

Research on Grains Packaging Design and Consumer Preferences

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Abstract. The packaging design of grain products has great impact on consumer preferences. By applying the conjoint analysis, the study investigates the important attributes of grains packaging design, getting the value and importance of attributes, finding the favorite product packaging that could improve the consumer purchase demand; thus offering some implications for grains product designers and marketers to gain more market share. The results of the study find that the packaging materials have the most important influence on consumer preferences, while the packaging volumes play the least role in choosing a grain product.

Introduction

In the past decade, the consumption of grain products has experienced a dramatic increase. In the meanwhile, numerous grain brands appear in the market to pursue the high profits. However, the domestic grain product packaging is in the early stage nowadays, playing the basis role of transporting and protecting products. Most of them display the features of lacking product characteristics and brand effects, which could highly reduce consumers' purchase desire. As the last step of food processing, packaging is an integral part of product. Good packaging design not only can protect products in marketing, but also could convey efficient information, which create the differentiation from competitors to improve product sales. There are more than 70% of purchase decisions are made in stores which may due to the reason that consumers have limited time and energy to acquire adequate information about products they want to buy; thus they often rely on product packaging to make their purchasing preferences at the point of purchase (Silayoi and Speece, 2004). Therefore, a full understanding of consumer preferences and purchase habits towards grains product design is crucial in order to meet the requirements of present and future customers and identify market opportunities.

Academic Relevance and Managerial Relevance

This study makes several contributions to the existing literature. First of all, reflecting the growing importance of product packaging design, some important progress have been made in understanding the linkage between product packaging design and consumer preferences in the last two decades. However, there are some contradicting opinions for some specific attributes and it is still uncertain which findings could be generalized to grain product design. Hence, this study provides a systematic empirical analysis based on the general product packaging design literature to explore the real impact of these disputed attributes. Second, the previous research on this topic often focus on production status of grains and the development prospects of grains industry, there is little research focus on the specific attributes design related to grain products. Therefore, this article contributes to fill in this gap and explore the relationship between grain products design attributes and consumer preferences.

Consequently, this study offers much practical benefit to both grains product designers and marketers. There are variety of high quality grains in Yulin, however, the sales of grains lag far behind other cities and provinces. The low level of packaging design is an important reason for the lack of competitiveness of grain products in Yulin market. Improving grain product's packaging design and making it a strong brand feature could greatly enhance its added value, thus attracting more consumers. In view of the above consideration, this study tries to build a link between grains

product design and evoked consumer preferences in a holistic perspective and provide useful managerial guidelines for packaging design in grains industry. In addition, the study could provide relevant information to marketers who what to maximize the package's impact in grains selling; hence the allocation of budget resource will be wiser.

Analysis Process of Grains Packaging

Research Objectives. Grains product is one of the important local speciality in Yulin. With the improvement of consumers' health awareness, the consumption of grains is increasing rapidly nowadays. The purpose of this study is to investigate the value and importance of grains packaging, finding the specific packaging attributes that could affect consumers' purchase decisions, hence helping manufacturers to design favorable products.

Methodology. In order to assess consumer preferences for grains design, this study employs the choice-based conjoint analysis, which has been widely used in the fields of marketing research to evaluate consumer preferences towards a range of target alternatives. This study uses a self-administered questionnaire to assess consumer preferences towards grain product design. Data collection process was conducted in Yulin and Xi'an, Shaanxi province. Four supermarkets located in the cities are selected to implement the survey. When determining potential participants, convenience sampling and simple random sampling techniques are considered. During the data collection period, 200 participants are asked to complete the questionnaires. Among these data, 8 response profiles are deleted because these participants do not complete the whole questionnaire. Finally, this study uses 192 usable responses for the conjoint analysis.

Establishing Attributes and Attributes Levels. There are many attributes that make up the packaging of grains. However, the selected conjoint attributes of this study should reflect the key characteristics of the product, which could provide meaningful insights for product managers. Considering the relevant theoretical studies and the real shopping experience, the key grains attributes which are taken into consideration by consumers are packaging volume, picture, packaging material, packaging structure, nutrition information and packaging technology. The detailed classification of attribute levels for each attribute can be seen in table 1 below.

Table 1 Attributes of the wine bottle design and their levels

| Attribute | Levels |
|-----------------------|--------------------------------|
| Packaging volume | Small |
| | Big |
| Picture | Present |
| | Not present |
| Packaging material | Paper bags |
| | Composite plastic bags |
| | Cloth bags |
| Packaging structure | Individual |
| | Series |
| Nutrition information | Precise |
| | Vague |
| Packaging technology | Normal packaging |
| | Vacuum packaging |
| | Evacuated inflatable packaging |

Six attributes, four with two levels and two with three levels, generate 144 possible scenarios ($2 \times 2 \times 3 \times 2 \times 2 \times 3$). From the consumers' perspective, it is tedious and time-consuming to evaluate so many various concepts. Therefore, on the premise of successfully fulfilling the research goal,

showing participates less grains concepts are necessary. In order to solve this problem, this study employs SAS software to select essential grains concepts in the questionnaire, which enable researcher to achieve the requirement of collecting a large number of data with only a modest number of product concepts. The SAS codes for this design can be found in fig.1. In applying the software, 14 choice sets of grains designs, each of which contains two alternatives, are selected to evaluate consumer preferences towards the entire 144 various grains concepts.

```
%mktruns(2 2 3 2 2 3);  
%mktex(2 2 3 2 2 3, n = 36, seed = 17);  
%mktlab( data=design, int=f1-f2);  
%choicoff( data=final, model=class(x1-x6), nsets=14, flags=f1-f2, beta= 1 1 0 1  
0.5 1 1 0.5, seed=17, maxiter=14);  
proc print; id set; by set; run;
```

Figure 1. SAS codes for determining the choice sets

Conjoint Model. In the analysis, six attributes are involved. Four attributes are dummy variables, including packaging volume, picture, packaging structure, and nutrition information. Two attributes are categorical variables, including packaging material and packaging technology. After receiving the answers of the respondents, the parameters for each variable are estimated. The SAS codes can be found in Fig. 2.

```
data grains;  
input subj set c volume picture dummymaterial2 dummymaterial3 structure label  
dummytechnology2 dummytechnology3 @@;  
datalines;  
1 1 1 1 1 0 1 1 0 0 1  
1 1 2 0 0 1 0 0 0 0 0  
1 2 2 0 0 0 0 1 0 1 0  
1 2 1 1 0 0 1 0 1 0 1  
.  
.  
.  
192 13 1 0 0 0 1 1 1 0 0  
192 13 2 1 1 1 0 1 0 1 0  
192 14 2 1 0 1 0 0 1 0 1  
192 14 1 0 1 0 1 1 1 1 0;  
procprint data= grains noobs;  
var subj set c volume picture dummymaterial2 dummymaterial3 structure label  
dummytechnology2 dummytechnology3;  
run;  
procphreg data= grains outest=betas;  
strata subj set;  
model c*c(2) = volume picture dummymaterial2 dummymaterial3 structure label  
dummytechnology2 dummytechnology3 / ties=breslow;  
run;
```

Figure 2. SAS codes for estimating parameters

In the next step, the utility for a specific grains product can be calculated by using the parameter estimates. Utilities depend on attribute levels and other unobserved factors (error terms). For calculating these utilities, the eq.1 is used.

$$U_i = \sum_k \beta_k X_{ik} + \varepsilon \quad (1)$$

Where, U_i refers to the utility of a certain grains product. X_{ik} refers to the coded value of attribute (or attribute level) k. β_k refers to the parameter estimates of attribute (or attribute level) k. ε refers to the error term.

Results for Utility and Importance. From the results of correlation table, it is clear that the sample do not have strong multi-colinearity problem. It can be found that all pairs of attributes are not significant at the 0.1 confidence level except for the pair of packaging volume and nutrition information (0.061). This means the correlation of each pairs of attributes is too small to be taken into account. In other words, all the attributes are independent. The results of parameter estimates for each variable and their significance levels represent that not all variable are significant. In general, over 37.5% of the parameters are significant at the 0.01 level and 25% of them are significant at least at the 0.10 level.

Table 2 Results of conjoint analysis (n=192)

| Attribute | Levels | Utility | Relative importance (%) |
|-----------------------|--------------------------------|----------|-------------------------|
| Packaging volume | Small | 0.01625 | 0.83% |
| | Big | -0.01625 | |
| Picture | Present | 0.02960 | 1.51% |
| | Not present | -0.02960 | |
| Packaging material | Paper bags | -1.80471 | 69.32% |
| | Composite plastic bags | 0.90958 | |
| | Cloth bags | 0.89513 | |
| Packaging structure | Individual | 0.21168 | 10.81% |
| | Series | -0.21168 | |
| Nutrition information | Precise | 0.10477 | 5.35% |
| | Vague | -0.10477 | |
| Packaging technology | Normal packaging | -0.30166 | 12.17% |
| | Vacuum packaging | 0.12682 | |
| | Evacuated inflatable packaging | 0.17484 | |

The results in table2 represent the utilities of each attribute level calculated by using the parameter estimates and the coded values for each level. For dummy variables, the attribute levels of small packaging volume, present pictures, Individual packaging, and precise label information have positive utility values, while the attribute levels of big packaging volume, not present pictures, series packaging, and vague label information represent offsetting negative utilities.

With regard to categorical variables, composite plastic bags and cloth bags elicit both positive scores of 0.89513 and 0.90958 respectively, whereas paper bags with a negative value of -1.80471. vacuum packaging and evacuated inflatable packaging exploit positive utilities of 0.12682 and 0.17484 respectively, while normal packaging has the lowest utility of -0.30166. Based on the utilities for attribute levels discussed above, the most attractive grains design is a product with a small volume, presenting a picture on its label, packing with a composite plastic bag, single packaging, having a precise description of nutrition information, and vacuum packaging.

In addition, the relative importance for each attributes is also presented in table 3. packaging material plays the most important role in selecting grains product design, with a relative importance weight of 69.32%, while the attributes of packaging volume (0.83%) and picture (1.51%) are perceived as the least important ones. The importance of packaging structure and packaging technology are similar to each other, for 12.17% and 10.81%, respectively. And nutrition information takes the fourth importance weight, accounting for 5.35%.

Conclusion and Discussion

The first result of the study is that the small volume of a grain product is slightly more preferred than the big volume. This is in line with earlier research that a small- volume grain product has the features of practicality and portability which could be easily accepted by consumers(Xing, 2015). However, product volume is of least importance, which is quite surprising. This may because this study involves in several specific design elements which may induce consumer more focus on the detailed information rather than some obvious elements. In this case, the importance weight for product volume may be underestimated by consumers.

Secondly, picture is the fifth important attribute among all the six attributes, and presenting a picture on product label is favored by consumers in this study. This finding supports Underwood's(2003) point of view that the label displaying a picture is more noticeable and easy to recall by consumers, which may enhance consumers' imaginary and visual information processing Therefore, the high evaluation of this grain product will weaken consumers' interests to view other products, which will increase the purchase probability of the original one.

Thirdly, one of the most interesting, though not surprising findings is that packaging material is perceived as the most important attributes in this study, which has received little evidence in previous research in the field of grains packaging design. Moreover, grains packed with composite plastic bags are more favorable than products packed with other materials. The above findings represent that consumers are used to choosing plastic products as packaging materials, which seems more reliable to protect grains.

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