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CONSUMER ACCEPTANCE OF A NEW PRODUCT: FOOD PACKAGING USING A SMART BIO-SWITCH CONCEPT

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INTRODUCTION

In the past twenty years, the use of plastic packaging has grown remarkably, because of its convenience for manufacturing, handling and daily usage. In particular, multilayer barrier packaging has challenged metal and glass for a longer shelf life in food packaging, because of its barrier properties as well as its versatility and convenience. For this reason, this barrier packaging market has grown rapidly, and represents about 2% of the Gross National Product of most developed countries (Ahvenainen, 2003).

Modern food packaging no longer has just a passive role in protecting and marketing the product. It increasingly has an active role in processing, preserving and in retaining the safety and quality of food throughout the distribution process. In order to improve the performance of packaging in meeting these varied demands, innovatively modified and controlled-atmosphere packaging, active and smart packaging systems are being developed, tested and optimized in laboratories around the world (Ahvenainen, 2003).

There are many types of active packaging widely used in Europe such as oxygen scavenger packaging, time-temperature indicators and moisture absorption packaging. Since Malaysia has varieties of food production and Malaysian consumers prefer to use plastic as packaging tools, active packaging is a suitable technology to be implemented and has big potential in commercialization.

Active packaging is intended to sense internal or external environmental changes and modify internal packaging environment by modifying its own properties. Therefore, the goals of active packaging is to extend the shelf life of contained food and beverages products either to remove oxygen or to prevent it from entering the in-package environment.

What is termed "smart packaging" could present a different case. It has not been the subject of such strained attempts to define the nature of the concept. It is merely presented as a class of materials "designed to monitor the condition of the food" (Heckman, 2005). Thus, presumably, such materials would serve no ordinarily protective purpose in the food packaging (i.e., would not help protect against contamination or adulteration of the food) other than to provide notice if the food had been spoiled or was otherwise adversely affected.

A revolutionary active-smart packaging using a bio-switch concept is a combination technology of biodegradable polymer, antimicrobial control releaser and pH-color indicator from Anthocyanidin extracts which was developed and had attracted attention from the industry. According to Muhamad (2007) the active-smart packaging using a bio-switch concept is able to detect the degree of continuous natural fermentation in food products or the spoilage of non-fermented food by microorganisms or chemical reaction by pH color changes. The first combination of active-smart packaging technology by combining antimicrobial agent and pH-color indicator with suitable compatibility makes the bio-switch concept a novel invention. Active packaging methods have been studied widely and smart packaging have already been developed but very few have been introduced into the market as commercially available products (Hurme et al., 1998). Until today, there is hardly any implementation of this technology in Malaysia.

One reason for the slow progress may have been the anticipated consumer concerns of these new applications (Muhamad, 2007). However, this technology can be implemented widely in order to extend shelf life, increase the safety assurance and provide better preservation as well as ensure the stability and freshness of the foods. Active-smart plastic film formulation for packaging will be enhanced by upgrading its functions. Hence, the value of the active-smart packaging using a bio-switch concept will be increased and the product will be more useful than the existing technologies.

As with any new product launch or line extension, it is critical during the early stages to monitor the acceptance amongst consumers with regards to the active-smart packaging using a bio-switch concept. Early indications are needed to allow for fine-tuning of the marketing mix in order to maximize initial sales opportunities and establish a solid foundation for growth. As such this study was conducted to assess consumers' reaction to smart bio-switch packaging as compared to the traditional packaging. The study seeks to identify which market position should the smart bio-switch packaging focus on and what factors affect the consumers' perceptions.

Because new technologies such as active packaging are complex and an element of uncertainty exists in the minds of decision makers with respect to the successful adoption of them, people form attitudes and intentions toward trying to learn to use the new technology prior to initiating efforts directed at using them. Attitudes towards usage and intentions to use may be ill-formed or lacking in conviction or else may occur only after preliminary striving to learn to appreciate the technology which had evolved. Thus, according to Bagozzi et al. (1998), actual usage of a new product or technology may not be a direct or immediate consequence of such attitudes and intentions.

METHODOLOGY

The Delphi method was used in the study as it is a systematic interactive method for obtaining opinions on smart bio-switch packaging based on feedback from a panel comprising of 12 independent experts. The carefully selected experts are requested to answer a carefully structured questionnaire that seek to identify factors affecting the consumers' perceptions regarding smart bio-switch packaging in the first round. The first round was able to uncover the following factors: performance, features, reliability, conformance, durability, aesthetics and perceived quality.

After the first round, an anonymous summary of experts' opinions from the previous round as well as the reasons they provided for their judgments are presented (Rowe and Wright, 2001). Thus, participants are encouraged to revise their earlier answers in light of the replies of other members of the group. It is believed that during this process the range of the answers will decrease and the group will converge towards the "correct" answer. However, problem arose due to the attrition of experts whereby only 9 experts continued in the second round of the Delphi Method.

The Delphi Method is arrived at after achieving a consensus or stability of results. For the Delphi method, a non-parametric analysis using Kendall's coefficient was utilised. The research hypothesis is that there is consistency in ranking by the experts based on the factors deemed as important for smart bio-switch packaging. The Kendall's Coefficients of Concordance (W) will be tested for statistical significance by observing the p-value and comparing the Chi-square test statistics with the critical value.

After the completion of the Delphi Method, content analysis and expert opinions were used to determine the market positioning of the smart bio-switch packaging. For this purpose, a number of perception maps were developed and presented to a panel of three marketing experts from various institutions of higher education. Based on a review of literature, critical information regarding properties and cost of packaging material, availability of raw material, safety and environmental features are provided to ascertain the position of various packaging options within the perceptual map.

FACTORS DEEMED AS IMPORTANT FOR SMART BIO-SWITCH PACKAGING

The first round of the Delphi Method uncovered 7 factors and 14 attributes deemed as important for the success of the smart bio-switch packaging in the market: (1) Performance (extend shelf life of the food than traditional food packaging; and monitor condition of packaged food to give information about the quality of the food), (2) Features (price of the smart bio-switch packaging: and freshness of food in the smart bio-switch packaging), (3) Reliability (ability to protect the food from any kind of microbe and chemical adulteration, oxygen, light, and water vapour; and ability to guarantee the safety and cleanliness of the food packaged), (4) Conformance (the adherence of Bio-Switch packaging from the perspective of biodegradability; and the suitability of Bio-Switch packaging for various types of food products i.e., liquid or solid), (5) Durability (high ability to absorb maximum load; and high ability to withstand stress), (6) Aesthetics (attractive from the indicator label design; and attractive from the other packaging methods), and (7) Perceived Quality (willingness of consumers to switch to Bio-Switch packaging because of the value for money; and consumer usage of Bio-Switch packaging for environmental considerations). The information obtained in the first round was conveyed for the second round of the Delphi Method.

Based on the results of the second round of the Delphi Method, the Kendall's Coefficients of Concordance and p-value for scored ranking was 0.448 and 0.00 respectively. Since the p-value was less than 0.05, the findings are deemed to be significant implying that the ranking of the 9 experts are consistent (refer Figure 1).

VARIABLES	EXPERTS									MEAN	GROUP RANK
	A	D	E	F	G	H	I	J	K		
Performance	2	3	3	3	1	2	1	1	4	2.22	1
Features	6	5	5	1	6	4	4	5	5	4.56	5
Reliability	1	2	4	2	3	1	2	3	3	2.33	2
Conformance	3	4	2	5	2	3	5	4	1	3.22	3
Durability	5	6	1	4	4	5	6	6	2	4.33	4
Aesthetics	4	7	6	7	5	7	3	7	6	5.78	7
Perceived Quality	7	1	7	6	7	6	7	2	7	5.56	6
Kendall's W = 0.488 , p-value = 0.00											

Figure 1: Round 2 Survey Results for Delphi Method

MARKET POSITIONING FOR SMART BIO-SWITCH PACKAGING

The content analysis was used to construct a perceptual map in order to position smart bio-switch packaging against other forms of packaging. The information obtained will help to select market target strategies and determine how to position the product for a market target (Cravens and Piercy, 2003).

The content analysis was able to uncover paper, glass and plastic as the traditionally dominant material used in packaging. Paper is economical and has good printing properties; however, it is not strong and it absorbs water and can be squashed easily thus damaging its contents (Robertson, 2007). Glass is transparent, which allows the consumer to see the product, but is fragile and breakable. However, the single biggest factor limiting the use of glass as a food packaging material is its price.

Plastics are finite barriers to permeation and this property manifests in the forms of gas transfer (e.g., oxygen penetration of packages), gain or loss moisture, and absorption of flavor and aroma bodies. Some food compounds, such as aromatic oils, may attack some plastics. The low densities of plastics may produce unique handling challenges on lines designed originally for glass and steel (Brown, 1992).

In addition, the content analysis was able to uncover new techniques such as oxygen packaging, active and smart packaging methods. Although there are many benefits to the safety and quality of food products using an oxygen scavenger, there are facts that should be considered when determining its application. One precaution for oxygen scavenger packaging is the prevention of anaerobic pathogen proliferation. Product developers must thoroughly investigate the food system with which they are intending to use oxygen scavengers. Studies have been done with oxygen scavengers that show pathogens such as Clostridium botulinium Type E surviving in an oxygen scavenger environment (Rooney, Chapter 6). The real risk is that the normal aerobic spoilage organisms that act as indicators for the consumer are not present because of the lack of oxygen in the package. Consumers could potentially eat a product with a pathogen unknowingly if other hurdle technology is not applied to the product (Kaufman et. al, 2000).

The use of active and smart packaging raises safety issues because of the potential effect of such packaging on the microbial ecology of the food. For example, packaging that absorbs oxygen from the inside package will affect both the types and growth rate of the microorganisms in foods, and could give rise to the growth of anaerobic pathogenic bacteria such as C botulinum. The inclusion of antimicrobial agents in the contact layer of a packaging material may result in a change in the microbial ecology of the food, and the types of micro-organisms present in food will be different from the same food packaged in a conventional manner (Robertson, 2006). Antimicrobial films that only inhibit spoilage in micro-organisms without affecting the growth of pathogenic bacteria will also raise food safety concerns.

Based on the aforementioned information and taking into consideration the availability of raw material, risk and the manufacturing costs, a focus group session involving five marketing experts and practitioners were conducted to develop a perceptual map of all possible packing options. After two hours of intense sessions, a finalised perceptual map was developed as shown in Figure 2.

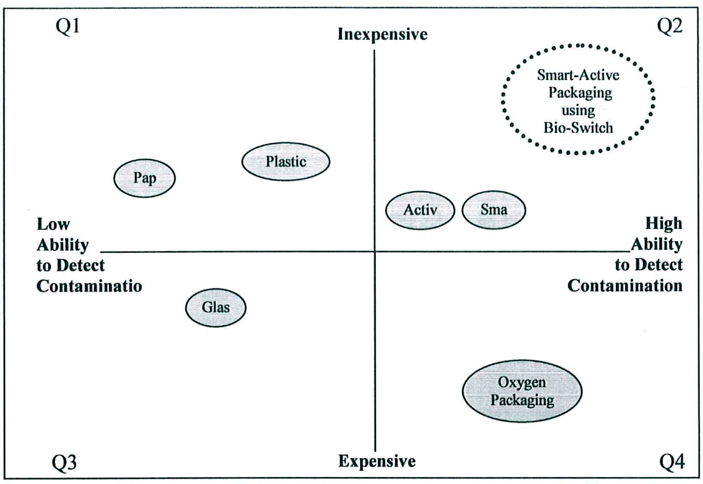

Figure 2: Perception Map of Packaging Options

The marketing experts viewed that the perception map should focus on two dimensions: food safety within the package and price of the end product. After taking into consideration all the information provided, the smart bio-switch packaging is positioned in the second quadrant (Q2). The vacuum in the second quadrant has the greatest potential to appeal due to its lower cost and high ability to detect contamination.

CONCLUSION

The development of the smart bio-switch packaging as a new entrant into the packaging industry holds much promise. It has the potential to be the perfect substitute to the existing product offered in the packaging industry, or a discontinuous innovation that could revolutionise the whole industry (McDermott and Handfield, 1997). Its eco-friendliness due to its bio-degradability and pricing attractiveness coupled with its ability to detect contamination makes the smart bio-switch packaging a very viable business proposition with tremendous potential to venture into the export market.

Based on the mean ranking from the Delphi Method, the ranking of dimensions based on importance for smart bio-switch packaging is as follows: performance, reliability, conformance, durability, features, perceived quality and aesthetics. This finding implies that the experts view that performance is the most important dimension in Smart Bio-Switch packaging as compared to the traditional packaging, while aesthetics is the least important dimension.

This finding is consistent with several dimensions of quality proposed by Garvin (1987). From the perspective of performance, the smart bio-switch packaging fulfills its primary role as a packaging option and has “extra” features as illustrated in the perception map. In addition, the smart bio-switch packaging is perceived as reliable and conforms to pre-established standards. Finally, the smart bio-switch packaging is viewed as durable and has aesthetics values.

RECOMMENDATIONS

Though the smart bio-switch packaging appears to be an attractive proposition to the food packaging industry, a precautionary approach is strongly recommended as numerous studies have shown the high failure rate of new product development (Cooper, 1999). As such, McDermott (2000) proposes the "probe and learn" process whereby companies developed their products by probing potential markets with early versions of the products, learning from the probes, and probing again. In effect, they ran a series of market experiments— introducing prototypes into a variety of market segments. This process, as described, understands the nature of emerging markets and uncertain technology. According to McDermott (2000), probes are simply "feelers" to get a better sense of the market. From the outset, it is viewed as an iterative process, with the goal of the first several attempts to learn as much as possible about the market so that later attempts might be more on target. Adherence to the aforementioned recommendation could ensure a better success rate for the introduction of the smart bio-switch packaging into the market.

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