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An Approach to Profit-Maximizing Product Design on the Basis of the Platform Concept

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Summary

Modeling consumer preferences for multiattributed alternatives has been an important consumer research topic for more than a decade. Conjoint measurement, one of the most useful techniques in this area, has been growing in popularity in recent years. The purpose of conjoint analysis is to determine the contributions of attributes to the choice order over combinations of attributes that represent realistic choice sets. Having identified the importance of attributes, an ideal product which maximizes market share can be developed. This article tries to merge conjoint measurement with the platform concept for maximizing profit rather than market share, and presents an empirical example for testing the proposed model.

Keywords: conjoint measurement, platform concept, product design, profit maximization

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Summary

Modeling consumer preferences for multiattributed alternatives has been an important consumer research topic for more than a decade. Conjoint measurement, one of the most useful techniques in this area, has been growing in popularity in recent years. The purpose of conjoint analysis is to determine the contributions of attributes to the choice order over combinations of attributes that represent realistic choice sets. Having identified the importance of attributes, an ideal product which maximizes market share can be developed. This article tries to merge conjoint measurement with the platform concept for maximizing profit rather than market share, and presents an empirical example for testing the proposed model.

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1. Introduction

The development, production and marketing of a profit-maximizing product form the core of entrepreneurial activity. In this respect it is not surprising that there are many approaches to designing output which maximizes profit, both in theory and in practice (Bayus 1997). Many of these ideas are based on conjoint measurement, which is particularly well suited as an approach to transforming customer preferences into product design specifications (Gustafsson et al. 2001, Urban and Hauser 1993). Numerous practical applications, such as in the design of automobiles, the development of cleansers, the shaping of collective agreements, the planning of airline services, the modification of mechanical and plant engineering products and the repositioning of specialty foods, illustrate the myriad possibilities of designing new products or modifying or varying existing products using this method (Green and Srinivasan 1990).

Conjoint measurement gives an indication of the relative significance of individual product features or their attributes (Hair et al. 1995). These findings yield concrete criteria for the design of a product's features. Of this data, particularly interesting are those features whose attributes deliver the greatest possible benefit to the prospective buyer. Consideration of the characteristics of these attributes in product design plays a decisive role in maximizing a product's market share. But this type of procedure does not go far enough in answering the question posed at the outset about how to arrive at a product that maximizes profit. Clearly, an approach is required which enables the cost of the feature attributes to be integrated into the analysis, so that not just market share but also profit can be maximized.

Against the backdrop of these observations, Green and Krieger (Green and Krieger 1989, Grenn and Krieger 1991a, Grenn and Krieger 1991b, Grenn and Krieger 1993, Grenn and Krieger 1996) have introduced approaches that are all based on conjoint measurement. In their studies, the utility functions of the feature attributes and their variable costs form the data base by which to identify the profit-maximizing product using complete enumeration. Although these methods were well received in science and industry, in addition to the problem of accounting for the variable costs and their allocation to the feature attributes, they all exhibit a common weakness: current circumstances of production and in turn, the fixed costs, were disregarded. The result is a product that in the short term only maximizes the contribution margin.

Management experience from various branches of industry indicates, however, that at least in the medium term, the pattern of production can also be changed, at times with considerable impact on corporate earnings. In many cases the platform concept contributes substantially to a reduction in production costs (Abel 1980, Fisher 1997). Although to date, this idea has not garnered a great deal of attention in the literature, diverse practical experiences have been recorded. In many sectors, such as the automotive industry, the platform concept is very widespread. The VW Beetle, for example, is produced on the VW Golf platform, whereas the Audi A4 and the VW Passat originate from a common platform. The anchoring of the platform spanning multiple brands led to a significant reduction in production costs in the Volkswagen Group, which in turn resulted in an improvement in profits. There is a growing number of people, however, warning against the total homogenization of a company's products as a consequence of an across-the-board implementation of the platform concept. The products manufactured on the basis of a single platform are in many cases so similar that prospective buyers are barely able to tell them apart (Day 1994).

At this point, however, the objective is not to describe the basics of this approach and debate its merits. Rather, the intent is to combine the platform concept with conjoint measurement and to investigate the effects of this endeavor on corporate success. This will require an expansion of the aforementioned approaches with the aim of linking with their variable and fixed costs the utility functions of the feature attributes reconstructed using conjoint measurement. The methodology involves first using conjoint measurement to transform customer preferences into product design specifications. The subsequent step uses the platform concept, which has its origins in production and cost theory, to adapt the circumstances of production for a promising concept to this design.

Moore, Louviere and Verma undertook an initial attempt in this direction (Moore et al. 1999). They draw on conjoint measurement for market-oriented platform specification. Their work, however, is less concerned with the design of a profit-maximizing product than with a response to the question of which products are to be manufactured on one platform. The number of features and feature attributes used is limited such that the complexity of the facts that are of interest to us here is insufficiently articulated. Furthermore, the effects of outsourcing the manufacture of individual components on corporate success are not covered (Tatikonda 1999).

The following procedure lends itself to solving the problems raised at the beginning of this article: First, a reappraisal of the platform concept and of those facets in particular that impact the design of goods and services. Second, an approach is introduced that combines conjoint measurement with the platform concept. The effect on company success of designing a product using this concept will be illustrated in an example from the durable consumer goods sector. In conclusion, the implications for company policy of the approach presented are discussed.

2. Fundamentals of the platform concept

Although each product has unique selling propositions, the similarities between a supplier's goods are often much greater than the differences. Most of a manufacturer's products are characterized by common technology, similar use, shared parts, components, modules and systems, comparable manufacturing processes, a mutual customer base, the same distribution channels and in some cases, even an identical brand name (Sawhney 1998). The Beoing 747, for example, is an example of one aircraft platform on which both the 747-400 and 747-200 models are built. The AS400 from IBM is a computer platform that can produce a specific hardware product depending on the data system and organizational circumstances of each buyer (Baldwin and Clark 1997).

All of these commonalties appearing in product development, production and marketing make up a platform of which there are different variations, such as product platform, customer platform, process platform and global platform (Ramdas and Sawhney 1997). The platform concept is founded on the idea of highlighting all the parts, components, modules and systems common to all objects and processes, instead of viewing the various products and technologies as independent of one another (Baldwin and Clark 1997). In this way, synergies between the diverse activities in development, production and marketing can be revealed and potential for streamlining identified. The following comments illustrate the problem-solving ability of the platform approach (Kagut and Kulatilaka 1994).

First, the time it takes for a new product to be designed can be dramatically reduced, provided that the project manager in charge of new product design can base the product on a product, customer, brand, process and global platform. Findings from an empirical study by Meyer and Lehnerd show that over a number of years, Black & Decker brought out a new product every week using this platform concept (Kim and Kogut 1996, Meyer and Lehnerd 1997). Furthermore, the use of essentially identical production technology for all products, as well as the same parts, components, modules and systems, ensures product quality. In particular, this can be attributed to the fact that the platform on which development, production and marketing are based has already been refined and the resulting products meet the expectations and preferences of dealers and potential buyers (Moore 1995).

Beyond this, products that are created on one platform are very easy to group into a product bundle. This allows the supplier to adapt its output to the features of specific markets with little expense or effort. The tremendous success of laser and ink jet printers from Hewlett-Packard, for instance, is a result of the consistent application of the platform concept (MacDuffie et al. 1996). By contrast, the variety of product lines from General Motors is evidence of insufficient standardization. Moreover, investment in core technologies and flexible production systems enables companies to benefit from a learning curve (MacDuffie et al. 1996), meaning that the experience gained with a particular product, customer, brand and process platform in one market can be transferred to another. General Motors is currently experiencing huge losses with production plants in India, for example, but the experience gained there will facilitate going into another Asian market with similar production technology and comparable development and marketing efforts.

A further favorable argument is geared to the relevance of the customers to the adoption and diffusion of new products (Robertson and Urich 1998, Kahn 1998). In applying the platform concept, a company adapts its new products to the expectations and needs of a core customer group and to a volume of prospective buyers directly related to this customer cluster. It is much easier to establish a new product in these market segments than it is, for example, in a customer group that has no previous relationship to the new product. Word of mouth among core customers in particular may make an important contribution to the popularity of the new item. Lotus Notes succeeded in selling its whole range of software products in exactly this way, through opinion-maker Price Waterhouse.

In addition to these arguments, particularly important to the following discussion is the fact that the platform approach contributes to considerable cost savings, especially complexity costs, in all phases of the product design process (Meyer and Lehnerd 1997, Lee and Tsang 1997, McGrath 1997). Using the same components and modules, for example, can cut manufacturing and logistics costs sustainably. Cusumano and Selby report that 1.4 million of the 4.0 million line codes in Microsoft Windows NT originate in earlier versions of this platform, which allowed the cost of developing this new version of Windows to be reduced significantly. Southwest Airlines in the US is famous for having the lowest operating costs of all airlines in the USA and Europe. This is in part due to the product platform, which consists solely of Boeing 737 aircraft (Cusumano and Selby 1995).

3. Profit-maximizing product design

The approach to maximizing profit through product design on the basis of the platform concept in combination with conjoint measurement can best be illustrated using a real-life example. For this purpose, a company was examined that manufactures four models of washing machines on different production lines. Models 1 and 2 are luxury items characterized by a complicated design, technical refinements, comprehensive service and warranty, and a high price. The difference between the two models mainly stems from the brand name and the product dimensions. Models 3 and 4, on the other hand, can be characterized as being in the category of mid-range products. The technical features and design and operating elements correspond to those of the more popular appliances on the market. The only noticeable differences between the two models are in load capacity and water consumption. To protect the anonymity of the manufacturer, this and all other data and information have been changed without, however, qualifying their meaning.

Between 1993 and 1996, the company succeeded in selling some 35,000 units of the four models of clothes washers each year, generating sales revenues of DM 63 million. The average annual contribution margin during this time was approx. DM 13.8 million, while profits amounted to about DM 1.4 million. Models 1 and 2 were primarily responsible for these profits, with models 3 and 4 contributing only negligibly to the return. If this company intends to maximize its profit, two key questions must be answered. Are these four models sufficient to satisfy completely the usually very heterogeneous needs of consumers in the consumer durables market, or can the number of washing machine models even be reduced? And: Must these models be produced on different production lines, or would it be possible to apply the platform concept?

To answer the above questions, the following procedure may be followed. The first task is to define the buyers' utility expectations. By means of conjoint analysis and subsequent market segmentation, the individual buyers can be subdivided into various groups of customers who have the same requirements of a washing machine. Then it should be determined which product can attain the maximum contribution margin and maximum profit for each segment. It is important that this analysis is done against the background of the current circumstances of production and thus, an existing cost structure. After orienting the range of goods offered to the preferences of potential customers in each segment, complexity costs must be cut. The platform concept lends itself to this purpose; in this concrete case, in consideration of the market conditions, application of the concept leads to a larger number of washing machine models. Finally, to reduce further the complexity costs, the manufacture of certain washing machine components is to be farmed out. In this way, the company's profits can be improved considerably.

- Defining the utility expectations

Conjoint analysis can be used to determine the utility expectations of the individuals surveyed. Its basic idea involves using empirically compiled blanket assessments of products to ascertain the partial contributions of individual features to the blanket assessment (Hair et al. .1995). A selection of fully described alternatives can be constructed by systematically combining feature attributes. To that end, feature-specific individual assessments are not compiled into an overall evaluation; rather, one proceeds in reverse order, with the overall evaluation serving as the data base by which to determine the contribution of the individual features according to their attributes. From the overall assessments, which are created by weighing the positive and negative feature attributes, the degree of pertinence of the product features to the purchase of the product can be determined.

This approach appears suitable for revealing which features of a washing machine are important in the eyes of real and potential buyers. A preliminary study shows that ten features of washing machines, with a total of 30 feature attributes, are relevant to the buyers' purchasing decision (see Table 1). According to these feature attributes, 43,740 (= 3 · 3 · 5 · 3 · 3 · 2 · 2 · 3 · 3 · 3) different washing machines can be designed! In order not to overwhelm the 568 respondents, however, and to limit the effort required for data collection, one design was used that allowed the number of theoretically possible combinations to be reduced to a reasonable number for the survey participants without a significant loss of information. This was done with adaptive conjoint analysis (Herrmann et al. 2001, Baier and Gaul 2001, Choi and DeSarbo 1994), whereby the individuals are surveyed in five stages of increasing complexity. In the first round, the importance of the individual attributes of each feature are classified, whereas in the fifth round, various washing machine concepts are to be evaluated in terms of preferability.

--- Insert Table 1 here ---

In addition to the relative importance of the various features, the analysis of this raw data also reveals the utility functions of the individual attributes on an individual basis. The individual utility functions form the basis for not viewing the potential buyers not as a homogenous unit, but subdividing them into segments (Baier and Gaul 2001). The identification of this kind of customer cluster enables washing machines to be designed specific to each segment. In this way it is possible to focus total company performance to the special requirements of the individual buyer groups and in so doing, offer an attractive product for each segment.

Using cluster analysis, respondents can be divided into clusters based on their proximity to one another with regard to the utility functions. Those individuals who are similar to one another in their utility expectations constitute a segment. By contrast, potential customers with differing utility functions for the feature attributes belong to different groups. An evaluation of the results of the classification in this case led to the choice of a 6-group solution (Choi and DeSarbo 1994). Table 2 shows the average relative importance of each feature in the individual segments. In view of these values, the groups that have been reconstructed can be labeled as follows.

--- Insert Table 2 here ---

In purchasing a washing machine, individuals in the "price-conscious" group pay particular attention to the price of the appliance and the additional costs connected with its use, such as water consumption. In contrast to these potential buyers, "functionalists" place great value on the technical dimensions of a washing machine, such as protection against leakage or load capacity. "Environment-oriented" consumers make their selection based above all on water use, capacity and the volume of the noise emitted by the rotating drum. The "design-conscious" buyers differ quite clearly from the aforementioned groups — they are particularly interested in design elements, maintenance and the warranty, and the shape and function of buttons and switches. The group of "feature-oriented" respondents includes those individuals who desire a high number of cycle options in a washing machine. The last group can be identified as "brand conscious." The brand name is an important criterion for their choice primarily, it seems, in order to avoid having to search out and sift through a great deal of product information prior to making a purchasing decision.

These results allow a specific washing machine to be designed for each segment that achieves a maximum market share. This product is characterized as having the specific attribute with the highest utility function from each feature. In this respect it is not surprising that the washing machine that maximizes market share in each segment is a luxury article, with a well-established name brand, that sells for DM 1,300, uses 50 liters of water, is a full-size appliance with noise dampening and leakage protection, and has a 2 year warranty. The buttons and switches as well as the color and outer panel can be customized to match other appliances. A hypothesis on buying patterns, proven in many empirical studies, is commonly used in determining market shares for products on the basis of preference ratings. It states that preference ratings of potential buyers can be converted into purchase probabilities for the individual products using one rule, such as BTL (Bruce-Terry-Luce) or MUC (maximum utility). At a given market volume, the purchase probabilities represent the market share of each product (Green and Srinivasan 1990).

It is easy to imagine, however, that it is not necessarily advantageous for a manufacturer to offer a product that is rated as having maximum utility by potential buyers. Were this product to be offered, an increase in market share, but not necessarily an increase in profit, would ensue. For this reason, in designing a product it is advisable for a supplier to concentrate on those feature or attributes that deliver high utility and can be manufactured at limited expense. Particular attention must be paid, therefore, to those features and their attributes that can be deemed cost-effective utility drivers.

- Designing a product to maximize profits

The conjoint + cost approach lends itself to determining the profit-maximizing product for each segment. The data input required includes the allocation of all major washing machine brands to the individual segments, as well as the utility functions and the variable costs of the individual feature attributes (Hair et al. 1995). The overall utility function of each product can be calculated by adding together the utility functions of its feature attributes. From this information, the market share of a product is calculated by determining the overall utility function of the washing machine brands under review for each person, and assuming the selection of the model with the greatest overall utility function (Herrmann et al. 2001). In a segment with n customers, a product could come out ahead n times, and in this case would have an assumed market share of 100%. In that case, the following applies:

(1) M_W = (number of times product W wins out)/n

M_W = anticipated market share of product W

n = number of potential buyers

At a market volume of V marketable units, sales revenues for product W are estimated as follows:

(2) $S_W = M_W \cdot V \cdot p_W$

S_W = anticipated sales revenues from product W

p_W = price of product W

V = market volume

M_W = anticipated market share of product W

At this point, variable unit costs are allocated to all feature attributes for which utility functions were determined as part of the adaptive conjoint analysis. Accordingly, each feature attribute is specified by a utility function and cost value. These data enable the contribution margin of product W to be stipulated:

(3) $CM_W = S_W - u_W \cdot M_W \cdot V$

CM_W = contribution margin of product W

S_W = sales revenue from product W

u_W = variable unit cost of product W

M_W = anticipated market share of product W

V = market volume

Taking into account the fixed costs of product W (C_W) determines its profits:

(4) $P_W = S - u_W \cdot M_W \cdot V - C_W$

It should be noted that P_W represents a decision-based profit, because only the feature attributes examined in the conjoint analysis have been given variable and fixed cost values.

All other attributes and their costs are disregarded, because they are irrelevant to all decisions derived from this model. To guarantee the anonymity of the supplier, no information about cost structure can be provided here. Table 3, however, contains an overview of sales figures and the number of competitors in each individual market segment. These figures indicate that all major competitors with their brands are included in the analysis. Together with the utility functions and the cost data, these market data form the input needed to determine which product will generate the maximum contribution margin and profit for the respective segment. The overall utility function, variable and fixed costs are enumerated for all possible performance profiles of product W through the systematic combination of all features reviewed (Drury 2000, Bromwich 1990). This is done under the assumption that the competing washing machines have not been modified during the observation period. If this premise is accepted, the anticipated contribution margin or profit can be determined for each performance profile of product W, and the most attractive performance profile can then be selected (see Table 4).

--- Insert Table 3 here ---

--- Insert Table 4 here ---

In the segment of price conscious consumers, for example, the profit-maximizing product was to be simple no-name equipment that costs only approx. DM 1,300, use only 50 liters of water per load, be a full-size appliance that needs no acoustic dampening or leakage protection, has a customary warranty period and no special operating or design elements. In 1996 the company set out to translate the profit-maximizing product concepts for the individual segments presented in Table 4 into actual washing machine models.

Table 5, column 2 provides an overview of sales volume, sales revenue, contribution margin and profit in 1997, after the predetermined profit-maximizing products had been offered in the individual segments. We are reminded that with the four washing machine models manufactured previously, revenues of DM 63 million were generated through the sale of 35,000 units. The contribution margin was DM 13.8 million, and profits were DM 1.4 million. By introducing six models geared to the preferences of potential buyers in each respective cluster, the economic situation was improved significantly. Despite a more or less constant overall market volume, the sales volume was increased to 48,000 units, which goes hand in hand with an increase in sales revenue to DM 81.9 million. The contribution margin is DM 19.6 million, and profits were boosted to DM 4.8 million. Therefore, by aligning the product range to segment-specific customer expectations, profits were tripled.

--- Insert Table 5 here ---

- Designing platforms and outsourcing costly variants

An analysis of the profit-maximizing washing machine models in Table 4 reveals that the supplier essentially must offer two variants to satisfy the needs of individuals. The price conscious, functionalists and environment conscious consumers would consider purchasing an appliance that has simple equipment and no special operating or design elements. Water use should be low, and the warranty should not deviate from the norm. The brand name of the washing machine is not critical to the potential buyers in this segment. Differences can be identified, however, when it comes to price, leakage protection, load capacity and noise dampening. Whereas in the segment of price conscious consumers, profit is maximized at a price of DM 1,300, in the two other groups of functionalist and environment conscious consumers, a somewhat higher price can be commanded. When it comes to capacity, the environment-oriented buyers value a compact appliance, whereas the individuals in the two other clusters prefer full-size machines. Moreover, noise dampening and leakage protection are important from the point of view of the price conscious. From the supplier's point of view, however, offering these product features is not worthwhile.

To satisfy the design-conscious, feature-oriented, and brand-conscious consumers, a washing machine must be offered that is characterized at the very least as being reasonably equipped with various operating and design elements. It also appears essential to offer to this segment an established name-brand product that features leakage protection, noise dampening and normal capacity. Water use, by contrast, is irrelevant, and the warranty desired by the customers in all segments runs for two years. The price accepted in this cluster, however, is much higher than in the other three groups of potential customers. For the profit-maximizing product it ranges from DM 1,900 in the segment of brand conscious, to DM 2,200 for the feature oriented, to DM 2,500 for the design conscious customer segment.

In 1998, two platforms were installed in response to this two-part classification of market requirements. On the first, appliances typical for the market of price conscious, functionalist and environment oriented consumers were manufactured. Appliances for the design conscious, feature oriented and brand conscious were produced on the second platform. This resulted in a significant reduction in the cost of each product, especially the fixed costs. But the variable costs of the individual feature attributes were also reduced slightly. On the assumption that the competition has not changed its products during the period under review, the products that maximize profits *after* introduction of the platform concept correspond to the products that maximized profits *before* introduction of the two platforms presented in Table 4 (Kohli and Krishnamurti 1983, Page and Rosenbaum 1987, Raman and Chajed 1995, Lenk et al. 1996).

Table 5 shows a comparison of sales volume, sales revenue, contribution margin and profit before and after implementation of the two product platforms (compare columns 2 and 3). Adding together all washing machine models, there was an increase in contribution margin from DM 19.6 million to DM 20.6 million. Because the platform concept contributes above all to a reduction in fixed costs, a clear profit increase from DM 4.8. million to DM 8.3

million was recorded. Therefore, by introducing two product platforms, profits could be almost doubled. In evaluating these figures, it should be noted that the sales volume between 1997 (before implementation of the platform concept) and 1999 (after implementation of the platform concept) dropped from 48,000 to 47,300 units. To evaluate the platform concept independent of the changes in the sales market, it appears advisable to compute corporate earnings in 1999 on the basis of sales figures and the distribution of sales across the six models of clothes washers in 1997. This type of analysis shows that the contribution margin and profit climbed as high as DM 21.3 and DM 8.9, respectively. This evaluation underscores the effect of implementing two platforms on corporate success.

Further to implementing the two product platforms, it seems natural to outsource the manufacture of those items that incur very high costs at a given utility contribution (Meyer and Seliger 1998). This may include special buttons or switches and unusual color and panel design variants. These articles were added to the product range in recent years due to market requirements, but because they are not among the core components, the cost of their manufacture is significant. In 1998, therefore, a specialized company took over the production of these articles for models 4, 5, and 6, that is, those washing machines that are offered to the segment of design conscious, feature oriented and brand conscious consumers. As evident in Table 5, the impact of this outsourcing on profit is considerable (compare columns 3 and 4). The contribution margin does in fact drop, which is attributed to the fact that select buttons and switches, outer panel designs and colors must be purchased separately, but there is an increase in profit from DM 8.3 million to DM 10.9 million. Once again, the impact of outsourcing on corporate success is of interest, without there being any influence from changes in market volume or market share. An additional evaluation on the basis of the sales figures and structure from 1997 results in a somewhat lower yet still notable increase in profits from DM 8.9 million to DM 10.2 million.

4. Discussion

The exposition above illustrates how, in three stages, the profits of the company under review were increased successfully, from DM 1,4 million to DM 10.9 million (or DM 10.2 million upon elimination of changes in market volume or market share), that is, sevenfold. Initially, the market-centric design of the product range led to an increase in profits from DM 1.4 million to DM 4.8 million. Here, the original four models of clothes washers were replaced by six other designs that met the preferences and expectations of potential customers in the individual consumer segments far better, whereupon the company implemented two platforms that produce three washing machine models each. This measure contributed decisively to a reduction in fixed costs, so that profits again increased from DM 4.8 million to DM 8.3 million (or DM 8.9 million upon elimination of changes in market volume or market share). Finally, the manufacture of costly utility drivers was outsourced to specialists. This facilitated another improvement in profits from DM 8.9 million to DM 10.9 million (or DM 10.2 million upon elimination of changes in market volume or market share).

Although this process appears quite convincing, a number of difficulties must be discussed that at the same time serve as points of departure for further investigation. The first of these is that the determination of the number and design of the platforms is done on the basis of a previously determined number and specification of washing machine models. This is done solely using the utility expectations of potential customers, from which profit-maximizing product profiles can be reconstructed under consideration of the utility functions of the feature attributes and the variable costs. Missing to date, however, is an algorithm that enables the number and nature of products and platforms to be determined simultaneously under the principle of profit maximization. Furthermore, the number of products to be manufactured on one platform must be included in the model as a variable. In this respect, at best the approach presented offers a successive method of profit maximization. Simultaneous optimization in the above example could lead to even higher profits.

The approach is also based on the assumption that competitors will not change their own products during the observation period. In markets like the one examined here, which are characterized by enormous technological change and rapidly changing customer requirements, this premise could be problematic. Accordingly, thought must be given to game theory that provides a method of taking into account the behavior of the competition regarding decisions on product nature and pattern of production (Meyer and Seliger 1998).

Despite these objections, it should be noted that the implementation of the approach presented here not only led to a considerable increase in profits, but also helped defuse various tensions between marketing and sales in one camp, and production and R&D in another. Focusing both parties on the company's most important target figure — profit — is an effective way of conquering department-specific goals and egotism.

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Table 1: Features of a washing machine and possible feature attributes

Feature	Feature attribute
Equipment	• Simple, i. e., maximum spin speed up to 1000 rpm, basic wash and energy-saving cycles. • Mid-range, i. e., maximum spin speed up to 1300 rpm, basic wash, energy-saving, delicates, hand washables and woolens, and quick wash cycles. • Luxury, i. e., maximum spin speed up to 1600 rpm, basic wash, energy-saving, delicates, hand washables and woolens, quick wash, and soak cycles, rinse-plus button, start preselection and time remaining display.
Brand	• Established brand, such as Miele or Bosch, that stands for quality, reliability, long life and solid technology. • Less established brand with a less identifiable personality such as Constructa or AEG. • No-name
Price	• DM 1,300 • DM 1,600 • DM 1,900 • DM 2,200 • DM 2,500
Water use	• 50 liters (below average) • 60 liters (average) • 70 liters (above average)
Capacity	• Compact appliance, 4 kg capacity • Medium-sized appliance, 5 kg capacity • Full-sized appliance, 6 kg capacity
Noise	• Without noise dampening • With noise dampening
Leakage protection	• Without leakage protection • With leakage protection
Service, maintenance and warranty	• With the exception of the usual warranties offered in the scope of the warranty period of one year, no additional service or maintenance offered. • After expiration of the warranty period of one year, the manufacturer offers an extended maintenance agreement in which once a year, those parts subject to wear are tested and replaced, where necessary. The cost of labor to be paid by the customer is a flat rate of DM 50; material costs are additional. • Supplier extends the warranty period to two years, without offering additional service or maintenance.
Operation	• Standard placement and design of buttons and switches. • Appliance is available with four different button or switch arrangements. • Placement and design of buttons and switches can be modified to match other household appliances in kitchen or bath.
Design	• Standard color and cabinet design. • Appliance is available in two colors and cabinet designs. • Color and cabinet panel can be modified to match other household appliances in kitchen or bath.

Table 2: Importance of the individual characteristics in the various clusters

Feature	Importance of each feature in each segment					
	Price conscious	Functionalist	Environment oriented	Design conscious	Feature oriented	Brand conscious
Equipment	8%	4%	6%	14%	23%	17%
Brand	7%	5%	6%	15%	16%	20%
Price	26%	12%	14%	6%	8%	8%
Water use	19%	13%	21%	5%	5%	4%
Capacity	14%	17%	17%	5%	4%	8%
Noise	4%	12%	16%	7%	6%	8%
Leakage protection	8%	15%	10%	4%	13%	11%
Maintenance and warranty	6%	10%	5%	14%	7%	12%
Operation	3%	6%	3%	11%	7%	5%
Design	5%	6%	2%	19%	11%	7%
Total	100%	100%	100%	100%	100%	100%

Table 3: An overview of market conditions

Segment	**Overall market (annual sales volume)**	**Number of products or brands examined**	**Sales volume of products or brands examined**	**Sales volume of products or brands not examined**
Price conscious	250,000	12	221,000	29,000
Functionalist	180,000	9	161,000	19,000
Environment oriented	80,000	7	64,000	16,000
Design conscious	20,000	3	13,000	7,000
Feature oriented	40,000	4	33,000	7,000
Brand conscious	60,000	7	56,000	4,000
Total	630,000	42	548,000	82,000

Table 4: Comparison of the product that achieves maximum contribution margin and the product that achieves maximum profit in each segment

Segment	**Product with maximum contribution margin before introduction of platforms**		**Product* with maximum profit before introduction of platforms**	
Price conscious	Equipment:	simple	Equipment:	simple
	Brand:	no-name	Brand:	no-name
	Price:	DM 1,300	Price:	DM 1,300
	Water use:	50 liters	Water use:	50 liters
	Capacity:	full size	Capacity:	full size
	Noise:	no noise dampening	Noise:	no noise dampening
	Leakage protection:	none	Leakage protection:	none
	Service/Warranty:	usual warranty period	Service/Warranty:	usual warranty period
	Operation:	standard	Operation:	standard
	Design:	standard	Design:	standard
Functionalist	Equipment:	simple	Equipment:	simple
	Brand:	less established	Brand:	*no-name*
	Price:	DM 1,600	Price:	DM 1,600
	Water use:	60 liters	Water use:	60 liters
	Capacity:	full size	Capacity:	full size
	Noise:	with noise dampening	Noise:	with noise dampening
	Leakage protection:	included	Leakage protection:	included
	Service/Warranty:	2 year warranty	Service/Warranty:	*usual warranty period*
	Operation:	standard	Operation:	standard
	Design:	standard	Design:	standard
Environment oriented	Equipment:	simple	Equipment:	simple
	Brand:	no-name	Brand:	no-name
	Price:	DM 1,600	Price:	*DM 1,900*
	Water use:	50 liters	Water use:	50 liters
	Capacity:	compact	Capacity:	compact
	Noise:	with noise dampening	Noise:	with noise dampening
	Leakage protection:	included	Leakage protection:	included
	Service/Warranty:	2 year warranty	Service/Warranty:	2 year warranty
	Operation:	standard	Operation:	standard
	Design:	standard	Design:	standard
Design conscious	Equipment:	luxury	Equipment:	*mid-range*
	Brand:	established	Brand:	established
	Price:	DM 2,500	Price:	DM 2,500
	Water use:	70 liters	Water use:	70 liters
	Capacity:	medium	Capacity:	medium
	Noise:	with noise dampening	Noise:	with noise dampening
	Leakage protection:	included	Leakage protection:	included
	Service/Warranty:	warranty and maintenance	Service/Warranty:	*2 year warranty*
	Operation:	buttons, switches match	Operation:	*four variants*
	Design:	color, panel made to match	Design:	*two variants*

Feature oriented	Equipment: luxury Brand: established Price: DM 2,200 Water use: 60 liters Capacity: medium Noise: with noise dampening Leakage protection: included Service/Warranty: warranty and maintenance Operation: four variants Design: color, panel made to match	Equipment: luxury Brand: established Price: DM 2,200 Water use: *70 liters* Capacity: medium Noise: with noise dampening Leakage protection: included Service/Warranty: *2 year warranty* Operation: four variants Design: *two variants*
Brand conscious	Equipment: luxury Brand: established Price: DM 1,900 Water use: 60 liters Capacity: medium Noise: with noise dampening Leakage protection: included Service/Warranty: warranty and maintenance Operation: standard Design: two variants	Equipment: *mid-range* Brand: established Price: DM 1,900 Water use: 60 liters Capacity: medium Noise: with noise dampening Leakage protection: included Service/Warranty: 2 year warranty Operation: standard Design: two variants

* Italics indicate a deviation in the same attribute from the product that maximizes contribution margin.

Table 5: Financial target figures for the profit-maximizing product according to segment

Segment	**Sales volume, sales revenue, contribution margin and profit of the profit-maximizing product**		
(1)	(2) Before implementation of the two product platforms	(3) After implementation of the two product platforms	(4) After implementation of the two product platforms and outsourcing of variants
Type 1 – Price conscious	Volume: 13,000 units Revenue: DM 16.9 m Contr. margin: DM 4.2 m Profit: DM 1.1 m	Volume: 12,100 units Revenue: DM 15.7 m Contr. margin: DM 4.1 m Profit: DM 1.9 m	Volume: 13,600 units Revenue: DM 17.7 m Contr. margin: DM 5.0 m Profit: DM 2.5 m
Type 2 – Functionalist	Volume: 15,000 units Revenue: DM 24.0 m Contr. margin: DM 5.8 m Profit: DM 1.3 m	Volume: 14,400 units Revenue: DM 23.0 m Contr. margin: DM 5.8 m Profit: DM 2.0 m	Volume: 15,200 units Revenue: DM 24.3 m Contr. margin: DM 6.5 m Profit: DM 2.4 m
Type 3 – Environment oriented	Volume: 5,000 units Revenue: DM 9.5 m Contr. margin: DM 2.3 m Profit: DM 0.6 m	Volume: 5,300 units Revenue: DM 10.1 m Contr. margin: DM 2.8 m Profit: DM 1.2 m	Volume: 4,900 units Revenue: DM 9.3 m Contr. margin: DM 2.6 m Profit: DM 1.2 m
Type 4 – Design conscious	Volume: 2,000 units Revenue: DM 5.0 m Contr. margin: DM 1.4 m Profit: DM 0.3 m	Volume: 2,100 units Revenue: DM 5.3 m Contr. margin: DM 1.6 m Profit: DM 0.5 m	Volume: 2,500 units Revenue: DM 6.3 m Contr. margin: DM 1.6 m Profit: DM 1.4 m
Type 5 – Feature oriented	Volume: 6,000 units Revenue: DM 13.2 m Contr. margin: DM 3.1 m Profit: DM 0.8 m	Volume: 6,200 units Revenue: DM 13.6 m Contr. margin: DM 3.3 m Profit: DM 1.3 m	Volume: 5,700 units Revenue: DM 12.5 m Contr. margin: DM 2.8 m Profit: DM 1.7 m
Type 6 – Brand conscious	Volume: 7,000 units Revenue: DM 13.3 m Contr. margin: DM 2.8 m Profit: DM 0.7 m	Volume: 7,200 units Revenue: DM 13.7 m Contr. margin: DM 3.0 m Profit: DM 1.4 m	Volume: 7,300 units Revenue: DM 13.9 m Contr. margin: DM 3.2 m Profit: DM 1.7 m
Total	Volume: 48,000 units Revenue: DM 81.9 m Contr. margin: DM 19.6 m Profit: DM 4.8 m	Volume: 47,300 units Revenue: DM 81.4 m Contr. margin: DM 20.6 m Profit: DM 8.3 m	Volume: 49,200 units Revenue: DM 84.0 m Contr. margin: DM 21.7 m Profit: DM 10.9 m
	Based on sales figures from 1997 →	Volume: 48,000 units Revenue: DM 81.9 m Contr. margin: DM 21.3 m Profit: DM 8.9 m	Volume: 48,000 units Revenue: DM 81.9 m Contr. margin: DM 20.5 m Profit: DM 10.2 m