CAPACITY BUILDING THROUGH ACTION RESEARCH: A CASE STUDY OF WASTE MANAGEMENT AMONG MIGRANT WORKERS IN A FACTORY WORKER CAMP IN HAT YAI CITY, THAILAND

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Abstract

Despite ensuring that compliance with international labor standards is crucial to Thai export-oriented manufacturers who employ migrant workers, relatively little is known about how to manage an effective program for the well-being of migrant workers. The objective of this study was to encourage all key stakeholders to work together for a remediation plan to solve an existing problem through action research. The method of action research needs to be applied to develop a continuing learning process, action for change which includes group decision, and a commitment to improve real situations. The study was carried out in a migrant worker camp of the large seafood plant in Hat Yai city, Songkhla Province, Thailand during 2016-2017. Primarily, a tripartite taskforce, that included migrant worker representatives, factory staff personnel, and a governmental health center as academic supporters including the researcher, was engaged to develop a one-year program which consisted of two

phases. Phase I emphasized the taskforce capacity building on community health diagnosis and program management while phase II gave priority to program implementation and evaluation. A solid waste management (SWM) problem was identified and planned for intervention based on two strategies: (i) knowledge and raising awareness and (ii) management of the 3Rs (i.e. reduce, reuse, recycle). The lessons learned and the limitations of the SWM program implementation were evaluated. A before-after intervention analysis was performed to determine the program effectiveness and illustrate the incremental changes of knowledge, attitude, and practice of the 3Rs. Likewise, waste weight, waste per capita, cost of municipal waste elimination, revenues from sales of recycling material, and the number of animal vectors from the SWM program were evaluated. This study affirmed the feasibility of capacity building through action research and its benefit to enable the effectiveness among registered migrant workers in the export manufacturing sector.

Keywords: Capacity building; community diagnosis; program management; waste management; action research; migrant workers

Introduction

Over the past decade, Thailand has become the country in the greater Mekong sub-region to offer more employment opportunities and higher wages than any of its neighbours (Soonthornthada, 2015). Migrant workers, mostly from Myanmar, are employed in manufacturing, construction, service industries, agriculture, and fisheries (Tangcharoensathien et al., 2017). In 2018, about 1.95 million migrant workers were legally registered in Thailand (Foreign Workers Administration Office, 2017), yet the number of undocumented migrant workers from neighbors was estimated to be another million (ILO, 2013). This has occurred because the Thai economy is heavily export-dependent and the unskilled or semiskilled labor force is insufficient as Thailand transitions toward an aging population (Kanthawee et al., 2014; Kohpaiboon and Wongcharoen, 2015).

All over the world, labor provisions in bilateral and regional trade agreements have tended to include trade sanctions and trade-incentive approaches as tools for migrant labor protection (ILO, 2017). Consequently, Thai export-oriented manufacturers must comply with international standards and regulations. Despite the challenges to find more effective, sustainable, and comprehensive methods for Thai exporters in the industrial sector, no study has advanced an understanding of how to manage effective programs for industrial migrant workers in Thailand. Based on a local and international literature review, successful programs among migrant workers addressed the key success factors on capacity building of involved partners, stakeholder collaboration and networking, migrant worker participation and empowerment, communication and dissemination of mass media, and culturally adapted intervention (Chaichana et al., 2018).

To capture an appropriate program with the above-mentioned features, action research is considered a powerful tool for onsite real-time research involving a tripartite of stakeholders that includes the migrant workers, factory staff personnel, and relevant governmental representatives.

Moreover, the nature of action research on seeking and solving problems with collective and self-reflective inquiry consistently throughout the research duration, leads participants to work in partnership for action to change based on the local context or new data, cultural and social concerns, including empowerment of growth, and the capabilities among all involved partners (Baum et al., 2006; Eden and Ackermann, 2018). This paper aims to describe the process and lessons learned by the key stakeholders in a large seafood factory in Hat Yai, Thailand to develop an effective program through capacity building on community diagnosis and program management via action research. The effectiveness of the program is also elaborated in this study.

Methods

This action research was conducted among migrant workers in a worker camp of a large seafood processing operation located in Hat Yai during January 2016 to December 2017. Hat Yai is the largest district in Songkhla Province. It is the economic center in the southern region covering various branches of business, service, and manufacturing industries, especially rubber and seafood production. Due to workforce shortages, the processing industries in Hat Yai employ migrant workers from Myanmar, Cambodia, and Laos under bilateral memorandum of understanding (MoU) agreements of the governments. The number of MoU workers in Hat Yai city and Songkhla province were 18,171 and 32,446 consecutively. About five factories provided migrant worker camps with the population size of the camp ranging from 2000 to 4000. After introducing a tentative action research program to the factories to solve problems in worker camp, one seafood factory with all MoU migrant workers, expressed their interest to collaborate with our action research.

This section describes the process which the first author worked with tripartite partnerships through repeated cycles of action research from initiating and engaging the taskforce, selecting health problem, developing and implementing the program. The details are as follows:

Engagement of taskforce

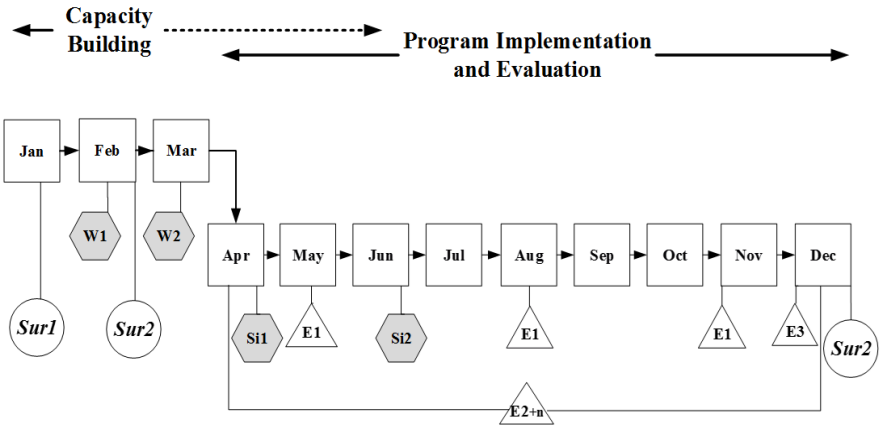
A partnership between the factory staff personnel and migrant worker representatives was developed by the organization of the worker camp committee (WCC) in 2015. The WCC was composed of 9 migrant workers elected by all camp residents for a two-year term and 4 Thai staff personnel nominated from the factory executives. Through a discussion of needy issues for an action program, the WCC chose the issues of health as the entry point because labor standards and human rights are strict requirements from their trade partners. The WCC could not yet specify health problem and agreed to perform the preliminary study in the next step. During January to October 2016, a collaboration between WCC and the researcher evolved mainly through the two cycles as a 6-month formal and informal contacts for identifying local needs and concerns of daily problems inside the worker camp and a 4-month preliminary study. Meanwhile, a partnership with a nearby primary health centers (PHC) was also initiated because they were considered a primary care contactor under Thailand's social security and worker's compensation fund for legal migrant workers under MoU. Successively, the taskforce was organized, consisting of 16 members: 13 WCC members, 2 PHC personnel, and the first author. The WCC chairman, who has Myanmar nationality, was also appointed as the taskforce chairman.

Program development and implementation

A preliminary qualitative study was conducted using a semi-structured questionnaire, field observations, and a documentary review from a computerized database available at the factory and two PHCs. Interviewees included 7 WCC members (3 factory staff personnel and 4 migrant workers) and 2 PHC staff personnel. The collected data included information on the residential housing and its living conditions, welfare and facilities, administrative organization of the worker camp, and common health problems. The finding revealed a total of 2,260 migrant workers under MoU in the worker camp and almost all were of Myanmar nationality. Their accommodations consisted of 21 two-storey apartments with a total number of 1,092 rooms with

a living space of 9 m^2 per room, as well as outside common kitchens and common bathrooms/toilets. The maximum number of workers per room could not exceed 4 persons. The rent was 300 THB per room, excluding electricity. Either male or female workers shared the same apartment while couples could live together, but not their children. After giving birth, the couple has to move out to rent private apartments. The secondary data from a medical room in the factory showed that the most common diseases among the camp residents were respiratory disorders (20.5%) followed by musculoskeletal disorders (17.1%), gastrointestinal tract disorders (15.9%), circulatory system diseases mostly hypertension (11.3%), and obstetric complications (6.7%).

The results from the preliminary study were reported in a taskforce meeting. In the process of selecting the problems, the tripartite committee made the decisions based on their own experiences or organization issues or both. For example, the factory staff personnel focused on the high pregnancy rate among the migrant workers while migrant workers proposed improvement of the factory medical room. On the other hand, PHC staff personnel placed emphasis on diseases that required epidemic control. After facing difficulties caused by disparities in their knowledge and experience, the taskforce intuitively perceived that not only identification of irrelevant problems but also a dissensus of problem prioritization might affect the goals and courses of actions for further program development. Therefore, they drew upon capacity building on community health diagnosis to address priority health needs. Moreover, they envisaged capability building on program management underpinning the Plan-Do-Check-Act (PDCA) cycle to empower the team as an effective approach for problem solving and continuous quality improvement. Furthermore, the taskforce explored a planned process and set two objectives for the program to identify and prioritize health problems among the migrant workers and develop and implement an appropriate program to solve the selected problems. Consequently, a one-year program consisted of two phases. Phase I consisted of capacity building of the taskforce (3 months) and phase II consisted of program implementation and evaluation (9 months) (Figure 1). It was launched in January 2017.



When:

Sur1 -1st survey for 49 health indicators; Sur2 -2nd survey for information relevant to prioritized problem both before and after the program intervention period

W1 -1st workshop on community health diagnosis to identify and prioritize the health problems; W2 -2nd workshop on program development and management

Si1 -1st site visit; Si2 -2nd site visit; the dashed line represents the flexible timing of both site visits

E1 -evaluation of taskforce participation; E2+n -performance evaluation of every project throughout program intervention period; E3 -evaluation performance of the whole program

Figure 1: A One-year Program Developed During Engagement of the Tripartite Workforce

Phase I - Capacity Building of the Taskforce:

This phase consisted of two workshops. A one-day *workshop I on community diagnosis* provided information on the community health diagnosis process, data collection, health indicators, and its interpretation, and setting the priorities. A three-day *workshop II on program management* focused on problem solving procedures based on iterative management of the PDCA concept that entailed definition of the program, project and activities,

how to formulate, manage, coordinate, and evaluate program which consisted of several related projects. The main purpose of the first workshop was to define problem for program development while the second workshop was to create, select and merge a variety of solutions into a program especially knowledge and skill for implementation and evaluation of the program.

To ensure that the workshops were beneficial, the researcher prepared bilingual and hand-on learning materials as supportive tools and enrolled the taskforce in the survey (Sur1, Sur2) as a preparation part of each workshop. Likewise, many techniques were used in the workshops to promote maximum involvement in the learning process of all participants, such as interactive activities and exercises, working and sharing feedback in different-size groups, and project writing and presentation. Site visits were also scheduled in the plan.

Subsequently, solid waste problem was obtained from the first workshop while the second workshop yielded 3 strategic plans with 5 projects for solid waste management (SWM) program.

Phase II - Program Implementation and Evaluation:

The taskforce planned a monthly meeting at which they shared reflection and action on how the program carried out, separating the tasks, staffing each member for his/her job, evaluating outcomes and identifying activities that should be added up or terminated both for program intervention and evaluation. The group discussion with process evaluation were deployed to take forward in line with PDCA model during 9-month cycles. Conforming to program plan in Figure 1, the timing of both process and product evaluations to capture information reflecting program functions was designated as follows:

- Process evaluation: taskforce participation and sense of ownership (E1) every three months; project satisfaction (E2+n) as assigned in accordance to its intervention period

- Product evaluation: knowledge, attitude, and behaviour including other information in relation to the selected problem using a pre- and post-cross sectional design with the systematic random sampling method of 340 subjects (Sur2), and program satisfaction (E3) at the end of program.

Ethical Considerations

The study was approved by the ethics committee of Health System Management Institute-HSMI (EC 011/59), Prince of Songkhla University.

Data Analysis

In this study, series of PDSA cycles were planned in regarding that the central feature of action research is PDSA for more than one cycles. During entrapment of taskforce and program development and implementation process, the researcher planned to work with the tripartite taskforce for at least two cycles. Additionally, a series of PDSA cycles in a 4-month capacity building phase via two workshops and a 9-months program intervention phase were also planned to create opportunity for shared reflection and action at least six to seven cycles. For each action, a monthly meeting of taskforce reviewed outcome and progress, summarized learning experience, evaluated the alternative solutions and either extended, discontinued or modified activities for the next cycle. Both qualitative and quantitative data were also planned as input for each monthly brainstorming.

For qualitative data analyses, the researcher performed daily field notes, informal observation and interview and employed analytic induction and content analysis. The quantitative data of Sur1, Sur2, E, E2+n and E3 were analyzed using descriptive statistics such as percentage, means and standard deviation, and median and interquartile range. The before and after program outcomes was compared using *t*-test, chi-square test, and Wilcoxon signed-rank test. The analysis was performed using SPSS statistics Bass 17.0 for Windows EDU S/N 5065845 (SPSS inc. Chicago USA).

Results

Phase I: Capacity Building of the Taskforce

Workshop I: community health diagnosis

Along with the first survey (Sur1) before workshop I, the taskforce assigned three Myanmar workers who had permanent jobs as camp interpreters to work throughout the program. Among 1092 rooms in 21 apartments, 340 rooms were recruited as planned and one person from each room was randomly

selected for data collection on the household health profile. The findings revealed the basic characteristics of 340 subjects as follows: Myanmar nationality 97.6%, women 57.9%, age group of 25-45 years 69.4%, marriage status 62.6%, Buddhism 98.5%, education level of primary to high school 92.7%, having household members of 2 persons 89.7%, and an average stay in worker camps of 4 years. The data also yielded information on 49 health indicators categorized into 6 groups as vital statistics, disease and accident, health promotion behavior, housing and environment, food sanitation, and reproductive health. Of all 49 health indicators, 26 indicators addressed ongoing health problems (Table 1).

Table 1: Health Indicators and Top-five Priorities of the Factory Staff Personnel and Migrant Workers in the Taskforce from Workshop I

Health Indicator	Survey value	Standard value*	Priorities	
			Factory personnel	Migrant workers
1. Vital statistics and baseline data				
Birth rate (per 1,000 population)	13	12		
Death rate (per 1,000 population)	0	8		
Natural increase rate (per 1,000 population)	13	4		
Immigration rate (per 1,000 population)	4.7	1		
Out immigration rate (per 1,000 population)	4.7	1		
Infant mortality rate (per 1,000 living birth)	10.3	6.4		
Stillbirth rate (per 1,000 population)	3.4	3.7		
Income (THB/person/year)	>86,400	>30,000		
Health insurance and medical treatment (percentage)	100	98.3		
2. Incidence of disease and illness in previous year (per 100,000 population)				
Work-related accident rate	179.0	102.5		
Other accident rates	141.0	60.9		
Traffic accident rate	41.0	18.1		
Diarrhea	1,872	1,756.5		
Tuberculosis	900	171	3	

Table 1: (continued)

Health Indicator	Survey value	Standard value*	Priorities	
			Factory personnel	Migrant workers
Malaria	6,200	6.5		
Syphilis	900	3.1		
Diabetes mellitus	67.5	175.3		
Hypertension	53.0	109.5		
Peptic ulcer	62.0	362.5		
Depression	333.3	18.0		
Suicidal attempt	14.7	35.0		
3. Health promotion behaviour (Percentage)				
Condom use with casual partner	78.6	57.0		
Helmet wearing both for driver and pillion rider	88.9	100		4
Physical activity	24.1	60	4	
Tobacco consumption	83.5	90		
Alcohol consumption	87.4	90		
Energy soft drink consumption	73.2	32.3		5
Self and over-the-counter medication	80.5	0	1	3
Annual health checkup	75	95		
4. Housing and environment (Percentage)				
Durable and secured households	100	100		
Adequate home ventilation	87.3	95		
Adequate home ambient light	98.2	95		
Keeping house neat and in order	-	95		
Disturbed by insects or pests (cockroach, rats, flies)	91.5	5	2	1
Appropriate waste management	35.9	95	5	5
Safe water sufficient for drinking at least 5/liters/person/day; for domestic use at least 45/liters/person/day	99.7	95		
Enough water to use throughout the year	100	95		

Table 1: (continued)

Health Indicator	Survey value	Standard value*	Priorities	
			Factory personnel	Migrant workers
5. Food sanitation (Percentage)				
Food safety	82	95		
Use serving spoon when eating in group	81.1	95		
Eating newly cooked food	79.3	95		
Washing hand before eating	74.9	95		
Washing hands after toileting	78.7	95		
Use topper to cover food	99.4	95		
Appropriated containers for food storage	99.4	95		
Iodized salt uses	99.4	95		
Use monosodium glutamate	98.5	70		
6. Reproductive health (Percentage)				
Contraceptive use in married couples	87.8	70		
Criminal abortion	8.9	19.5		

*Basic-minimum-needs (Community Development Information Centre, Community Development Department, 2016)

In workshop I on community health diagnosis, the taskforce received information from the survey data, bilingual booklet on community health diagnosis, and the setting of priorities that included brief tutorials as necessary. The main practical work was interpreting health indicators, identifying health problems, and prioritizing the problems using 4 components: magnitude, seriousness, feasibility, and community participation. It was noted that the workshop was carried out separately for factory staff personnel and migrant workers due to time constraints. During the workshop, the problem of opinion domination was obvious among the migrant workers. For instance, prior scorings or opinions often had a dominating influence on the entire group when setting the priorities. To ensure that every participant provided his/her input, the facilitator asked each member to simultaneously raise their fingers

for scoring in the first round, then sharing their views in the second one. This method enabled all participants to freely express their opinions.

As expected, the results of the top-five priorities were different between the groups (Table 1). When the priorities between the two groups were compared, the issues 'affected by insects or pests' and 'self- and over-counter medication' were both listed as the first and second priorities but in swapping order. The factory staff personnel listed tuberculosis as the 3rd priority because of the sporadic outbreak of tuberculosis in nearby factories. However, migrant workers listed 'not wearing a helmet when driving' as the 3rd priority. Neither group, however, listed serious infectious diseases (i.e. tuberculosis, malaria or syphilis) as high priorities. They knew that the Ministry of Public Health had implemented nationwide health screening and surveillance for communicable diseases for migrant workers when they applied for a work permit which included active follow-up of disease cases. The 4th and 5th priorities were 'not segregated waste' and 'not sufficient exercise' in swapping order as well.

In a meeting the taskforce chairman brought up the issue of navigating the differences in prioritizing the problems. Since the workers might not express ideas that opposed those of the factory staff personnel, a brainstorming approach was introduced to allow each one in the group to share their best ideas but not to criticize the opinions of others. After brainstorming, the group decided to place the problems into 2 groups: (1) 'affected by insects or pest' as a result of 'poor waste management' and (2) 'self- and over-counter medication', 'not wearing a helmet when driving' and 'insufficient exercise' as health behavior problems. By a vote of 15 out of 16 members, it was decided that waste management would be chosen for program development.

Workshop 2: Program management

In order to capture SWM situation before developing an action program, the taskforce worked together in both the design of the bilingual questionnaire and data collection. The second survey (Sur2) yielded data on current knowledge, attitude, practices on SWM, barriers of waste segregation, willingness to participate, and preferable roles or activities for their participation. The key findings from the survey showed that 16.8% of the

camp residents segregated recyclable waste, 28.6% segregated hazardous waste, and 53.8% segregated wet waste. Moreover, the survey revealed these hindrances of waste segregation: insufficient waste bins (43.5%), unclear labels on the bins (43.8%), and lack of knowledge on solid waste segregation (32.4%).

Likewise, the survey data, bilingual booklet on practical and step-by-step program formulation, implementation and evaluation through the PDCA model were distributed to the taskforce. After closely scrutinizing data, the taskforce gained insights on barriers causing failure in the waste segregation project launched in late 2015. In the past, the factory provided a two-bin system at particular waste collection points at all apartments: a blue bin for wet waste and a yellow bin for dry waste. After segregation, the camp residents had to dispose recyclable and hazardous waste at a recycle center. The distance from each apartment to the center ranged from 25 meters to 400 meters which was considered inconvenient. Consequently, the camp residents threw all dry, recyclable, and hazardous waste in the yellow bins until they were full and overflowed every day. Finally, they dumped dry waste into the blue bins which disrupted the daily wet waste collection service which was provided free-of-charge by the municipality. Through the discussion, they realized that the wet waste not only caused smelly odours and attracted insects and pests but also caused the factory to spend more money because of the municipal weight-based pricing system for waste removal. In addition to problem identification on insufficient infrastructure (i.e. bin system, inadequate labelling, regulations and rules), lack of knowledge, poor cooperation and engagement, the taskforce formulated two operational plans and 6 projects for the SWM program (Table 2) while a third plan focused on program evaluation.

Unfortunately, the two PHC staff persons left the taskforce after workshop II because the camp residents preferred medical service after working hours. However, the official working hours of the PHC was 8:30 a.m. to 16:30 p.m. Therefore, the migrant workers did not register for health care as planned.

Table 2: SWM Program from Workshop II

Strategic plan	Project	Activities	Time	Recipients
1. Raising knowledge and awareness	Raising knowledge	Daily 20-minute talk via local public address system available in worker camp	Apr-Dec	camp residents
		30-minute weekly group tutorials on the 3Rs method with demonstrations and brief presentations on waste segregation into wet, recyclables, non-recyclables, and hazardous waste. Outdoor cinema and various rewards were used to motivate camp residents	Apr-Jul	Ranged from 250-300 participants/tutorial x 16 tutorials
		Door-to-door visits with distribution of brochures by the taskforce to facilitate practical problem solving on waste segregation and promotion of the elements of the 3Rs	Apr-Jun	1,092 rooms
	Raising awareness	Poster, signs, photo watch (taking a photo of best and worst practice), bulletin board for public relations linked to the ongoing promotion theme and overall program	Apr-Dec	camp residents
		Exhibition on waste management consisting of performance-based 3Rs, slogans, and upcycling innovative contest, quiz, games, and recreation activities	Sep	352 participants

Table 2: (continued)

Strategic plan	Project	Activities	Time	Recipients
2. 3Rs waste management	4-bin system for recyclable waste	Bin system design (i.e. number, coloring, labelling, and collection location) based on 4 waste types as wet, non-recyclable, recyclable, and hazardous waste; making contact with municipal service for collection of wet, non-recyclable, and hazardous waste; making contact with private waste dealer for recyclables sales	Apr-May	camp residents
	Reuse and reduce into practice	Group teaching by professional instructor from career development center on "how to reuse everyday items" (e.g., basket from aluminum cans, handbags from jeans, tote bags from T-shirts, hair bands and hair clips from plastic bottle)	May-Jun	Ranged from 50-90 recipients x 3 classes
		Seeking cooperation from a grocery store inside the worker camp to cut down on use of plastic bags	Apr-Jul	Can't evaluate
	Recycling for Buddhist charity	Donation revenue from sale of recycling materials for Buddhist robes offering or "tod phapa" ceremony on behalf of migrant workers	Jun and Sep	camp residents

Table 2: (continued)

Strategic plan	Project	Activities	Time	Recipients
3. Program evaluation	Process evaluation	Summary of information from assessment tools for feedback of each project in a monthly taskforce meeting; example of assessment tools such as project performance questionnaire (E2+n), taskforce participation questionnaire (E1), some new assessment tools developed during intervention such as photograph taking, checklists, and behavioural observation forms	Apr-Dec	-
	Product evaluation	Knowledge, attitude and practice (Sur2), secondary data from financial records such as waste weight for municipal collection and elimination, revenue from sales of recycling materials, and number of insects and pests were all analyzed before and after the intervention		

Phase II: Program Implementation and Evaluation

Program implementation

The first operation plan was to raise knowledge and awareness on the SWM program including cooperation and engagement. Each taskforce member was scheduled to give a 20-minute weekly talk via local public address system focusing on ideas, attitudes, and better practice of the elements of the 3Rs. Since wet waste segregation was a core issue, the taskforce arranged the first field trip to a municipal bio-waste composting plant to gain insight into complete wet waste management. This in turn gave the taskforce the confidence to communicate on wet waste management. Since a cornerstone of a program is successful marketing, a talk also included advertising and promotion of the ongoing program activities. Meanwhile, the campaign to raise awareness released several forms of media that included posters, signs, and a bulletin board according to the project timeline. For highly interactive learning, weekly group tutorials and door-to-door household visits by the taskforce at which demonstrations and counselling were provided on how to segregate waste at the source into wet and dry waste, how to segregate dry waste into recyclables, non-recyclables, and hazardous waste. Furthermore, discussions were conducted on the locations of communal bins in different colours.

The second operation plan was aimed at putting the 3Rs elements into practice. Project implementation started with the taskforce visiting a community with a successful SWM program. The community was a municipal area with a successful record of using different methods and techniques for household segregation at the source, waste storage, and collection for hazardous, recyclables, and non-recyclables. The visit also included home composting of organic waste for bio-fermented or organic fertilizers. Tacit knowledge obtained from visiting the site promoted the taskforce's understanding on the full system of SWM from management, technology, and infrastructure perspectives. Subsequently, to solve the problem of not having an adequate number of bins, the taskforce deliberately embarked on a new bin system in parallel with the activities of promoting awareness on waste segregation. They explored the ideas from the camp residents on the bin system in terms of quantity, color, labeling, collection points, and waste collection day. The camp residents finally designed the collection system of 4 bins. Wet waste would be collected daily, non-recyclable waste would be collected weekly, recyclable waste would be collected monthly, and hazardous

waste would be collected once every 3 months. They also opted for bin labeling using colors, pictograms, and bilingual text including locations for waste collection. Afterwards, the taskforce conducted correction feedback using a prepared checklist and taking photos for non-compliance practice in the recycling process as well as rewards and social recognition for best practice in public places as reinforcing feedbacks. The aforementioned feedback information and revenue from the sales of the recyclable materials were communicated via bulletin boards on a monthly basis. Most interesting was the donation of the revenue from recyclables sales for a Buddhist charity called 'tod phapa' which played an important role in boosting recycling practices, harmonizing camp residents, and creating an organization atmosphere throughout the whole program.

On the other hand, the first training session on "how to reuse everyday items" by a team from a vocational training center drew the attention of only 85 residents who were mostly women. Some taskforce members pointed out that the products of reusable materials, such as handbags, tote bags, and hair bands, seemed too feminine for male workers, while some people pointed out the weak advertising of the project. Given that the project was originally planned to use peer tutorials by asking the first group of trainees to teach their friends, the next two classes proceeded with even fewer participants. This project was finally terminated. For waste reduction, the taskforce sought cooperation from one grocery store inside the worker camp to reduce the use of plastic bags. However, the campaign in the first operation plan highlighted waste reduction alternatives such as bringing ones' own bags when shopping, reducing the use of plastic bags and foam containers, and buying refill packs. The taskforce implemented outcome measurements by observing the number of camp residents with waste reduction behavior at the grocery store and the market, and discontinued the activities after they questioned its validity. Thereafter, the taskforce implicitly consented that a critical gap of knowledge and technique to reuse and reduce waste materials might have restricted innovative interventions and proper evaluation methods.

Program evaluation

The 3rd operational plan included both process and product evaluation of the program. For the *process evaluation*, a description should be first given of how the taskforce was organized, managed, led, and controlled all of the related projects. Basically, six project teams consisted of 2-3 voluntary taskforce members in each team who were organized to initiate, execute, monitor, and measure project progress as planned. To monitor all related projects under the

program, the taskforce assigned a catchment zone of 2-3 camp apartments to each member to distribute information and advice, campaign certain issues, and communicate the opinions of the local tenants in relation to the ongoing program. The main vehicle for program control was a monthly meeting where the taskforce used a combination of numerical measurements of project evaluation questionnaires (E2+n) and semi-structured questionnaires to feedback on project delivery and practical problems encountered, and to take immediate corrective actions. The meeting was also used to determine task breakdown, interfacing between the projects and their synchronization, design of the control process and instruments as needed as well as communication on the peculiarities of the program. For example, various tools were developed to facilitate better management such as checklists, taking photos, and giving rewards for waste segregation best practice. The reuse activity was terminated due to a lack of interest in the majority of the camp residents. The SWM exhibition was rescheduled on the same day as the Buddhist charity or "tod phapa" to maximize the project efficiency since this first-class event could attract a large number of camp residents.

Originally, *product evaluation* was planned using only variables from the second survey (Sur2) and program satisfaction questionnaire (E3) in accordance with the before-and-after design. In a subsequent discussion during intervention, the taskforce exercised other parameters to be more objective and more accountable to reflect the program effectiveness such as waste weight, waste elimination cost, and revenues from the sales of recyclables. Since the factory purchased municipal service for waste removal, they were allowed to use the available data on the weight of the waste and the cost of waste removal and elimination. Indicators for animal vectors from waste were also introduced.

Table 3 shows that the knowledge and attitude on SWM among the camp residents were significantly higher after the program intervention, except waste types and perception on susceptibility and severity. In practice, they increasingly segregated all kinds of waste materials but only changed significantly in hazardous waste. Regardless of the insufficient effort in the reuse and reduce project, the camp residents improved their practice on basket or cloth bags use and refused to use foam boxes when shopping but there was no significant change in the reuse practice. Figure 2a illustrates that the total amount of general waste per month and general waste per capita per day decreased significantly after the program intervention. Correspondingly, there was a downturn in the costs for

municipal waste disposal and an upturn of revenues from recyclable sales which were statistically significant in the before-and after-design analyses during the 9-month program (Figure 2b). To monitor animal vectors, highly infested areas underwent observation using appropriate tools in accordance with the guideline book from the Ministry of Public Health. The intervention led to a significant reduction of animal vectors-based indicators (Table 4).

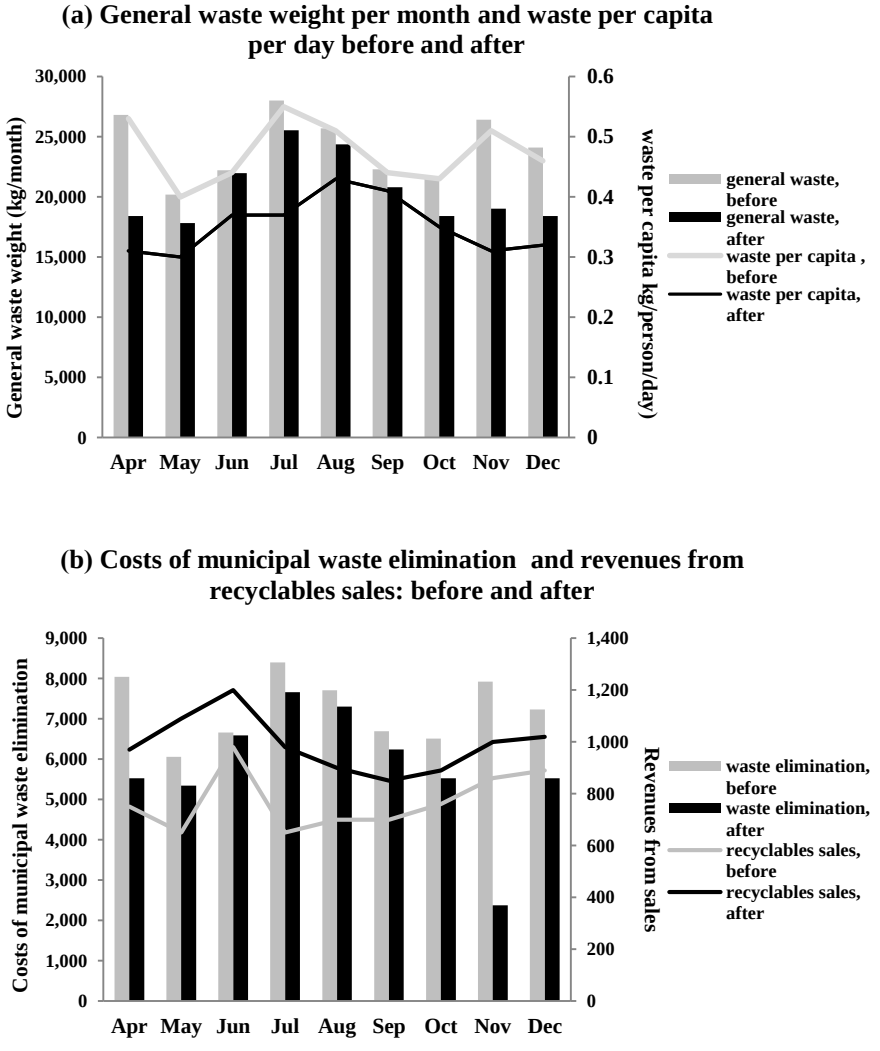


Figure 2: Comparison of before and after Program Intervention

Table 3: Changes in Knowledge, Attitude and Practice of the Before and After Program Intervention (n=340)

	before	after	p-value[a]
	$\bar{x} \pm sd$		
Knowledge (full mark)			
Type of waste (4)	2.4 ±0.9	2.5 ±0.8	0.146
Management (5)	3.1 ±1.3	3.5 ±0.9	0.000
Effect (5)	3.3 ±1.0	3.6 ±0.8	0.000
Animals that cause diseases of waste (3)	1.5 ±0.8	1.7 ±0.8	0.000
Attitude (full mark)			
Perceived susceptibility (20)	14.6 ±5.2	15.1 ±3.3	0.144
Perceived severity (20)	19.4 ±6.8	20.2 ±4.6	0.055
Perceived benefits (20)	15.1 ±5.3	16.4 ±3.6	0.000
Perceived barriers (10)	5.4 ±2.9	4.9 ±2.9	0.010
Perceived self-efficacy (15)	11.1 ±4.0	12.1 ±3.2	0.000
	Person (%)		**p-value[b]**
Practice			
Waste segregation			
Wet waste segregation	183 (54.4)	206 (60.6)	0.082
General waste segregation	175 (51.5)	193 (56.7)	0.166
Hazardous waste segregation	97 (28.6)	152 (44.7)	0.000
Recyclable waste segregation	57 (16.8)	64 (18.8)	0.483
Reduce			
Cutting down plastic bags	156 (45.9)	235 (69.1)	0.000
Use a basket or cloth bag when shopping	85 (25.0)	118 (34.7)	0.006
Buy refill products	189 (55.6)	170 (50.0)	0.133
Refuse foam boxes	59 (17.4)	94 (27.6)	0.001
Reuse			
Reuse glass bottles, plastic bottles	93 (27.4)	87 (25.6)	0.586
Reuse plastic bags	97 (28.6)	98 (28.8)	0.932

[a] independent t-test; [b]chi-square test

Table 4: Changes of Indicators for Animal Vectors from Waste, Before and After Program Intervention

Indicators for animal vectors[#]	Timing	Total samples	Animal vector counts	p-value[*]
No. of rat footprints per tile [a]	before	15 tiles	1, 6, 5, 1, 7, 0, 8, 4, 11, 7, 9, 2, 0, 0, 6	0.000[*]
	after	15 tiles	0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0	
Average no. of flies counted per grill [b]	before	15 grills	3, 7.5, 0.5, 2, 7.5, 3,1.5, 0 ,3.5 ,0.5 ,1, 4.5, 0.5, 3.5, 4.5	0.005[*]
	after	15 grills	0, 0, 0, 1, 1, 0, 1.5, 0, 0, 0, 1, 0, 1.5, 0, 1.5	
No. of cockroaches collected per trap [c]	before	15 traps	1, 1, 1, 0, 0, 3, 2, 0, 2, 1, 1, 1, 1, 1, 0	0.031[*]
	After	15 traps	1, 0, 0, 1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 1, 0	
Percentage of water holding containers infested with larvae [d]	before	667 containers, 5 areas	3.3, 0, 16, 29.2, 0	0.109[**]
	After	601 containers, 5 areas	0, 0, 0, 3.6, 0	

[*]Wilcoxon signed-rank test, [**]chi-square test

[#]all methods in according to Ministry of Public Health (Bureau of Environmental Health, 2016)

[a] measured by tracking tiles technique (a 23 × 23 cm white rubber tile painted with half black ink was placed at the point of anticipation of rodent path, then rodent mouse footprints were counted)

[b] measured by fly grill count technique (a 24 × 24 inches grill painted in bright color was arranged in a square shape to attract the flies. The number of flies landing on the grill was counted twice at 30 second intervals and then calculated for a mean value)

[c] measured by jar trap method (a wide mouth jar according to the size of the cockroach trap was placed at the expected point and then counted the number of cockroaches trapped

[d] measured by Container Index (CI), calculated from $100\% \times \frac{\text{no of containers with Aedes aegypti larvae}}{\text{total no of surveyed containers}}$

Discussion

This study revealed the value of the action research approach to achieve changes in a migrant worker camp of a large-scale factory. It has been acknowledged that the strength of action research is based on the generation of a program that solves practical problems. Moreover, it empowers pertinent practitioners to engage in the spiral cycles of planning, implementing action, observing current evidence, and critical reflection in order to improve the effectiveness of their own practices in their own context (Phalasuek et al., 2018; Ampansirirat and Wongchaiya, 2018; Eden and Ackermann, 2018). In this study, the taskforce of a tripartite partnership made up of migrant workers, factory staff personnel, and primary health center personnel outlined the first step to develop the program. The practical problems confronted during the program formulation, such as disparity in problem identification and different perspectives on program development and management, made them struggle to find the relevant knowledge and skills to complete the job. The capacity building phase in the program plan thus reflected the taskforce's action to improve their capacities for problem solving. The findings of the study found that partnership and capacity building played coactive roles in bridging the gap of inadequate knowledge, technology, and resources at the personal and organizational levels, was in line with previous studies (Lederer et al., 2015; Mohamad et al., 2013; Nguyen-Viet et al., 2018).

Furthermore, the capability of the taskforce for program management was expedited during phase II of the program by underpinning the PDCA approach to generate iterative cycles of reflexive monitoring and collective actions in the regular monthly meetings (Chakpitak, 2015). Of note, the ongoing dynamics of taskforce interaction throughout the SWM program showed more cooperation than confrontation in making decisions. Apart from that, each taskforce member worked in the WCC. This was possibly the reason for the sense of an organizational culture in the manufacturing industry which involves teamwork, active participation, and correction action, especially the challenge of quality assurance warranty for international labor standard (Dhiravegin, 2017; Srisuntisuk and Boonrugsa, 2018).

According to the evaluation woven into the design of the program, the effectiveness of the SWM program was assessed by subjective outcomes which showed positive incremental changes in knowledge and attitude, even though the 3Rs behaviors were ambiguous. This was partly explained by the ineffectiveness of the reuse and reduce project. Moreover, the high proportion of recycling behavior was evident before the intervention, which could not be promoted to exceed its maximum compared to other newly introduced behaviors such as hazardous waste and wet waste segregation. However, the objective outcome that evaluated general waste weight, financial report on waste disposal cost, and revenues from the sales of recyclables including indicators of animal vectors from the waste showed significant program effectiveness. In this study, the effectiveness of the program played the role of driving all partners to regularly engage in cognitive participation in planning, reflective monitoring, collective action, and stimulating social mechanisms in the context of a worker camp (Tripp, 2005). The evidence of donating revenue from the sales of the recyclables boosted the program effectiveness. This also supported the flexible nature of the action research which allowed the intervention project to be autonomously adapted and applied in a community cultural and social context (Lekdamrongkul et al., 2012; Ramaiya et al., 2017; Tsarouk et al., 2007).

The key features that enhanced the workshop effectiveness of the taskforce are worth mentioning. First, to avoid language barriers, the workshop provided bilingual teaching materials with eye-catching images and Burmese and Mon language interpreters. It was helpful that one Lao person and one Cambodian person who were in the taskforce could speak and read the Thai language. Second, the workshop applied interactive learning techniques with a hands-on approach and precise content pertinent to the current problematic issues since the facilitator split the workshop into several sessions and tailored each one as needed. Third, the workshop enhanced the data-based decision making practice by enrolling participants in questionnaire preparation, data collection, and data utilization for both workshops. The evidence-based approach has recently been recommended and is a beneficial aid in decision making tailored to program formulation and effective evaluation (Anderson et al., 2005; Leach et al., 2018). Actually, the taskforce adopted these fruitful skills

to gather information when in doubt which created innovative evaluation tools and evaluation of the objective outcomes during phase II of the program.

However, since the PHC staff personnel left the taskforce after workshop II, the success of the program was limited in building a partnership with the academic supporter. This possibly affected the capability of the taskforce in the long run; however, it did not jeopardize the effectiveness of the program. This was because SWM has been promoted as a national agenda, so the taskforce could easily access technological, institutional, and policy support. Another limitation was poor knowledge and technology of the methods to reuse and reduce waste. This was understandable when we consider that recycling and waste disposal is the predominant practice for SWM in Thailand, whereas the 3Rs technologies are in the budding stage (Ali and Sion, 2014; Dhokhikah et al., 2012).

Conclusion

This action research illustrated that knowledge and skills from workshops resulted in the increase of taskforce capacity and assisted them to identify health problem of concern and to develop program appropriately. Along with the substantiating data form survey pertinent to program design, the program attained its effectiveness considering both process and product indicators. It was of note that the taskforce, in agreement with the factory manager, decided to expand the program to another worker camp at the end of program. In the process, effective and meaningful partnership was essential for sharing skills and resources, addressing and balancing the needs of all partners as well as stability in partnership which had to be sustained until the program was complete. Although public health policy and service systems for migrant workers service might be too rigid, there was a room for flexible partnership of public health staffs to play major role in academic consultation.

Mindset of supportive organizations to improve solid waste problem not only by the factory facing international labor standard for workers wellbeing but also by local municipality confronting with crisis from significant solid waste accumulation was one of key drivers for the effectiveness of SWM program. Besides the policy, the economic factor took considerable part such as

solid waste elimination cost, incentive revenue from sale of recyclables and supportive budget from factory. Other key drivers included action research methodology with its participatory character, its democratic inclination and its contribution for freely flow of social mechanism and sociocultural innovative changes such as the Buddhist ceremony "tod phapa" which was a focal point of the program, positive and negative corrective activities such as observational checklist, rewards/trophy, photography shoot in 3Rs projects, and ultimate concern on language barrier using both bilingual media and three interpreters. Unsuccessful reuse and reduce methods in the study lied in a budding stage of legislations, infrastructure and technology at national level while recycling method were relatively in better shape. Difference of organization culture and workplace labor standard enforcement should be considered when applying our results to real situation.

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References

Ali, N. E. and Sion, H. C. (2014) Solid waste management in Asian countries: a review of solid waste minimisation (3'r) towards low carbon. IOP Conference Series: Earth and Environmental Science 8th International Symposium of the Digital Earth (ISDE8).

Ampansirirat, A. and Wongchaiya, P. (2018) The participatory action research: Key features and appliccation in community. *Journal of Human Sciences and Social Sciences Mahasarakrm university* 36(6): 192-202.

Anderson, L. M., Teutsch, M.S. and Land, G.H. (2005) Evidence-Based Public Health Policy and Practice: Promises and Limits. *American Journal of Preventive Medicine* 28(5): 226-230

Artsanthia, J., Imsorn, P. and Pongauksorn, P. (2016) Best practice for development of community competency in prevention and problem solving in parasite worm: reflective academic service. *Journal of The Royal Thai Army Nurses* 17(2): 175-183.

Baum, F., MacDougall, C. and Smith, D. (2006) Participatory action research. *Epidemiology community health journal* 60: 854-857.

Bureau of Environmental Health, Department of Health. (2016) Control of disease. [Online URL: www.env.anamai.moph.go.th/ewtadmin/ewt/env/main.php?filename=totalbook#article] accessed on August 12, 2016.

Chaichana, S., Pakthongsuk, P. and Kittitornkoo, J. (2018) *Community diagnosis and health management of migrant workers in camps: participatory action*: *Proceedings of the International Research Symposium Series (IRSS) 2018 Conference*, pp. 34- 41. Malaysia: Penang.

Chakpitak, W. (2015) Task process reference model on elderly's lifestyle for cluttered homes of the elderly in Northern Thailand. *Ramkhamhaeng International University Journal* 3(1): 114-116.

Community Development Information Centre, Community Development Department. (2016) *Basic-minimum-needs (BMN) information 2016*. [Online: http://www.cdd.go.th/our-services/] accessed on August 13, 2017.

Dhiravegin, K. (2017) Organizational Culture Affecting Effective Management of Social Enterprises in Organic Food Industry in Thailand. *International Journal of Interdisciplinary Research* 6(1): 111-115.

Dhokhikah, Y. and Trihadiningrum, Y. (2012) Solid waste management in Asian developing countries: Challenges and opportunities. *Journal of Applied Environmental and Biological Sciences* 2(7): 329-335.

Eden, C. and Ackermann, F. (2018) Theory into practice, practice to theory: Action research in method development. *European Journal of Operation Research* 271(1): 1145-1155.

Foreign Workers Administration Office. (2017) Statistics of the number of foreign workers who have received work permits throughout the Kingdom, December 2018.

International Labour Organization. (2013) Thailand-A labour market profile ILO regional office for Asia and the pacific Bangkok: ILO, pp.73.

International Labour Organization. (2017) Labour-related provisions in trade agreements: Recent trends and relevance to the ILO. 328th Session, Geneva, 27 October–10 November 2017.

Kanthawee, P., Pongpanich, S., Meenuck, P., Maiarin, R., Taneepanichskul, S. and Hansudewechakul, C. (2014) Quaity of life, psychosocial health and health care among aging people in Chiang rai province, Thailand: The frist phase. *Journal Health Research* 28(5): 343-352.

Knodel, J., Teerawichichainan, B., Prachuabmoh, V. and Pothisiri, W. (2015) The situation of Thailand is Older population. Population Studies center PDC Research Reports, pp. 1-106.

Kohpaiboon, A. and Wongcharoen, P. (2015) Export Performance of Thailand: What Going on and Upcoming Challenges. *Thammasat Economic Journal* 33(3): 35-65.

Leach, M. J., Canaway, R. and Hunter, J. (2018) Evidence based practice in traditional & complementary medicine: An agenda for policy, practice, education and research. *Complementary Therapies in Clinical Practice* 31(2018): 38-46.

Lederer, J., Ongatai, A., Odeda, D., Rashid, H., Otim, S. and Nabaasa, M. (2015) The generation of stakeholder's knowledge for solid waste management planning through action research: A case study from Busia, Uganda. *Habitat International* 50(1): 99-109.

Lekdamrongkul, P., Pongthavornkamol, K., Chompoobubpa T. and Siritanaratkul, N. (2012) Relationships among information needs, information received, self-care behaviors and quality of life in hematologic cancer patients receiving chemotherapy. *Journal of Nursing Science* 30(3):64-73.

Mohamad, N. H., Kesavan, P., Rasid, A. R A., Hamzah, A. and Khalifah, Z. (2013) Capacity building: Enabling learning in rural community through partnership. *Social and Behavioral sciences* 93(1): 1845-1849.

Nguyen-viet, H. et al. (2018) Research and training partnership to assist policy and capacity building in improving food safety in Vietnam. *Global Food Security* 19 (1): 24-30.

Organizational culture affecting effective management in organic food industry Thailand. *PSAKU International Journal of Interdisciplinary Research* 6(1): 111-115.

Phalasuek, R., Thanomchayathawatch, B., and Songloed, D. (2018) Participatory action research: Development of a participatory process for health promotion in the community. *Journal of Network,of Nursing College and Southern Public Health* 5(1): 211-222.

Ramaiya, M. K., Regmi, U. and Kohrt, B. A. (2017) A Cultural Adaptation of Dialectical Behavior Therapy in Nepal. *Cognitive and behavioral practice* 24(1): 428-444.

Soonthornthada, A. (2015) Migrant Workers in Greater Mekong Sub-Region. *Diversity and social diversity in Thailand 2015*, pp.149-163.

Srisuntisuk, S., and Bonrugsa, T. (2018) The Influence of Myanmarese workers' Organizational Culture Perception on Organizational Commitment in Samutsakorn province. *Veridian E-Journal, Silpakorn University* 11(1): 2368-2385.

Tangcharoensathien, V., Thwinb, A. A. and Patcharanarumola, W. (2017) Implementing health insurance for migrants. *Bull World Health Organ* 95(1): 146–151. [Online URL: www.dx.doi.org/10.2471/BLT.16. 179606] accessed on March 1, 2019.

Tripp, D. (2005). Action research a methodological introduction. Invited theme paper in a special action research edition of *Educao e Pesquisa* 31(3): 444-467.

Tsarouk, T., Thompson, A. E., Herting, J. R., Walsh, E. and Randell, B. (2007) Culturally specific adaptation prevention intervention: An international collaborative research project. *Addictive Behaviors* 32(1): 1565–1581.