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Article

Extended AHP Approach with Latent Factor and Stratum in Prioritizing and Positioning of OTOP Thailand's Program for Elderly Market

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Abstract: We proposed a modified AHP technique to prioritize and position the OTOP product for the elderly consumer market. This research developed and extended the methodology proposed by R. Suttipong to account for both latent and stratum factors. The product preferences defined as the latent factor are included in the model. This paper applied the AHP with the latent factor of product preferences inserted into the calculation. The prioritized weights are computed overall and at each stratum classified by gender. This stratum has been statistically found significant by S. Phanphet based on the large survey result of product preference and affects the latent factor of the preferences. This proposed method leads to new findings on the implementation plan to promote the OTOP product among different sectors attributed to the latent factor. This newly proposed analysis technique was used to set the strategic action plan for product development for each gender group for the northern Thailand OTOP development program. This proposed technique can justify and prioritize the group of OTOP for efficient product development.

Keywords: Elderly Market; One Tambon One Product (OTOP); Analytical Hierarchical Process; Thailand Program OTOP.

1. Introduction

One Tambon One Product (OTOP) has been initiated as a program to support the local economy and generate income for the local community. The OTOP has been considered the main driver for Thailand's government to stimulate the local economy. This program was adopted from the Japanese success model of One Village One Product. It was proven as the major economic engine to provide local communities with opportunities to create, market, and sell their local product. The OTOP program has helped create many

entrepreneurs, small and medium (SME) enterprises, and local employment (Natsuda et al., 2012). This program also helps the community transform their local resources into a highly valued product economically. This drives the success of rural area development. This program creates the collaboration between local community members and generates a system of cooperatives whose business is capitalized based on the local resources. This program also increases local skilled labour and drives human resource development for the community (Denpaiboon & Amatasawatdee, 2012).

The OTOP product is designed and typically made by and within the local community. There are substantial amounts of OTOP products created from the total of Thailand's 7,255 Tambons or sub-district registered with the government. According to the large numbers of OTOP products. The government launched projects to support the program in design and development. However, according to the overwhelming number of products, selecting product groups and types for design improvement is challenging for the Thailand government. The right group of products must be selected and must be consistent with the demand and market opportunity.

The systematic approach to identifying what action shall be invested or positioned must be defined clearly for different OTOP groups. The OTOP products have been classified into five different groups or categories. Each product is certified and rated with its value for the, i.e., five stars system or championship system. The Thai government can use this methodology of valuing the product to spot the low rank or low star products and initiate the improvement and support programs. Even though this championship system can be used to identify the potential and action for improvement, this system is only conducted through a panel of experts selected by the government. There is no input from the market used for the ranking and grading. Hence to select the right product for marketing and promotion, this championship or star grading system may not always lead to business success. Hence, this research provides the systematic approach for the program to define the group of products that will be strategically focused with new creativity for the new market. With the improved methodology of product group selection, government intervention can be effectively applied and enhance the OTOP program's effectiveness (Kurokawa, 2009).

There is a strong need for a systematic methodology that can value, rank and select the group of products according to or based on customer demand yet aligned with the results certified by the championship system. It can help maximize the benefits for the development of OTOP products. It will help sustain the competitiveness of the OTOP. The product development strategy must link the information to the need of the customer, especially the new larger growing market such as the elderly in Thailand will economically improve the OTOP program. This research aims to develop and propose a new approach based on the nexus model concept that considers various actors of academia, policy maker, and business (Noble, 2019) in determining and prioritizing the value of each OTOP group. These concepts of product development selection, when applied to draw information from the new emerging market of elderly consumers in Thailand, will alternatively increase the opportunities for OTOP entrepreneurs to generate more sales. This proposed concept will help the Thai government deploy the right strategic action and choose the right OTOP product developments to match customer needs, perceptions, and satisfaction with the current product value (Joompha & Pianthong, 2018).

Phanphet et al. (2019) and Suttipong et al. (2019) studied and identified customer needs differences in the OTOP product. The study identified and revealed the customer perception of different high sale-based products on each group. The researchers analyzed the data and ranked the consumer preferences using the data obtained from large systematic surveys and focus groups. The top three most potential groups of OTOP product for product development for elderly consumer market were identified. The authors devised and used criterions called BOSE model consisting of Business, Opportunity, Self- Sustainability, and Environment aspects to weight, identify, and prioritize the customer needs and perceptions concerning each of those five OTOP groups. The Analytical Hierarchy Process (AHP) technique was used to compare those five groups for those BOSE criteria and identify the relative importance weights. The government used their results to position the OTOP product that meets the need of the elderly consumer segment and deploy the right policy for product evolution (Suttipong et al., 2019).

Even though that technique can be applied and reveal the product position for the elderly consumer market, this top-level analysis may yield different suggestions when auxiliary information is available. For example, (Phanphet et al., 2019) found that the preference of each OTOP groups can be different among genders. Therefore, if this latent factor can be included, the policy and action design can result in the OTOP product's different position. Thus, an improved and new analysis that can incorporate the latent factor is proposed in this research. This paper proposed a new technique incorporating auxiliary information on the product preference defined as Latent factor into the AHP process. This research first defines the, i.e., elderly, consumer preference information derived from the AHP and presented in form of weights for those

OTOP groups. The information provided from the survey conducted by is large surveys of 1,275 customer from Suttipong et al. (2019) were used to identify the latent weights of OTOP product preference. Next, the AHP was used to define the potential of OTOP based on those four BOSE criteria developed by (Suttipong et al., 2019). Lastly, the aggregation of AHP from elderly preference and OTOP product group potential are combined using the adjusted weight derived from the latent factor. This new method will enhance the effectiveness of the government's OTOP product support policy. This research is demonstrated as follows. Section 2 presents the literature review on the OTOP product and selection methodology. Section 3 presents the methodology of this extended AHP with details. Finally, the summary and discussion were given in last section.

2. Literature Review

The analytic hierarchy process (AHP) has been widely used to identify and prioritize decision-making alternatives (Battistoni et al., 2013). This AHP has been developed since 1970 as a multi-criteria decision-making technique. The AHP is a structured approach based on a pairwise comparison approach used to justify different alternatives. The AHP summarizes the preference degree of priority for the alternatives using weights (Belton, 1986). The numerical priorities through weighting scores are used to identify each decision alternative's important values. To apply the AHP, the objective function must be first specified. The fixed set of criteria is then used to derive the total score computed from the product of the weights of each criterion and the weights of the alternatives (Saaty, 1980). The AHP has been widely used to decide on the OTOP context, such as the selection of OTOP product distribution (Choomrit et al., 2011), the management and practices of OTOP supply chain and logistics (Vasiliauskas & Jakubauskas, 2007), as well as the industrial product development (Battistoni et al., 2013).

The AHP can be applied to select strategy of OTOP business management that aligns with the value and market opportunity of OTOP product group for effective promotion. Many researchers defined success factors of the OTOP business management without accounting market opportunity for different of product group. For instance, (Tuamsuk et al., 2013) found and presented the knowledge management model derived from the business communities of OTOP product champions. The researchers presented and outline what knowledge management factors that influence the success of the five-star OTOP businesses. The authors suggested that the OTOP business must identify organization leader, manage culture, staff and knowledge to improve the businesses. (Thammasang & Poonikom, 2016) showed that the indicators on knowledge management must also relate with the production management. Most authors reported the success factors related to the knowledge management. However, those findings do not regard the product priority, hence cannot be adopted to define OTOP product improvement or development policy. This research applied the AHP to extracted information on opportunities and needs of the elderly consumer market. It used that knowledge on to prioritize the OTOP product group in relation to business management criteria.

The AHP was also used to improve the OTOP business. (Noknoi & Lungtae, 2014) applied the AHP technique to derive the marketing strategies for the herbal product group. Several researches conducted the analysis on specific single product development such as wood handicraft (Phriwanrat, 2014),(Mendoza & Prabhu, 2000), processed food (Joompha & Pianthong, 2018). Recently, Suttipong et al., (2019) used the AHP to prioritize and select OTOP product group for marketing and product development by simultaneously incorporating all five groups of OTOP products. The results in a high-level strategy considering overall structure or groups of OTOP products. Hence, to develop a holistic view on OTOP product development, the information on the importance of OTOP groups must be first considered and included in the analysis. Even though identifying product group priority by (Suttipong et al., 2019) helps outline the set of products for promotion, this approach can be improved and extended to account for more online information generated from customers, especially in the IoT era. By considering the customer preferences that can be easily aggregated from several public media sources, the customer preferences can be quickly derived, such as by using data mining. This additional information on customer preference can be used to improve the accuracy of the decision-making process.

Even though the AHP methodology proposed by Suttipong et al., (2019) can identify the weights as the degree of importance of those five major OTOP groups to the developed BOSE criteria, this high-level analysis could provide different suggestion if additional auxiliary information is included and accounted for. The analysis conducted by (Phanphet et al., 2019) showed that the preference of each OTOP groups may be different among customer gender. Thus, the preferences of product from different gender shall be considered in defining the product group priority. Therefore, if this latent information of customer preference was identified and included, the policy and action design results will be greatly improved for the government to position the OTOP product that meet the need of elderly consumer segment. Thus, an

improved and new analysis that can incorporate the latent factor is proposed. Based on the literature review, no AHP-based OTOP product development considers auxiliary information such as customer preference. Hence, this research proposed a new method to extend the hierarchical AHP by Suttipong et al. (2019) to prioritize and position the OTOP product for the new elderly market under auxiliary product preference information defined as the Latent factor.

3. Materials and Methods

This research methodology starts by first defining the preferences and their associated weights among potential groups of products for the needs of the elderly customer. First, the AHP was applied to define and outline the OTOP preference structure of customer preference for OTOP product. The proposed methodology starts from

Step (1) identifying the latent information defined as preferences and needs of the elderly about those five OTOP product groups. The elderly preferences were next decomposed and analyzed to define the latent weights of OTOP product preference. Then, the priority of each group was derived using two following steps.

Step (1.1) Analyze Customer Preferences and derive Latent Weights for the overall group. In this step the multiple comparison is used to derive the corresponding weights of elderly consumer preferences in which are elderly consumer preferences on Utensil, Beverage, Cloth, Herbs, and Food respectively.

Step (1.2) Analyze Customer Preferences and derive Latent Weights for each stratum, i.e., gender or occupation etc. In this step the corresponding weights of elderly or consumer preferences are obtained based on each stratum are elderly consumer preferences on Utensil, Beverage, Cloth, Herbs, and Food for stratum i^{th}.

Step (2) Deriving the OTOP product potential and their weights. In this process, we adopted the same concept of Suttipong et al. (2019) and employed expert panels and literature to adhere the four main criteria of BOSE model. Each group of OTOP product was evaluated according to these criteria and the results of product group priority were summarized. The AHP was used to define the potentials of OTOP based on those criterions. In this step the usual AHP process was applied. The final OTOP product potential weights are defined as representing the OTOP potential weights of the Utensil, Beverage, Cloth, Herbs, and Food, respectively

Step (3) Aggregating the OTOP potential weights with the latent factor weights. The final OTOP product group priority is combined using the adjusted weighted. The calculation consists of the following steps

Step (3.1) Aggregate the Latent Weights at top level from step1.1 with AHP weights from step 2.2

$$\boldsymbol{\omega}^{oveall} = \boldsymbol{\omega} \times \boldsymbol{\omega}^{P} = \left(\omega_1 \omega_1^{P}, \omega_2 \omega_2^{P}, ..., \omega_k \omega_k^{P} \right), \tag{1}$$

and then normalized the weights $\boldsymbol{\omega}^{oveall}$. Step (3.2) Aggregate the Latent weight of each stratum from step1.2 with AHP weights from step 2.2

$$\boldsymbol{\omega}_i^{oveall} = \boldsymbol{\omega}_i \times \boldsymbol{\omega}^{P} = \left(\omega_{i1} \omega_1^{P}, \omega_{i2} \omega_2^{P}, ..., \omega_{ik} \omega_k^{P} \right), \tag{2}$$

and then normalized the weights $\boldsymbol{\omega}_i^{oveall}$. The application of the new method as shown in Figure 1.

We used the same approach and criteria derived from the expert panels and literature review of Suttipong et al. (2019) during the second step. The OTOP product potential were derived and reports among 5 main groups of (i) Food, (ii) Cloth & Apparel, Accessories, (iii) Beverages, (iv) Herbal product, and (v) Utensils, Decorative items and Souvenirs using AHP weights denoted as the product potential $\boldsymbol{\omega}^{P} = \left(\omega_1^{P}, \omega_2^{P}, ..., \omega_k^{P} \right)$.

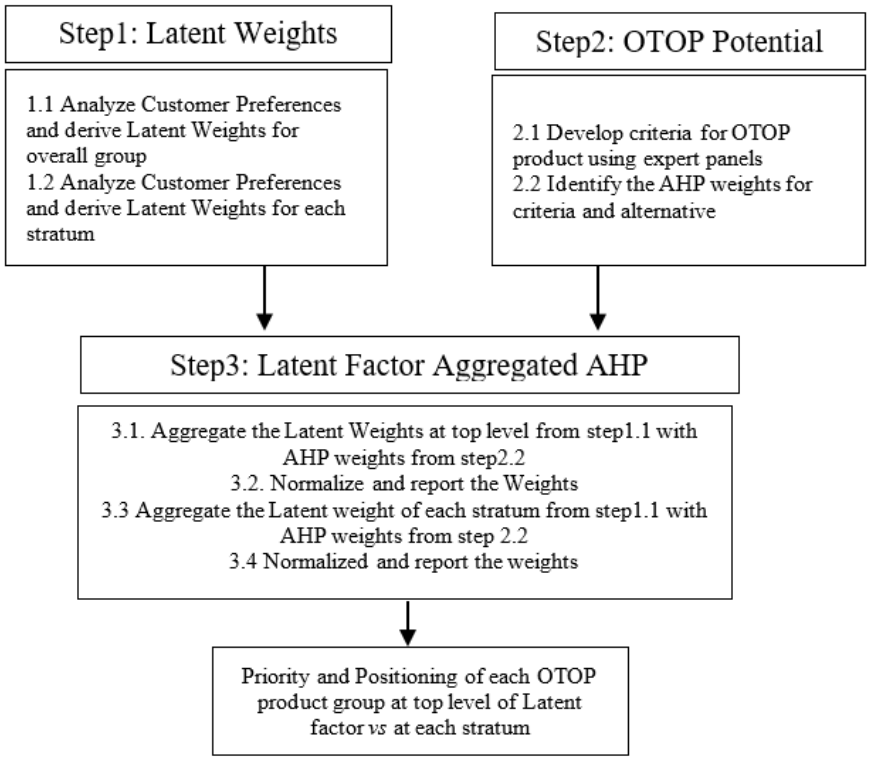

Figure 1. Steps of the new extended approach

We again adopted the same concept of four main criteria of BOSE, the Business contribution value to the OTOP program. Since the product potential were derived based on AHP process where product group was defined as alternatives. The prioritization of these alternative in the view of the AHP concept with respect to the four criteria were depicted as the model structure of AHP in Figure 2.

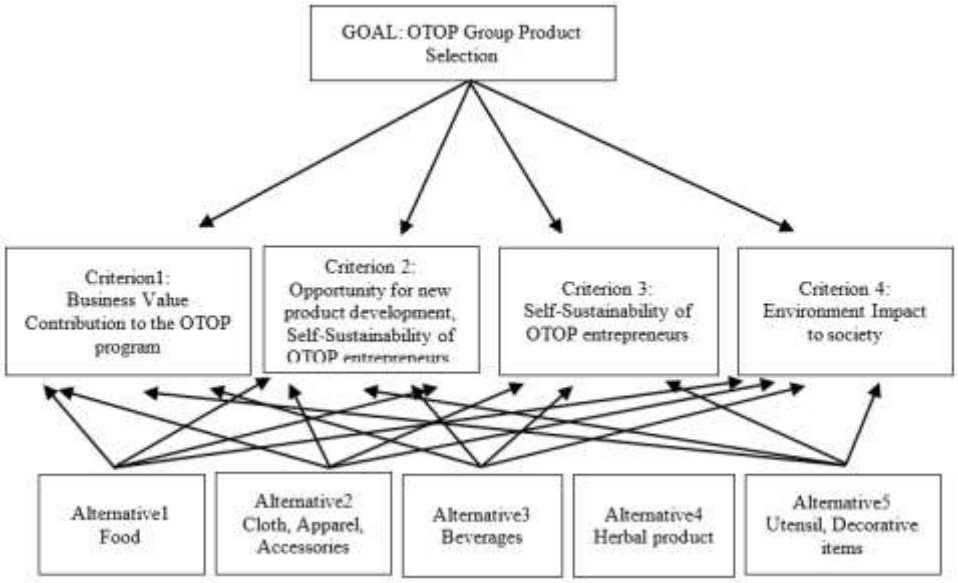

Figure 2. Analytic hierarchy process (AHP) structure

4. Results

The pairwise comparisons were conducted using the data set provided by Suttipong et al. (2019). The weights from the elderly consumer preference with respect to each OTOP product category or group were summarized in Table 1. Based on the Consistency Index (CI) and the Consistency Ratio (CR) of less than 0.1, the information is coherent. The preferences can be considered justified for the decision-making process. The derived weights shown in Figure 3 show the decreeing weights from utensils, beverages, cloth, herbs, and foods. This research also tested whether the weights are different among male and female elderly. There is no strong evidence suggesting the differences. Hence the weights will be used for prioritizing each OTOP product group in the next step.

Table 1. Comparison matrix of elderly preferences

Preferences categories	**Overall** ω^{oveall}	**Male** ω_1^{oveall}	**Female** ω_2^{oveall}
Utensil	37%	36%	38%
Beverage	23%	25%	23%
Cloth	17%	16%	18%
Herbs	13%	13%	12%
Food	10%	10%	9%

The result shows that the consumer preferences are different among different groups of products. The Utensil received highest preferences of buying among elderly followed by Beverage, Clothes, Herbs and Food. This result aligned with formal report conducted by the OTOP office that the Utensil are among the highest volume of buying compared with others.

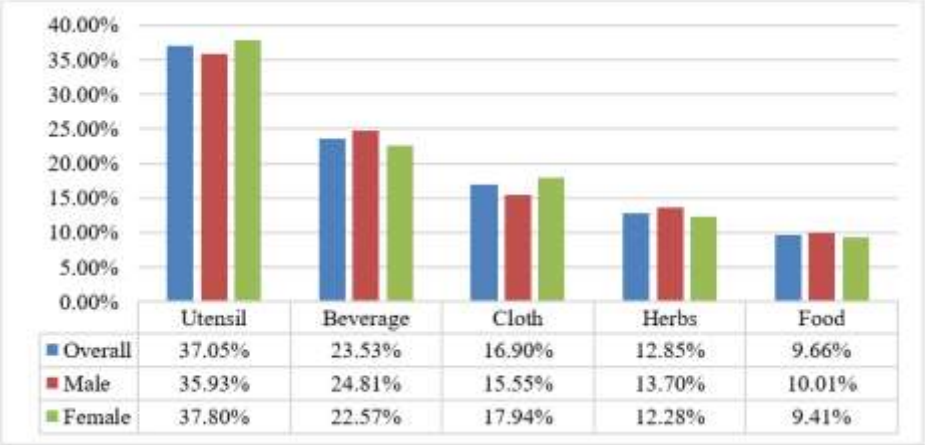

Figure 3. Derived latent weights of each OTOP product

However, the gender stratum used to demonstrate the technique shows little difference in the preferences. Second, the weights concerning each criterion were calculated based on the panel judgement. The pairwise comparison to the 5-point scale is shown in Table 2. Again, both CI and CR are less than 0.1, confirming the consistency of the information derived from expert group judgments. Figure 3 shows the weights derived for each criterion.

Table 2. Standardize pairwise comparison of expert judgement on each criterion

Expert Judgement	**Business**	**Opportunity**	**Sustainability**	**Environment**
Business	1.00	3.25	2.50	3.25
Opportunity	0.31	1.00	2.50	3.25
Sustainability	0.40	0.40	1.00	2.50

Environment	0.31	0.31	0.40	1.00
Max Eigen Value =		4.23	R.I. =	0.9
C.I. =		0.07778674	C.R. =	0.08642971

Next, each OTOP group was defined as a decision alternative. In this research, five groups of five alternatives for the selection of OTOP were compared with each criterion of BOSE. The expert judgements were asked to make the pairwise comparison, whereas the results from the AHP process were summarized in Table 3 (a-d).

Table 3. Standardized unit of pairwise comparation of expert judgement on each criterion

Business	Utensil	Beverage	Cloth	Herbs	Food	Eigen Vector
Utensil	0.39	0.59	0.38	0.31	0.17	37%
Beverage	0.12	0.18	0.38	0.27	0.17	22%
Cloth	0.16	0.07	0.15	0.31	0.24	19%
Herbs	0.10	0.06	0.04	0.08	0.32	12%
Food	0.22	0.10	0.06	0.03	0.10	10%
	1	1	1	1	1	1.00

Opportunity	Utensil	Beverage	Cloth	Herbs	Food	Eigen Vector
Utensil	0.41	0.61	0.38	0.29	0.23	38%
Beverage	0.13	0.19	0.38	0.29	0.23	24%
Cloth	0.17	0.07	0.15	0.29	0.30	19%
Herbs	0.13	0.06	0.05	0.09	0.16	10%
Food	0.17	0.07	0.05	0.05	0.09	9%
	1	1	1	1	1	1.00

Self-Sustainability	Utensil	Beverage	Cloth	Herbs	Food	Eigen Vector
Utensil	0.41	0.63	0.30	0.31	0.26	38%
Beverage	0.11	0.17	0.43	0.24	0.20	23%
Cloth	0.23	0.07	0.17	0.31	0.26	21%
Herbs	0.13	0.07	0.05	0.10	0.20	11%
Food	0.13	0.07	0.05	0.04	0.08	7%
	1	1	1	1	1	1.00

Environment	Utensil	Beverage	Cloth	Herbs	Food	Eigen Vector
Utensil	0.44	0.63	0.44	0.32	0.20	41%
Beverage	0.12	0.17	0.34	0.24	0.20	21%
Cloth	0.13	0.07	0.14	0.32	0.26	18%
Herbs	0.13	0.07	0.04	0.10	0.26	12%
Food	0.18	0.07	0.04	0.03	0.08	8%
	1.00	1	1	1	1	1.00

The final evaluation of the OTOP group alternative was calculated using those weights. The overall priority was computed and summarized in Table 4 and Figure 5. The analysis shows that the weights derived from the AHP are again consistent with the weights derived from the elderly consumer needs. This research does not find a statistically significantly different between the two sets of weights.

Table 4. Overall AHP Calculated Priority Weights for Each OTOP Product Group

Priority categories	**Potential weights** ω^P	**Latent weights** ω	**Adjusted weights** $\omega \times \omega^P$	**Normalized adjusted weights**
	100%			100%
Utensil	38%	37%	14%	56%
Beverage	23%	24%	5%	22%
Cloth	19%	17%	3%	13%
Herbs	11%	13%	1%	6%
Food	9%	10%	1%	4%

The results showed that the new extended approach emphasises the Utensil group of products that need to be developed and promoted (see Table 4). The last two groups of Herbs and Food are also adjusted with less emphasis.

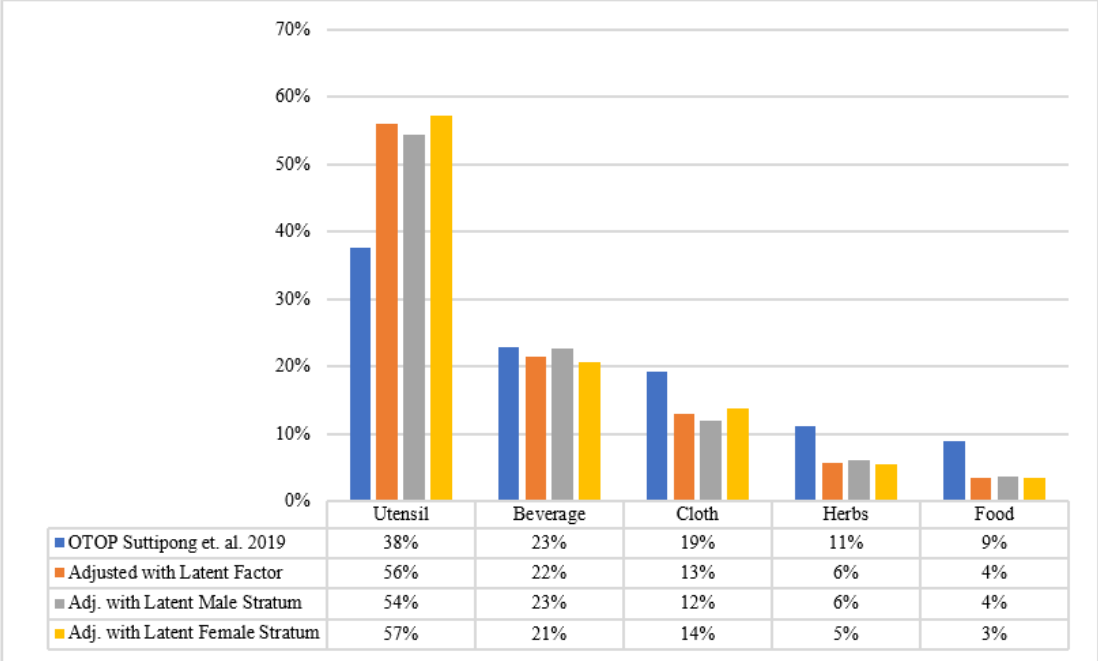

Figure 4. Adjusted Priority Weights of OTOP Product Group with Latent Preference Factor

The analysis reveals that the stratification of the aggregated weights using gender as a stratum leads to the same policy that the Utensil group needs to be strongly promoted (see Figure 4).

5. Discussion

Similar to Suttipong et al. (2019), the analysis showed differences in the market opportunity of the five OTOP product categories in the elderly consumer market. However, this approach has strong priority discrimination compared with the previous approach. By considering and adjusting the weights with each stratum, this result indicates the same patterns and same results. Using gender as a stratum factor leads to the more general AHP approach that can reflect the real implication of product targeting. The analysis of shows that the elderly prefers differently on different OTOP product. It can be attributed to each product group's different basic function and value. After adjusting with the latent weights, this research concludes that the Utensils, Decorative items and Souvenirs group received the highest priorities to focus on and support.

The new finding results show that the product development must be emphasized in those high potential OTOP groups. This new product development is verified and agreed with the OTOP statistic reports. Thus, the high priority group of the Utensil has been reported and planned to be further promoted. Newer product development ensures the triple bottom line of economic, social and environment will be achieved. The

newly proposed technique leads to stronger discrimination of product targeting and suggests the new positioning of the OTOP product for the elderly market. Thus, the results of this new technique affirm the right selection of the right OTOP product group. It can justify the OTOP product and process development strategic action plan.

Lastly, the value of this new proposed methodology is justified by the contextual concept that the priority needs to be viewed from the customer perspective. Hence the auxiliary information on the consumer preferences needed to be included. The traditional AHP approach to product selection cannot consider auxiliary or latent factors. The traditional uses of the AHP by Suttipong et al. (2019) depend heavily on the step2 of OPOP potentials. This research extended the AHP by introducing the latent factor and stratum analysis technique. This new technique can be applied in general to 2 or more latent factors as well as different stratum layers.

6. Conclusions

In conclusion, this study has proposed a new technique used to set the strategic action plan for product development for each gender group for the northern Thailand OTOP development program. This proposed technique can justify and prioritize the group of OTOP for efficient product development.

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References

Battistoni, E., Fronzetti Colladon, A., Scarabotti, L., & Schiraldi, M. M. (2013). Analytic hierarchy process for new product development. *International Journal of Engineering Business Management*, *5*(42), 1–8.

Belton, V. (1986). A comparison of the analytic hierarchy process and a simple multi-attribute value function. *European Journal of Operational Research*, *26*(1), 7–21.

Choomrit, N., Chantana, P., & Janverod, W. (2011). The study in economic feasibility for OTOP's distributed location of Chonburi Province in Thailand. *2011 IEEE 18th International Conference on Industrial Engineering and Engineering Management*, 1593–1596.

Denpaiboon, C., & Amatasawatdee, C. (2012). Similarity and difference of one village one product (OVOP) for rural development strategy in Japan and Thailand. *Japanese Studies Journal Special Issue: Regional Cooperation for Sustainable Future in Asia (Thammasat, 2012)*.

Joompha, W., & Pianthong, N. (2018). Development of Durian Chips Product by Apply of Quality Function Deployment. *Journal of Science & Technology*, *20*(3), 204–218.

Kurokawa, K. (2009). Effectiveness and limitations of the 'One Village One Product'(OVOP) approach as a government-led development policy: Evidence from Thai 'One Tambon One Product'(OTOP). *Studies in Regional Science*, *39*(4), 977–989.

Mendoza, G. A., & Prabhu, R. (2000). Development of a methodology for selecting criteria and indicators of sustainable forest management: a case study on participatory assessment. *Environmental Management*, *26*(6), 659–673.

Natsuda, K., Igusa, K., Wiboonpongse, A., & Thoburn, J. (2012). One Village One Product–rural development strategy in Asia: the case of OTOP in Thailand. *Canadian Journal of Development Studies/Revue Canadienne d'études Du Développement*, *33*(3), 369–385.

Noble, V. (2019). Mobilities of the One-Product policy from Japan to Thailand: a critical policy study of OVOP and OTOP. *Territory, Politics, Governance*, *7*(4), 455–473.

Noknoi, C., & Lungtae, S. (2014). The Human Resource Management Strategies of Community Businesses in Songkhla Province, Thailand. *European Conference on Management, Leadership & Governance*, 200.

Phanphet, S., Sukprasert, N., Suttipong, R., Wangmai, A., & Chattinnawat, W. (2019). Factor affecting elderly consumer buying attitude on Thailand OTOP product. *International Journal of Engineering and Advanced Technology*, *9*(1), 942–946.

Phriwanrat, T. (2014). Properties of Rhizophora Charcoal for Product Design. *International Journal of Humanities and Social Sciences*, *8*(4), 333–335.

Saaty, T. L. (1980). The analytic hierarchy process, new york: Mcgrew hill. *International, Translated to Russian, Portuguesses and Chinese, Revised Edition, Paperback (1996, 2000), Pittsburgh: RWS Publications*, *9*, 19–22.

Suttipong, R., Wangmai, A., Phanphet, S., Reungsri, S., & Chattinnawat, W. (2019). Prioritizing and positioning of Thailand's program of OTOP product for elderly using AHP. *International Journal of Advanced Engineering and Technology*, *9*(1), 2110–2116.

Thammasang, S., & Poonikom, K. (2016). The Development of Indicators and Form of Knowledge Management in Production Management Case Study: Agricultural Machine Industry in the Northeast of Thailand. *International Journal of Applied Engineering Research*, *11*(22), 10912–10922.

Tuamsuk, K., Phabu, T., & Vongprasert, C. (2013). Knowledge management model of community business: Thai OTOP Champions. *Journal of Knowledge Management*, *17*(3), 363–378.

Vasiliauskas, A. V., & Jakubauskas, G. (2007). Principle and benefits of third party logistics approach when managing logistics supply chain. *Transport*, *22*(2), 68–72.