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Introduction of Quantitative Marketing Research Solutions in a Traditional Manufacturing Firm: Practical Experiences

> Robert J. Goodwin, Lifetime Products, Inc.

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### INTRODUCTION OF QUANTITATIVE MARKETING RESEARCH SOLUTIONS IN A TRADITIONAL MANUFACTURING FIRM: PRACTICAL EXPERIENCES<sup>1</sup>

ROBERT J. GOODWIN LIFETIME PRODUCTS, INC.

#### ABSTRACT

Lifetime Products, Inc., a traditional manufacturing company based in Clearfield, Utah, has introduced progressively more sophisticated conjoint and other quantitative marketing research tools over the past three years. Along the way, the company has gained valuable insight into the process of adopting conjoint and choice analysis tools in this corporate environment.

This paper presents some of Lifetime's practical experiences as they relate to (a) challenges experienced by key stakeholders in accepting and trusting conjoint analysis, (b) success stories with conjoint analysis, and (c) the resulting escalation in client demands for more sophisticated and robust conjoint tools. This case study should provide useful insight to marketing research practitioners, especially those who either have or are planning to acquire similar conjoint tools in-house.

#### **INTRODUCTION**

In a very general sense, entities that use - or are interested in - conjoint and choice analysis may be classified into one of the following groups:

- 1. Academics who research and generate new statistical procedures and explore variations and improvements in those procedures to meet specific research needs;
- 2. Research consultants who provide specialized and even customized research and statistical services to corporate and other clients; and
- 3. Corporate and institutional research users who either retain the services of research consultants or act as their own research practitioners to complete needed statistical analyses to support management decision making.

While the work of the first two groups is well-represented in literature dealing with conjoint and choice analysis, the third group – corporate research users – often receives less attention in journal articles and conference presentations.

This paper presents a case history of Lifetime Products, Inc., a medium-size, traditionally managed manufacturing company, as it decided to adopt a program of quantitative marketing research to enhance its decision making process. In particular, this paper will:

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- 1. Describe some of the challenges faced by the corporate marketing research department and the proactive activities it employed to build trust among an often-skeptical in-house clientele generally unfamiliar with conjoint and choice analysis;
- 2. Recount a few key examples of conjoint success stories that generated confidence in the efficacy of these new statistical procedures; and
- 3. Demonstrate how this increased management confidence and the resulting escalation in client demands required the corporate marketing research department to incrementally increase its conjoint and choice analysis capabilities commensurately.

#### **COMPANY BACKGROUND**

Lifetime Products, Inc. is a privately held, vertically integrated manufacturing company headquartered in Clearfield, Utah. Founded in 1986, Lifetime currently employs approximately 1,700 employees at multiple facilities in the United States, Mexico, and China. The company manufactures consumer hard goods typically constructed of blow-molded polyethylene resin and/or powder-coated steel. (See examples in Figure 1.) The company is considered "vertically integrated" because, in addition to product assembly, it also fabricates its own metal components from steel coil and blow-molds its own plastic parts from high-density polyethylene pellets. Its products are sold mainly to consumers and small businesses worldwide through a wide range of department and discount stores, home improvement centers, warehouse clubs, office supply stores, sporting goods stores, and other retail outlets.



Throughout its 23-year history, Lifetime Products has prided itself in the application of innovation and cutting-edge technology in plastics and metals to create a family of affordable lifestyle products that feature superior strength and durability. A few of the product "firsts" for the company include:

First home portable basketball system with height-adjustable rim and backboard

- First folding utility tables and chairs using light-weight plastic resins and rust-resistant steel structures
- First resin-based outdoor storage/garden sheds with steel-reinforced roof and walls

First utility trailer featuring longitudinal fold-in-half functionality for easy storage

Lifetime's track record in product innovation and market success over the years had been supported by an often-informal mix of qualitative marketing research efforts, including secondary research, competitor analysis, focus groups, and feedback from purchasing agents at key retail chain accounts. Over time, company management realized that it also needed more sophisticated quantitative tools to better inform its decision making process and to facilitate future success in its often-crowded and -maturing markets.

In 2006, Lifetime's marketing research department embarked on a program of conjoint and choice analysis to help the company formalize its product development program by the use of quantitative consumer input. Over the next three years, the company gradually increased the sophistication of its conjoint and choice analysis capabilities to keep pace with escalating management information demands (described later), adopting the following analytic programs in fairly rapid succession:

- 1. SPSS Conventional Conjoint (2006);
- Sawtooth Software Choice-based Conjoint (CBC) with Latent Class analysis (early 2007);
- 3. Sawtooth Software Partial-profile CBC using Advanced Design Module (late 2007); and
- 4. Sawtooth Software Adaptive Choice/ACBC with Hierarchical Bayes analysis (2008 beta test; 2009 full implementation).

From 2006 to the present (late April 2009 at this writing), the company has engaged in 19 conjoint and choice analysis studies against a half-dozen product categories. The company's practical experiences in implementing these quantitative research tools and using them in multiple studies provides a foundation for the three main sections that follow.

#### I. CLIENT CHALLENGES IN ACCEPTING CONJOINT ANALYSIS

Lifetime Products implemented a number of "trust-building" activities to help key stakeholders to better understand – and  $\underline{trust}$  – conjoint analysis as a tool to reduce uncertainty in marketing decision making.

Despite the management's desire to augment its marketing research capabilities with quantitative methods, they initially had many questions and even doubts about the conjoint analysis tool as proposed by the marketing research director in 2006. They expressed incredulity that with conjoint one could indeed (a) determine the relative value of attributes/levels, (b) analyze *all* possible product combinations, and (c) conduct realistic market simulations, all by simply asking respondents to sort a few product concept cards! Consequently, these stakeholders were initially reluctant to make – or change – product development decisions based on conjoint findings.

To allay some of these management concerns, the marketing research department instituted a number of learning and trust-building activities and procedures to help management (a) to become better acquainted with conjoint, (b) to bolster their confidence in the results therefrom, and (c) to become a more integral part of the research process itself. The following section describes some of these learning and trusting-building initiatives.

*In-house Pretests.* Since the beginning of the current decade, the company had used in-house pretests occasionally as a means of debugging and "wordsmithing" quantitative survey instruments prior to fielding. With the introduction of conjoint analysis in 2006, however, the pretest function took on increased importance. Since the conjoint survey method (i.e., cardsorting initially) was so different from "normal" survey protocols, efforts were made to ensure that all key stakeholders (category and product managers, design engineers, marketing directors, and even some senior management) were invited to serve as subjects in pretest interviews. The purpose of this effort (in addition to the usual debugging) was to allow these stakeholders to "walk through" the conjoint interview personally so they could better understand the conjoint process and appreciate what "live" respondents would be doing. Rudimentary conjoint utilities were calculated from this collected pretest dataset, allowing stakeholders to see pro forma results similar to those which would be generated from the consumer interviews to follow.

*Out-of-House Pilot Tests.* Prior to the full field work in many of these early conjoint studies, the company also used out-of-house pilot tests against small convenience samples. These were generally conducted as intercept interviews at a local mall research facility or appended to already-scheduled focus-group discussions on the same topic. This procedure allowed category and product managers to test "straw-man" conjoint designs – often with large numbers of attributes and/or levels that they felt were reflective of the customer mindset – in a relatively inexpensive research setting. If the preliminary results (generally using sample sizes of only 40 to 80) suggested that a given attribute was contributing only a percent or two of importance to the overall model, the stakeholders were more inclined to drop that attribute in favor of a more parsimonious conjoint model prior to proceeding with the production phase of the study.

*Proactive Demonstrations of Conjoint Capabilities.* The initial SPSS conventional conjoint software was "sold" to management on the basis that, in general terms, it would be an excellent way to provide consumer feedback on the relative value of product features and options, and thus guide product development and marketing efforts. Ultimately, however, study results would need to be presented in such a way that management was comfortable in relying on the information for its decision making. The typical output of conjoint analysis – part-worth utilities and average importance percentages – was found by stakeholders to be interesting but *not* always useful. They sometimes asked that conjoint utility data be converted to a more understandable "price-per-utile" indicator, but attempts to provide this type of dollar-equivalent metric often met with theoretical and computational roadblocks (as discussed by Orme, pp. 1 & 5).

In an effort to provide more palatable delivery of conjoint results, Lifetime's marketing research department began to conduct market simulations using realistic assumptions germane to pending management decisions. However, early attempts to present these simulation results to stakeholders left them with a feeling that the process was fairly "black box." They needed to have a more flexible and insightful view of how the simulations worked in order to gain confidence in the results. Consequently, the marketing research department began to construct

Excel-based market simulators for hands-on client use. (See Outdoor Storage Shed example in static view in Figure 2.)

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## Hands-on Market Simulator for Outdoor Storage Sheds

	Product 1: Lifetime Resin		Product 2: Rubbermaid Resin		Product 3: Arrow Metal		Product 4: Tuff Shed Wood		
	Attribute	Description	Utility	Description	Utility	Description	Utility	Description	Utility
1	Materials of Construction	Plastic/resin (\$549 med)	0.14780	Plastic/resin (\$549 med)	0.14780	Sheet metal (\$399 med)	0.05071	Wood (\$799 med)	-0.34840
2	Size of Shed	6'x5' (30 SF)	-0.17585	5'x5' (25 SF)	-0.27734	6'x6' (36 SF)	0.11071	5'x5' (25 SF)	-0.27734
3	Roof Height	8' roof w/ 6.5' door	0.23962	8' roof w/ 6.5' door	0.23962	6' roof w/ 5' door	-0.23962	8' roof w/ 6.5' door	0.23962
4	Floor	Soft plastic floor	-0.00427	Hard plastic floor	0.20764	Floor not included	-0.43554	Wood floor	0.23217
5	Shed Color	Neutral color (CANNOT be painted)	-0.09777	Neutral color (CANNOT be painted)	-0.09777	Neutral color (can be painted)	0.05083	Variety of colors	0.04694
6	Added Features	No added features	-0.14632	No added features	-0.14632	No added features	-0.14632	No added features	-0.14632
7	Expandability	Not expandable	-0.24385	Not expandable	-0.24385	Not expandable	-0.24385	Expandable	0.24385
8	Brand Name	Lifetime	0.05098	Rubbermaid	0.19191	Arrow	-0.00677	Tuff Shed	0.13452
9	Warranty	10 years	0.05398	10 years	0.05398	5 years	-0.23773	10 years	0.05398
10	Price Level	Median price	0.00263	Median + 12.5%	-0.13715	Median - 12.5%	0.13846	Median + 12.5%	-0.13715
		\$549		\$629		\$349		\$899	
То	tal Utility		-0.17305		-0.06148		-0.95912		0.04187
Ап	tilog of Total Utility		0.84110		0.94037		0.38323		1.04276
Sha	are of Preference		26.2%		29.3%		11.9%		32.5%

During the analysis phase of each conjoint study, one of these custom market simulators was provided to the respective category managers so they and their teams could conduct their own rudimentary "what-if" analyses. The spreadsheet was designed so that, through the use of pulldown attribute lists, the users could see the impact of a potential product design change not only in the utility score but also in the simulated share of preference. Managers could also use this tool to gauge potential competitor responses to proposed company initiatives.

It should be noted that this Excel-based simulator (using partial-profile CBC utilities generated by aggregate multinomial logit) for client use served only as a *supplement* to the market research department's use of Sawtooth Software's SMRT simulator (using utilities generated by Latent Class or, later, Hierarchical Bayes). Clients were instructed that, if they found a particularly interesting direction from their what-if analysis, they should request confirmation from the marketing research director using more-rigorous simulations available via SMRT. But the mere activity of generating their own preliminary simulations added markedly to their understanding of and appreciation for conjoint analysis.

#### **II. SUCCESS STORIES WITH CONJOINT ANALYSIS**

As Lifetime progressed in its use of conjoint analysis tools, a number of conjoint findings have had a direct impact on product and marketing decision-making. This section will describe some of these success stories.

<u>Success Story #1: Fold-in-half Utility Trailer</u>. Lifetime Products conducted its first conjoint study in 2006 as it was planning the market introduction of an innovative new fold-in-half design of utility trailer. (See fold-up sequence in Figure 3.) This survey was administered in four mall locations across the U.S. (the folded-up trailer was even wheeled into the small interview rooms to demonstrate the fold-up feature "live") and the analysis done using SPSS Conventional Conjoint from a card-sort survey method.



One of the primary objectives of this study was to determine an appropriate initial retail price point for the fold-in-half trailer. A pre-conjoint question asked respondents to project what price they would expect to see on the price tag for this new product. The distribution of responses had a noticeable downward inflection above the \$999 price point. Subsequent conjoint analysis using part-worth plots and market simulations confirmed that demand for this new concept might be considerably restrained if it were priced above \$999.

*"The Rest of the Story..."* Due to cost and other considerations, the new fold-in-half utility trailer was introduced at a manufacturer's suggested retail price (MSRP) somewhat above the \$999 price point suggested by the conjoint findings. First-year sales of the product were substantially lower than hoped for. However, subsequent sales promotions down to \$999 or less often resulted in substantial boosts in unit sales. As a result, management gained initial respect for conjoint analysis as a tool to help predict consumer price sensitivity.

<u>Success Story #2: Folding Utility Chair</u>. This conjoint study involved a visual and tactile comparison of Lifetime's commercial-grade folding utility chair (at far left in Figure 4) against three other similar steel-and-plastic offerings and a popular padded vinyl model. These folding utility chairs are used not only as supplemental seating in the home, but also in large numbers by churches, clubs, schools, and businesses for banquets, meetings, temporary work use, and the like.





One of the key objectives of this study was to determine price sensitivity for the Lifetime commercial-grade folding utility chair. Most retailers had been pricing the chair at \$19.99 and were hesitant to breach this perceptual price barrier. This study, using mall-intercept surveying in five U.S. cities, was one of the company's first uses of Sawtooth Software's Choice-based Conjoint (CBC) with Latent Class segmentation analysis.

The conventional wisdom was that, at first glance, the padded vinyl chair would be perceived as the most comfortable of the five models, simply because it was the only padded option. However, qualitative research by Lifetime had found that many consumers were "pleasantly surprised" at the ergonomic comfort of the "hard" Lifetime steel-and-polyethylene chair. Therefore it was considered essential that respondents not only *view* but also *sit* in each chair before proceeding with the conjoint experiment.

The CBC and Latent Class analyses produced evidence that the market was somewhat price*ins*ensitive to the Lifetime commercial-grade folding utility chair at retail prices above \$19.99. Crosstabulations of the price utilities by chair model showed a definite flattening above \$19.99 for the Lifetime chair, especially when contrasted with the other, more price-sensitive models. Results of market simulations showed virtually no degradation in share of preference for the Lifetime chair when priced above \$19.99 (even with the non-commercial competitors simulated at \$17.99 or *below*). Thus, it appeared that consumers who were most sensitive to a \$20-plus price had *already* decided to purchase a lower-cost, non-commercial model, even without a Lifetime price increase. Latent Class analysis confirmed that there was indeed a very loyal Lifetime-friendly segment that was relatively price-tolerant to the Lifetime chair within the \$19.99 to \$21.99 range. (See Figure 5.)





*"The rest of the story..."* The Lifetime sales department began to "educate" retail accounts on the results of this pricing analysis and its potential ramifications for increasing the profitability of this SKU. Eventually several retailers decided to boost their prices above the traditional \$19.99 price point. Initially, there were no serious sales consequences to this action. However, the current worldwide economic downturn eventually depressed sales volumes for *all* furniture products (including the Lifetime chair), so the issue is presently clouded (i.e., "the jury is still out"). Even so, Lifetime sales managers say they like having this type of concrete data on consumer price perceptions, considering it to be valuable "ammunition" when negotiating with their retail accounts.

<u>Success Story #3: Market Segmentation</u>. For many years, Lifetime's products were developed nominally with the "mass market" in mind. The company conducted little if any segmentation analysis to examine differences in preferences or price sensitivity among different segments of the market. As the company began to develop different product grades or models for various market segments, management began to feel the need to study differences in segment preferences more formally.

*"The rest of the story..."* With the introduction of Sawtooth Software's CBC with Latent Class analysis in 2007, Lifetime had to ability to explore behavioral market segments within the context of conjoint analysis projects. In all product categories studied, these analyses revealed several *distinct* market segments, often defined by quality, product features, and price sensitivity. (For example, see generalized visualization of Basketball consumer segments in Figure 6.) These findings supported nascent company efforts to position itself as the supplier of choice for consumer market segments demanding high-quality, feature-rich product designs (though not necessarily at the lowest price). (The company has since acquired Sawtooth Software's

Convergent Cluster & Ensemble Analysis package – CCEA – for more generalized segmentation analysis.)





<u>Success Story #4: Folding Utility Table "Back-forecast."</u> Lifetime Products recently conducted a cooperative partial-profile CBC study on polyethylene-and-steel folding utility tables with a retail chain store account. While most of the results of this study are proprietary, a summary of a "back-forecast" calibration simulation can be shared in this paper.

A key component of the analysis was to generate market simulations of the array of different sizes of Lifetime tables and compare the share-of-preference results with the actual sales distributions for these table models. Regardless of the simulation assumptions employed, it was clear that (a) the conjoint model consistently *over*estimated sales of larger tables and *under*estimated sales of smaller tables and (b) the mean absolute errors (MAEs) of prediction were in the 7% to 9% range. Tuning the sensitivity of the market simulator using of a scaling factor (or exponent) of 0.45 provided the best possible MAE improvement (to just under 5%), but the pattern of over- and underestimation was still evident.

*"The rest of the story..."* While these findings were of some concern to the company and its retail account, further analysis of the consumer purchasing process led to an interesting explanation for this apparent conjoint model "residual" error. It was concluded that the purchase decision making process is probably somewhat different for small vs. large tables (as described in Figure 7). As a result, what began as an initially disturbing finding became the springboard for illuminated understanding of customer behavior.

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Smaller Tables	Larger Tables
Impulse Purchase: •Self-service using shopping cart •Use own vehicle to transport	<ul> <li><u>Planned Purchase</u>:</li> <li>•Need assistance from store associate</li> <li>•Need alternate vehicle to transport</li> </ul>
Impact: Actual sales <i>greater</i> than projected	Impact: Actual sales <i>less</i> than projected

#### **III. ESCALATING CLIENT DEMANDS ON CONJOINT ANALYSIS**

As Lifetime managers gained confidence in the conjoint method, they began to place increasingly greater demands on the analysis. This section will describe company actions taken to respond to this demand.

*Use of Graphics in Partial-profile CBC.* As Lifetime managers gained greater confidence in conjoint analysis, particularly with the adoption of choice-based conjoint, they were no longer satisfied with simplified product models involving only five or six attributes (a generally accepted limit for reasonable respondent understanding and attention). When the company upgraded from full-profile to partial-profile CBC (using Sawtooth Software's Advanced Design Module), it was possible to design models with ten, fifteen, or more attributes, while displaying only five or six at a time in each choice task. Given the rotation of attributes and changing product configurations from task to task, however, the marketing research department concluded that it would be helpful to use graphics to facilitate respondent comprehension. (See Trailer example in Figure 8; note that animated GIF files were included in the actual online interview to demonstrate the trailer's fold-in-half feature in the choice task at far right.)



Figure 8

*The Next Step: Adaptive Choice/ACBC.* While partial-profile CBC with use of graphics became Lifetime's conjoint method of choice in late 2007 and 2008, it still had several perceived shortcomings. The use of graphic attribute representations did much to facilitate respondent understanding during the interview, but it was still felt that the task assignments involving only a *portion* of the attributes in each task were not as realistic as desired. There was always some doubt as to how respondents behaved as they read "assume any feature not listed is the same for all three options." Of even greater concern to the company was the need for larger sample sizes to compensate for the reduced individual information in each sample point. Analysis of standard errors in the CBC designs suggested that sample sizes in the order of 700 to 800 (or more) might be needed for a typical Lifetime study of 12 to 15 attributes shown only five at a time.

Because of these concerns, the company watched the development of Adaptive Choice/ACBC by Sawtooth Software with great interest and was excited to serve as a beta tester in late 2008. Lifetime viewed the value proposition for ACBC as having the *flexibility* of adaptive conjoint (such as Sawtooth's ACA application), the *realism* of choice-based conjoint, and the *task simplification* of partial-profile CBC, all with *more reasonable* sample sizes.

The company's first ACBC beta-test study, involving Outdoor Storage Sheds, consisted of 16 attributes and 45 levels (eight brand names was the maximum levels used for any one attribute). Constructed-list technology was used to reduce the attributes shown to each respondent from 16 to 10 (see screenshot example in Figure 9) and brand names from eight to four. In essence, each respondent had to deal with his/her most important 10 attributes, but the entire market considered all 16. The sample size was reduced considerably from the level needed in comparable partial-profile CBC studies (400 vs. 800 or more).



Figure 9

At the same time, the company was favorably impressed by the innovative survey devices in the ACBC interview, such as the Build Your Own worksheet (or BYO; see screenshot example in Figures 10a & 10b), Must Have and Unacceptable reality checks (to more accurately capture non-compensatory decision behaviors), and an engaging adaptive interview protocol (personalized by the use of "sales associate" model photographs).

Figures 10a & 10b



With the upgrades available in version 1 of ACBC, Lifetime now has the ability to use the conditional graphics feature demonstrated in static form in Figure 11. The company is currently (late April 2009) conducting an ACBC project on Backyard Playsets where various configurations of swings, clubhouse designs, and other activity centers, along with different color combinations, are depicted graphically throughout the ACBC online interview.



#### Figure 11

#### CONCLUSION

As a relatively new user of quantitative marketing analysis, Lifetime Products, Inc. has been able to increase its analytic sophistication using conjoint and choice analysis. The company's internal clients have gradually increased in their understanding of and trust in these analytic techniques and are starting to rely more heavily on the results in their product and marketing decision-making. As the level of trust has increased, these clients have begun to demand increasingly more sophisticated solutions, leading up to Adaptive Choice/ACBC. Graphic representations of products in survey instruments are being used to enhance respondent understanding of complex product designs in conjoint models.

#### **ADVICE TO NEW CONJOINT PRACTITIONERS**

This paper represents a summary of key actions and practical experiences that have helped Lifetime Products, Inc. to adopt sophisticated conjoint and choice analysis tools for better decision making. To the extent that this case study may help other conjoint practitioners, particularly those using or planning to implement similar tools in-house, here is a brief list of suggestions for consideration:

- 1. Solicit support from a marketing research "champion" within the organization (i.e., someone already familiar with the benefits if not the technical details of quantitative research tools);
- 2. Ask internal clients (and key management!) to participate "hands-on" in conjoint study planning and development processes;
- 3. Demonstrate conjoint capabilities to stakeholders using lower-risk (i.e., lower-cost) tools first;
- 4. Benchmark conjoint results against actual performance wherever possible; and
- 5. As managers gain trust and confidence in the conjoint method, upgrade tools to provide the increased functionality they demand.

Referring to the third and fifth points above, Andrew Elder, discussant for this paper at the 2009 Sawtooth Software Conference, posed the question as to whether, in retrospect, Lifetime would have adopted ACBC if that product had been immediately available when the company started using conjoint tools in 2006. Given the price sensitivities of a medium-size manufacturing company such as Lifetime and its virtual lack of prior use of quantitative marketing research tools, it is doubtful that the company would have "sprung for" a new, sophisticated, and admittedly pricey option such as ACBC without any in-house track record to examine. Internal clients were initially unfamiliar with the methods and results of these tools and probably needed the "conjoint acclimatization" from less-sophisticated and less-expensive options. Only after they began to see the real value of conjoint and choice analysis – and they started to demand increasingly more sophisticated tools – did their decisions to upgrade come with relative ease.

#### REFERENCE

Orme, Bryan K. (2001); Assessing the Monetary Value of Attribute Levels with Conjoint Analysis: Warnings and Suggestions; Sawtooth Software Research Paper Series.