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Factor Analysis of Built Environment Design and Management of Residential Communities for Enhancing the Wellbeing of Elderly People

Porntip Ruengtam *

Faculty of Architecture Urban and Creative Arts, Mahasarakham University, Mahasarakham, 44150 Thailand

Abstract

Globally, the number of senior people over 60 years of age is expected to be two billion by 2050 as reported by the United Nations. Thailand is a country facing the problem of an increasing senior population. The main objective of this research is to study the factors related to the environmental perception and requirements in the residential community of the Thai elderly. The research methodology began with observations of and interviews with three case studies in terms of management processes and the environmental designs of existing residential community projects in Thailand. The interview results were used to conclude with related theories and literature. A questionnaire survey was designed for the data collection in order to confirm the factors regarding the requirements of the elderly in the residential community with a group of Thai elderly (531 respondents). The statistical technique exploratory factor analysis (EFA) was used to classify the factors. The research revealed that the requirements in the residential community of the Thai elderlies were classified according to 3 groups by the EFA. The factors were comprised of the following (1) the requirement of activities and general facilities, (2) the requirement of facilities related to health and security, and (3) the requirement of facilities related to physical exercise in the residential community. The results led to formulating policies in the design and management of the residential community in order to enhance the quality of life, both physically and mentally, of the Thai elderly appropriately. The policies are discussed in the final part of this article.

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Keywords: Elderly; Built environment design; Residential community; Exploratory factor analysis.

* Corresponding author. Tel.: +668 0503 4298
E-mail address: porntip.r@msu.ac.th

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1. Introduction

The United Nations reported that the number of the world population greater than 60 years of age is expected to be two billion by 2050, making global aging a concern for countries, both rich and poor. Thailand is a country facing the problem of an increasing senior population. Because of modern medical science and better public health science at present, together with the lack of appropriate planning in population policy, the death rate of the Thai population has decreased. A yearly report on the Thai elderly situation for 2012 [1] indicated that the Thai elderly (60 years and above) will represent 19.1%, 26.6%, and 32.1% of the Thai population in 2020, 2030, and 2040 respectively. This leads to a question concerning how the Thai government can cope when Thailand reaches this situation. However, the National Committee on the Elderly under the Ministry of Social Development and Human Security Thailand [2] defined a framework for the Thai elderly as follows:

- Elderly persons with good living standards are physically and mentally healthy; have a happy family and social care, and an enabling and friendly environment; have stable security and access to appropriate welfare and services; lead a valuable life with dignity, are independent and autonomous, and serve as central reliability and participate in family, community, and social activities; and have access to data, information, and news.
- The family and the community serve as strong institutions and as a key sector of efficient support for the elderly.
- The welfare and service systems ensure a high quality of life and full participation of the elderly both in their family and in the community.
- All parties and sectors shall take part in the welfare and service system accessible and usable by the elderly, where safeguards are needed to protect them as a group of consumers.
- The proper undertakings and settings shall be performed to enable elderly persons that face difficulties and are in need of care to be recognized and included as members of their community in all areas.

This framework leads to the next question: Where will a large number of elderly live after their retirement while they face the inevitable degeneration of their body? They need assistance from their children or others when they have to go the hospital or clinic. For these reasons, a residential community for enhancing the well-being of the elderly is the answer. The researcher is committed to investigating the idea of a place that has all of the necessary facilities for the living and needs of the Thai elderly, where people can take care of them when they get sick, where there is good social management, a place where they can be a part of society with happiness and a place that is convenient and safe until their final days of life. What would such a place be like?

Therefore, the objective of this research is to study the environmental design and management requirements for a residential community for the elderly using exploratory factor analysis (EFA) to classify the factors. In order to achieve this objective, this research has done the following: identified the components of the Thai elderly's requirements; developed constructed factors that demonstrate the elderly's requirements that match willingness of the elderly to join a residential community; recommended policies for the design and management of a residential community to enhance the well-being of the elderly in the context of the Thai residential community.

2. Research background

The elderly have been defined by The National Committee on the Elderly under the Ministry of Social Development and Human Security Thailand [2] as follows: "the elderly are not a vulnerable nor social burden, but able to take part as the social development resources, so they shall be entitled to recognition and support by the family, community and the state to lead a valuable life with dignity and sustain their healthiness and living standards as long as possible." The World Health Organization, WHO [3], has specified on their website that "most developed world countries have accepted the chronological age of 65 years as a definition of an elderly or older person, but like many westernized concepts, this does not adapt well to the situation in developing countries". While this definition is somewhat arbitrary, it is many times associated with the age at which one can begin to receive pension benefits. At the moment, there is no United Nations (UN) standard numerical criterion, but the UN agreed on a cutoff of 60 years up to refer to the older population. In this research, the Thai elderly are defined as being 60 years of age and above, together with the health condition of the elderly classified according to 5 levels: (1) strong, can help

themselves with everything, (2) sometimes need some assistance, (3) mainly need assistance, (4) need assistance all the times, and (5) are unable to move and need assistance all the times.

2.1. Urban design

Plunz [4] stated that “urban design is the process of addressing surrounding environmental parameters when devising plans, programs, policies, buildings, or products”. An urban design can also refer to the applied arts and sciences dealing with creating the human-designed environment. These fields include architecture, geography, urban planning, landscape architecture, and interior design. Urban design studies the physical surroundings that provide the setting for human activity, ranging in scale from buildings and parks, green space to neighborhoods, the local community. Urban design is defined as the physical and constructed environment in which people live, work, and recreate on a day-to-day basis. In addition, urban design is concerned with the way these places are experienced and used, as well as other aesthetic elements that contribute to the quality of community environments. The urban design is considered in this research in terms of the Thai elderly’s requirements.

2.2. Healing environment

Jonas and Chez [5] believe that “an emphasis on healing is a key to the future medical management of chronic illness and the establishment of sustainable approaches to health care”. Healing defined as the process of recovery, repair, and return to wholeness, healing is the foundation for a vision of medicine that integrates diverse approaches from around the world for the alleviation of suffering, the enhancement of well-being, and the treatment of chronic illness. Healing is facilitated through the development of proper attitudes and intentions in both the provider and the recipient, use of personal self-care practices, creating healing relationships, applying the knowledge of health promotion and maintenance, and the appropriate integration of complementary and conventional medicine practices. Nelson et al. [6] stated that “a healing environment is synonymous with a therapeutic environment, and a therapeutic environment is one that is “designed to not only support and facilitate state-of-the-art medicine and technology, patient safety, and quality patient care but to embrace the patient, family and care providers in a psychosocially therapeutic environment”. The healing environment as discussed in the present study would be checked and compared to the mentioned literature and existing cases in Thailand. Then, the concluded results would be used in the questionnaire design.

2.3. Residential community

Paul et al. [7] stated that “a community is a social unit of any size that shares common values, or that is situated in a given geographical area (e.g. a village or town)”. It is a group of people who are connected by durable relations that extend beyond immediate genealogical ties, and who mutually define that relationship as important to their social identity and practice. The WHO Regional Office for Europe [8] defined “a community residential health facility as a non-hospital, community-based mental health facility that provides overnight residence for people with mental disorders”. The facilities include supervised housing unstaffed group homes; group homes with some residential or visiting staff; hotels with day and night staff; hostels and homes with 24-hour nursing staff; halfway houses; and therapeutic communities. Both public and private not-for-profit and for-profit facilities are included. Perkins et al. [9] stated in a textbook of building type basics for senior living that “common facilities within a skilled nursing facility serving all of the nursing units may include: a multipurpose room, a coffee shop/snack bar, a gift shop, a library, outdoor terraces and recreation areas, art/activities, a clinic, and a rehabilitation facility”. In the textbook, it was also stated that “in adult communities, landscaped and natural areas should be developed for walking, contemplation, golf, lawn sports, shuffleboard, gardening activities, fishing, and other recreational activities”. Presently, the residential community for elderly is being interested in implementing design projects in Thailand. However, there are no formal studies about this in Thailand. This study might be a first present in this area.

3. Research method

3.1. Case studies

The research process began with observations of and interviews with three case studies in terms of management processes and built environment designs. The three cases are existing elderly community projects and are still operating in Thailand. The three cases include the following.

- A private project: 600 single houses, 3 condominium buildings, and facilities related to the elderly. The project is suitable for the elderly with their family, patients with chronic diseases, and people that need special care or rehabilitation. The project is located in Chang-Lek, Bangsai, Ayutthaya.
- A governmental foundation project: 163 rooms of a building (8 floors), 300 rooms of 8 buildings (6 floors), and facilities. This project is suitable for the elderly at the beginning of their retirement, who are living alone, are strong, and can help themselves with everything. The project is located in Pathumwan, Bangkok.
- A religious foundation project: 164 rooms/beds of 5 buildings (2 floors), facilities related to the elderly, and nursing wards. The project is suitable for low-income elderly with amnesia, and elderly that are unable to help themselves. The project is located in Sampran, Nakhon Pathom.

The managers or management staff at the three case study sites were appointed and interviewed at their own community places on the topics of management, the environment, facilities, and activities in their community. After the three case studies were observed and the individuals interviewed, the facilities and activities were classified and defined using an item list. The item list result of this part was used to summarize the related theories and literature for the questionnaire design in the next section.

3.2. Questionnaire design

A questionnaire survey was designed for the data collection in this study to confirm the factors or requirements in the residential community of a group of Thai elderly. The questionnaire items were designed by referring to the literature review and the case studies as mentioned above. The questionnaire was comprised of two parts. The first part was general information about the respondents, including gender, age, health condition, education, and economic status (5 questions). The second part contains the requirement items in their residential community where they are expected (30 questions). The first part was measured according to the frequency (percentage) of the respondents while the second part was measured using a 5-level Likert scale from “strongly disagree” to “strongly agree.” The questionnaire items for the second part are shown in Table 1.

Table 1. Questionnaire items.

Factor		Item
Elderly's requirements	Location	Q1: Calm and natural place
		Q2: Near religious places
		Q3: Near hospitals
	Facility	Q4: Health food shop
		Q5: Convenience shop
		Q6: Beauty salon
		Q7: Laundry service
		Q8: Cleaning service
		Q9: Building maintenance service
		Q10: 24-hour security guards
		Q11: 24-hour medical center
		Q12: Care center for the elderly
		Q13: Sauna and spa
		Q14: Training center for improving quality of life
		Q15: Library
		Q16: Computer and internet room
		Q17: Karaoke lounge

Factor		Item
		Q18: Swimming pool
		Q19: Fitness
		Q20: Outdoor stadium
		Q21: Garden and outdoor patio
		Q22: Indoor activities
		Q23: Religious place
		Q24: Sidewalks and bike lanes
		Q25: Fence and gate guards
	Activity	Q26: Religious activities
		Q27: Recreational activities
		Q28: Important dairy activities
		Q29: Training activities
		Q30: Excursions programs

3.3. Validity and reliability

In order to ensure that the items in the questionnaire were appropriate for the Thai elderly in this research, interviews were held with five experts that have had relevant experience with elderly behavior and with residential communities. The experts reviewed the items and gave comments on whether they were accurate representations for measuring the model in this research. They also suggested some items that were more appropriate to be used in the context of the research. This exercise was useful for providing content validity and ensuring that the items were neither ambiguous nor confusing. Cronbach's alpha was used to evaluate the reliability of the questionnaire. Cronbach's alpha is a coefficient number used as an estimate of the reliability of a questionnaire in a psychometric test [10]. In this study, a pilot study was applied with 30 target elderlies for the reliability. The Cronbach's alpha coefficients for the factor of location (Q1-Q3), facility (Q4-Q25), and activity (Q26-Q30) were 0.942, 0.850, and 0.953 respectively. The coefficient for all items (Q1-Q30) was 0.964. All of the coefficients were above 0.7, demonstrating that the questionnaire was reliable [11].

3.4. Data collection

Once the questionnaire was designed, a target group of Thai elderly (aged 60 years and above) was selected using the convenient non-probability sampling technique. This is a sampling technique where the samples are gathered in a process that does not give all the individuals in the population equal chances of being selected. Almost all of the respondents were in Bangkok, while some of them were in big cities surrounding Bangkok. The period of the survey began in May and it concluded in July 2015 (3 months). Face-to-face interviews were conducted for explaining the details of the questionnaire to ensure that the respondents understood the survey. In total, 550 questionnaires were responded to, while 19 were discarded due to incomplete or biased responses. As such, 531 data were valid and used for the analysis in the next section.

4. Results

4.1. Descriptive results

Profile of the respondents totals 531 data of the Thai elderly in this research were shown as below Table 2.

Table 2. Descriptive results

Description	Frequency	Percentage
Gender		
- Male	220	41.4%
- Female	311	58.6%
Age		
- 60 - 65 yrs.	265	49.9%
- 66 - 70 yrs.	154	29.0%
- 71 - 75 yrs.	79	14.9%

Description	Frequency	Percentage
- 76 - 80 yrs.	27	5.1%
- More than 80 yrs.	6	1.1%
Health condition		
- Strong, can help themselves with everything	282	53.1%
- Sometimes need some assistance	194	36.5%
- Mainly need assistance	40	7.5%
- Need assistance all the time	11	2.1%
- Unable to move and need assistance all the time	4	0.8%
Education level		
- No education	24	4.5%
- Primary school	62	11.7%
- High school	155	29.2%
- Bachelor degree	257	48.4%
- Higher than a bachelor degree	33	6.2%
Economic status (last income, before retirement)		
- Less than 10,000 Baht/month	93	17.50%
- 10,000 to 30,000 Baht/month	223	42.0%
- 30,001 to 50,000 Baht/month	95	17.9%
- 50,001 to 100,000 Baht/month	85	16.0%
- More than 100,000 Baht/month	35	6.6%

4.2. Exploratory factor analysis

Exploratory factor analysis (EFA) is a statistical method used to uncover the underlying structure of a relatively large set of variables [12]. EFA is used to reduce the number of variables to a smaller set of underlying summary variables called a “factor.” EFA was implemented to determine the underlying factor structure construct of the built environmental design and management of the residential community in Thailand. The important coefficients of the EFA were presented to show the accuracy of the analysis, such as the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy = .973 (KMO>0.7) [13]. Bartlett's test of sphericity had a significant value = .000 (less than .05), and Approx. Chi-square = 15384.567, df = 435. Factor loading values that were less than 0.5 were eliminated. In the extraction of the EFA, based on the initial eigenvalues greater than 1 [14], as shown in Table 3, the analysis output showed three components were the factors in this EFA. The percentage of explained variance was 70.6%.

Table 3. Total variance explained

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	17.430	58.101	58.101	17.430	58.101	58.101	9.441	31.471	31.471
2	2.371	7.904	66.006	2.371	7.904	66.006	6.145	20.484	51.955
3	1.378	4.593	70.598	1.378	4.593	70.598	5.593	18.643	70.598
4	.853	2.843	73.441						
5	.734	2.446	75.887						
6	.603	2.008	77.895						
7	.551	1.835	79.731						
8	.501	1.671	81.401						
9	.442	1.475	82.876						
10	.392	1.308	84.184						
11	.355	1.185	85.369						
12	.340	1.135	86.503						
13	.339	1.131	87.635						
14	.330	1.102	88.736						
15	.312	1.040	89.776						
16	.276	.921	90.697						
17	.272	.908	91.605						
18	.267	.891	92.496						
19	.253	.843	93.338						
20	.228	.760	94.098						
21	.213	.711	94.809						

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
22	.208	.695	95.504						
23	.198	.662	96.166						
24	.194	.648	96.813						
25	.183	.609	97.423						
26	.176	.588	98.011						
27	.172	.572	98.582						
28	.155	.518	99.100						
29	.142	.474	99.574						
30	.128	.426	100.000						

The EFA output showed that three factors of the 30 items (Q1-Q30) were classified according to three groups: factor 1: Q2, Q4, Q6, Q7, Q8, Q9, Q13, Q14, Q15, Q16, Q17, Q23, Q26, Q28, Q29, and Q30 (16 variables); factor 2: Q1, Q3, Q5, Q10, Q11, Q12, and Q25 (7 variables); factor 3: Q18, Q19, Q20, Q21, Q22, Q24 and Q27 (7 variables). Furthermore, the reliability of the questionnaire in terms of the 3 factors was assessed on the basis of Cronbach's alpha coefficient. According to Nunnally [11], Cronbach's alpha coefficients of 0.7 or higher are recognized as acceptable values. The values of the coefficient were acceptable for all 3 factors, ranked from 0.928 to 0.964, and the value of all items (Q1-Q30) was 0.975. The outputs for all of the above are shown in Table 4.

Table 4. Factor loading of the EFA and Cronbach's alpha

Item	Factor loading			Cronbach's alpha	
	1	2	3		
Q28	0.78	0.22	0.206	0.964	0.975
Q29	0.766	0.178	0.302		
Q14	0.757	0.19	0.278		
Q15	0.752	0.203	0.187		
Q30	0.748	0.11	0.355		
Q2	0.714	0.451	0.086		
Q26	0.713	0.341	0.192		
Q13	0.709	0.226	0.331		
Q9	0.697	0.346	0.271		
Q4	0.694	0.297	0.324		
Q16	0.673	0.109	0.548		
Q23	0.658	0.385	0.186		
Q17	0.65	0.075	0.578		
Q8	0.64	0.349	0.248		
Q6	0.636	0.204	0.473		
Q7	0.63	0.349	0.399		
Q11	0.189	0.853	0.153	0.928	
Q10	0.171	0.831	0.188		
Q12	0.384	0.741	0.095		
Q3	0.239	0.735	0.357		
Q25	0.154	0.705	0.424		
Q1	0.36	0.676	0.351		
Q5	0.447	0.566	0.394		
Q19	0.252	0.303	0.807	0.940	
Q18	0.386	0.234	0.783		
Q20	0.376	0.366	0.682		
Q22	0.34	0.483	0.621		
Q21	0.362	0.472	0.606		
Q24	0.355	0.508	0.577		
Q27	0.438	0.414	0.553		

In Table 4, the EFA indicated that the requirements in the residential community of the Thai elderly were classified according to three factors. In this research, the three factors were determined by considering the majority

of the items in the factors, including factor 1, “activities and general facilities,” factor 2, “health and security,” and factor 3, “exercise facilities”.

5. Discussion

As described above, the elderly’s requirements were classified according to three factors: activities and general facilities, health and security, and exercise facilities. Regarding the factor of activities and general facilities, all 16 variables had factor loading scores between .630 and .780, and the top-5 factor loading scores were the requirements of important daily activities (Q28; .780), training activities (Q29; .766), a training center for improving quality of life (Q14; .757), a library (Q15; .752), and excursions programs (Q30; .748). For the factor of health and security, there were 7 variables which had factor loading scores between .566 and .853, and the highest-5 factor loading scores were the requirements of a 24-hour medical center (Q11; .853), 24-hour security guards (Q10; .831), a care center for the elderly (Q12; .741), being near a hospital (Q3; .735), and a fence and gate guards 2 (Q25; .705). For the factor of exercise facilities, there were 7 variables which had factor loading scores between .553 and .807, and the highest-5 factor loading scores were the requirements of fitness center (Q19; .807), a swimming pool (Q18; .783), an outdoor stadium (Q20; .682), indoor activities (Q22; .621), and a garden and outdoor patio (Q21; .606).

6. Conclusion

This research studied the factors related to the environmental perception and requirements in the residential community of Thai elderly. The research began with observations and interviews at the three case study sites, in terms of the management processes and environment designs of existing residential community projects in Thailand. The interview results were used to summarize the related theories and literature as a list of factors. Five hundred and thirty-one Thai elderly respondents (Table 2) were employed for the data collection to confirm the factors using the designed questionnaire. EFA was used to classify the factors, and the results revealed that the requirements in the residential community of the Thai elderly were classified in terms of three groups. The three factors comprised (1) the requirement of activities and general facilities, (2) the requirement of facilities related to health and security, and (3) the requirement of facilities related to physical exercise in the residential community. The top 5 requirements in terms of activities and general facilities were important daily activities, training activities, a training center for improving the quality of life, a library, and excursion programs. The top 5 requirements in terms of health and security were a 24-hour medical center, 24-hour security guards, a care center for the elderly, being near a hospital, and a fence and gate guards. The top 5 requirements in terms of exercise facilities were a fitness center, a swimming pool, an outdoor stadium, indoor activities, and a garden and outdoor patio. The conclusion regarding the residential community for the Thai elderly is shown in Table 5.

Table 5. The residential community for the Thai elderly

Residential community for Thai elderly	Activities and general facilities	- Important daily activities
		- Training activities
		- Training center for improving quality of life
		- Library
		- Excursions programs
	Health and security	- 24-hour medical center
		- 24-hour security guard
		- Care center for the elderly
		- Near hospitals
		- Fence and gate guards
	Exercise Facilities	- Fitness center
		- Swimming pool
		- Outdoor stadium
		- Indoor activities
		- Garden and outdoor patio

Regarding the policies for the design and management of a residential community for enhancing the well-being of Thai elderly, the following can be concluded:

1. The Thai government should prepare to cope with the increase of the Thai elderly in the near future as defined in the framework (section 1) of The National Committee on the Elderly under the Ministry of Social Development and Human Security Thailand (2009).
2. The facilities in the residential community should be focused on:

    - Activities and general facilities such as important daily activities, training activities, a training center for improving the quality of life, a library, and excursions programs.
    - Health and security such as a 24-hour medical center, 24-hour security guards, a care center for the elderly, being near hospitals, and a fence and gate guards.
    - Exercise facilities such as a fitness center, a swimming pool, an outdoor stadium, indoor activities, and a garden and outdoor patio.

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References

[1] The Thailand Nation Elderly Committee, The Yearly Report of Thai Elderly Situation 2012, The Ministry of Social Development and Human Security Thailand, Bangkok, 2012.
[2] The National Committee on the Elderly, the Ministry of Social Development and Human Security Thailand, The 2nd National Plan on the Elderly (2002-2021), The Ministry of Social Development and Human Security Thailand, Bangkok, 2009.
[3]World Health Organization; WHO. Definition of an older or elderly person. Retrieved from http://www.who.int/healthinfo/survey/ageingdefnolder/en/ (on 1 Jan. 2016)
[4] R. Plunz, Design and the Public Good, MIT, Massachusetts, 1982.
[5] W.B. Jonas, R.A. Chez, Toward Optimal Healing Environments in Health Care, The Journal of Alternative and Complementary Medicine. Volume 10 Supplement 1 (2004) pp. S-1-6.
[6] C. Nelson, T West, C. Goodman, The hospital built environment: what role might funders of health services research play? Rockville, MD: Agency for Healthcare Research and Quality, Contract no: 290-04-0011. AHRQ Publication No. 06–0106-EF (2005).
[7] J. Paul, Nadarajah, Yaso, H. Karen, S. Victoria, Sustainable Communities, Sustainable Development: Other Paths for Papua New Guinea, University of Hawaii Press, Honolulu, 2012, pp. 14.
[8] WHO Regional Office for Europe, Policies and Practices for Mental Health in Europe, Copenhagen, 2008, pp. 71.
[9] B. Perkins, J.D. Hoglund, D. King, E. Cohen, Building Type Basics for Senior Living, John Wiley & Sons, Inc, New Jersey, 2004.
[10] L.J. Cronbach, Coefficient alpha and the internal structure of tests. Psychometrika. Volume 16, Issue 3 (1951) pp. 297–334.
[11] J.C. Nunnally, Psychometric Theory, 2nd. Edition, McGraw-Hill Inc, New York, 1978.
[12] M. Norris, L. Lecavalier, Evaluating the Use of Exploratory Factor Analysis in Developmental Disability Psychological Research, Journal of Autism and Developmental Disorders. Volume 40, Issue 1 (2010) pp. 8-20.
[13] B.G. Tabachnik, L.S. Fidel, Using multivariate statistics. 4th ed., Allyn & Bacon, Massachusetts, 2001.
[14] H.F. Kaiser, The varimax criterion for analytic rotation in factor analysis, Psychometrika. Volume 23, Issue 3 (1985) pp. 87-200.