 1. The table reveals that group 1 has the average output per 0.16 hectare of maize is 1,147.65 kg. with a standard deviation of 401.22 kg per 0.16 hectare, the average of using seed, labor cost, chemical-pesticide cost,

fertilizer cost is 4.19 kg, 1,019.62 baht, 833.17 baht, 2,117.50 baht per 0.16 hectare respectively. The greatest variation existing for inputs rank from fertilizer cost, labor cost, pesticide and seed.

Group 2 has the maize average output per 0.16 hectare is 790.35 kg, with standard deviation of 238.12 kg per 0.16 hectare, the average of using seed, labor cost, chemical-pesticide cost, fertilizer cost was 4.02 kg, 434.92 baht, 1,042.82 baht and 2,440.74 baht per 0.16 hectare respectively. The greatest variation existing for inputs used rank form fertilizer cost, pesticide cost, labor cost and seed.

Group 1 has maize yield more than group 2 by 353.3 kg per 0.16 hectare and used input less in pesticide and fertilizer, in the other way group 2 has used input less than group1 in labor and seed. An average maize production cost of group 1 is cheaper than 1.98 baht and group 2 cheaper than 0.42 baht per kg when comparing with cost of maize production in Phetchabun province [29].

Description	Group	Unit	Mean	SD	Min	Max
			Group 1			
Output						
Maize Yield	1	Kg	1,147.65	401.22	400	2,500
Input						
Seed	1	Kg	4.19	1.95	2	10
Labor	1	Baht	1,019.62	734.94	0	4,000
Chem-Pesticide	1	Baht	833.17	395.64	300	2,000
Fertilizer	1	Baht	2,117.50	758.93	500	4,000
			Group 2			
Output						
Maize Yield	2	Kg	790.35	238.12	400	2,000
Input						
Seed	2	Kg	4.02	1.86	1.83	10
Labor	2	Baht	434.92	530.52	0	2,000
Chem-Pesticide	2	Baht	1,042.82	565.13	300	2,500
Fertilizer	2	Baht	2,440.74	1,225.61	1,000	7,000

Table 1 Summary Statistics for Variable Used

2) Farm's characteristics in this study. (Table 2)

Farmer in group1 has experience in maize farming between 3-30 years with average 12.82 years while group2 has 3-25 years and 14.49 years. This indicated that farmer in group 2 has average experience of maize farming more than 1.67 years, The average of farm size of group 1, group2 equal 14.60 rai and 23.04 rai respectively. The average family size is 6.35 and 6.41. However, the variable burn is dummy variable describe the use of burning process in land-prepare and agriculture's waste if yes equal 1, 0 if otherwise.

Description	Variable	Unit	Mean	SD	Min	Max
Group 1						
Farm Experience	Fexp	Years	12.82	6.72	3	30
Farm Size	Fsize	Rai	14.60	9.58	3.5	40
Burn	Burn	Dummy	0	0	0	0
Family Size	Famsize	No.	6.35	2.66	2	11
Group 2						
Farm Experience	Fexp	Years	14.49	6.15	3	25
Farm Size	Fsize	Rai	23.04	13.01	4	60
Burn	Burn	Dummy	1	0	1	1
Family Size	Famsize	No.	6.41	2.79	2	11

 Table 2 Descriptive statistic of farm's characteristic

3.2 Technical Efficiency of Maize Producer between sample group. (Table 3)

The efficiency score for group 1 range from 22.26% to 100%. Including 15.38% of farms are operating efficiently and 84.61% of farms are operating inefficiently with constant return to scale condition. For group 2, the efficiency score range from 60.01% to 100%. Including 11.76% of farms are operating efficient and 88.23% are operating inefficient with constant return to scale condition.

The efficiency score for group 1 range from 66.60% to 100%. Including 26.92% of farm was operated efficiently and 73.07% was operated inefficiently with variable return to scale. For group 2, the efficiency score range from 55.50% to 100%. Including 23.53% of farm was operated efficiently and 76.47% was operated inefficiently.

The result from DEA estimation pointed out on the average technical efficiencies of group 1 were equal 67.65 and 87.69 percent under constant return to scale and variable return to scale respectively. Group 2 were equal 60.01 and 86.42 percent under constant return to scale and variable return to scale respectively. This indicated that group 1 has better technical efficiency score TEcrs, technical efficiency score TEvrs than group 2 by 7.64 and 1.27 percent respectively.

-						
Efficiency	(Group1 Non-B	urn	G	roup2 Burn Far	m
Range	TEcrs	TEvrs	SE	TEcrs	TEvrs	SE
0 200 0 299	1	0	1	1	0	1
0.200-0.299	6	0	1	12	0	4
0.400-0.499		Ő	3	10	Ő	7
0.500-0.599	8	0	8	5	2	11
0.600-0.699	7	4	10	4	6	5
0.700-0.799	5	9	3	7	6	2
0.800-0.899	9	14	7	4	11	8
0.900-0.999	1	11	11	2	14	6
Equal 1	8	14	8	6	12	7
Mean	0.67653	0.87698	0.76411	0.60017	0.86425	0.68998
SD	0.22259	0.10900	0.20336	0.23263	0.12577	0.22311
Max	1	1	1	1	1	1
Min	0.270	0.666	0.270	0.239	0.555	0.281
Total	52	52	52	51	51	51

Table 3 Frequency Distribution, summary of TE Measures

3.3 The scale efficiency result (Table.4)

The average scale efficiency in group 1 is 76.41% and group 2 is 68.99% this indicated that group 1 has a better scale efficiency than group 2. The characteristic of return to scale in Table 6, show that maize farm in group 1 including 15 farms are constant return to scale, 35 farms are increasing return to scale and 2 farms are decreasing return to scale. Maize farm in group 2 shows the different return to scale characteristic of 51 farms by 13 farms are constant return to scale, 32 farms are increasing return to scale and 6 farms are decreasing return

to scale. These results can state that most of maize producers in the study are facing increasing return to scale. Therefore, they could reduce inefficiency by increasing farm size more than present size.

Sample Groups	Characteristic of return to scale				
	CRS	IRS	DRS	Total	
Group 1	15	35	2	52	
Group 2	13	32	6	51	
Total	28	67	8	103	

Table 4 Characteristic of farms with respect returns to scale [Scales Efficiency]

Note: CRS = Constant Return to Scale, IRS = Increasing Return to Scale, DRS = Decreasing Return to Scale, **Source:** Model Results

3.4 Determinants of Technical Efficiency. (Table 5,6)

As the report by Table 5, the Tobit regression model indicated that important variables affecting the technical efficiency were farm experience, burn and family size. Farm experience was statistically significant at positively to the technical efficiency of maize farmer at less than 10 percent level of significance. In meanwhile, burn was statistically significant but at negative to technical efficiency of maize production. Family size also statistically significant at positively to the technical efficiency at less than 5 percent level of significant.

Farm Experience and family size have positive relationship with technical efficiency. Hence, the more farm experience and family size have increased maize productivity and technical efficiency their production. The relationship between burning procedure and technical efficiency in maize production was negative and statistically significant. Thus, burning is crucial to decrease technical efficiency in maize production.

Table 6, show farm experience and Family size have positive relationship with technical efficiency (VRS). Hence, the more farm experience and family sizes have increased maize productivity and technical efficiency VRS. As the result on table 9 and 10 reveal that farm experience has positive correlate both of technical efficiency CRS and VRS.

Variables	Coef.	Std.Err	t	<i>t</i>
Constant	0.4489054***	0.1047834	4.28	0.000
Fexp	0.007553*	0.0041257	1.83	0.070
Fsize	0.0006147	0.0023218	0.26	0.792
Burn	-0.101818*	0.0531018	-1.92	0.058
FamSize	0.019247**	0.0095135	2.02	0.046
/sigma	0.2477008	0.0192995		
LR chi 2(4)	8.95			
Log likelihood	-18.477235			

Table 5 Tobit Regression result in determinants of Technical Efficiency CRS

Table 6 Tobit Regression result in determinants of Technical Efficiency VRS

Variables	Coef.	Std.Err	t	t
Constant	0.5229883***	0.1254726	4.17	0.000
Fexp	0.0108724**	0.0020289	2.19	0.031
Fsize	-0.0020289	0.0634097	-0.74	0.464
Burn	-0.085194	0.0113813	-1.34	0.182
FamSize	0.0196233*	0.0113813	1.72	0.088
/sigma	0.2899426	0.0250384		
LR chi2 (4)	8.53			
Log likelihood	-40.027237			

3.5 Marginal Effect on Technical Efficiency.

1) Marginal effect of change in explanatory variable for Technical Efficiency CRS.

The result from Tobit regression show a unit change in farm experience variable increases the probability of a maize producer being efficient by about -0.4 percent and the mean level of efficiency by 0.53 percent with an overall increase in the probability and level of technical efficiency by 0.6 percent. This unit change in the farm experience brings 0.6 percent increase to the expected value of unconditional technical efficiency. Family size's unit changes would increase the probability of maize producer being efficiency by -1 percent and the expected valued technical efficiency by 1.36 percent and bring about 1.75 percent increase to the unconditional technical efficiency. A change in the dummy variable represent the using of burning in preplanting varies form 0 and 1 would increase the probability of maize producer to fall on efficiency by 5 percent and decreasing the expected condition technical efficiency about -7 percent and by -9 percent for unconditional expected value of technical efficiency.

2) Marginal effect of change in explanatory variable for Technical Efficiency VRS.

As the result in table 12, A unit change in farm experience variable can decrease the probability of maize producer being efficient about 0.9 percent and the mean level of efficiency by about 0.6 percent and overall increasing in the probability and level of technical efficiency by 0.8 percent and A unit change in Family size would decrease probabilities chance to being between limits about 0.167 percent, and increasing the expected conditional (mean level of efficiency) about 1.104 percent and overall increasing in the probabilities and level of technical efficiency by 1.59 percent.

4. Conclusions

This study was executed in Mae Chaem district, Chiang Mai, Thailand to assess the technical and scale efficiency of maize producer between of non-burn farm and burn farm. The study was based on the crosssectional data collect 103 randomly select households in 2014/15 crop. The DEA model was applied to determine the level of technical efficiency of each maize producer in the sample. In additional, a two-limit Tobit regression was employed to classify factor determining technical efficiency. The average technical efficiency was found to be 67.65 and 60.01 percent for group 1 and 2 respectively under a constant return to scale. The average variable return to scale was 87.69 and 86.42 percent. This shows that if average maize farm in the group 1 sample was to achieve the technical frontier, they should decrease 32.35 and 12.31 percent of using input without any reduction of the output produced. In the same way, if average maize farm in group 2 sample was to achieve the technical frontier, they could reduce 39.99 and 13.58 percent of using input without any reduction of the output produced. Both of group have greatest inputs excess were seed used, pesticide, labor, and fertilizer. The correlation between TE(crs) and TE(vrs) is 0.5461, this indicated a moderate relation between both conditions. Scale efficiency (SE) were 76.41 and 68.99 percent. This means non-burn farms are operating near optimal scale than burn farm. The Tobit regression results show that farm experience, Burn, and Family size were significantly determinant of technical efficiency under a constant return to scale. The technical efficiency under a variable return to scale had a significant affected by 2 factors including farm experience and family size. From above result, confirm that farm experience and family size had a positive relation with both of technical efficiencies while burn process has a negative relation to only technical efficiency under a constant return to scale. As a result of the study, policy maker should focus on maize producer's training and promote non-burn agriculture to farm household which can decrease technical inefficiency in maize production.

References

- [1] Forest Fire Control Division National Park, W.a. (2015). [Internet]. Available from: http://www.dnp.go.th/forestfire/hotspot/hotspotmap.htm
- [2] Department of Pollution Control. Retrieved from http://air4thai.pcd.go.th/web/region.php?region=2; 2015
- [3] Darrat, A. Assessing Cost and Technical Efficiency of Banks in Kuwait. ERF"s 8th Annual Conference in Cairo, 2004.
- [4] K Ramanathan. An introduction to Data Envelopment Analysis. London: Sage Publication; 2003.
- [5] Coelli T. A guide to DEAPv2.1 : Data Envelopment Analysis (Computer) program CEPA Working paper. University of New England. Department of Econometrics; 1996.
- [6] Coelli T. E. An introduction to efficiency and productivity analysis. Boston: Kluwer Academic Publisher; 1998.
- [7] Karimov, A. Production and scale efficiency of maize farming households in South-Western. 2014
- [8] Endras Geta. Technical Efficiency of Smallholder Maize Producer in Ethiopia: The Case of Wolaita and Gamo Gofa Zones. **International Journal of African and Asian Studies.** 2013; (1) : 86-91.

- [9] Ogunniyi, L. T. Fertilizer Use Efficiency of Maize Producer in Ogun State of Nigeria. The Pacific Journal of Science and Technology. 2012; 13(2): 370-376.
- [10] Gilles Quentin Kane. Efficiency of Groundnuts/Maize Intercroped Farms in Zoetele, South Cameroon: A Data Envelopment Analysis Approach. Life Science Journal. 2012; 9(4): 3955-3962.
- [11] Yusuf S.A, O. Technical Efficiency of Poultry Egg Production in Ogun State: A Data Envelopment Analysis (DEA) Approach. International Journal of Poultry Science. 2007; 6(9): 622-629.
- [12] Parikh, A. F. Measurement of Economic Efficiency in Pakistani Argiculture. American Journal of Agriculture Economic. 1995: 675-685.
- [13] Battese A. Identification of factors which influence the Technical Efficiency of Indian Farmer. Australian Journal of Agriculture Economics. 1996; (40): 103-128
- [14] Ajibefun I.A, A. D. Technical efficiency of small scale farmer: an application of stochastic frontier production function to rural and urban farmer in Ondo State, Nigeria. International Economic Journal. 2006; 20(1): 87-107.
- [15] Seyoum, B. F. Technical efficiency and productivity of maize producers in Eastern Ethiopia: a study of farmer within and outside the Sasakawa-Global 2000 project. Agricultural Economics. 1998; 19(3): 341-348.
- [16] Maurice, A. Identification of factors that influence technical efficiency in rice-based production system in Nigeria. workshop paper presented, Cotonou; 2014
- [17] Wakili. Technical efficiency of maize Farmer in Gombi local government of Adamawa State, Nigeria. Agricultural Journal. 2012; 7(1): 1-4.
- [18] Okike, I. Crop-livestock interactions and economic efficiency of farmers in the savannah zones of Nigeria. [Phd.Thesis]. Ibadan: University of Ibadan; 2000.
- [19] Ingram, F. A. Sources of Agricultural Productivity Growth and Stagnation in Sub-Saharan Africa. Agricultural Economics. 1994; (13): 51-61.
- [20] Pender, J. Strategies to Increase Agricultural Productivity and Reduce Land Degradation: Evidence from Ugunda. Agricultural Economics. 2004; **31**(3) : 181-195.
- [21] Brambilla. Market Structure, Out grower Contracts and Farm Output, Evidence from Cotton Reform in Zambia. [Research Project]. Food Security Research Project, Lusaka; 2009.
- [22] Budak, F. Measuring the Technical Efficiency of Turkish Corn Farms by Data Envelopment Analysis and Relation with Farmer's Characteristic. [Agriculture Information Research]. 2005; 14(2): 109-188.
- [23] Sharma, P. Technical, allocative and economic efficiencies in swine production in Hawaii : A comparison of parametric and nonparametric approaches. **Agri Economic**. 1995; (201) : 23-35.
- [24] Tipi, T. Measuring the technical efficiency and determinants of efficiency of rice(Oryza sativa) farms in Marmara region, Turkey. New Zealand Journal of Crop and Horticultural Science. 2009; (37): 121-129.
- [25] Bagi F. Relationship between farm size and technical efficiency. Journal of Agriculture Economics. 1982; 14(2): 139-144.
- [26] Dhungana BR. Measuring the economic inefficiency of Nepalese rice farms using data envelopment analysis. The Australian Journal of Agricultural and Resource Economics. 2004; **48**(2) : 347-369.
- [27] Maddala, G. Limited Dependent Variable in Econometrics. Cambridge University Press; 1996.
- [28] Tobin, J. Estimation of relationships for limited dependent variables. Econometrica. 1958; (26) : 24-36.
- [29] Khampian, P. **Study of Cost and Return for Cultivation of Animal Corn**. [Research]. Phetchabun Rajabhat University, Accounting, Petchabun; 2014.