SECOND-ORDER CONFIRMATORY FACTOR ANALYSIS OF COMMUNITY INNOVATOR IN THAILAND

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Abstract*: The objectives of this research were to study the level of importance and analyze the attributes of community innovators among communities in Thailand. This research was exploratory research. The data were collected from 525 representatives from various sectors in Thailand such as local administrative organizations, municipalities, and community enterprises, etc. The instrument used in this research was a questionnaire. The data were analyzed using descriptive statistics and second-order confirmatory factor analysis. The results showed that the importance levels of 20 subfactors were ranging from 3.72 (Attitude in Politeness) to 4.35 (Role in Leader) and the second-order confirmatory factor analysis of the community innovator measurement model showed that the developed measurement model was consistent with the empirical data. This could be determined from the chi-square value of 157.19 (p-value=0.59) and degrees of freedom was 162, Goodness of Fit (GFI) was 0.97, Adjusted Goodness of Fit Index (AGFI) was 0.96, and Root Mean Square Error of Approximation (RMSEA) was 0.0. All factor loadings of subfactors in terms of standard scores were positive, ranging from 0.72-0.90, and statistically significant at the .05 level. The proportion could be explained by a factor was about 43% to 65%.*

Index Terms— *Community Innovator, Confirmatory Factor Analysis, Measurement Model, Second-order CFA*

I. INTRODUCTION

'Innovation' is a key issue in national development and reform policies because in order to build a country's competitiveness, it is necessary to make a differentiation, especially at the community level. In Thailand, OTOP (One Tambon One Product) is an example of managerial innovation that can drive many unique products from communities all over Thailand.

Nowadays, the strategy for human capital development and strengthening in National Strategy 2018-2037 of Thailand aimed to develop Thai people by promoting innovators in the community called “Community Innovators” but there is no research that can clearly identify the key characteristics of community innovators. As a result, the development of these has no clear direction too.

Therefore, this research has investigated the components of the community innovator in order to find the key characteristics to be a community innovator including the importance level of these characteristics for the benefit of developing according to priorities under budget and time constraints effectively and efficiently.

Research Objectives

2.1) To investigate the characteristics of community innovators in Thailand.

2.2) To analyze the importance of the characteristics of community innovators in Thailand.

Literature Reviews

A community innovator is someone who has the capacity to turn new knowledge and skills into a successful product or service in the community. KSA model (Knowledge, Skills, and Attitudes) were taken as a fundamental workforce model for community innovator [1]. We often used the KSA model to map these characteristics for some workforce profiles. but for community innovators, the roles in their communities were also important [2]. In summary, there were four essential components of community innovators: knowledge, skill, attitude, and role.

1. *Knowledge* – was defined as the acquaintance with or understanding of science, art, or technique [3] and researchers used STEAM model to be knowledge components for innovators that has 5 main subjects [4, 5] :

1.1) *Science* – the knowledge of gathering and analyzing evidence about the natural world

1.2) *Technology* – the application of scientific knowledge for practical purposes.

1.3) *Engineering* – the branch of science and technology concerned with the design, building, and use of engines, machines, and structures.

1.4) *Arts* – the expression or application of human creative skill and imagination, typically in a visual form such as painting or sculpture, producing works to be appreciated primarily for their beauty or emotional power.

1.5) *Mathematics* – the study of numbers, shapes, and space using reason and usually a special system of symbols and rules for organizing them

2. *Skill* – was defined as the ability to use one's knowledge effectively and readily in execution or performance [6]. National Innovative Agency (Public Organization) suggested that the innovators must have 5 skills called "5I" those are [7]:

2.1) *Inspiration* - the ability to perceive the environment to inspire a new creation.

2.2) *Imagination* – the ability to form a mental image of something not present to the senses or never before wholly perceived in reality.

2.3) *Ideation* - the capacity for or the act of forming or entertaining ideas.

2.4) *Integration* - the ability to design all concepts and management plans that will linking people, technology, resources and diversity to achievable goals.

2.5) *Implementation* - the ability to access knowledge and everything profoundly and to take some actions to produce tangible results in business.

3. *Attitude* – was defined as a mental position with regard to a fact or state [8]. Researchers had adapted the ideas from many scholars [9, 10, 11] into 5 attitudes as follows:

3.1) *Positive thinking* - the practice of focusing on the good in any given situation

3.2) *Public mind* – the attitude of having or showing an unselfish interest in the public welfare

3.3) *Politeness* - the attitude of being respectful and considerate of other people

3.4) *Patience* - the capacity to accept or tolerate delay, trouble, or suffering without getting angry or upset

3.5) *Self-confidence* - the belief that you can do things well and that other people respect you.

4. *Role* – was defined as a socially expected behavior pattern usually determined by an individual's status in a particular society [12]. Researchers had adapted the ideas from many scholars [9, 10, 11, 13, 14, 15, 16, 17] into 5 roles as follows:

4.1) *Storyteller* – a person who can share and transfer knowledge, especially experiential and tacit knowledge in the community by narrating stories.

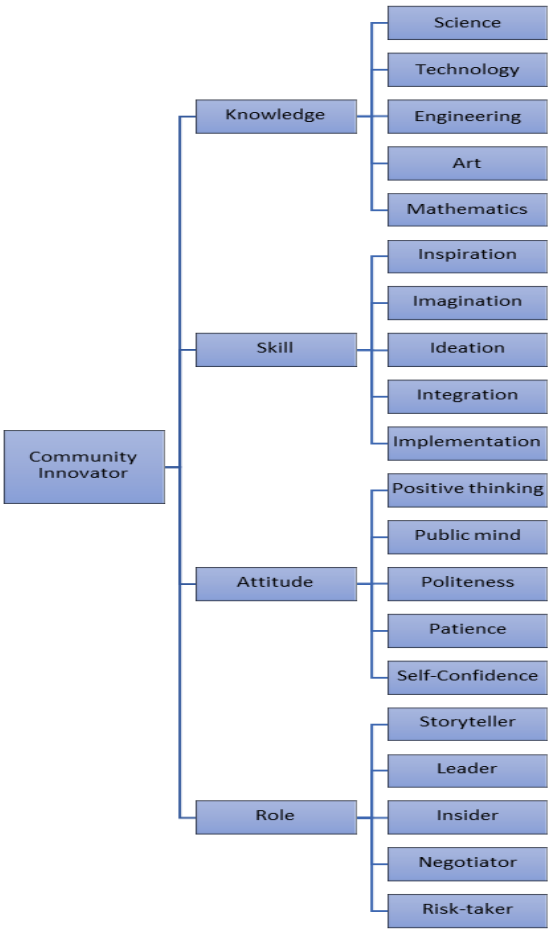
4.2) *Leader* – a leading figure in a community.

4.3) *Insider* – a person who can access anywhere in community.

4.4) *Negotiator* – a person who is involved in formal/informal discussions between people who are trying to reach an agreement, especially for community benefit.

4.5) *Risk-taker* – a person who can take a risk with reasonable consideration.

Fig.1: Conceptual Framework of Community Innovator



RESEARCH METHODS

This research was exploratory research. Data were collected from 525 representatives from various sectors in Thailand such as local administrative organizations, municipalities, and community enterprises, etc. The multi-stage sampling was used. In the first stage, we classified by the region (north, northeast, central, and south) and then we use convenience sampling in the second stage. The instrument used in this research was a questionnaire to measure components of community innovators as shown in Fig. 1. The researcher developed questionnaires with a total of 4 questions for demographic data and 61 questions for second-order confirmatory factor analysis. we used IOC with 3 experts to verify the content validity. all questions have been improved to get a score of more than 0.5 on each question. We then checked for reliability using 30 samples and the reliability of each subfactor ranged from 0.946 to 0.950. The measurement model showed acceptable convergent validity as all constructs demonstrate, composite reliability (CR) values are above 0.70, Cronbach's alpha (α) are above 0.8, and average variance extracted (AVE) for each construct exceeding 0.50. The data were analyzed using descriptive statistics and confirmatory factor analysis as shown in Table I.

Table I Summary of Cronbach's α, Factor Loadings, AVE, C.R. of the factors

Factor	Subfactors	Cronbach's α (if item deleted)	Factor Loadings	AVE	C.R.
Knowledge	Science (KSci)	0.949	0.72	0.617	0.889
	Technology (KTech)	0.948	0.85		
	Engineering (KEng)	0.949	0.83		
	Art (KArt)	0.948	0.74		
	Mathematics (KMath)	0.947	0.78		
Skill	Inspiration (SIns)	0.946	0.86	0.744	0.935
	Imagination (SImg)	0.946	0.83		
	Ideation (SIdea)	0.946	0.87		
	Integration (SInt)	0.947	0.9		
	Implementation (SImp)	0.946	0.85		
Attitude	Positive Thinking (APosTh)	0.950	0.79	0.672	0.911
	Public Mind (APubM)	0.950	0.73		
	Politeness (APolite)	0.949	0.85		
	Patience (APat)	0.948	0.88		
	Self Confidence (AConfi)	0.948	0.84		
Role	Storyteller (RStoTel)	0.948	0.78	0.666	0.909
	Leader (RLeader)	0.947	0.85		
	Insider (RInsider)	0.949	0.81		
	Negotiator (RNego)	0.949	0.82		
	Risk-taker (RRisk)	0.947	0.82		

RESULT

The respondents consisted of 525 representatives from communities all over Thailand. Most of them were 271 males (51.62%), and 254 females (48.38%).

For the age period, most of the respondents were 21-30 years old (n=224, 42.67%), followed by 31-40 years old (n=103, 19.62%), and the minorities were 60 years old or above (n=18, 3.43%).

For education level, most of the respondents graduated with a bachelor's degree (n=159, 30.29%), followed by a secondary school/ vocational certificate (n=143, 27.24%), and the minorities graduated with a master's degree or higher (n=17, 3.24%).

For the region, most of the respondents lived in the central region (n=196, 37.33%), followed by the northern region (n=139, 26.48%), and the minorities lived in the northeastern region (n=78, 14.86%) as shown in Table II.

Table II Demographic data of the respondents (n=525)

Demographic Data		Frequency	Percent
Gender	Female	254	48.38
	Male	271	51.62
Age	20 years old or below	36	6.86
	21-30 years old	224	42.67
	31-40 years old	103	19.62
	41-50 years old	92	17.52
	51-60 years old	52	9.90
	60 years old or above	18	3.43
Education	Primary school or lower	81	15.43

	Secondary school/Vocational certificate	143	27.24
	High vocational certificate/Diploma	125	23.81
	Bachelor's degree	159	30.29
	Master's degree or higher	17	3.24
Region	Northern	139	26.48
	Central	196	37.33
	Northeastern	78	14.86
	Southern	112	21.33

For the mean and standard deviation of Community Innovator, most subfactors were in high importance levels except the attitude subfactors which were very high levels and the overall average was 4.04

When considering 4 factors, it was found that the Role factor had the highest importance with a mean was 4.30, followed by the Skill factor, Knowledge factor, and Attitude factor and the mean was 4.07, 3.94, and 3.85, respectively as shown in Table III.

Table III Mean and standard deviation of Community Innovator

Factor	Sub factor	$\bar{X}$	SD	Meaning	Factor	Sub factor	$\bar{X}$	SD	Meaning
Knowledge		*3.94*	*0.684*	*High*	*Attitude*		*3.85*	*0.666*	*High*
	KSci	3.96	0.766	High		APosTh	4.06	0.672	High
	KTech	3.87	0.804	High		APubM	3.84	0.747	High
	KEng	3.93	0.775	High		APolite	3.72	0.854	High
	KArt	3.93	0.765	High		APat	3.75	0.810	High
	KMath	4.01	0.721	High		AConfi	3.88	0.780	High
Skill		*4.07*	*0.573*	*High*	*Role*		*4.30*	*0.560*	*Very High*
	SIns	4.05	0.595	High		RStoTel	4.29	0.656	Very High
	SImg	4.01	0.693	High		RLeader	4.35	0.622	Very High
	SIdea	4.17	0.625	High		RInsider	4.34	0.655	Very High
	SInt	4.05	0.714	High		RNego	4.27	0.650	Very High
	SImp	4.06	0.716	High		RRisk	4.23	0.647	Very High
ComInn		**4.04**	**0.515**	**High**	**(Overall)**				

The results of the second-order confirmatory factor analysis in the community innovator measurement model in terms of structural validity found that the developed measurement model was consistent with the empirical data. This could be determined from the chi-square value was 157.19 (p-value=0.59) and degrees of freedom was 162, Goodness of Fit (GFI) was 0.97, Adjusted Goodness of Fit Index (AGFI) was 0.96, and Root Mean Square Error of Approximation (RMSEA) was 0.0

When considering the factor loadings obtained from the standard scores of each observed variable in the community innovator measurement model of representatives in Thailand, it was found that all factor loadings of subfactors in terms of standard scores were positive, ranging from 0.72-0.90, and statistically significant at the .05 level. The community innovator could be explained by a factor ranging from 26% to 65%. The best factor is the Role factor which could explain the community innovator by 65%, followed by the Skill factor and the Knowledge factor which could explain the community innovator by 55% and 52%, respectively. as shown in Fig. 2 and Table IV.

Fig. 2: Results of second-order confirmatory factor analysis of community innovator

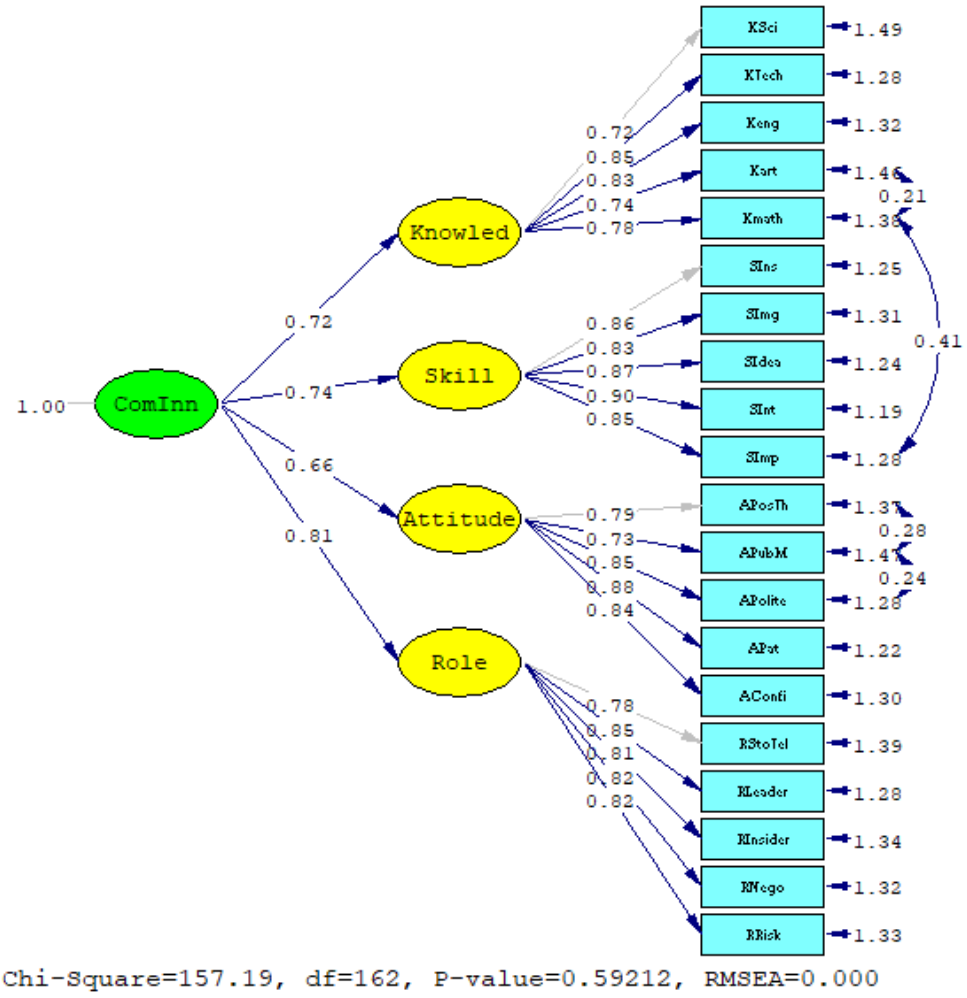


Table IV Results of second-order confirmatory factor analysis of community innovator measurement model

Factors	Subfactor	Standardized factor loading		t-value	R^2
		B (SE)	β		
Knowledge		*0.72 (0.08)*	*0.72*	*8.57*	*0.52*
	KSci	0.72	0.51		0.26
	KTech	0.85)0.10(	0.60	8.47	0.36
	KEng	0.83)0.10)	0.58	8.36	0.34
	KArt	0.74)0.10(	0.52	7.71	0.27
	KMath	0.78)0.10(	0.55	8.05	0.30
Skill		*0.74 (0.07)*	*0.74*	*10.41*	*0.55*
	SIns	0.72	0.61		0.37
	SImg	0.85)0.10(	0.59	10.22	0.35

	SIdea	0.83 (0.10)	0.62	10.53	0.38
	SInt	0.74 (0.10)	0.64	10.75	0.40
	SImp	0.78 (0.10)	0.60	10.46	0.36
Attitude		*0.66 (0.08)*	*0.66*	*8.73*	*0.43*
	APosTh	0.86	0.56		0.31
	APubM	0.83 (0.08)	0.51	9.06	0.26
	APolite	0.87 (0.08)	0.60	9.01	0.36
	APat	0.90 (0.08)	0.63	9.24	0.39
	AConfi	0.85 (0.08)	0.59	9.00	0.35
Role		*0.81 (0.08)*	*0.81*	*9.96*	*0.65*
	RStoTel	0.78	0.55		0.31
	RLeader	0.85 (0.09)	0.60	9.43	0.36
	RInsider	0.81 (0.09)	0.57	9.19	0.33
	RNego	0.82 (0.09)	0.58	9.27	0.34
	RRisk	0.82 (0.09)	0.58	9.23	0.33

DISCUSSIONS

According to the study, the representatives place the highest importance on the role component in the community and followed by skill, knowledge, and attitude components, respectively. This was consistent with the study of Kilgour, Reynaud, Northcote, & Shields [18] showed that role-playing is a tool to facilitate learning, self-reflection, and social awareness as well as the study of Anbarasan, P. [19] showed that role playing is an innovative teaching technique because role playing will make you easier to work as a community innovator. Once the role plays have been performed, discuss them. This is often more important than the role plays themselves as it is a time when insights are revealed and problems identified. This is where everyone learns.

RECOMMENDATIONS

1) In case of limited budget, time, or resources and it is impossible to develop community innovators all components at once. Developers can choose to develop according to the priorities of the components, in order of roles, knowledge, skills, and attitude components, respectively.
2) If considering at subfactor level, the Role of the Leader is the most important factor for community innovator. So, it ought to be the first component to be developed for community innovators.

3) According to the results of the study, this component of the developed community inventor model has a maximum predictive ability of 65%. In the future, Further studies should add other components to make the composition of the inventor in the community more complete.

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