Analyzing the marketing strategies of dietary supplements for seniors

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Abstract. In recent years, people pay more and more attention on health concepts. Also, with the changes of our diet and living habits, the rising awareness of Alternative Medicine, and the development of life science research become more active, people not only want to enjoy good taste when they eat but also ask for absorbing healthier foods. This trade makes the dietary supplements industry flourishes. With the continuously rising elderly population, the government starts to value the seniors' health welfare an important issue. What's more, elderly would become the max customer group of the market of heath care food. Pharmaceutical factories vigorously launch various kinds and effect medicine for different patient and requesters. Besides, governments are reinforcing banning the merchandise of fake drugs. That's why, it is worth to research the condition that how elderly consume dietary supplements and products. However, with the trade of global village, the competition is fiercer. The phenomenon shows that our domestic factories must join the international market. Thus, how to integrate our domestic research and development capability and find out Taiwan's own advantages for technology and the method to face and resolve the out-coming challenges, is really an important for the dietary supplements products industry. This research investigated the marketing strategies for dietary supplements products, such as adjusting marketing access, which could help the company to correspond to the future changing climate. The purpose of this research is to evaluate the marketing strategies of dietary supplements for seniors with InLinPreRa.

Introduction

Some technologic preview shows that some advanced countries are looking forward to develop customized function foods for different bodies and living habits. For eastern countries, their researches about dietary supplements mostly focus on regulating gastrointestinal and inhibiting ageing. On the contrary, most western countries pay attention on circulatory system and the effect of preventing people from suffering cancer. In terms of industry, due to the report from each country's health care foods market, in 2011, global functional foods market value reaches up to 853 billions.US dollars. Among them, America is focusing on cardiovascular health and the effect of losing weight; Europe market appeals to increase immune function of health and intestinal health; in Japan, products that feature intestines and stomach accounted for the largest number; and Taiwan, medicines which aim to adjust blood lipid and ability of intestines and stomach are most certified as health care food.

With the upgrading of domestic consumer health consciousness and the socio-demographic structure is growing to aging society, the demand of health care products increases rapidly. Besides, the development of health care products has become a trend in the international food industry.

According to the research of dietary supplements, most papers tend to investigate about customers habit or manufacture [1-3]. Relatively, companies which apply globalization or localization are less to former. This research is going to investigate the marketing strategies for health care products, such as adjusting marketing access, which could help the company to correspond to the future changing climate. What's more, the research can also solve the dilemma

whether a company should keep developing domestic marketing or move towards international.

Literature Review

Incomplete Linguistic Preference Relations (InLinPreRa)

Linguistic preference relations are usually used by decision makers to express their linguistic preference information based on pairwise comparisons [4, 5]. The relevant definitions are described as follows.

Definition1. Incomplete Linguistic Preference Additive Relation

Let $A=(a_{ij})_{n\times n}$ be linguistic preference relation, if A is an incomplete linguistic preference relation, it counters the fact that decision makers can carry out pairwise comparison for attributes so as to satisfy Eq.(1).

$$a_{ij} \in S,\ a_{ij} \oplus a_{ji} = S_0,\ a_{ii} = S_0 \tag{1}$$

Definition2. Incomplete Linguistic Consistent Additive Preference Relation

Let $A=(a_{ij})_{n\times n}$ be complete consistent additive preference relation, which counters all of the i, j, k decision makers for pairwise comparison, if $a_{ik} > S_0$ represents x_i is better than x_k; while $a_{kj} > S_0$ represents x_k is better than x_j, then $a_{ij} > S_0$ can be derived the equation of x_i better than x_j is

$$a_{ij} = a_{ik} \oplus a_{kj} \tag{2}$$

If $a_{ij}=S_0$, $a_{ij}=0$ represents x_i and x_j are the same, both of them can satisfy $a_{ik} = a_{kj} = a_{ij} = S_0$.

Then based on equations, preference relation matrix is generated. For different known factors of decision-making expert's choice, it could obtain few matrices. Xu[4] proposed the algorithm rules of three different decision making matrices and Wang et al. [6, 7] used the InLinPreRa the solve the Multi-Criteria Decision Making. Chang et al. [8] utilized the Incomplete Linguistic Preference Relations to measure the success possibility of implementing ERP.

Dietary Supplement

Different countries have different names and definition for health food, and laws that rule the health food are different, too. For example, Taiwan calls them health care products, whereas Japan names them specified health foods, China says health foods, and the US names such specific oral item as Dietary Supplement. Dietary Supplement that defined by FDA are not classified to the category of food. Therefore, how to satisfy seniors with different health situation on their various demand on diet has become an unsolved problem on the food supplement chain. The important channel attributes for consumers when selecting stores were analyzed by statistical methods (5% level); reasonable pricing being the most important store attribute, the second important attribute is professional service, followed by convenient location, purchase guarantees, merchandise category, fine store image and selection of name brand products.[1-3]

Framework the globalization of functional dietary supplements and the development of strategic alliance

Investigating the success of influential factors on the globalization of functional dietary supplements

The selection of globalization of functional dietary supplements is one of the most important decisions for international logistics managers owing to the need to consider various criteria that involve a complex decision process in which multiple requirements and uncertain conditions have to be taken into consideration simultaneously. [9, 10]

Determining the priority weights of Dietary Supplements influential factors

Subjectivity and vagueness within the measuring process are dealt with using linguistic variables quantified in a scale of $[-t, t]$. This study used linguistic to express their strength of preference among influential factors.

(1) Linguistic variables

This study provides the evaluators simple linguistic terms quantified on a scale of [-8, 8] to express their strength of preference among influential factors (Table 1). Linguistic variables [8] are simultaneously used to measure the likelihood of success/failure regarding each influential factor (Table 2).

Table 1 Linguistic terms for the importance weights of influential factors

Definition	value		value
Absolutely more important (AB)	8	Less Weakly more important (LWK)	-2
Very strongly more important (VS)	6	Less Strongly more important (LST)	-4
Strongly more important (ST)	4	Less Very strongly more important (LVS)	-6
Weakly more important (WK)	2	Less Absolutely more important (LAB)	-8
Equally important (EQ)	0		

Table 2 Linguistic variables for the priority ratings of possible outcome

Definition	value
Very high (VH) 5	4
High (H)	2
Fair (F)	0
Less High (LH)	-2
Less Very high (LVH)	-4

(2) Obtaining priority weights of influential factor

Construct pairwise comparison matrices amongst the influential factors (C_r, $r = 1,2,...,k$). The evaluators (E_e, $e = 1,2,...,n$) used three types of pairwise comparisons algorithm which are horizontal vertical and oblique to construct pairwise comparison matrices. Using the horizontal comparison of matrices are as below:

$$C^{(e)} = \left[a_{ij}^{(e)}\right]_{k\times k} = \begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ C_4 \\ \cdots \\ C_k \end{array} \begin{array}{c} \begin{array}{cccccc} C_1 & C_2 & C_3 & C_4 & \cdots & C_k \end{array} \\ \begin{bmatrix} 0 & a_{12}^{(e)} & a_{13}^{(e)} & a_{14}^{(e)} & \cdots & a_{1k}^{(e)} \\ \times & 0 & \times & \times & \cdots & \times \\ \times & \times & 0 & \times & \cdots & \times \\ \times & \times & \times & 0 & \cdots & \times \\ \cdots & \cdots & \cdots & \cdots & 0 & \times \\ \times & \times & \times & \times & \cdots & 0 \end{bmatrix}_{kxk} \end{array}$$

The remaining $a_{ij}^{(e)}$ can be calculated using Eqs.(1) and (2) to obtain the other known $\times$ of triangular second half. Finally, obtain the full preference matrix.

Transform the preference value $a_{ij}^{(e)}$ into $b_{ij}^{(e)}$ in an interval scale [0, 1], then the matrix C_t be obtained as $C_t = f(C^{(e)})$. The transformation function is given by

$$f:[-a,a]\to[0,1], \quad f(x)=\frac{x+a}{2a} \tag{3a}$$

$$Ct^{(e)} = \left[b_{ij}^{(e)}\right]_{kxk} = \begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ C_4 \\ \cdots \\ C_k \end{array} \begin{array}{c} \begin{array}{cccccc} C_1 & C_2 & C_3 & C_4 & \cdots & C_k \end{array} \\ \begin{bmatrix} 0 & b_{12}^{(e)} & b_{13}^{(e)} & b_{14}^{(e)} & \cdots & b_{1k}^{(e)} \\ b_{21}^{(e)} & 0 & b_{23}^{(e)} & b_{24}^{(e)} & \cdots & b_{2k}^{(e)} \\ b_{31}^{(e)} & b_{32}^{(e)} & 0 & b_{34}^{(e)} & \cdots & b_{3k}^{(e)} \\ b_{41}^{(e)} & b_{42}^{(e)} & b_{43}^{(e)} & 0 & \cdots & b_{4k}^{(e)} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ b_{k1}^{(e)} & b_{k2}^{(e)} & b_{k3}^{(e)} & b_{k4}^{(e)} & \cdots & 0 \end{bmatrix}_{kxk} \end{array} \tag{3b}$$

Utilize the method of average value to integrate the judgment values of n evaluators, namely

$$\overline{C} = [p_{ij}]_{kxk} \tag{4a}$$

$$p_{ij} = \frac{1}{n}(b_{ij}^{(1)} + b_{ij}^{(2)} + ... + b_{ij}^{(n)}) = \frac{1}{n}\sum_{e=1}^{n} b_{ij}^{(e)} \qquad i = 1,2,...,k \quad , \quad j = 1,2,...,k \tag{4b}$$

Use h_{ij} to indicate the normalized preference values of each influential factor, such as

$$\overline{\overline{C}} = [h_{ij}]_{kxk} = \begin{array}{c} \\ C_1 \\ C_2 \\ C_3 \\ C_4 \\ \dots \\ C_k \end{array} \begin{array}{c} \begin{array}{cccccc} C_1 & C_2 & C_3 & C_4 & \dots & C_k \end{array} \\ \begin{bmatrix} 0 & h_{12}^{(e)} & h_{13}^{(e)} & h_{14}^{(e)} & \dots & h_{1k}^{(e)} \\ h_{21}^{(e)} & 0 & h_{23}^{(e)} & h_{24}^{(e)} & \dots & h_{2k}^{(e)} \\ h_{31}^{(e)} & h_{32}^{(e)} & 0 & h_{34}^{(e)} & \dots & h_{3k}^{(e)} \\ h_{41}^{(e)} & h_{42}^{(e)} & h_{43}^{(e)} & 0 & \dots & h_{4k}^{(e)} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ h_{k1}^{(e)} & h_{k2}^{(e)} & h_{k3}^{(e)} & h_{k4}^{(e)} & \dots & 0 \end{bmatrix}_{kxk} \end{array} \tag{5a}$$

$$h_{ij} = \frac{p_{ij}}{\sum_{i=1}^{k} p_{ij}} \quad i = 1,2,...k \quad , \quad j = 1,2,...,k \tag{5b}$$

Given the ${}^{r}w$ denoting the priority weight of influential factor r, the priority weight of each factor can be obtained, that is

$${}^{r}w = \frac{\sum_{j=1}^{k} h_{rj}}{\sum_{i=1}^{k}\sum_{j=1}^{k} h_{ij}} \quad i = 1,2,...,k \tag{6}$$

$${}^{1}w, {}^{2}w, ..., {}^{k}w, \quad {}^{r}w \in [0,1], \quad \sum_{r=1}^{k} {}^{r}w = 1$$

Determining the priority ratings for possible outcome regarding factors

The evaluators are asked to express their subjective judgments regarding the preference ratings of possible outcome ($A_i, i = 1,2,...,m$) regarding each influential factor in linguistic terms, as listed in Table 2.

The evaluators used three types of pairwise comparisons algorithm to choose the better of two possible outcomes for a set of m-1 preference data under each influential factor. Using the horizontal comparison kinds of matrices are below.

$${}^{r}D^{(e)} = \left[{}^{r}a_{uv}^{(e)} \right]_{m\times m} = \begin{array}{c} \\ A_1 \\ A_2 \\ A_3 \\ A_4 \\ \\ \vdots \\ A_m \end{array} \begin{array}{c} \begin{array}{cccccc} A_1 & A_2 & A_3 & A_4 & \dots & A_m \end{array} \\ \begin{bmatrix} 0 & {}^{r}a_{12}^{(e)} & \times & \times & \dots & \times \\ \times & 0 & {}^{r}a_{23}^{(e)} & \times & \dots & \times \\ \times & \times & 0 & {}^{r}a_{34}^{(e)} & \dots & \times \\ \times & \times & \times & 0 & \dots & \times \\ \dots & \dots & \dots & \dots & \dots & {}^{r}a_{m\text{-}1m}^{(e)} \\ \times & \times & \times & \times & \dots & 0 \end{bmatrix}_{m\times m} \end{array}$$

Using Eqs. (1) and (2) to obtain the corresponding value. Finally, obtain the full preference matrix.

Next, the preference value ${}^{r}a_{uv}^{(e)}$ is transformed in the range [-4, 4] into ${}^{r}b_{uv}^{(e)}$ in an interval scale [0, 1], then the matrix ${}^{r}Dt$ be obtained as ${}^{r}Dt = f({}^{r}D^{(e)})$. The transformation function is given by

$$f : [-a, a] \to [0,1], \; f(x) = \frac{x + a}{2a}$$

$${}^{r}Dt = [{}^{r}b_{uv}^{(e)}]_{mxm} \; u, v = 1,2,...,m \tag{7}$$

Utilize the method of average value to integrate the judgment values of n evaluators, namely

$${}^{r}\overline{D} = [q_{uv}]_{mxm} \tag{8a}$$

$$q_{uv} = \frac{1}{n}({}^{r}b_{uv}^{(1)} + {}^{r}b_{uv}^{(2)} + ... + {}^{r}b_{uv}^{(e)})$$

$$= \frac{1}{n}\sum_{e=1}^{n} {}^{r}b_{uv}^{(e)} \qquad u = 1,2,...,m \quad , \quad v = 1,2,...,m \tag{8b}$$

Use ${}^{r}\lambda_{uv}$ to indicate the normalized preference values of each influential factor, such as

$$\overline{\overline{D}} = [\lambda_{uv}]_{mxm} \tag{9a}$$

$$\lambda_{uv} = \frac{q_{uv}}{\sum_{u=1}^{m} q_{uv}} \quad u, v = 1, 2, ..., m \tag{9b}$$

Consequently, φ_u denoting the average rating of possible outcome u with respect to influential factor r is provided. The desired rating of each possible outcome can be obtained for each influential factor that is

$$\varphi_u = \frac{1}{\pi} \sum_{v=1}^{m} \lambda_{uv} \tag{10}$$

Obtaining the priority weight for prediction

Multiplying the priority weights of influential factors by the ratings of possible outcomes, a predicted value Z_u for chance in success/failure implementation is obtained as:

$$Z_u = \varphi_u \otimes w \tag{11}$$

Empirical case study

We have a meeting with all members to make sure they know what the model meant and how to measure the importance weights of influential factors before prediction. Seven major influential factors are considered in this problem of factor that those globalization or localization. The seven major risk factors are (C1) Transportation convenience; (C2) Community Environment; (C3) Life function; (C4) Public facilities; (C5) Size of the venue; (C6) Sales targets; (C7) Competition.

The priority weight of each influential factor can to be obtained by Eqs.1-10. The priority weight and rank of each influential factor assessed by eleven evaluators are listed in Table 3.

Table 3 The rank of the influential factor importance weight

	C_1	C_2	C_3	C_3	C_5	C_6	C_7	Total	Rank	Weight($^k w$)
C_1	0.175	0.185	0.228	0.171	0.169	0.169	0.158	1.255	1	0.170
C_2	0.159	0.170	0.228	0.171	0.169	0.169	0.158	1.224	2	0.166
C_3	0.116	0.112	0.170	0.132	0.137	0.109	0.102	0.877	7	0.119
C_4	0.159	0.154	0.197	0.157	0.163	0.163	0.152	1.145	3	0.155
C_5	0.116	0.112	0.154	0.110	0.126	0.147	0.137	0.902	6	0.122
C_6	0.137	0.133	0.207	0.130	0.119	0.139	0.164	1.029	4	0.139
C_7	0.137	0.133	0.207	0.130	0.119	0.103	0.130	0.958	5	0.130
							Total	7.390		1

The following is the evaluation result with globalization and localization.

$$Z_{\text{globalization}} = (0.500 \times 0.170) + (0.466 \times 0.166) + (0.614 \times 0.119) + (0.466 \times 0.155) + (0.364 \times 0.122) + (0.330 \times 0.139) + (0.386 \times 0.130) = 0.473$$

$$Z_{\text{localization}} = (0.500 \times 0.170) + (0.534 \times 0.166) + (0.386 \times 0.119) + (0.534 \times 0.155) + (0.636 \times 0.122) + (0.670 \times 0.139) + (0.614 \times 0.130) = 0.527$$

Conclusion and contribution

The evaluation result shows that the possibility of globalization is 47.3%, and the possibility of localization is 52.5%. Dietary supplements which defined by HEALTH FOOD MANAGEMENT LAW are in order to improve people's health, reduce the risk of disease hazards, and their effects could been proved by concrete science evidence but not for medical treating and redress.

According to the result of the research, if a country's health insurance system and the concept of preventive health care are both put into practice, the national age would be extended and the

number of seniors would increase yearly at the same time. We could easily predict that seniors would like to pursuit to live with more dignity and high quality life. Thus, this program can help a company prepare a marketing strategy and related segments according to considerations to the domestic consumer groups future target market, product positioning, segmentation capabilities, channel strategy and the reinforcement to government regulations. Heading the international market might be required to having more marketing investment because of the bigger different among different customer groups. As to, go forward after grasping economic and societal and other relating factors, do not hastily join the global market without taking integrated consideration and evaluations.

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