TDRI

QUARTERLY REVIEW

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CONTENTS

CAN WE AFFORD A UNIVERSAL LONG-TERM CARE INSURANCE SYSTEM IN THAILAND?

Worawan Chandoevwit
Phasith Phatchana
Wannapha Kunakornvong
Yos Vajragupta*

I. BACKGROUND

Thailand is an aging society. Currently, about 16 percent of the population are 60 years of age or older. This proportion will approach 30 percent in 2035 (UN 2015). An older population is normally associated with long stays in hospitals and high healthcare expenditure. Transition from a healthcare facility to home care among least able elderly people lowers medical expenses substantially (Kim and Lim 2015). Besides improving the quality of life, using long-term care (LTC) services at the end of life can also reduce healthcare expenditure (Holland, Evered and Center 2014).

In 2001, Thailand achieved universal healthcare coverage comprising three different public healthcare schemes. Thailand's healthcare coverage provides comprehensive healthcare benefits ranging from healthcare treatment to prevention and rehabilitation. However, LTC services are not covered under any of three healthcare schemes. A small number of the elderly could occasionally receive some care from community-based volunteers. Most of the elderly who become dependent and need LTC bear their own costs. Some elderly patients with LTC conditions may not want to be discharged from the hospital since receiving care at home is troublesome and they must pay out of pocket for such care. If public LTC services were the patients' choice, hospital resources could be used more efficiently.

Many of the countries in the Organisation for Economic Co-operation and Development (OECD) provide publicly funded LTC, either separately from social health insurance or as part of health insurance schemes (Costa-Font and Courbage 2012; Courbage and Roudaut 2011). Some OECD countries are concerned that aging populations possibly result in expensive LTC. Adams and Vanin (2016) projected that the LTC cost liability in Canada would reach $1.2 trillion in 2046, which would be too expensive for universal public funding. On the other hand, the cost of LTC could be made affordable if the benefits were steeply income-adjusted and the amounts kept low as in the case of France (Doty, Nadash and Racco 2015). The future cost of LTC will vary from country to country. LTC expenditure has been shown to be sensitive to a country's income, the degree of population aging and availability of informal support or care from family members (Costa-Font, Courbage and Swartz 2015). LTC systems have been developed and financed differently based on the institutional and historical settings of countries. Financing LTC can be from mixed sources, including public-private partnership or multistakeholder cost-sharing (Courbage and Roudant 2011; Colombo 2012). Many OECD countries have encouraged home-care settings with independent living in which users share some portion of the total costs (Colombo 2012).

Although many middle-income countries are experiencing demographic transition and population aging, only a few countries have established a public LTC insurance program; for example, in China local governments provide different LTC insurance programs varying in focus and scope to achieve equitable access and reduce financial burdens on the elderly and their families (Yang et al. 2016). While China and Thailand share a common tradition of filial piety, with regard to LTC risk reduction, China has moved more quickly than Thailand in terms of LTC insurance policies.

Public LTC in Thailand is not part of health insurance schemes. A

small private LTC insurance market has come into existence only recently in the Bangkok area. There is no systematic LTC program to help the elderly with their functional disabilities. The government has the perception that the LTC system is too expensive for a middle-income country. Demonstrating Thailand's governmental concern about the rising needs posed by LTC, a small health budget (600-900 million baht in 2016/17) was allocated for community-based care programs targeted at the elderly. Caregivers, mostly female, are volunteer-based, and supervised by nurses working for the Ministry of Public Health.

The objectives of this research are to study the cost of providing home-based LTC insurance and to project future LTC expenditures when the number of dependent elderly persons start increasing significantly. In the context of a possible long-term care insurance system, we recommend a financing mechanism for the system. This careful design of the LTC system can ensure that it will not be developed in a piecemeal manner and will be sustained in the long run (Colombo et al. 2011). The model may be applied to other middle-income countries with a rising level of an aging population.

This paper is organized as follows. Section II contains a description of the method used to estimate the unit cost of home-based LTC, future LTC expenditure, and the LTC financing mechanism. Section III contains an explanation of the data used. Sections IV and V provide the results and discussion, and are followed by the last section, the conclusion.

II. METHOD

We define dependent elderly persons as those who need assistance to perform the "activities of daily living" or ADLs, including self-care (eating, dressing, grooming, bathing, using the toilet, and managing incontinence) and mobility (moving around at home, getting into or out of a bed or chair and climbing stairs). The Barthel Index of Activities of Daily Living (Mahoney and Barthel 1965) is used to assess the severity of dependency of the elderly. The Barthel 0-20 index score is used by Thailand's Ministry of Public Health (MoPH 2015), which classifies dependent elderly persons into two types. The first includes the elderly with scores of 4 or lower; they can perform only very limited ADLs. This type of elderly person is defined as "bedridden elderly." The second comprises elderly persons with scores of 5-11 who need some help to perform ADLs. Their levels of dependency range from moderate to severe. This type of elderly person is defined as "housebound elderly."

Figure 1 provides an overview of the steps of LTC expenditure and cost-sharing estimations. In the first step, we calculate the unit cost of home care. In the second step, we forecast the number of bedridden and housebound elderly. In the third step, we forecast LTC expenditure. In the last step, we estimate the cost shared by multistakeholders.
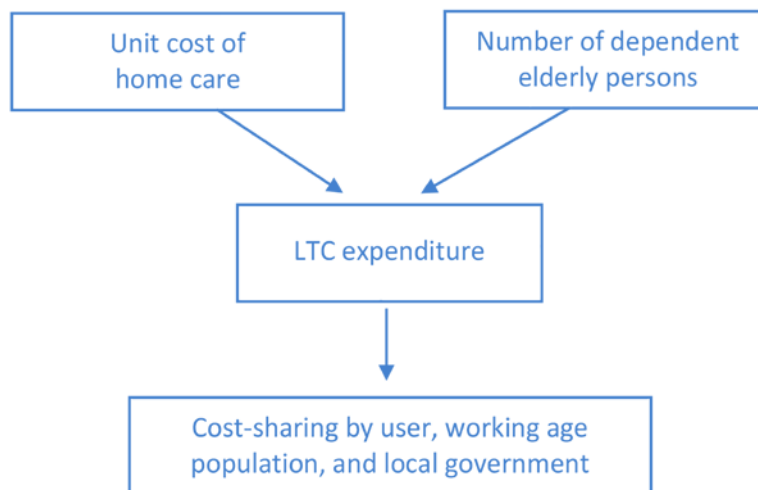
Unit cost of home care

The cost of home-based LTC includes the cost of LTC products (P), equipment, assistance devices (E), disposable material (W), labor costs (L), and travel costs (T). The labor cost is a payment to the caregiver. The travel cost is for caregivers and care managers to visit dependent elderly persons at home.

The monthly cost of LTC products, equipment, assistance devices and disposable material (PEW_Cost) is shown in the following equation:

$$PEW\_Cost_A = \sum_{j=1}^{k}[item_{A,j} \times \text{Pr}\_item_j] \dots\dots(1)$$

where
- A is the type of dependent elderly person, that is, $A = 1$ for the bedridden elderly, and $A = 2$ for the housebound elderly;
- j is the type of products, equipment, assistance devices and disposable material for LTC ($j = 1, \dots k$);
- $item_{A,j}$ is the number of j used per month for the elderly of type A;
- Pr_item_j is the average price of j.

For products which can be used for many years, we divided the product's price by the product's lifetime use in order to obtain .

The labor cost ($L\_Cost_{A=1}$) per month is the lump sum payment per month ($Lsum$) to the caregiver to take care of the bedridden elderly person who needs a total of 24 hours per day of care. For the housebound elderly, the labor cost per month is the product of the hourly minimum wage (W) and hours of care per month (H_A). There is no extra cost for care managers because they are salary-based nurses of public hospitals. Their working

hours are paid from the budget of the Ministry of Public Health. The labor costs can be written in the following equations:

$$L\_Cost_{A=1} = Lsum \dotfill (2)$$

$$L\_Cost_{A=2} = W \times H_A \dotfill (3)$$

The travel cost per month is the product of the daily travel rate (*T_rate*) and frequency (*Freq*) of travel per month. It is estimated that the caregiver travels 20 km in the vicinity of the health center, and the care manager travels 30 km in the vicinity of the district hospital. Unlike the labor cost, the travel cost of the care manager is added in the long-term care system because visiting elderly persons under the new LTC system would be an additional responsibility that requires extra travel expenditure. Therefore, the travel costs of the caregiver (*T_Cost^{CG}*) and the care manager (*T_Cost^{CM}*) are:

$$T\_Cost_A^{CG} = Freq_A^{CG} \times (T\_rate_A^{CG}), \text{ and} \dotfill (4)$$

$$T\_Cost_A^{CM} = Freq_A^{CM} \times (T\_rate_A^{CM}) \dotfill (5)$$

The annual cost of LTC (*Total*) is:

$$Total_t = \sum\nolimits_{A=1}^{2}(PEW\_Cost_A + T\_Cost_A^{CM} + L\_Cost_A + T\_Cost_A^{CG})(1 + p\_rate)^t \times 12. \dotfill (6)$$

where *p_rate* is the annual inflation rate, and $t = 1, \dots, 27$. *t* equals one in the base year, which is 2016, and equals 27 in 2042.

Number of dependent elderly

To estimate the number of dependent elderly, we followed the World Health Organization (WHO 2002) and Australian Institute of Health and Welfare (AIHW 2001) methods by assuming the constant disability prevalence rate. Alternatively, the number of elderly persons using LTC can be forecast from the population model, in which that number is explained by demographic, economic, and health status conditions (Eggink, Woittiez and Ras 2016). The population model therefore demands future projection of the explanatory variables.

The age- and gender-specific disability prevalence rates or the proportions of bedridden and housebound elderly persons (*Prop_A^{a,g}*) by age and sex are assumed to be constant. The number of dependent elderly in year *t* is:

$$Elderly_t = \sum\nolimits_{A=1}^{2} \sum\nolimits_{a=1}^{9} \sum\nolimits_{g=1}^{2} Prop_A^{a,g} \times Elderly_t^{a,g}; \text{ for } t = 1, \dots, 27, \dotfill (7)$$

where the gender dimension *g* (for sex) equals 1 for males and 2 for females, and *a* is for age group, which equals 1 to 9 for age groups 60-64 years, 65-69 years, 70-74 years, 75-79 years, 80-84 years, 85-89 years, 90-94 years, 95-99 years, and 100 years and older, respectively.

Additionally, we estimated the number of dependent elderly over the next 25 years using two scenarios. The first scenario is when every elderly person has a higher ADL score of one index point starting from the next five years, or in 2021. This is possible when the pre-elderly population becomes more health conscious and mildly change their behavior for the sake of good health. The second scenario is contrary to the first scenario, that is, every elderly person has one ADL score lower than the constant disability prevalence case. This outcome is possible when the pre-elderly population does not change its current lifestyle, which could cause a deterioration in their functional capacities in old age.

LTC expenditure and financing mechanism

LTC expenditure is the product of the annual cost of LTC (*Total*$_t$) and the number of dependent elderly persons (*Elderly*$_t$). LTC expenditure is divided into two parts. Each part is shared by different stakeholders. The first part is expenditures for LTC products, equipment, assistance devices, disposable material, and the travel costs of the care manager and public health team (Figure 2). The second part is expenditures for LTC services which are for the caregivers' working hours and their travel costs. Service providers can be local governments, non-profit organizations, hospitals, and for-profit companies.

Figure 2: Financing mechanism of the long-term care system
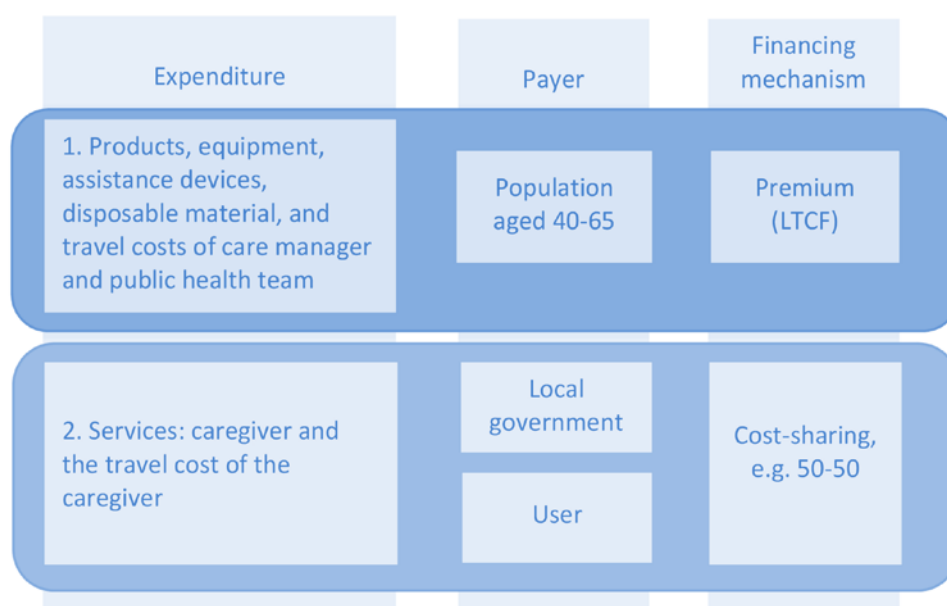
The population between 40 and 65 years old pay a premium for the first portion of expenditures. The population younger than 40 years are less likely to think about funding LTC (Costa-Font and Courbage 2015). The annual premium rate will be determined on a pay-as-you-go basis. A national long-term care insurance fund (LTCF) will be established to administer the premium revenue and the first part of the expenditure. The fund will be a purchaser of LTC products, assistance devices, and disposable material. Contracted hospitals and their health centers can be centers for product distribution. LTCF also would pay for the travel costs of the care manager and public health team, who work for a contracted hospital, to visit the dependent elderly persons. The government would finance the cost of administration from general tax revenues.

We stipulate that local government and users share equally the second portion of expenditures. Users are the population 60 years or older who have been certified by a physician as being disabled and in need of help to perform activities of daily living. Disability assessment by physicians would be covered by the universal healthcare schemes.

The annual premium rate of the LTCF in the first five years is set at 500 baht. This rate is used because it is low enough to encourage participation; at the same time, it would not cause too much burden for the government to support the LTCF around the time of its establishment. The premium rate would be adjusted at the beginning of each five-year interval. The new rate would be the previous rate plus 100 baht. If the new rate meets the rate-adjustment criteria, we use it as the new rate. If not, another 100 baht would be added. The "adding-up" step would continue until the new rate meets all of the following rate-adjustment criteria.

(a) The new premium rate ($Premium_{t,5}$) causes the annual revenue to exceed expenditure ($Balance_t > 0$), that is,

$$Balance_t = Premium_{t,5} \times Pop4065_t - F\_cost_t > 0, \dotfill (8)$$

where *Pop4065* is the number of the population aged 40-65 years, and *F_cost* is the LTCF expenditure or:

$$F\_cost_t = \sum_{A=1}^{2} Elderly_{A,t} \times [(PEW\_Cost_{A,t} + T\_Cost_{A,t}^{CM}) \times (1+p\_rate)^t \times 12]; \dotfill (9)$$

for $t = 1, \ldots, 27$;

(b) The new premium rate does not result in a large future liability. The maximum liability in the last year of the five-year interval is set at 2 billion baht;

(c) When fund accumulation (*Accum_F*) exceeds 50 billion baht at the end of each five-year interval, or:

$$Accum\_F_t = \sum_1^t Balance_t > \text{THB 50 billion;} \dots\dots(10)$$

the criterion (a) can be relaxed as long as the fund accumulation is positive for the next five-year interval.

III. DATA

For the unit cost calculation, we interviewed healthcare personnel working at public hospitals in four regions, each having three provinces (*i.e.*, Chiang Rai, Phayao, Phrae, Khon Kaen, Mahasarakham, Kalasin, Lop Buri, Phetchaburi, Bangkok, Trang, Satun and Songkhla). We used a purposive method for selecting provinces as the types of data collected were quite homogenous across provinces. The data collected comprised the lists of products, equipment, assistance devices, and disposable material used for home care of the bedridden and housebound elderly persons; quantities and prices of products, equipment, assistance devices and disposable material; lifetime use of products and assistance devices; time use for caretaking; and frequency of the care manager's home visits. The current price estimation method was used, and prices were adjusted using the inflation rates derived from Thailand's Ministry of Commerce.

The proportions of bedridden and housebound elderly persons by sex and age group ($Prop_A^{a,g}$) were derived from the 2014 Survey of Older Persons in Thailand, which was conducted by the National Statistical Office. The projected number of elderly by sex and age group ($Elderly_t^{a,g}$) was from the United Nations medium-variant population projection (UN 2015).

IV. RESULTS

Unit cost of home care

The LTCF provides necessary products, equipment, assistance devices, and disposable material for providing home care and for helping dependent elderly persons to perform basic activities of daily living. The services can be combined with lower-level care related to domestic help, such as for food preparation, measuring vital signs, cleaning the rest area, doing laundry, clipping nails and cutting hair. Health personnel and caregivers provided us with lists of minimum requirements for home care (Tables 1-5). Table 1 lists the products, equipment and assistance devices needed for home care. Average costs of LTC products, equipment and assistance devices were 587 baht per month for the bedridden elderly and 191 baht per month for the housebound elderly.

Table 1: List and average cost of products, equipment and assistance devices per month

Equipment and products	Average unit cost (baht)	Product lifetime (years)	Average cost per month (baht)
Bedridden elderly			
Wheelchair	3,200	5	53
Hospital bed	15,500	6	215
Pressure relief mattress	4,600	2	192
Reusable waterproof sheeting	850	1	71
Overbed table	4,000	6	56
Total			587
Housebound elderly			
Walker/cane	502	3	14
Walking rail	513	5	9
Wheelchair	3,200	5	53
Toilet seat	2,683	5	45
Bed	1,300	7	15
Mattress	1,990	3	55
Total			191

Disposable material necessary for caretaking of bedridden and housebound elderly persons are disposable underpads, adult diapers, tissue paper, cotton, and cotton buds. The average costs per month were 3,242 baht for the bedridden and 2,576 baht for the housebound (Table 2).

Table 2: List and average cost of disposable materials per month

Type of supplies	Average unit cost/piece (baht)	Used/week (pieces)	Average cost per month (baht)
Bedridden elderly			
Disposable underpads	8.17	13.3	468.22
Adult diapers	15.27	20.1	1,320.23
Tissue paper	11.58	6.1	304.38
Cotton	0.11	1,542.9	735.30
Cotton buds	0.80	120.2	413.37
Total			3,242.51
Housebound elderly			
Disposable underpads	8.17	10.4	366.77
Adult diapers	15.27	19.4	1,273.55
Tissue paper	11.58	5.0	249.04
Cotton	0.11	900.0	428.93
Cotton buds	0.80	75.0	258.00
Total			2,576.29

Note: Cost per month = cost per week multiplied by 4.3.

The bedridden elderly needed 24 hours per day of caretaking. From the interviews, the average cost of caretaking for the bedridden elderly was found to be 15,000 baht per month. The travel cost was inclusive. For the housebound elderly, they needed assistance for toileting, walking,

bathing, food preparation, measuring vital signs, cleaning, doing laundry, clipping nails, and cutting hair. These required 6,004 minutes or 100 hours of caregivers' time (Table 3). In 2016, the minimum wage was 300 baht per day or 37.50 baht per hour. Average cost of caretaking for the housebound elderly was 3,750 baht per month (Table 4). Caregivers who took care of the housebound elderly traveled 20 km in the vicinity of the health center. The lump sum travel cost was 100 baht per visit or 3,000 baht per month per housebound elderly person (Table 4).

Table 3: Time use for caretaking of housebound elderly persons

Type of assistance activity	Minutes/activity	Frequency/month	Minutes/month
Toileting (urinating)	11	104	1,144
Toileting (defecating)	14	48	672
Walking and exercising	24	48	1,152
Bathing	18	43	774
Food preparation	26	40	1,040
Measuring vital signs	6	21	126
Cleaning	25	19	475
Doing laundry	34	16	544
Clipping nails	14	3	42
Cutting hair	35	1	35
Total			6,004

Note: Frequency per month = frequency per week multiplied by 4.3.

Care managers visited bedridden elderly persons twice a month, and housebound elderly once a month. They traveled 30 km in the vicinity of the district hospital. The lump sum travel cost was 150 baht per visit. Therefore, the travel cost of care managers for each bedridden elderly person was 300 baht per month and for each housebound elderly person, 150 baht per month. Average costs of home care for the bedridden and housebound elderly were 19,129 baht and 9,667 baht per month, respectively (Table 4).

Table 4: Average cost per month for home-based caretaking

Items	Average cost (baht/month)	
	Bedridden elderly	Housebound elderly
Products, materials and supplies	3,829	2,767
Products and materials	587	191
Supplies	3,242	2,576
Care manager: travel cost	300	150
Caregiver	15,000	6,750
Labor cost	15,000	3,750
Travel cost	–	3,000
Total cost	19,129	9,667

Number of dependent elderly

The Survey of the Older Persons in Thailand in 2014 showed that there were about 10 million people in the population who were 60 years or older (Table 5). About 55 percent of them were females. Of the total, only 24 and 28 percent of males and females, respectively, were older than 74 years. About 2.5 and 3.6 percent of the male and female elderly, respectively, needed help to perform ADLs. These proportions were much lower than those prevalent in such developed countries as Australia (AIHW 2001). About 40 percent of the bedridden or housebound elderly persons were in the age groups 80-84 and 85-89 years. About 57.6 percent of the population who were older than 100 years needed help to perform ADLs.

The proportions of bedridden and housebound elderly persons increased in older age groups, as shown in Figure 3. About 44.5 percent of those who were 100 years old or older were bedridden. We found that more than half of the bedridden elderly were given care by informal caregivers or their family members (Table 6). About 40 percent of male bedridden elderly persons were given care by their spouse. However, the parallel rate was only 7 percent for female bedridden elderly. One of the reasons explaining this is that females have a longer life expectancy than males. About 5-7 percent of bedridden elderly persons were self-caring.

**Table 5: Age- and gender-specific disability prevalence rates in 2014**

Age group (years)	Number of elderly	Elderly who are:			
		Bedridden	Housebound	Bedridden or housebound	
				Total	Percentage of elderly
Males					
60-64	1,558,548	5,605	8,869	14,474	0.93
65-69	1,083,081	3,163	8,413	11,576	1.07
70-74	784,641	4,242	12,409	16,651	2.12
75-79	536,141	11,891	9,172	21,064	3.93
80-84	340,469	7,580	16,385	23,965	7.04
85-89	144,701	5,682	10,032	15,714	10.86
90-94	41,188	1,268	6,574	7,843	19.04
95-99	9,314	246	1,848	2,093	22.47
100 and older	1,114	353	393	746	66.97
Total males	4,499,196	40,032	74,095	114,127	2.54
Females					
60-64	1,748,998	4,369	6,448	10,817	0.62
65-69	1,249,466	5,148	11,431	16,580	1.33
70-74	955,648	7,290	15,472	22,762	2.38
75-79	711,198	12,608	16,861	29,469	4.14
80-84	497,407	16,923	32,452	49,375	9.93
85-89	229,154	12,628	22,670	35,298	15.40
90-94	75,312	13,419	14,275	27,694	36.77
95-99	18,326	1,398	3,706	5,104	27.85
100 and older	3,610	1,749	224	1,973	54.67
Total females	5,489,119	75,532	123,540	199,071	3.63
Males and females					
60-64	3,307,546	9,974	15,317	25,291	0.76
65-69	2,332,547	8,311	19,844	28,156	1.21
70-74	1,740,289	11,532	27,881	39,413	2.26
75-79	1,247,339	24,499	26,034	50,533	4.05
80-84	837,876	24,503	48,837	73,340	8.75
85-89	373,855	18,310	32,702	51,012	13.64
90-94	116,499	14,687	20,849	35,537	30.50
95-99	27,640	1,644	5,553	7,197	26.04
100 and older	4,724	2,103	617	2,720	57.57
Total	9,988,315	115,563	197,635	313,198	3.14

Source: National Statistical Office, 2014 Survey of Older Persons in Thailand.
Note: The bedridden and housebound elderly are those who have ADL scores below 5 and 5-11, respectively.

Figure 3: Dependent elderly persons as a percentage of the total elderly, by age group
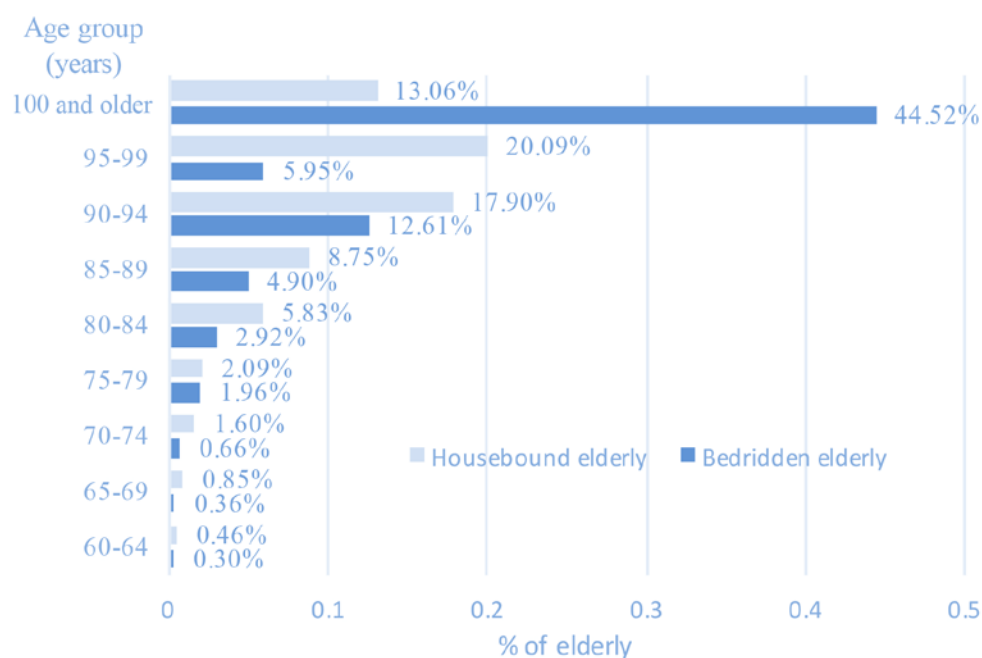
Source: National Statistical Office, 2014 Survey of Older Persons in Thailand.

Table 6: Percentage of dependent elderly and relationship with caregiver

Relationship with caregiver	Males		Females	
	Bedridden	Housebound	Bedridden	Housebound
No caregiver (self-care)	5	17	7	21
Spouse	41	38	7	7
Son	5	10	7	12
Daughter	31	25	50	44
Son- or daughter-in-law	7	5	8	5
Grandchildren	2	2	4	3
Relatives	5	3	9	5
Paid caregiver	3	0	5	3
Others	2	0	3	1
Total	100	100	100	100

Source: National Statistical Office, 2014 Survey of Older Persons in Thailand.

Using equation (7) and the constant age- and gender-specific disability prevalence rates as shown in Table 5, the number of bedridden and housebound elderly will double in the next 20 years (Table 7). In the scenario where each elderly person has one ADL score lower starting from 2021 and thereafter, the number of bedridden and housebound elderly persons will increase by approximately 43,000 and 148,000 persons, respectively, in 2037 compared with the constant disability prevalence rates. The total number of dependent elderly persons will reach 1 million persons in 2037. However, if each elderly person has one ADL score higher than the constant disability prevalence rates in 2021 and thereafter, the number of bedridden and housebound elderly persons will decrease by approximately 58,000 and 72,000 persons, respectively, in 2037. The total number of dependent elderly persons will be approximately 700,000 persons. From both scenarios, it is expected that there will be more dependent elderly persons in Thailand compared with the current situation.

Table 7: Number of dependent elderly under three activities of daily living score conditions

Year	Constant ADL score[a]		Lower ADL score[b]		Higher ADL score[c]	
	Bedridden	Housebound	Bedridden	Housebound	Bedridden	Housebound
2017	136,677	235,301	136,677	235,301	136,677	235,301
2022	169,282	292,998	192,474	374,158	136,732	252,542
2027	209,227	357,391	237,218	458,241	169,271	307,610
2032	256,080	434,464	291,073	557,580	207,520	375,183
2037	311,256	526,228	354,682	673,968	253,632	453,975
2042	374,212	628,686	425,834	803,656	307,862	538,597

[a] *Constant ADL score as in 2014.*
[b] *Every elderly person will have one ADL score lower in 2021 and thereafter.*
[c] *Every elderly person will have one ADL score higher in 2021 and thereafter.*

LTC expenditure and financing mechanism

In 2017, there were 371,978 elderly persons who needed long-term care (Table 7). Total costs of caretaking for bedridden and housebound elderly persons were 59.8 billion baht (Table 8). In the next 25 years, when more than 1 million elderly persons will need help to perform ADLs and domestic work, the cost of LTC for these people will quadruple. In the case when each elderly person would have one ADL score higher, the total cost of LTC would be much lower. In 2042, the cost of LTC would be reduced by 25 billion baht, or 21 percent, for the bedridden elderly, and 17 billion baht, or 17 percent, for the housebound elderly.

Table 9 shows the cost-sharing scheme of the LTC system under constant ADL conditions. Total expenditures for products, equipment, assistance devices, disposable material and care manager's travel cost were

Table 8: Total cost of long-term care under three activities of daily living score conditions

(Billions of baht)

Year	Constant ADL score[a]		Lower ADL score[b]		Higher ADL score[c]	
	Bedridden	Housebound	Bedridden	Housebound	Bedridden	Housebound
2017	32.0	27.8	32.0	27.8	32.0	27.8
2022	43.8	38.3	49.8	48.9	35.3	33.0
2027	59.7	51.5	67.7	66.1	48.3	44.4
2032	80.7	69.2	91.7	88.8	65.4	59.7
2037	108.3	92.5	123.4	118.5	88.2	79.8
2042	143.7	122.0	163.6	156.0	118.3	104.6

[a] Constant ADL score as in 2014.
[b] Every elderly person has one ADL score lower in 2021 and thereafter.
[c] Every elderly person has one ADL score higher in 2021 and thereafter.

Table 9: Cost-sharing of the long-term care system and long-term care insurance fund revenue from premiums

Year	Total expenditure (billions of baht)			Long-term care insurance fund (LTCF)		
	Paid from LTCF	Paid by local government	Paid by user	Population aged 40-65 (millions)	Premium (baht/year)	LTCF revenue (billions of baht)
2017	15.3	22.3	22.3	25.3	500	12.6
2022	21.0	30.5	30.5	26.1	1,000	26.1
2027	28.4	41.4	41.4	25.8	1,500	38.8
2032	38.3	55.8	55.8	25.1	2,000	50.2
2037	51.3	74.8	74.8	24.0	2,500	60.0
2042	67.9	99.0	99.0	22.7	3,000	68.1

15.3 billion baht in 2017. These expenditures could be financed from the premium revenue of the LTCF. In 2017, the working-age population comprised 25.3 million persons who could pay 500 baht each for the premium. The premium rate should be raised by 500 baht every five years to offset the effects of the declining working-age population and rising LTC expenditure.

About 75 percent of LTC expenditures are for caregivers and their travel costs. These costs were 44.6 billion baht in 2017. They could have been shared equally between the local government and the elderly who used caretaking services. These costs are 15,000 baht per month for the bedridden elderly and 6,750 baht per month for the housebound elderly (see Table 4 showing figures in 2016 prices).

If the LTCF had been established in 2017, the premium revenue would be short by 2.7 billion baht to cover the Fund's expenditure (Table 10). When the premium rate increases by 500 baht per person in five-year intervals, the Fund will accumulate sufficient funds to achieve sustainable conditions. However, if the ADL performance of the older persons deteriorates, the premium rates should increase more than under the constant ADL condition. Under this scenario, the premium rate should be 3,700 baht per

year in 2042. The premium rates could be lower when older people perform at higher ADL conditions. The premium rate could increase to 900 baht per year in 2022 and to 2,800 baht per year in 2042.

Table 10: The premium rates and fund accumulation under three activities of daily living score conditions

Year	Constant ADL score[a]		Lower ADL score[b]		Higher ADL score[c]	
	Premium (baht/year)	Fund accumulation (billions of baht)	Premium (baht/year)	Fund accumulation (billions of baht)	Premium (baht/year)	Fund accumulation (billions of baht)
2017	500	-2.7	500	-2.7	500	-2.7
2022	1,000	-17.8	1,200	-21.3	900	-13.8
2027	1,500	-0.9	1,700	-5.5	1,100	2.8
2032	2,000	31.9	2,400	20.9	1,600	12.3
2037	2,500	59.9	3,000	50.7	2,300	32.7
2042	3,000	57.3	3,700	45.2	2,800	55.2

[a] Constant ADL score as in 2014.
[b] Every older people has one ADL score lower in 2021 and thereafter.
[c] Every older people has one ADL score higher in 2021 and thereafter.

V. DISCUSSION

The principles of filial piety are commonly observed in Thai society. The majority of the population expect younger members in a household to take care of the older ones (Chandeovwit 2013; Knodel, Saengtienchal and Sittitrai 1995). However, the expectation from the younger generation cannot easily be met. Family size has been declining. An increasing proportion of the population stays single (Chandeovwit, Paichayontvijit and Vajragupta 2016). This can possibly affect both male and female bedridden elderly persons as about half of males were cared for by their spouse and about half of females were cared for by their daughters.

Under changing socio-economic conditions, however, it has been more difficult for spouses or daughters to fulfill the informal caregiving tradition (Yang et al. 2016). Changing family structure and rising female labor market participation affect the supply of informal caregivers (Brau and Lippi 2008; Brown and Finkelstein 2011). Formal caregivers covered by LTC insurance can replace or supplement informal care and avoid strains on the informal caregiver's health (Courbage and Roudaut 2011; Colombo et al. 2011). Specifically, this arrangement helps release stress on a number of females.

To mitigate old-age risks, we introduced a universal coverage, LTC insurance system separately from the healthcare schemes. Financing the system with mixed funding from both the public and private sectors in coverage of LTC risks is recommended as has been done in many other countries

(Courbage and Roudaut 2011). The system can be viewed as equitable and efficient (Colombo 2012). That is, the population aged 40 to 65 years would pay a small annual premium to the LTCF. The Fund's administrative costs would be covered by the central government. The population aged 60 years and older who need help to perform activities of daily living would receive LTC products, assistance devices and services regardless of their financial condition and geographical location. Users and local governments would share equally the cost of caregivers. Users could supplement public LTC by buying private insurance, if it exists in the future, to insure themselves against caregiver costs. The system supports the home-based setting for LTC as it is affordable, sustainable, and widely promoted (Brau and Lippi 2008). The introductory system enables institutional LTC utilization by supporting the same amount of benefits as received by home-based LTC beneficiaries. This will encourage people's decision to choose home care.

Overall, the unit costs of home care for bedridden and housebound elderly persons in 2016 were 19,129 baht and 9,667 baht per month, respectively, whereas Thailand's per capita gross domestic product (GDP) was about 18,000 baht per month in that year. Total LTC expenditure would have been 59.8 billion baht in 2017. It was about 0.42 percent of GDP in 2016. These costs are currently born by the elderly and their family, either explicitly through the expenditure of out-of-pocket expenses or implicitly through informal caregivers.

To implement LTC insurance, an LTCF should be established. The working-age population would pay premiums of 500 baht per year, which was equivalent to 0.36 percent of per capita income in 2015 (NESDB 2017). The amount is considered small; however, the premium rate should be raised by 500 baht every five years in accordance with the declining working-age population and rising LTC expenditure. The premium rate will grow faster than per capita income. However, this aspect might discourage families with a low income to support the system.

This point is a limitation of this study in that we do not know the preferences of the Thai population. People in rural areas might prefer receiving tender loving care from their family members and may not want to contribute to the fund. This issue could be explored further in future research to elicit the preferences for long-term care insurance among the Thai population.

At the beginning of establishing the LTCF, the premium revenue would be short by 2.7 billion baht needed to cover the Fund's expenditure. This deficit is considered very small compared with the Thai government's fiscal capacity. However, the LTCF benefit based on the basic standard of care assessed in interviews of nurses and caregivers makes its expenditure at the minimum level. With a higher standard of care, LTC expenditure would be even higher, which means higher cost-sharing expenditures would be required from all stakeholders.

LTC expenditures may grow slower or faster when the health conditions of the elderly vary from the status quo. It is a limitation in this study that we did not have enough information on the future incidence of elderly persons' chronic conditions. The projected number of dependent elderly persons was based on demographic factors alone. Using micro-simulation technique with information about the incidence of physical disabilities, chronic disorders and dementia in the future may result in a smaller number of dependent elderly persons than in this projection (Eggink, Woittiez and Ras 2016).

VI. CONCLUSION

Long-term care is an insurable risk of aging. It is crucial for a country to design an LTC system that limits the pressure on public budgets while it can protect the elderly and their families from catastrophic LTC expenditures. The home-based setting of an LTC system can be an affordable option for middle-income countries with an aging population.

We would like to recommend that the government develop an equitable and efficient LTC system early—before the effects of an aging population become severe. This would ensure that the system has time to adapt to achieve affordability and sustainability (Rhee, Done and Anderson 2015). Investing in the LTC system could possibly create new employment in the caregiver market and economic opportunity for LTC products. It could reduce healthcare expenditures toward the end of life (Holland, Evered and Center 2014). Limiting LTC expenditure so that it does not go beyond the economic growth rate is a challenge for countries with an increasingly large aging population. The most obvious way to reduce the LTC cost would be to reduce potential disabilities in later life through lifelong health promotion (Colombo et al. 2011).

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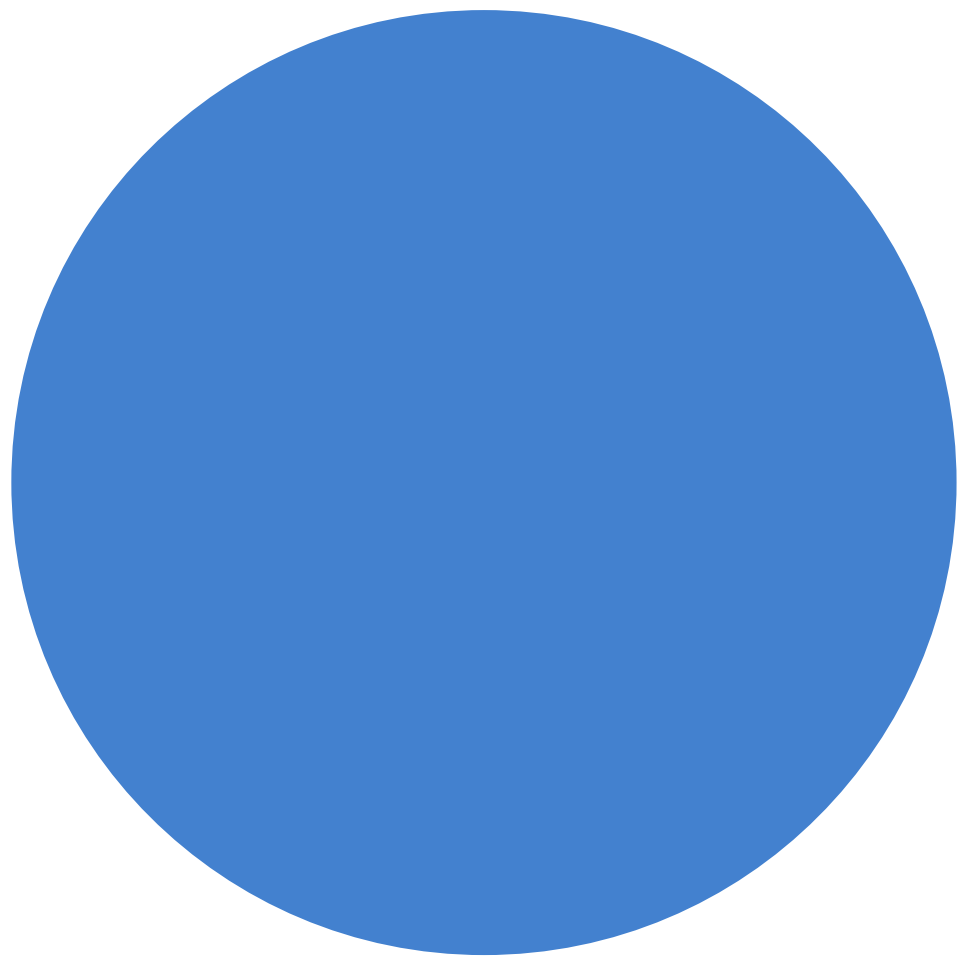
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ICT WORKFORCE DEVELOPMENT AND THAILAND 4.0: SHIFTING FROM QUANTITY TO QUALITY*

*Saowaruj Rattanakhamfu**

1. INTRODUCTION

The "Thailand 4.0" vision is aimed at propelling Thailand from the status of a middle-income economy to that of a high-income country. The vision is to be implemented through the development of five existing and five new "S-curve," or targeted, industries so that they become the new engines of growth. The existing S-curve industries include the "next generation automotive," "smart electronics," "medical and wellness tourism," "agricultural and biotechnology," and "food processing" industries. The new S-curve industries are the "robotics and automation," "aviation and logistics," "biofuels and biochemicals," "digital," and "integrated medical hub" industries.

To promote the development of these 10 combined "S-curve" industries, the Eastern Economic Corridor (EEC), covering the three eastern provinces of Chachoengsao, Chon Buri and Rayong, has been designed to attract foreign and domestic investment. Implementation of the EEC is based on three pillars: infrastructure development; provision of tax and non-tax incentives; and investment facilitation through a one-stop service.

While the EEC is a major project to transform Thailand into a high-income economy, there are still many challenges to overcome. Most importantly, Thailand still has an insufficient number of highly skilled professionals, which prevents the country from engaging in high value-added activities. The lack of highly skilled ICT manpower is a clear example of such a challenge, and it must be addressed urgently.

The objective of this article is to analyze the causes of the lack of highly skilled ICT manpower in Thailand, and to provide policy recommendations to address them.

** Dr. Saowaruj Rattanakhamfu is Senior Research Fellow, Thailand Development Research Institute.

2. OVERVIEW OF THE EASTERN ECONOMIC CORRIDOR

The EEC, announced in mid-2016, established three pillars for industrial development: infrastructure development, super-generous incentives, and investment facilitation. Infrastructure development includes upgrading existing infrastructure projects, such as U-Tapao Airport, Maptaphut, Laem Chabang and Sattahip seaports, dual-track railways and motorways. It also includes new projects, such as a high-speed train connecting three major international airports around Bangkok and the creation of a number of "smart cities."

The second pillar involves the provision of tax and non-tax incentives. Investors in the EEC receive generous tax incentives, such as corporate income tax exemption for up to 13 years, making the effective corporate tax rate of Thailand among the lowest in Southeast Asia. For the first time in Thai history, the personal income tax rate has been lowered to 17 percent for "world-class" specialists. Investors in the EEC also get unprecedented non-tax benefits, such as the ability to lease land for up to 99 years, freedom to trade using foreign currencies, ability to undertake currently prohibited service businesses, and eligibility to obtain "smart visas" for highly skilled professionals.

The last pillar is investment facilitation through a one-stop service administered by the Office of the Eastern Special Development Zone, which can issue licenses and permits to investors in the zone, including those for building construction and commercial registration, thus cutting regulatory red tape. With all these privileges, the EEC constitutes the most attractive invitation to invest in Thailand that the Thai government has ever offered to any investors.

In 2017, the total value of projects in the EEC approved by the Board of Investment (BOI) was 334 billion baht; they were expected to create more than 33,000 jobs (Table 1). In addition, the approved projects within the list of the S-curve industries in the EEC were valued at 175 billion baht; they were expected to create 22,000 jobs.

Table 1: Projects in the Eastern Economic Corridor approved by the Board of Investment in 2017

Type of industries	Number of projects	Value of projects (billions of baht)	Number of jobs (persons)
Targeted	138	175	22,000
Others	186	159	11,000
Total	324	334	33,000

Source: Thailand Board of Investment.

Figure 1: Projects in the Eastern Economic Corridor approved by the Board of Investment, classified by types of targeted industries in 2017
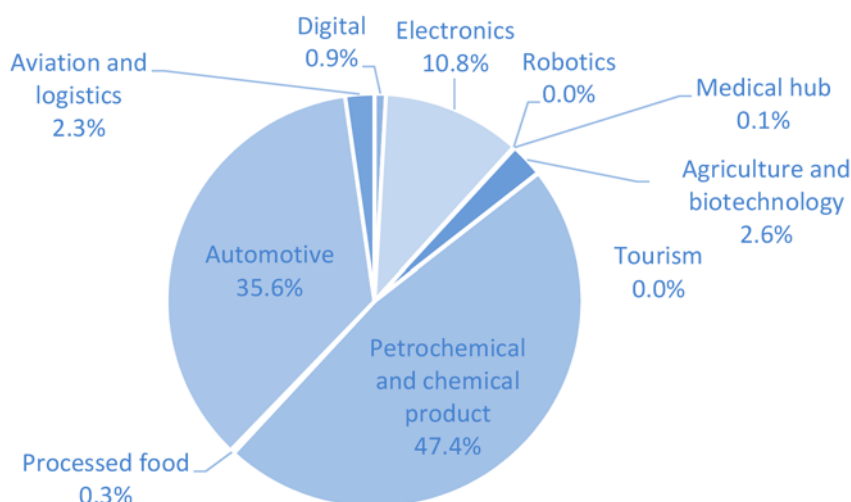
Source: Thailand Board of Investment.

Most investment in targeted industries is concentrated in the existing industries, especially petrochemical and chemical products. Investment in the new industries, such as robotics and automation, and digital, is still limited (Figure 1).

Based on BOI data, half of the workforce in the EEC possess only a high school level of education or lower (Figure 2). One-third of the workforce has received vocational education; however, only 17 percent hold higher educational degrees. This implies that the majority of the workforce in the EEC is unlikely to be involved in high value-added activities. Still, they have relatively higher skill levels compared with average workers nationwide. Among the total of 17.1 million workers in the formal sector nationwide, most have a high school education or lower, especially those in the agricultural sector (93%) and the industrial sector (70%), as shown in (Table 2).

3. THAI INFORMATION AND COMMUNICA-TION TECHNOLOGY WORKFORCE

Although Thailand has a large number of ICT workers, only a small number can be considered high quality. In 2017, Thailand produced almost 20,000 new graduates in computer-related subjects. However, 7,000 computer-related graduates, including those who had graduated in previous years, remained unemployed that year. Meanwhile,

Figure 2: Labor force in the Eastern Economic Corridor, classified by level of education, 2017
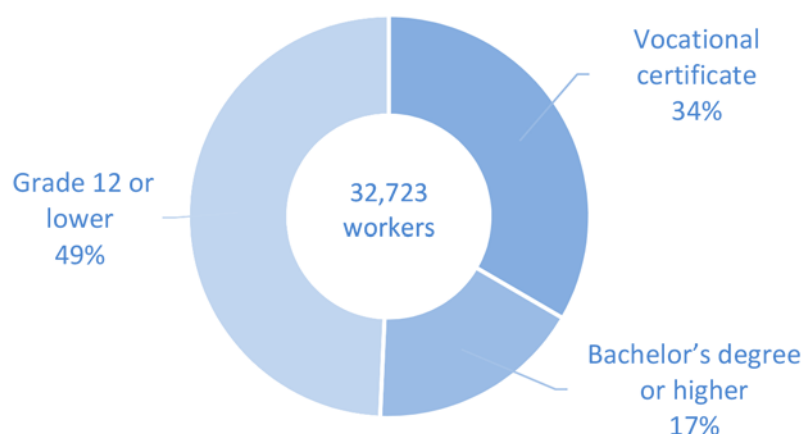

Source: Thailand Board of Investment.

Table 2: Percentage of workforce nationwide, disaggregated by education level and economic sector (2017)

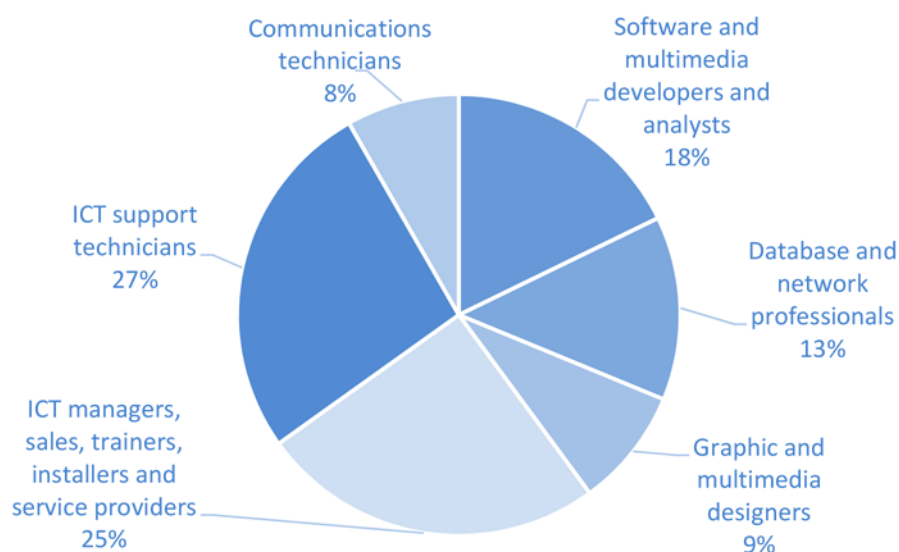| Education level/sector	Agriculture	Industry	Services	Unknown	Total
Grade 12 or lower	92.6	69.7	48.0	19.6	58.5
Vocational or higher vocational certificate	3.8	13.6	12.9	13.6	12.5
Bachelor's degree or higher	2.8	14.3	38.4	64.4	27.6
Others	0.1	1.2	0.1	0.0	0.5
Unknown	0.8	1.2	0.6	2.5	0.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Labor Force Survey, Quarter 3, 2017, National Statistical Office of Thailand.
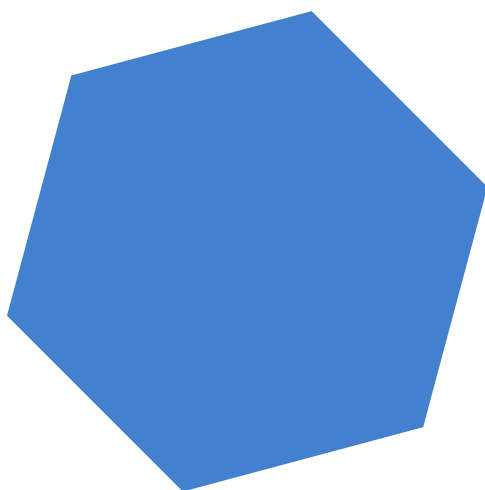
the business sector complains about the lack of manpower, which reflects a serious problem of either skills mismatch or the low quality of graduates.

Overall, the number of employed workers in ICT-related jobs in Thailand was 268,065 in 2017, a 6 percent increase over that of the previous year. Among these, 35 percent were ICT technicians, including ICT support and communications technicians; 31 percent were ICT specialists, including software and multimedia developers and analysts; and 25 percent were ICT managers, sales professionals, trainers, installers and service providers (Figure 3).

Figure 3: Information and communication technology employment classified by types of occupation in 2017

Communications technicians 8%

Software and multimedia developers and analysts 18%

ICT support technicians 27%

Database and network professionals 13%

ICT managers, sales, trainers, installers and service providers 25%

Graphic and multimedia designers 9%

Source: Labor Force Survey, Quarter 3, 2017, National Statistical Office of Thailand.

Figure 4: Information and communication technology workforce classified by major field of study in 2017

Computer-related field 32.5%

Others 31.0%

Other engineering fields 36.1%

Mathematics 0.4%
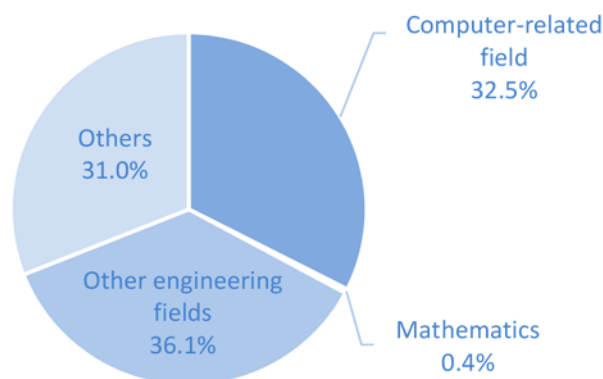
Source: Labor Force Survey in Thailand, Quarter 3, 2017, National Statistical Office of Thailand.

Most ICT workers were graduates in the areas of engineering (36%), followed by computer-related subjects (33%) (Figure 4). Classified by their level of education, the majority of graduates had bachelor's degrees (64%), while the remaining 23 percent held vocational and higher vocational certificates and 13 percent held master's degrees and higher (Figure 5).

While Thailand has a large number of graduates in computer-related subjects, only a small proportion work in ICT occupations. In 2017, the total workforce with computer-related degrees was 570,407 (Table 3). However, only 15.3 percent worked in ICT occupations. The majority, 81.3 percent, worked in non-ICT occupations; for example, 10 percent were clerical workers.

Figure 5: Information and communication technology workforce classified by education level
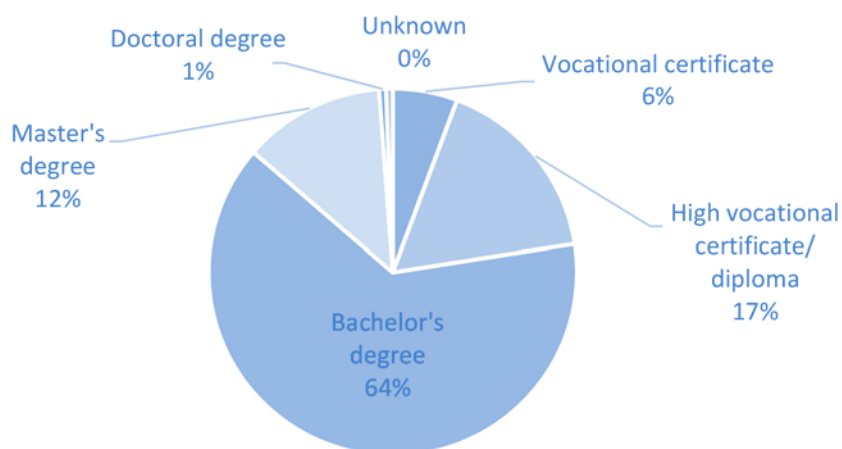
Source: Labor Force Survey, Quarter 3, 2017, National Statistical Office of Thailand.

Table 3: Labor force with computer-related degree in 2017

Type of labor force	Number of workers	Percentage share of workers
Employed as ICT workers	87,024	15.3
Employed as non-ICT workers	463,672	81.3
- Clerical workers	54,127	9.5
- Others	409,545	71.8
Unemployed	19,005	3.3
Seasonal workers	706	0.1
Total	**570,407**	**100.0**

Source: Labor Force Survey, Quarter 3, 2017, National Statistical Office of Thailand.

Meanwhile, the unemployment rate of graduates with computer-related degrees was 3.3 percent, which is higher than the overall unemployment rate of 1.2 percent.

In addition, nearly 20,000 students graduated with bachelor's degrees in computer-related fields in 2017, excluding other related fields, such as telecommunication engineering (Table 4). Nearly half graduated in the fields of business computers or business information systems, which might not equip them with such essential professional IT skills as information management, integrated systems technology and user experience design. Thus, many graduates in 2017 did not have the skills needed to meet the demands of industry.

Table 4: Graduates with a bachelor's degree in computer-related fields, categorized by programs in 2017

Programs	Number of graduates	Percentage share of graduates
Computer science	4,328	21.9
Computer engineering	344	1.7
Software engineering	2,025	10.2
Information technology	4,288	21.7
Business computers	8,796	44.5
Total	**19,781**	**100.00**

Source: Office of the Higher Education Commission.

Figure 6: Educational institutions with computer-related curricula
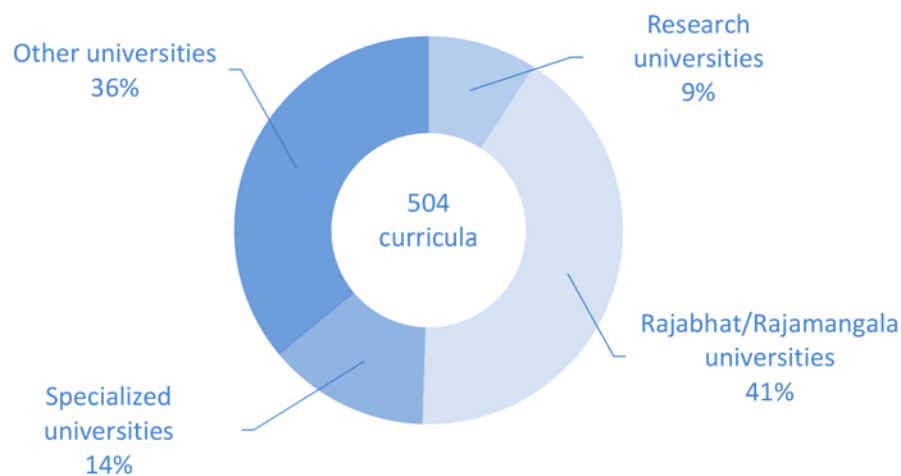
Source: Office of the Higher Education Commission.

Currently, more than 500 computer-related curricula are taught in various institutes and universities in Thailand (Figure 6): in Rajamangala University of Technology and the Rajabhat University systems (41%), non-research universities (36%), specialized universities or institutions (14%), and research universities (9%). The problem of uneven standards among these courses are also often identified by the private sector.

Another major problem is outdated curricula, which poorly prepare students for rapid technological changes. For example, many existing curricula do not cover cloud computing and the so-called Internet of things. In addition, most are designed and developed by academic staff, without sufficient engagement from the private sector.

4. CONCLUSIONS AND POLICY RECOMMENDATIONS

The lack of highly skilled manpower, including ICT manpower, is a major barrier for developing the targeted industries. To achieve the Thailand 4.0 vision, the Thai government must address the issue urgently.

In the short and medium-term, Thailand

should focus on developing or attracting three groups of ICT workers.

The first group comprises those who can apply and develop key disruptive technologies, such as artificial intelligence (AI), big data, and the Internet of things. It is useful to learn from the good practices of other countries and economies. For example, Singapore and Taiwan, organize six-month intensive courses on such technologies that use actual data to solve real-world problems. These courses are implemented by the Institute for Information Industry (III) in the case of Taiwan and the Skills Framework for Infocomm Technology in the case of Singapore. All courses have a common characteristic: focusing on quality, not quantity.

The second group covers a larger part of the ICT workforce, such as software developers and programmers, who are in great demand. Needless to say, the quality of the workforce must meet the demands of industry. Therefore, a close working relationship between educational institutions and the private sector is indispensable. Again, Thailand should learn from the good practices of other countries.

South Korea's ICT Model Schools program provides a good example. Educational institutions can join this program only if they are partnered with the business sector and meet stringent requirements on curricula and facilities. They are also evaluated annually and would be dropped from the program if evaluation results are poor.

Thailand needs to strengthen the linkage between its educational institutions and the private sector in order to develop its workforce. As is done in South Korea, it should also promote the accountability of its educational institutions. In the Thai case, internationally accepted examinations, such as Information Technology Professional Examination (ITPE) based on Japan's Information Technology Engineers Examination, may be a tool to inject accountability into the system.

The last group is focused on highly skilled foreign ICT professionals as they can immediately address Thailand's talent shortages. Thailand may provide incentives for them to work in this country and streamline immigration procedures. In this regard, Thailand can learn from Australia, Singapore, and the United States, all of which have successfully attracted foreign workers over a long period of time.

In early 2018, Thailand introduced the "Smart Visa" scheme to attract foreign professionals in the targeted industries, including the digital industry. The scheme provides four-year visas and work permit exemption for such professionals. However, these measures are still inadequate as the minimum salary required at 200,000 baht per month is too high, thus preventing many companies from recruiting foreign talent. The government should make the requirements more flexible; for example, it should allow a person with a salary between 100,000 and 200,000 baht per month to receive a two-year visa.

In the long run, Thailand should create a mechanism for educational institutions to understand the needs of business and improve their curricula accordingly. The Thai government should also try to create linkage between research and development and manpower development in the area of ICT. Good examples to be learned from are Japan's famous KOSEN (Colleges of Technology) and South Korea's Nurturing Excellent Engineers in Information Technology (NEXT).

The good practices of foreign countries show that creating a high-quality ICT workforce requires: (a) focusing on quality rather than quantity; (b) cooperating closely with the private sector; and (c) introducing accountability into the country's education and training systems.