3 THE EFFECTS OF REUSABILITY AND GREEN DESIGN IN CONSUMER PACKAGING ON CONSUMER SATISFACTION – USING SEM ANALYSIS

Wei-yao Wang* **and Jordan Tzu-ho Huang**[†]

**Graduate School of Visual Communication Design, National Taiwan University of Science and Technology, Taiwan, R.O.C. Tel: +886-(0)2-2730-1016. Email: wyw@mail.ntust.edu.tw*

[†]*Graduate School of Visual Communication Design, National Taiwan University of Science and Technology, Taiwan, R.O.C. Tel: +886-(0)9-8981-8175, Fax: +886-(0)7-553-9937. E-mail: jordan@yahoo.com*

More contemporary product packaging are designed to be environmental- friendly as efforts of the environmentalists grow more enthusiastic and the number of green design supporter increase. However, there remain consumers that care about the appearances and quality of packaging over the wellbeing of our planet. The truth is, they cannot be blamed for some objects are indeed required to last, and recycled paper simply cannot satisfy everyone's needs. Nevertheless, this research observes that consumers will keep packaging materials for various reasons, which helps lighten the burden on landfills. Therefore, this research explores the factors that affect reusability in packaging, and how the concept of green design relates to reusability. This research conducts analysis using SEM to decipher the relationships among factors of reusability, green design, and consumer satisfaction. By analyzing data from a survey of 215 participants from three major shopping centers in Taipei, the results clearly indicates a positive relationship between reusability and consumer satisfaction. Moreover, the results also show green design strengthens the relationship between reusability and consumer satisfaction.

Keywords: Packaging Design, Reusability, and Green Design.

1. INTRODUCTION

In modern society, commercial designs are applied in many extremely competitive areas. Within these areas where designs are influential toward consumer selection, packaging design is one of the most apparent and direct application of design as a marketing tool. According to Heller (1999), although a package is undeniably utilitarian, modern packaging is a function of a war that is fought daily. A war that many of us don't even realize is being waged, and yet it affects both our pocketbooks and consuming habits. While the choices of products grow large in current competitive market, it is becoming progressively more difficult for a package to market a particular product, and among the endless selection of products, Grossman (2005) suggests, is precisely the point where shoppers make seven out of 10 purchase decisions. Whether it is on the shelf of a super market or in an apparel store of a mall, contemporary packaging faces unprecedented challenges in the marketing aspect. In the United States, Heller (1999) points out that the transformation came during the late 1900s, when individual packages replaced huge bags and bushels that once filled the old general stores and the physical package itself symbolized progress. Yet as globalization emerges, Rodrigue (2006) notes, it is widely acknowledged that improvements in transport and distribution have contributed to significant changes in the geographies of production.

The spatial and functional fragmentation of manufacturing and attempts at reducing inventories have led to smaller, more frequent and synchronized shipments, transforming the logistics industry, but

placing intense pressures on transport systems to support these flows. As a result, contemporary manufacturers must package their goods with more protective materials in order to ensure the integrity of products is safely preserved. Moreover, since industrialization, product packaging also require additional marketing capabilities to compete in the growing selections of products. Thus packaging has evolved to its current complex state in both form and function, and the level of complexity in consumers today requires us to think beyond current methods of designing for packaging in order to fulfill the needs of consumers and the now highlighted environmental issues.

This research will center its focus on the packaging qualities that increase the chance of reuse. Also, this research will be mainly concerned with practical issues such as consumer preference and realistic cost and benefits. In short, this research will attempt to gain an understanding on current packaging on market, consumer reusing habits, and finally highlight the important qualities of reuse.

2. LITERATURE REVIEW

2.1. Environmental Issues

While the end consumers may enjoy the cheap price from mass-production and specialization, our environment has to pay the price for the extra materials used on packaging. Luckily, some consumers have already realized that packaging is a waste. Yet, such wasteful methods of transporting products are extremely irreversible and difficult to reduce. According to Walsh (2007), Mega-retailer Wal-Mart, far out front in this effort, has trimmed everything from its rotisserie-chicken boxes to its water bottles, each now made with 5 g less plastic. The company plans to cut packaging 5% starting in 2008–enough to prevent 667,000 tons of carbon dioxide emissions. This may seem like good news. But if 5% of Wal-Mart's annual CO2 emissions equals 667,000 tons, then it only means that Wal-Mart still emits 95% of the original volume, which equals to 12,673,000 tons of CO2 per year on just packaging!

It is important to state exactly how significantly packaging waste can affect our environment. According Parsons (2006), packaging waste is estimated to consume over 30% of landfill space. By weighing the functions of packaging and its harm to society, it would not be exaggerating to say packaging in modern society has gone completely absurd and out of control. While other printed materials can be recycled more easily, packaging often uses various plastics that impose greater harm to the environment. And for the great price society pay just to advertise products to consumers, it is not only unnecessary but inappropriate.

Answering to the environmental concerns, packaging used during the transporting stage of the production has adopted a more resource-saving route by employing materials that can be reused multiple times in recent years. As the author of article *Choose to Reuse* (Anonymous, 2004) suggests, "The main advantage is that reusable containers you money. They're made to use over and over again also reduce the costs of disposal or recycling associated with ordinary cardboard boxes."

Extending this quality of reusability in transport packaging, some designers have taken a route in pursuing their solutions for point of sale packages that are both unique and environment friendly — a package with extended functionalities other than protection, transit, and marketing. According to Grossman (2005), a functional innovation means designing packages that introduce new value for users in terms of convenience. By adding extended functionalities to a package, the package may be preferred over traditional, less-convenient packaging and result in an extended usage. Accordingly, this research proposes the following hypothesis:

H1. Functionality in a packaging is related to consumer willingness to reuse packaging.

2.2. Definitions of Green Design

Cheng (1994) defined Green Design with design principles as follows: 1) easy to recycle, 2) easy to exchange parts for repair, which extends product life-cycle, 3) utilize recyclable and low-pollution material, 4) product uses minimal energy for maximized effect, 5) product operates with low-pollution level, and 6) product considers safety and health.

However, the real-life situation seems to contradict to Cheng's ideal. According to Parsons (2006), the nature of packaging — requiring distinctive colors and shapes to attract consumer attention — has meant a wider range of manufacturing methods, with a correspondingly higher risk of adverse environmental impact. Although it is possible to design within the standards provided by Cheng, it is not always practical to do so in the marketing aspect. Luckily, there are broader definitions that encompass a wider definition of green design. For example, Simon (1992) explains in the following points of the qualities of a green product: 1) reduced raw material, high recycled content (aluminum cans), 2) non-polluting manufacture/non-toxic materials, 3) no unnecessary animal testing (cosmetics), 4) no impact on protected species (dolphin-free tuna), 5) low energy consumption during production/use/disposal, 6) minimal or no packaging, 7) reuse/refillability where possible (beverage containers, detergent bottles), 8) long useful life, updating capacity (office machines), 9) post-consumer collection/disassembly system (cars), and 10) remanufacturing capability ("closed loop" total reuse or "partial loop" partial reuse and appropriate disposal, i.e. composting or incineration.

Some of these criteria above relating to manufacturer do not concern this research since they are not within the scope of graphic designers' area of expertise. Rather, this research is only concerned with the a) reuse/refillability and b) long useful life qualities. The list above therefore serves to demonstrate the value of reusability and product life-cycle in green design. Summing these definitions up, it is appropriate for this research to consider reusability as a possible criterion of green design and this research proposes the following hypothesis:

H2. Durability (long useful life) in a packaging is related to consumer willingness to reuse packaging.

H3. Refillability in a packaging is related to consumer willingness to reuse packaging.

H4. When considering green design, relationship between reusability and consumer satisfaction is strengthened.

2.3. Consumer Perspective

Heller (1999) writes, "It (packaging) gave allure to a product on both conscious and unconscious levels. It provoked the consumer to take pride in their consumption. It made the consumer desirous to consume." While some might say that they are willing to give up the packaging to save our rain-forests, the majority of consumers are ignorant to the issue. Although it would be nice to follow the green design's ideals, protect our environments and preserve the limited resources, it is nevertheless impractical. Immediately brought to attention in article Marketing Green Products in the Triad (Simon, 1992), were three challenges for developing green consumerism:

1. Government regulation, while steadily increasing, still fluctuates widely across the Triad. Proactive companies have had to develop their own guidelines in the absence of national standards in the United States or harmonized laws in Europe.
2. Consumer demand is itself ambiguous…in the sense that a self proclaimed environmentalist is not always willing to pay a premium or sacrifice convenience for a green product.
3. Industry initiatives have so far met with varying levels of success or disaster.

These challenges demonstrate that the ideas of green consumerism are still in the developing stage and have not matured. Also notable is that even self-proclaimed environmentalists are not always willing to pay the premium for a green product. Adding to the challenges is the fact that consumers do not all realize products are over-packed. Yet, while the over-packing of products may be overlooked, consumers seldom miss the quality-related details in packaging.

As Lennon (2007) observes in the cosmetics industry, the more commercially available luxury brands have all but ignored environmentalists' calls for them to reduce solid waste and energy consumption. Although some brands like Clarins and Aveda are being as green as possible, they nevertheless, do not represent the majority of the companies.

These above evidences demonstrate the need for alternative solutions other than material reducing and recycling. In the short-term period, this research believes that reusing packaging may help lighten the impact on environment considering the realistic circumstances in consumer habits, government limitations, and corporate interests. Consequently, this research proposes the following hypothesis:

H5. Reusability in a packaging is related to consumer satisfaction.

3. RESEARCH METHODS

3.1. Conceptualized Framework

From the above discussion and exploration, this research designs a conceptual framework containing several causal paths that feed into the outcome construct. That is, there exists a positive relationship between functionality and reusability (H1), durability and reusability (H2), refillability and reusability (H3), and reusability and consumer satisfaction (H5). In addition, green design is a moderator in the relationship between reusability and consumer satisfaction (H4).

3.2. Data Collection and Samples

This research conducts its survey in Taipei, the busiest and most populated city of Taiwan. In Taipei, there are several major commercial/shopping centers, and this research selects four areas from west Taipei, east Taipei, Taipei train station, and southern Taipei. A total of 600 surveys are distributed, with 150 surveys per area. Of the 600 surveys distributed, 236 surveys are returned. Subtracting from 17 surveys with missing/incomplete information, this research gathers a total number of 219 usable samples with 36.5% response rate, providing a valid sample size for subsequent statistical analysis. The resulting sample is diverse in terms of demographic characteristics: 37.9% are male and 62.1% are female; 10.5% are 18 years old or below, 35.2% are within 19 to 25 years old, 31.5% are within 26 to 30 years old, and 22.8% are above 30 years old. The data was gathered in 2008, over roughly three months.

3.3. Measures

The instrument is comprised of six constructs: durability, refillability, functionality, reusability, green design, and consumer satisfaction. Of these constructs, each item is measured by a 7-point Likert scale ranging from 7 being "strongly agree" to 1 being "strongly disagree." In the following lists, constructs are explained in their specific context along with corresponding items.

Durability
1. I care about whether or not a packaging deteriorates.
2. I care about whether or not a packaging is easily crushed.
3. I care about whether or not a packaging is easily deformed.
   The Cronbach α measure of reliability for this construct is 0.91.

Refillability
1. I like packaging that has no caps or reclosing mechanism.
2. I like packaging that has caps but not completely air tight.
3. I like packaging that has caps and is air tight.
   The Cronbach α measure of reliability for this construct is 0.89.

Functionality
1. I care that a packaging has additional functions other than its basic functions relating the packaging role.
2. I care that a packaging can be used as something else.
3. I care that a packaging may be an independent product by itself.
   The Cronbach α measure of reliability for this construct is 0.89.

Reusability
1. I care that a packaging can be reused and I may place the original item in it.
2. I care that a packaging can be reused and I may place a different item in it.
3. I care that a packaging can be reused for another purpose other than a container.
   The Cronbach α measure of reliability for this construct is 0.85.

Green Design
1. I care that the material used in a packaging can be reused.
2. I care that a packaging can used for a long time.

4. EMPIRICAL RESULTS

4.1. SEM Analysis

To test the conceptualized model shown in Figure 1, this research employs the LISREAL statistical software package. The instrument is comprised of two parts, the measurement model and the structural equation model. First, the measurement model serves to indicate the dependent relationship between latent variables (hypothesized constructs) and observed variables, which describes the reliabilities and validities of the observed variables. Second, the structural equation model specifies the casual relationships among the latent variables, describing the casual effects and assigns the explained and unexplained variances (Jöreskog and Sörbom, 1996). This work uses the maximum likelihood (ML) estimation (Jöreskog and Sörbom, 1996) to examine the structural equation model. The full model is comprised of the structural model, which included six latent variables and the measurement model that specifies the relationships between the latent and manifest variables. The hypothesized model illustrated in Figure 2 presents the results of the relationships between the exogenous and endogenous variables and the relationships between the endogenous variables. The model illustrates the hypothesized relationships among the functionality, durability, refillability, reusability, green design, and consumer satisfaction. The 219 observations from three major shopping centers in Taipei are used to test the hypothesized relationships.

4.2. Model test and Goodness-of-fit test

The hypothesized model had a significant chi-squire statistic ($\chi 2 = 15.86$ with df $= 8$), indicating acceptable model fit. Common criteria for testing an overall model are as follows: 1) A ratio of model-fit statistics based on a degree of freedom not exceeding 3; and 2) Goodness of fit indices, particularly
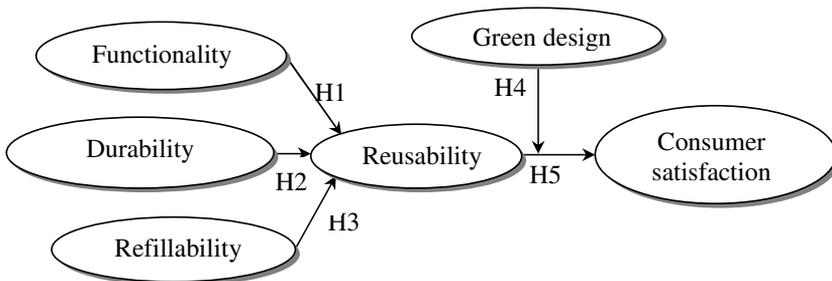

Figure 1. The conceptual framework.

Table 1. Results of model comparison (N=219).

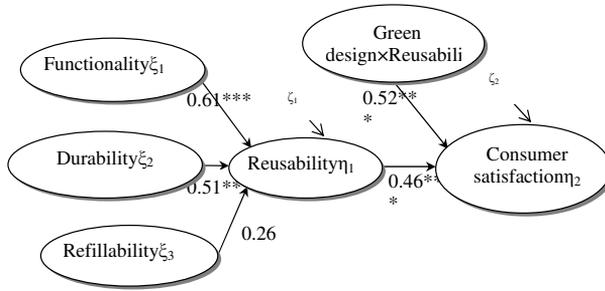| Model	χ^2	*df*	χ^2/df	GFI	CFI	NNFI	IFI	NFI	RMSEA
Hypothesized Model	15.86	8	1.98	0.93	0.94	0.91	0.90	0.89	0.056

Figure 2. A causal model with computed parameters.

t]

Table 2. Parameter estimates for structural equations model.

Hypothesized Model	Parameter estimates	T-value
Construct relationship		
H1: Functionality → Reusability ($\gamma 11$)	0.61***	4.62
H2: Durability → Reusability ($\gamma 21$)	0.51***	3.26
H3: Refillability → Reusability ($\gamma 31$)	0.26	1.57
H4: Green design × Reusability→Consumer satisfaction ($\gamma 24$)	0.52***	3.27
H5: Reusability?Consumer satisfaction (β_{21})	0.46***	2.98

Note¡G""p<0.1 "**"p<0.05 "***"p<0.01*

(a) goodness of fit index (GFI), (b) comparative fit index (CFI), (c) non-normed fit index (NNFI), (d) incremental fit index (IFI), (e) normed fit index (NFI), each of which must exceed a threshold value of 0.9 for a model to be classified as closely fitting the model (Bagozzi and Yi, 1988). For this model, the GFI, CFI, NNFI and IFI exceed the cut-off value of 0.90, demonstrating that the hypothesized model has statistically significant model fit.

Table 2 summarized the statistics for the goodness-of-fit test. The results of testing the hypothesized model revealed good fit. A ratio of model-fit statistics based on degree of freedom below 3 indicates adequate model fit ($\chi 2/df = 1.98$). RMSEA value reached an acceptable value of 0.08. The hypothesized model in Figure 3 thus can be classified as closely fitting the data. Table 3 lists the results of the goodness-of fit measures of the hypothesized model.

4.3. Hypothesis Test

To test Hypotheses 1 through 3, the proposed theoretical model was tested using the LISREL 8.52 version. The following paths were estimated: path between functionality and reusability (H1), path between durability and reusability (H2), path between refillability and reusability (H3), path between green design × reusability and consumer satisfaction (H4), and path between reusability and consumer satisfaction (H5). The hypotheses regarding the relationships were tested based on the associated t-statistics. T-values exceeding 1.65 or 1.98 or 2.576 were considered significant at the 0.10, 0.05 and 0.01 levels, respectively. Functionality significantly and positively influenced the reusability ($\gamma 11$ = 0.61, t-value = 4.62). Furthermore, durability significantly and positively influenced (P < 0.05) the reusability ($\gamma 21$ = 0.51, t-value = 3.26). Thus, Hypotheses 1 and 2 were supported. However, contradicting the predictions, no significant association was identified between the refillability and the reusability (H3). Table 4 lists the results of the parameter estimates of the hypothesized model. Hypotheses 4 and 5 were supported. Four hypothesized relationships were classified as significant.

5. CONCLUSIONS AND FUTURE RESEARCH

5.1. Conclusions

With the issue of global warming getting more intense everyday and the concept of green design maturing, it is this research's main goal to find the characteristics in consumer packaging that will encourage consumers to reuse a packaging. As previously mentioned, there are industries that simply cannot sacrifice their product's image and employ more environmental-friendly materials for packaging. Therefore, this research intends to identify the qualities in a packaging that extends its life cycle and maximizes the material efficiency by providing it extra functionalities or value.

From the results of surveying and statistical analysis, the SEM results clearly indicate the positive effects of reusability on consumer satisfaction. Further, the concept of green design also shows positive reinforcing effects as moderator between reusability and consumer satisfaction. As for the latent variables that are hypothesized to have relationships with reusability, not all are statistically proven by the SEM tests. While durability and functionalities do have strong positive relationships with reusability, refillability proves to have a weak relationship with reusability. These results suggest that perhaps while consumers do desire reusability in packaging, the extended life of the packaging is not limited to containing objects. However, these results do serve to prove that reusability is a possible alternative solution for environmental problems, and future packaging designs should take into consideration that packaging can be reused post unpacking for original or other purposes.

5.2. Limitations and Future Research

It is noteworthy that, consumers demonstrate high interests in packaging as an independent product. Perhaps if this concept is widely adopted, most products may be packaged with another product, and packaging would have a permanent role rather its current transient and wasteful role. It is this research's hope to pave the way for future researches on this topic. Due to the lack of relating researches on this topic, this research is limited in literature for proving the benefits of reusing a packaging. However, with the results from this work, future researches may explore the endless possibilities of packaging being something more than a container, and transform a packaging's purpose as well as its value to society.

REFERENCES

[1] Cheng, Y. J. (1994). Green Design Concept in Product Design. Learning Development, 77-82.
Busby, J.S., The neglect of feedback in engineering design organizations, Design Studies, 19, 103–117, 1998.

[2] Dresang, Joel. (2007, November 17). Making Bacon Pop: New Package puts Oscar Mayer a Cut above the Competition. Milwaukee Journal Sentinel.

[3] Grossman, Gary. (2005, January 17). Put Some Pizzazz in Your Packaging. Brandweek, **46**(3), 17.

[4] Heller, Steven. (Spring, 1999). Appetite Appeal. Social Research, **66**(1), 213–224.

[5] Lennon, Christine. (2007, Spring). Behind the Pretty Picture. Time, 170, 13–15.

[6] Parsons, John. (2006, Oct.). The Package Factor. The Seybold Report: Analyzing Publishing Technologies, **6**(6), 9.

[7] Rodrigue, Jean-Paul. (2006, Dec.). Transportation and the Geographical and Functional Integration of Global Production Networks. Growth and Change, **37**(4), 510–525.

[8] Simon, Francoise L. (1992, Fall/Winter). Marketing Green Products in the Triad. Columbia Journal of World Business, 27(3–4), 268–285.

[9] Walsh, Bryan. (2007, Apr. 9). 37 Think outside the Packaging. Time, **169**(15), 93.

[10] Jöreskog, K. & Sörbom, D. (1996). LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language. Chicago: Scientific Software International.

[11] Bagozzi, R.P. & Yi, Y. (1988). On the Evaluation of Structural Equation Models. Academy of Marketing Science, **16**(1), 74–94.