Considerations in Pricing Strategies for Local Sportswear

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Abstract

Some Taiwanese textile firms are the original equipment manufacturers (OEMs) for internationally well-known brands. Although Taiwan has the know-how and capability to produce up-to-market hiking wear, and accessories, Taiwan outdoor stores are imported wears. The purpose of this study is to investigate the willingness to pay for different segmentations. A total of 1001 sets of questionnaire were given to members of various hiking clubs in Taiwan through some contacts in April 2007. There were 367 (or 36.66%) returns with 322 valid responses. The respondents were asked for their willingness to pay for locally branded garment made of suitable material and with proper design for the three layers that they commonly wear when hiking: the absorbent inner layer, the middle thermo layer, and the protective outer layer. The procedure of self-organizing map (SOM) is used to generate clusters in unsupervised way. Ordinal Logistic Regression was used to estimate willingness to pay by hikers in different cluster based on SOM. The results should be of interest to firms that aim to transform businesses from OEM or original design manufacturing (ODM) to original brand manufacturing (OBM) when considering pricing strategies for the local market.

Keywords: Willingness to pay; Ordinal regression; Self-organizing maps

本土運動服飾價格策略之探討

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摘要

許多台灣紡織廠替部份國際知品牌進行登山服飾代工，雖然實際上台灣廠商在紡織業不但具研發能力並擁有多項專業技術，進口登山服飾仍較受國人歡迎，因此本研究將針對不同屬性的消費者，調查其對台灣製造的登山服飾(吸濕排汗層、保暖層、防風防雨層)之願付價格。樣本針對北、中、南之登山社成員進行發放，共發出 1001 份，回收 367 份，有效問卷爲 322 份。本研究採用自我組織映射圖進行集群分析，並使用次序羅吉斯廻歸估計不同集群之願付價格，結果將可協助廠商於定價策略之應用。

關鍵字：願付價格、次序羅吉斯廻歸、自我組織映射圖

1. INTRODUCTION

It has been well researched that a higher share of the value chain for many products typically comes from two ends of supply chains: the upper end of research and design and the lower end of retailing (Kaplinsky, 2000; Kaplinsky and Morris, 2001; Schmitz and Knorringa, 2000). For countries facing higher labour costs or increasing labour costs, firms aspire to exploit more profit either through improved R&D or developing their own retail brands. These efforts often require long term accumulation of knowledge, experiences and skills and a network of firms in the related industries. Newly developed economies with technological capabilities, such as Taiwan, often start to build their industrial base with low cost of production through original equipment manufacturing (OEM) for established firms with well-known brand names. While there are still sizable profits in OEM when the quantity is large, in the long term the industry needs to move toward original design manufacturing (ODM) or further, original brand manufacturing (OBM). This kind of industry transformation is critical to survival because emergingeconomies with lowerlabour costs are also capable of low cost production.

Currently in Taiwan, most of the up-market sportswear and accessories are imported despite the fact that it has the technology to make them. Some Taiwanese textile firms have long been the original equipment manufacturers for well-known brands. This is largely due to the situation that many Taiwanese firms are not certain about changing market requirements and the corresponding marketing mix, though they are good at low cost production. As a consequence, Taiwanese textile firms failed to capture a larger share of the profits in the global textile value chain.

Willingness to pay (WTP) is crucial in designing optimal pricing policies or for estimating demand for new products(Voelckner, 2006).There ismany factors influence customers' willingness to pay. Research has shown that customers' willingness to buynew store brands is lowest for product groups associated with high social risk. Accordingly, premium store brands are preferred for products with higher social risk (Zielke and Dobbelstein, 2007). Various product features influence on WTP, but it depends on them being made salient and that this can be done by asking consumers about them (Sevdalis and Harvey, 2006). The effort that firms exert in making or displaying their products can also contribute to WTP. Consumers reward firms with such effort by increasing their willingness to pay, store choice, and overall evaluations, even if the actual quality of the products is not improved. This rewarding process is defined broadly as general reciprocity and is consistent with attribution theory (Morales, 2005). Other factors that influence WTP include price and quality positioning, store brand perceptions, attitudes and

aspects of purchasing behavior (Zielke and Dobbelstein, 2007).

The main purpose of this study is to understand, through adequate statistical procedures, how Taiwan consumers are willing to pay for good quality hiking garments, but made in Taiwan. Products with Taiwan brands can be just as good (Taiwan Textile Research Institute, 2004); however, imported sportswear might have the better reputation hence status for the wearer. Studies have shown that Asian consumers often buy imported products as a symbol of social status (Sun and Collins, 2006; Wei et al., 2003). In this study, WTP for locally-branded hiking wear will be looked at by different market segments.

Taiwan is one of the world's most densely populated places. The land mass of the island is only 36,000 km^2, yet has a population of 23 million. Most of the population dwells in urban areas.Taiwan has a dynamic economy with a USD 16,494 per capita income in 2006 (Department of Economics, 2007). About three fifths of the island is mountainous terrain covered by tropical and subtropical vegetation. As income of the average population improved and the interest in ecotourism heightened, more people engaged in mountain hiking. There are abouthalf millionpeople engaging in this form of ecotourism in Taiwan.Major cities and universities all have mountain hiking clubs or associations. Due to safety and cultural (collectivism) reasons, hiking takes place in groups rather than independently. The activities are generally guided by experienced hikers. Schedules for group hiking are set well in advance.

2. METHODOLOGY

Six focus groups were held in three geographical regions in the northern, central and southern parts of Taiwan among mountain hikers affiliated with hiking associations. This gave an overall understanding the price ranges that mountain hikers were generally paying currently and willing to pay for local brands. It was found that hikers generally possess three kinds of hiking wear for different purposes: the outer protective clothes, the middle thermo clothes and the inner absorbent clothes. Prices that hikers were paying for the outer, middle and inner layers were USD 200-400, USD 50-100 and USD 33-67 respectively.Having collected the base information, a set of questionnaire was then designed and reviewed by professional mountain hikers and textile experts and pre-tested by a group of 20 mountain hikers.Questions included demographic characteristics, hiking pattern,life style attitudinal variables, willingness to pay for hiking sportswear in pre-determined price brackets for the inner, middle and outer layer, and attitude and opinion variables in 7-point Likert scale. A total of 1001 sets of questionnairewas mailed to hiking associations whose management was able to distribute survey and collect responses. Draw prizes

were given out to encourage cooperation. There were 367 responses, or 36.66% response rate and 322 responses were usable.

The neural network technique was used to segment the respondents. Itis a computational model based on biological neural networks, which processes information through neurons. Recently, the neural network technique has been used in a wide range of management problems. The difference between traditional statistics methods and neural network technique is that neural network technique makes no assumption on statistical distributions or properties of the underlying data, which is often a constraint in practice (Smith and Gupta, 2000).

Punj and Steward (1983) and Kuo et al. (2002) proposed a two-stage cluster method. The SOM is first to determine the number of clusters and then the K-means method are employed to determine the cluster membership of the respondents. In this paper,data is first trained in a 7x13 map as shown in Figure 1.The number of map units is determined by following formula, 5*sqrt(totalnumber of data). After determining the map unit, the two biggest eigenvalues of the training data are calculated and the ratio betweenside-lengths of the map grid is set to the square root of this ratio. The actual side-lengths are then set so that their product is as close to the desired number of map units as possible.

In this study, respondents' demographics, hiking pattern and attitudinal variables were used to in the SOM procedure to determine the appropriate number of clusters. The weight distance of the map after a series of simulations is plot in Figure 2. The K-means procedure followed to determine respondents' cluster membership. The color distance plot of SOM and color cluster plot of K-means are shown in Figure 3 and Figure 4.

Figure 1: The self-organizing map.

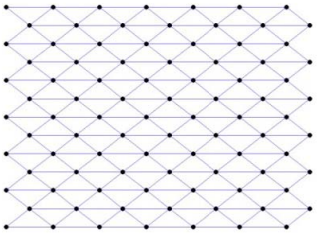


Figure 2: **The weight distance map**

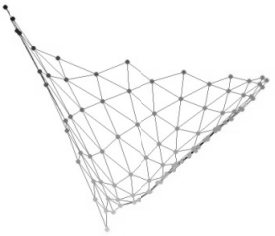


Figure 3: **SOM results**

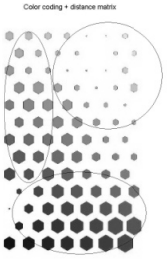
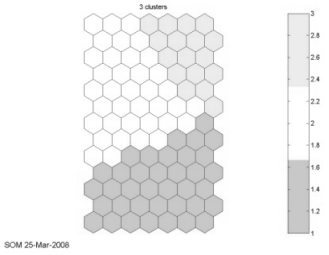


Figure 4: **K-means results**



2.1 Uses of self-organizing maps for segmenting the market

The purpose of segmentation is to group cases of similar characteristics together (Smith, 1956). Traditionally, partitioning algorithms and hierarchical algorithms werecommonly used clustering tools for market segmentation. More recently neural networks have been used for classification orclustering for complex business data (Kateet al., 2000, Kim et al., 2003). SOM is one of the neural network methods which trains data without supervision. Unsupervised neural networks group similar characteristics automatically, which was developed by Kohonen(1982) in the early 1980s.The main characteristic is its ability to convert high-dimensional data into low-dimensionaldata and is easy to visualize during the data analysis process.The advantage of using SOM over k-means cluster analysis is that theneural network technique is not dependent on the scales of the criteria variables when grouping respondents. Criteria variables, such as gender, income and age have different ranges, eg. the range for age is between 18 to 77, forpersonal month incomebetween 0.24 to 150 million TWD, the range for family month income between 0

to 300 million TWD. SOM procedure won't be affected by these varying units of analysis.

The SOM algorithm can be summarized as in the following steps (Kohonen,1995).

1. The weights of the neurons in the maps, $m_i(t)$, are initialized randomly.
2. Choose a vector x randomly from the set of training data.
3. Compute the Euclidean distance,$d_i = \| x - m_i(t) \|$, between x and every neuron.
4. Find the best matched neuron which has the shortest distance among all neurons.The shortest distance, d_c, is defined as $d_c = \| x - m_c(t) \| = \min\{ \| x - m_i(t) \| \}$ for all neurons, where $m_c(t)$ is the winning neuron.
5. Update the weight vectors of the winning neuron c and its neighboring neuron according to thelearning rule,

   $m_i(t+1) = m_i(t) + \alpha(t) h_{c,i}(t)[x - m_i(t)]$,

   where α(t) is an adaptive function. In this study, the adaptive function is set as 0.5 and it decreases with time. The$h_{c,i}(t)$ is the neighborhood kernel defined as

   $$h_{c,i}(t) = \exp\left(-\frac{\|r_c - r_i\|^2}{\sigma^2(t)}\right)$$

   , wherer$_c$ and r$_i$ are coordinates of neurons c and i.
6. Repeat step 2 until weights have stabilized.

2.2 Estimating willingness to pay by market segments

In this study WTP by respondents for hiking wear is estimated by the contingent valuation method (CVM). The method was first proposed in theory by Ciriacy-Wantrup (1947) as a method for price approximation for non-market goods, for example, goods that are being under development for potential commercialization. The process of WTP evaluation is as follows. Respondents are given detailed information on the potential product which firms intend to produce. Respondents are then given a sequence of price brackets for them to indicate their willingness or unwillingness to pay, i.e., in a yes or no referendum format. The dependent variable is the WTP price ranges, and is an ordinal-level variable. The independent variable in this study is cluster membership that respondents belong to.

Criteria for respondents' cluster membership are based on their demographics, hiking pattern and attitudinal variables. An ordinal logistic regression (OLR) function is used to estimate the proportion of respondents that are willing to pay for each price bracket. The whole process is repeated for each of the three layers of mountain wear, the inner absorbent layer, the middle thermo layer and the outer protective layer. The ordinal regression model can be written asfollow:

$$\ln(\theta_j(X)) = \alpha_j - \beta X, \quad (1)$$

where $j = 1,2,\ldots,k-1$, and

$$\theta_j(X) = \text{prob}(\text{WTP} <= y_j | X) / \text{prob}(\text{WTP} > y_j | X), \quad (2)$$

where j being the cut-off points for all categories of k.

After substituting, we can get

$$\text{prob}(\text{WTP} <= y_j | X) = 1/(1+e^{-(\alpha_j - \beta X)}). \quad (3)$$

The threshold (α_j) and the regression coefficient (β) are unknown parameters to be estimated by means of the maximum likelihood method.

3. Results

A total of 322 responses were valid for analysis. Close to 70% of the respondents were male and the rest of over 30% being female. Close to 70% of the respondents were married. About 64% of them had tertiary education or above.Over half of the respondents were between the age of 40 and 60 reflecting the fact that this age group has the time and resources for mountain hiking regularly.Over60% of the respondents havemonthly personal income of USD625-2500, orfamily income of USD1250-2750.

3.1 Market segmentation

Respondents were segmented based on their demographics, hiking pattern, and lifestyle attitudinal variables. Both of the commonly used segmentation techniques, K-means and SOM+K-means were tried. Table 1 shows the comparison ofthe two methods. The results fromSOM+K-means were more satisfactory as using K-means along yields over 70% of the cases falling in one group.

Table 1: Items in clusters of K-means algorithm and SOM algorithm

	K-means		SOM+K-means	
Cluster	Number	Percent	Number	Percent
1	229	71.1%	125	38.8%
2	91	28.3%	141	43.8%
3	2	0.6%	56	17.4%
Total	322	100.0%	322	100.0%

A good clustering procedure should show the property that cases within the cluster are homogeneous and cases from different clusters are very heterogeneous. Wilk's λ measures this property, It is defined as

Wilk's$\lambda = SS_{within}/SS_{total}$.

SS_{within}denotes sum of squares (or variance) within clusters and SS_{total}denotes total sum of squares, which include within and between sum of squares. According to the definition, smaller value of λ is more desirable. The value of Wilk's λ approaches zero when within cluster variance (SS_{within}) is very small relative to total variance (SS_{total}). Wilk's λ of the SOM+Kmeans method is 0.53 which is smaller than λ of the K-means method of 0.67. This is also a criterion that the SOM+Kmeans method is preferable over the K-means method.

The appendix 1 shows the means of the segmentation variables and the results of ANOVA tests for the differences of means between the three clusters.Interestingly, all attitudinal variables were not statistically different across three clusters except for the two variables 'I am confident in myself' and 'I usually buy products recommended on the Internet'. The demographic and hiking pattern variables differentiate the clusters better.Cluster 1 could be called the young and inexperienced segment. This segment is generally hiking beginners, not so better-off financially, but willing to buy products recommended on the Internet. Cluster 2 could be called the better-off and knowledgeable segment although their hiking experiences are not as long as Cluster 3. Cluster 3 could be called the professional segment. They tend to be older with some wealth and thus have the time and resources for hiking. They are also confident about themselves. The main differences between the better-off segment and the professional segment lie in that the professional segment hikes more frequently and they also regard themselves as professionals although their year of hiking is less the better-off segment.

3.2 Willingness to pay by clusters

Respondents'WTP for the inner, middle and outer layers in each cluster are evaluated based on the ordinal regression. The independent variable for the model is the cluster number, and thepredict variable is the WTP. The coefficients for the model are shown in Table 1.The notation of the WTP1, the WTP2, the WTP3, the WTP4 and the WTP5 are represented the range of the WTP based on survey results.

Table 1: The coefficients of the logistic regression

		Inner layers Estimate(Sig.)	**Middle layers Estimate(Sig.)**	**Outer layers Estimate(Sig.)**
Threashold	**WTP1**	-.805(0.003)	-.758(0.004)	-.135(0.604)
	WTP2	1.002(0.000)	.972(0.000)	1.363(0.000)
	WTP3	2.310(0.000)	2.236(0.000)	2.460(0.000)
	WTP 4	4.092(0.000)	4.476(0.000)	3.957(0.000)
Location	**Cluster1**	-.580(0.062)	-.184(0.546)	.035(0.573)
	Cluster2	-.678(0.028)	-.032(0.915)	.164(0.433)
	Cluster3	0	0	0.

The cumulative predicted probability from the model is calculated based on the ordinal regression model.The predict WTP probabilities for the inner layer of cluster 1 is as follows:

prob(WTP1)= 1/(1+exp(-(-0.805+0.580)))=44.4 %

prob(WTP1 or WTP2)= 1/(1+exp(-(1.002+0.580)))=82.95 %

prob(WTP1 or WTP2 or WTP3)= 1/(1+exp(-(2.310+0.580)))=94.74%

prob(WTP1 or WTP2 or WTP3 or WTP4)= 1/(1+exp(-(4.092+0.580)))=99.08%

The probability for the individual WTP is calculated the differences between cumulative probabilities:

prob(WTP2)= prob(WTP1 or WTP2)- prob(WTP1)= 38.55%

prob(WTP3)= prob(WTP1 or WTP2 or WTP3)- prob(WTP1 or WTP2)= 11.79%

prob(WTP4)= prob(WTP1 or WTP2 or WTP3 or WTP4)- prob(WTP1 or WTP2 or WTP3)= 4.34%

prob(WTP5)= 1-prob(WTP1 or WTP2 or WTP3 or WTP4)=0.93%

The WTP for different clusters and layers are shown in Table 2, Table 3 and Table4. Cluster 3respondents were willing to pay more for the inner and middle layers than the respondents from

the other two respondents. Cluster 2 respondents, on the other hand, were willing to pay more for the outer layer than the respondents from the other two clusters. This is consistent with the fact that clusters 2 and 3 were generally better-off than cluster 1, which consists of younger and not-so-better-off respondents. The results mean that firms targeting the young and inexperienced segment should offer products at very competitive price,although there is little difference between the better-off and knowledgeable segment and the professional segment.

Table 2: Willingness to pay for the inner layer by clusters in Taiwan Dollar and USD, N= 322

	<USD33	**USD33-40**	**USD40-50**	**USD50-67**	**USD>67**
Cluster 1	44.40%	38.55%	11.79%	4.34%	0.93%
Cluster2	46.83%	37.46%	10.92%	3.95%	0.84%
Cluster 3	30.89%	42.24%	17.84%	7.38%	1.64%

Table 3: Willingness to pay for the middle layer by clusters in Taiwan Dollar and USD, N= 322

	<USD50	**USD 50-60**	**USD 60 -75**	**USD 75-100**	**>USD100**
Cluster 1	36.04%	40.03%	15.76%	7.23%	0.94%
Cluster 2	32.61%	40.58%	17.42%	8.29%	1.09%
Cluster 3	31.90%	40.65%	17.79%	8.54%	1.13%

Table 4: Willingness to pay for the outer layer by clusters in Taiwan Dollar and USD, N= 322

	<USD 200	**USD 200-240**	**USD 240-300**	**USD300-400**	**> USD 400**
Cluster 1	45.78%	33.29%	12.81%	6.18%	1.94%
Cluster 2	42.59%	34.25%	14.01%	6.94%	2.20%
Cluster 3	46.64%	32.99%	12.50%	5.99%	1.88%

4. Discussion and Conclusion

The Taiwan textile industry is capable ofproducing up-market sportswear. However, currently most of the companies are having the business model of OEM, extracting a smaller portion of profits in the global supply chain. For the industry to move towards ODM, itneeds to understand the market better. This study looked into the mountain hiking wear industry by studying the market segments and their willingness to pay for locally-branded quality garment. Results from clustering showed that market segmentation was best based on demographic and

hiking pattern criteria rather than attitudinal variables. Three clusters could be identified with a distinct younger segment, a knowledgeable segment and an older professional segment. In general, the younger cluster was least better-off financially, but was willing to buy from the Internet. The knowledgeable and professional clusters were willing to pay for locally-branded hiking wear.

It is worth noting that consumers' buying behavior may not be consistent with their positive attitude for socially desirable consequences, such as supporting local products in this study (De Pelsmacker, 2005). Other research methods, such as experimental design, could be explored in the future to approximate more closely the relationship between price information and trust (Romani, 2006). It is also possible to consider, when the products are on the test-market stage, how to induce real economic incentives, such as giving participants in the experiment one binding scenario. This means the participants have to buy the product they had chosen in their binding scenario (Alfnes et al., 2006).

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Appendix 1: Means for demographic, hiking pattern, and attitudes for the three clusters

		Cluster			ANOVA
	Variables	1	2	3	p-value
Demographic	Education (1: Under High School,2: High School 3:College, 4: Graduate)	2.965[a]	2.582	2.447	0.000*
	Age (year) (18-77)	30.020	52.611	53.440[a]	0.000*
	Personal month Income (Millions dollars) (0.24-150)	3.700	4.421[a]	4.388	0.006*
	Family month Income (Millions dollars) (0-300)	8.691[a]	7.962	8.194	0.6447
Hiking pattern	Years of hiking (0-50)	4.389	14.126[a]	10.764	0.000*
	Average hiking days per trip (0-30)	2.076	2.202[a]	1.608	0.060
	Hiking frequency (1: Once a year, 2: At least half a year ,3: At least two months, 4:At least once a month,5: At least twice a month)	2.949	3.781	4.412[a]	0.000*
	Frequency of hiking at mountains below 1,000 meters high per year (0-80)	2.700	5.908	33.991[a]	0.000*
	Frequency of hiking at mountains between 1,001-3,000 meters high per year (0-48)	1.440	4.298	11.196[a]	0.000*
	Frequency of hiking at mountains above 3,000 meters high per year (0-20)	1.284	1.816	2.366[a]	0.050
Attitudes	I regard myself a professional hiker	3.548	3.891	4.140[a]	0.014*
	I can make the decision of purchase	5.336	5.589	5.661[a]	0.236
	I am confident in myself	4.956	5.290	5.414[a]	0.044*
	I have professional knowledge in hiking	4.187	4.615[a]	4.595	0.026*
	I am more independent than others	4.813	4.939	4.941[a]	0.713
	I likes to buy new product	4.381[a]	4.338	4.232	0.780
	I often notice the new product information	4.532[a]	4.472	4.500	0.941
	To shop for trendy items is fun	4.276[a]	4.177	3.827	0.173

	I like to try various things	4.494 [a]	4.417	4.182	0.367
	I will buy as low price as I can	4.640	4.359	4.670 [a]	0.200
	I likes to buy low-price product	5.005 [a]	4.820	4.855	0.551
	I do not care brand	4.149	4.470 [a]	4.204	0.184
	I think it is important to compare products in each store	5.271	5.450	5.508 [a]	0.396
	I pay attention to material when purchasing hiking wear	5.650	5.569	5.656 [a]	0.840
	I notice the development of new material	4.633	4.909	5.021 [a]	0.123
	I am willing to purchase the product which is suitable but expensive	4.684	4.778	4.839 [a]	0.737
	I usually buy products recommend by hiking mates	4.568 [a]	4.478	4.293	0.404
	I usually buy products recommended by store sellers	4.258 [a]	4.119	3.938	0.242
	I usually buy products recommended on the internet	4.049 [a]	3.493	3.515	0.003*
	Products with lots advertisements are reliable	3.712 [a]	3.677	3.572	0.816
	Advertisements can help consumers knowing the product	4.908 [a]	4.845	4.706	0.634
	Advertisements connect sellers to buyers	4.795 [a]	4.784	4.794	0.997
	I am used to buy products in the same store	4.909 [a]	4.797	4.814	0.771
	I am used to buy product with the same brand	4.526	4.564	4.574 [a]	0.961
	I tend to buy products habitually	4.950 [a]	4.776	4.909	0.531

* : $p < 0.05$

a : highest value