

SELECTING A PRICING STRATEGY: A STATISTICAL APPROACH

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Abstract

Pricing management, as part of the marketing strategy of an organisation, is a difficult and highly complex – but also critically important – management activity, as it affects the revenue and therefore the profits of an organisation. However, scholars such as Bruck (2010), Cram (2006:5), Eugster, Kakkar and Roegner (2000:133), Hinterhuber (2004:765) and Pratt (2007) believe that the pricing function in organisations has largely been neglected by managers and academics and that price is generally set by guesswork and not by scientific means.

This article maintains that the pricing function in an organisation can be successfully managed through the implementation of a pricing plan. A critically important step in the pricing plan is to select a pricing strategy or combination of pricing strategies to set the price of a product or service. A number of nonparametric statistical tests are available to assist management in the selection of the most suitable pricing strategy, or combination of pricing strategies, when determining the price of a product or service.

The aim of this article is to demonstrate the use of statistical methods in selecting a pricing strategy as part of a comprehensive pricing plan. The article contains an analysis of selected literature, while taking a descriptive and statistical approach to demonstrate the use of statistical methods in selecting a pricing strategy.

Keywords: Pricing plan, pricing objectives, pricing determinants, pricing strategy, chi-square

1. INTRODUCTION

Price can be defined as the agreed value placed on the exchange by a buyer and a seller to acquire a product or service (Lamb, Hair & McDaniel, 2001:498). Palmer (2005:322) expressed the opinion that the concept “price” includes aspects such as rent and tuition fees, and that it reflects the nature of the relationship between the customer and the provider when the exchange of goods or services takes place. Pricing is not a single concept, however, but a multidimensional one with different meanings and implications for the manufacturer, the middleman, and the end consumer (Hollensen, 2006:187; Saxena, 2009:315).

To set, manage and control the price of a product or service, an organisation needs a pricing plan that serves as a framework for the pricing of a product or service. A pricing plan is a process consisting of six major steps: developing pricing objectives; estimating demand; determining costs; evaluating the pricing environment; choosing a pricing strategy, and developing pricing tactics (Dibb & Simkin, 2001:153; Mullins, Walker & Boyd, 2008:273; Solomon & Stuart, 2000:323). When selecting an appropriate pricing strategy for the setting of the price (which is the focus of this article), the development of pricing objectives and the evaluation of the pricing environment is of pivotal importance.

The first step in selecting an appropriate pricing strategy or combination of pricing strategies is to develop pricing objectives that provide the direction for actions aimed at achieving the goals of the organisation (Avlonitis & Indounas, 2004:344). The benefit of setting pricing objectives lies in knowing what is expected and how to measure the efficiency of the operations (Tzokas, Hart, Argouslidis & Saren, 2000:95-117). Although many categories of pricing objectives exist, this article concurs with the categories according to Diamantopoulos (cited in Avlonitis & Indounas, 2005:48), who stated that pricing objectives can be divided into three main categories relating to their content, the desired level of attainment, and the associated time horizon.

The content category of pricing objectives includes both quantitative and qualitative objectives as part of the objective functions of the organisation. Pricing objectives in the category of the desired level of attainment are those objectives aimed at achieving maximisation, which means maximum profits, maximum market share, and maximum sales or production volume. The pricing objectives in the last category are linked to the time horizon of attainment, and can be divided into either short-term or long-term objectives. Short-term pricing objectives are objectives that will enable an organisation to achieve specific goals within a year, while long-term objectives will only be realised after a year (Avlonitis & Indounas, 2005:48).

In light of the above, Jain (2004:413) and Saxena (2009:317) expressed the opinion that organisations may pursue more than one pricing objective, but the pricing objectives should be mutually consistent, and the interrelationship between the objectives clearly defined.

Organisations function within an ever-changing environment and should therefore conduct a complete analysis of the pricing environment on a continuous basis in order to formulate a pricing strategy as part of the pricing plan. A complete analysis of the pricing environment is a pivotal ingredient of a pricing plan. There are a number of complex internal and external factors, known as pricing determinants, which affect pricing decisions, such as the selection of an appropriate pricing strategy or combination of pricing strategies in setting the price of a product or service.

Both the role of cost in pricing and the customers' perceptions of value are important pricing determinants, since the cost of a product or service sets the price floor, while customers' perceptions of value set the price ceiling (Dibb & Simkin, 2001:153; Ingenbleek, Debruyne, Frambach & Verhallen, 2003:291; Monroe, 1990:13).

Another critically important step in the pricing plan is the selection of a pricing strategy or combination of pricing strategies to set the price of a product or service. An organisation can select one pricing strategy or a combination of pricing strategies to determine the price of a product or service. A number of nonparametric statistical tests are available to assist management in the selection of the most suitable pricing strategy, or combination of pricing strategies, when determining the price of a product or service.

In selecting a pricing strategy as part of a pricing plan, an organisation must establish a pricing committee that will be responsible for, amongst other things, selecting and managing the selected pricing strategy or combination of pricing strategies. Selecting the most appropriate pricing strategy or combination of pricing strategies will require effective cooperation amongst the different departments in the organisation such as sales, marketing, finance accounting, marketing research, forecasting and others (Lancioni, Schau & Smith, 2005:123-131).

This article presents more scientific methods of price setting in organisations. The aim of the article is to demonstrate the use of statistical methods to determine a pricing strategy or combination of pricing strategies based on an organisation's pricing objectives and pricing determinants as related to an organisation's operations. The article further argues that effective pricing management in any organisation can be achieved by adopting and implementing a comprehensive pricing plan that is in line with the overall strategies and objectives of the organisation, and which will address price setting, price implementation, and price management and control.

2. PRICING STRATEGIES

Pricing strategy refers to the method used by an organisation to price its products or services. A variety of different pricing strategies have been formulated by marketing academics, but the feasibility of any pricing strategy depends on the characteristics of the organisational environment, as well as the general marketing strategy and pricing objectives of the organisation (Hollensen, 2006:191; Saxena, 2009:326).

Management accounting and pricing literature distinguishes between two major categories of pricing approaches, namely market-based pricing and cost-based pricing.

Market-based pricing focuses on demand-based pricing and competition-based pricing, while cost-based pricing focuses on total-cost pricing, product-cost pricing, variable-cost pricing and other aspects such as break-even pricing and target-cost pricing (Miller & Layton, 2000:360; Phillips, 2005:22; Warren, Reeve & Fess, 2002:M308; Zeithaml, Bitner & Gremler, 2006:523). The main characteristics of these pricing strategies can be summarised as follows:

- With cost-based pricing, the cost of the product or service is the starting-point in price setting. Prices are thus based on the cost structure of an organisation, but competition and customers in the market do not play a role.
- With demand-based pricing, the customer is the frame of reference in price setting. Pricing thus relies on consumer perception of value to drive pricing decisions, but neither the cost structure of an organisation nor the competition in the marketplace has any importance.
- With competition-based pricing, the competition is the frame of reference in price setting. Prices are thus based on what competitors are charging, but the cost structure of an organisation and the customers in the marketplace are unimportant.

(Miller & Layton, 2000:360; Phillips, 2005:22; Warren et al., 2002:M308; Zeithaml et al., 2006:523)

In light of the above, selecting an appropriate pricing strategy for price setting in an organisation can mean the difference between success and failure. In addition, incorrect prices can have catastrophic consequences for an organisation, as they can cause customers to abandon the organisation for its competitors. One could also argue that incorrect prices lead to insufficient revenues and profits and can negatively affect the image of the organisation, and ultimately cause the organisation to close down. At this point, then, questions can be raised as to how organisations should go about selecting an appropriate pricing strategy scientifically, in view of setting prices for their products or services. Attention is subsequently focused on the methodology in selecting a pricing strategy for price setting.

3. METHODOLOGY IN SELECTING A PRICING STRATEGY FOR PRICE SETTING

Smit (2012:317) found that in selecting a pricing strategy to determine the price of a product or service, it is essential for pricing objectives and pricing determinants to be developed, evaluated and ranked. The focus here is on inter alia pricing objectives.

3.1 Pricing objectives

As the first step in selecting a pricing strategy, the organisation needs to develop clear, attainable and measurable pricing objectives, expressed in terms of value for a specific period. The purpose of pricing objectives is to give direction to the pricing plan, and to outline the goals the organisation plans to achieve with the pricing of products or services (Avlonitis & Indounas, 2004:344; Mullins et al., 2008:273).

The process for the development of effective pricing objectives, as described by Smit (2012:317-320), includes the identification of possible pricing objectives, their evaluation and prioritisation, and the compilation of a final statement of pricing objectives.

Identifying possible pricing objectives

The pricing committee identifies multiple short-term and long-term pricing objectives that comply with the criteria in that regard (Smit, 2012:317-320).

Evaluating identified pricing objectives

The pricing committee evaluates each valid, identified pricing objective by means of a Likert scale, which is a psychometric scale commonly used in questionnaires to measure respondents' attitudes in terms of the extent to which they agree or disagree with a set of questions or statements. A Likert scale usually offers five potential choices, namely "strongly agree", "agree", "neutral", "disagree" or "strongly disagree" (Bryman & Bell, 2007:729).

In the evaluation of each valid identified pricing objective, the pricing committee can use a five-point Likert scale with the following response values, as shown in Table 1:

Table 1: Evaluation of each valid identified pricing objective

Score	Response statement
5	Extremely favourable as a pricing objective
4	Somewhat favourable as a pricing objective
3	Neutral as a pricing objective
2	Somewhat unfavourable as a pricing objective
1	Extremely unfavourable as a pricing objective

(Smit, 2012:318)

Prioritising identified pricing objectives

The pricing committee prioritises the identified pricing objectives through the mean opinion score, which represents the average score achieved on the Likert scale by each pricing objective.

The mean opinion score of each identified pricing objective is calculated on the basis of the following formula:

$$M = \frac{\sum X}{N}$$

(Steinberg, 2008:73)

Where:

- M = Mean score
- X = Total score achieved by an identified pricing objective
- N = Number of respondents on the pricing committee

Compiling a final statement of pricing objectives

The pricing committee compiles a list of pricing objectives in accordance with the importance attached to each. The pricing objective with the highest mean score is ranked first, while the pricing objective with the lowest mean score is ranked last. Table 2 shows an example of the format used in compiling a final statement of pricing objectives:

Table 2: Final statement of pricing objectives

Pricing objective	Mean score	Rank according to mean score
Pricing objective A	X	X
Pricing objective B	X	X
Pricing objective C	X	X

(Smit, 2012:319)

Pricing is often the subject of conflict between the different departments in an organisation, especially the marketing and finance departments, since each has its own objectives to achieve. For example, the accountant is primarily concerned about covering costs, while the marketer is more concerned about market share, even if it means reducing prices (McDonald & Payne, 2006:208; Pitt, 2002:165). This final statement of pricing objectives thus includes multiple pricing objectives identified by the pricing committee, ranked according to importance. The benefits of such a final statement of pricing objectives include knowing the expected outcome of the pricing function and being able to measure the efficiency of the pricing operations in an organisation (Tzokas et al., 2000:95-117).

3.2 Pricing determinants

The choice of a pricing strategy for any organisation is influenced by a set of complex factors known as pricing determinants. In developing pricing strategies, the pricing committee must determine and assess the internal and external pricing determinants related to the organisation's operations (Forman & Hunt, 2005:133; Smit, 2012:320-322).

According to Smit (2012:320-322), being in a position to determine and assess pricing determinants requires that the pricing environment be analysed and that the pricing determinants be identified, evaluated and prioritised.

Analysing the pricing environment

The pricing committee analyses the pricing environment to identify a broad set of internal and external pricing determinants that may affect the choice of a pricing strategy, or combination of pricing strategies.

Listing the pricing determinants

The internal and external pricing determinants affecting the choice of a pricing strategy, or combination of pricing strategies, can be listed according to the following categories, as indicated in Table 3:

Table 3: Categories of pricing determinants

Pricing determinant	Example
Organisational characteristics	Geographic area and size of organisation
Customers' considerations	Value and price perceptions
Competitive considerations	Number and prices of competitors
Product considerations	Strategic value of products or services
Demand considerations	Demand value for product or service
Cost considerations	Cost per product or service
Market conditions	Market growth rate and rate of inflation

(Smit, 2012:321)

Evaluating identified pricing determinants

The pricing committee evaluates each identified pricing determinant on the basis of a five-point Likert scale, as shown in Table 4, with the following response values:

Table 4: Evaluating identified pricing determinants

Score	Response statement
5	Extremely important in determining price
4	Somewhat important in determining price
3	Neutral in determining price
2	Somewhat unimportant in determining price
1	Not at all important in determining price

(Smit, 2012:322)

Prioritising identified pricing determinants

The list of pricing determinants affecting the organisation's choice of a pricing strategy, or combination of pricing strategies, is ranked in order from most influential to least influential on the basis of the mean opinion score of each.

Again, this article is in favour of price setting being done in a scientific manner and not on the basis of guesswork or “gut feelings”. As such, it is important to remember that pricing is dictated by a whole set of internal and external factors, i.e. pricing determinants. Taking these factors in account when selecting a pricing strategy may go a long way towards optimising an organisation's pricing function, increasing profitability, and satisfying the expectations of customers.

3.3 Selection of a pricing strategy or combination of pricing strategies

The pricing committee aims to achieve the pricing objectives of the organisation by identifying a suitable pricing strategy, or combination of pricing strategies, to determine the price of a product or service.

According to Smit (2012:322-330), the process of selecting the most suitable pricing strategy, or combination of pricing strategies, entails the identification and evaluation of suitable pricing strategies, the matching of the most important pricing objectives and the most influential pricing determinants with the most suitable identified pricing strategies, and the selection of the most suitable pricing strategy or combination of pricing strategies in determining the price of a product or service.

Identifying suitable pricing strategies

The pricing committee should identify all suitable pricing strategies for the pricing of the product or service in question. Management accounting and pricing literature have identified multiple pricing strategies suited to this purpose (Avlonitis & Indounas, 2006; Cravens & Piercy, 2006; Shipley & Jobber, 2001; Solomon & Stuart, 2000; Sullivan, 2008).

The following are examples of available pricing strategies:

- Cost-based pricing strategies
- Demand-based pricing strategies
- Competition-based pricing strategies
- Break-even pricing strategies
- Profit-based (surplus-based) pricing strategies
- Value-based pricing strategies
- Prestige pricing strategies
- Psychological pricing strategies

Evaluating identified pricing strategies

Furthermore, the pricing committee should evaluate each identified pricing strategy on the basis of a five-point Likert scale, as indicated in Table 5, with the following response values:

Table 5: Evaluating identified pricing strategies

Score	Response statement
5	Extremely suitable when determining prices
4	Somewhat suitable when determining prices
3	Neutral when determining prices
2	Somewhat unsuitable when determining prices
1	Not at all suitable when determining prices

(Smit, 2012:323)

Matching identified pricing objectives and identified pricing determinants with suitable identified pricing strategies

A questionnaire format, as illustrated in Table 6, was found by Smit (2012:324) to be useful in assisting the members of a pricing committee when asked to match the most important pricing objectives and the most influential pricing determinants with the most suitable identified pricing strategies.

Table 6: Matching identified pricing objectives and identified pricing determinants with suitable identified pricing strategies

Pricing objectives	Pricing strategies		
	Pricing strategy A	Pricing strategy B	Pricing strategy C
Pricing objective X			
Pricing objective Y			
Pricing objective Z			
Pricing determinants			
Pricing determinant X			
Pricing determinant Y			
Pricing determinant Z			

Such a questionnaire format, as illustrated in Table 6, can be used by the pricing committee to match the most important pricing objectives and the most influential pricing determinants with the most suitable identified pricing strategies.

Selecting the most suitable pricing strategy, or combination of pricing strategies, to be used when determining the price of a product or service

Smit (2012:325) further argued that when selecting the most suitable pricing strategy, or combination of pricing strategies, to be used in the pricing of a product or service, the three key elements of price-setting, i.e. objectives, determinants and strategies, should be linked to determine their association with one another. Thus, pricing strategies are the means whereby an organisation achieves the identified pricing objectives, while the pricing determinants may affect the pricing committee's choice of a pricing strategy, or combination of pricing strategies.

In addition, one can determine the association of the three key elements in price setting through the use of several nonparametric statistical tests, such as the chi-square test and the Kruskal-Wallis test. For purposes of this article, the chi-square test of independence is used to determine the association of the identified pricing strategies, the most important pricing objectives, and the most influential pricing determinants. The chi-square test of independence is ideally suited to this type of analysis, as it can be used to analyse the frequencies of two variables with multiple categories and to determine whether the two variables are independent of each other (Black, 2011:656). In addition, Black (2011:656-663) and Steinberg (2008:351-357) expressed the opinion that when determining the value of the chi-square of independence, the following seven steps should be followed:

- *Step 1: Constructing a contingency table and entering the frequencies in the appropriate cells.* A contingency table is a two-way table, consisting of rows and columns displaying the frequency distribution of two variables. One variable determines the row categories, while the other determines the column categories. Combined, the row and column categories are known as cells. The frequency distribution of the two variables in the contingency table represents the number of observations at a specific intersection of categories of each of the two variables. The frequencies for the appropriate cells of the contingency table are obtained from the questionnaires completed by the pricing committee. For purposes of the questionnaires, the most suitable identified pricing strategies must be matched with the most important pricing objectives and the most influential pricing determinants (Black, 2011:656-663; Steinberg, 2008:351-357). The format of a contingency is illustrated in Table 7.

Table 7: Contingency table

Pricing objectives (Pricing determinants)	Pricing strategies				Row Marginal
	Pricing Strategy 1	Pricing Strategy 2	Pricing Strategy 3	Pricing Strategy 4	
Pricing Objective 1	$n_{1,1}$	$n_{1,2}$	$n_{1,3}$	$n_{1,4}$	
Pricing Objective 2	$n_{2,1}$	$n_{2,2}$	$n_{2,3}$	$n_{2,4}$	
Pricing Objective 3	$n_{3,1}$	$n_{3,2}$	$n_{3,3}$	$n_{3,4}$	
Column Marginal					

Where: n = Total of all frequencies for a cell

- *Step 2: Establishing the hypotheses.* A hypothesis represents a statement of expected results on the possible association between two variables. All hypotheses consist of a null hypothesis and an alternative hypothesis: The null hypothesis, symbolised by H_0 , indicates that there is no relationship between two variables, while the alternative hypothesis, symbolised by H_1 , assumes that there is a relationship between two variables (Black, 2011:292).

The following hypotheses must be tested:

Null hypothesis (H_0): Pricing objectives/pricing determinants and pricing strategies are independent.

Alternative hypothesis (H_1): Pricing objectives/pricing determinants and pricing strategies are not independent.

- *Step 3: Computing the test statistic:* Chi-square-test of independence (X^2). Testing the above-mentioned independence hypothesis requires the computation of the chi-square statistic, calculated by means of the following formula:

$$X^2 = \sum \left[\frac{(F_o - F_e)^2}{F_e} \right]$$

Where:

F_o = Observed frequency for each cell

F_e = Expected frequency for each cell

$F_e = (\text{Frequency for the column}) (\text{Frequency for the row})/n$
(Steinberg, 2008:355).

- *Step 4: Establishing the significance level.* The significance level, or relative standard that can serve as a basis for accepting or rejecting the hypothesis, must be stated. The significance level illustrates the level of confidence that exists in the relationship between two variables.

- *Step 5: Evaluating the test statistic.* In order to evaluate the chi-square statistic (X_2), it must be compared to the critical value of the chi-square statistic ($X_{2,crit}$) for the appropriate degrees of freedom. The critical value is a term used in statistics to represent the number that must be achieved in order to demonstrate statistical significance. If the critical value is achieved, the null hypothesis is rejected (Pagano, 2010:302). Degrees of freedom describe the number of values in the final calculation of the test statistic that are free to vary and are calculated as $(r - 1) \times (c - 1)$,

Where:

r = Number of rows in the contingency table

c = Number of columns in the contingency table

(Black, 2011:658; Steinberg, 2008:185)

To determine the critical value of the chi-square ($X_{2,crit}$) for the appropriate degrees of freedom, the statistical table for the chi-square distribution can be used.

- *Step 6: Interpreting the results.* This step entails the rejection of the null hypothesis or the acceptance of the alternative hypothesis. The rejection of the null hypothesis applies when the value of the chi-square (X_2) is greater than the critical value of the chi-square ($X_{2,crit}$), thus indicating that pricing objectives/pricing determinants and pricing strategies are independent.

The acceptance of the alternative hypothesis applies when the value of the chi-square (X_2) is less than the critical value of the chi-square ($X_{2,crit}$), thus indicating that pricing objectives/pricing determinants and pricing strategies are not independent.

- *Step 7: Selecting the most suitable pricing strategy or combination of pricing strategies.* The rejection of the null hypothesis (H_0) and the acceptance of the alternative hypothesis (H_1) indicates that there is an association between the suitable identified pricing strategies, the most important pricing objectives and the most influential pricing determinants. If there is an association between the most suitable pricing strategies, the most important pricing objectives and the most influential pricing determinants, additional analysis (known as post hoc analysis of the chi-square) can be conducted to identify the most suitable pricing strategy, or combination of pricing strategies, for determining the price of products or services.

A post hoc analysis of a significant chi-square test, as described by Markowski and Markowski (2009:59-65), entails the following:

- The analysis of the components of the chi-square statistic, and the identification of the row or column in the contingency table with the highest average contribution to the chi-square total;
- The interpretation of the discrepancy between the observed and expected frequencies for the cell in that row or column with the highest chi-square component;
- The elimination of the identified row or column from the contingency table; and
- The repetition of the chi-square test on the reduced contingency table.

If the new chi-square statistic is not significant, no further post hoc analysis is required. If the chi-square is significant, the row or column of the reduced contingency table with the highest average contribution to the chi-square total is again identified and interpreted.

These steps are repeated until the chi-square statistic is no longer significant.

Following the post hoc analysis, the remaining pricing strategies can be considered and applied in the pricing of the products or services of the organisation.

One of the main advantages of using the nonparametric statistical test, the chi-square analysis, is that it can be done using Microsoft Excel. The use of chi-square analysis in pricing, on the other hand, will only be of value to larger organisations, as it requires a sufficient sample size for the minimum expected frequency in every cell to be five or more (Steinberg, 2008:352).

4. SETTING THE PRICE

The chosen pricing strategy, or combination of pricing strategies, is used to set the price of a product or service. The question is how organisations go about determining the price of a product or service using the two major categories of pricing approaches, namely market-based pricing and cost-based pricing. The market-based pricing strategy focuses on demand-based pricing and competition-based pricing.

Cost-based pricing is product driven and starts with the design and production of the product or service, and then sets a price that covers costs plus a target profit. The marketers of the organisation then need to convince the customers that the value of the product or service at that price is justified. Below is a diagrammatic presentation of the use of cost-based pricing strategies:

Cost-based pricing



(Nagle & Holden, 2002:4)

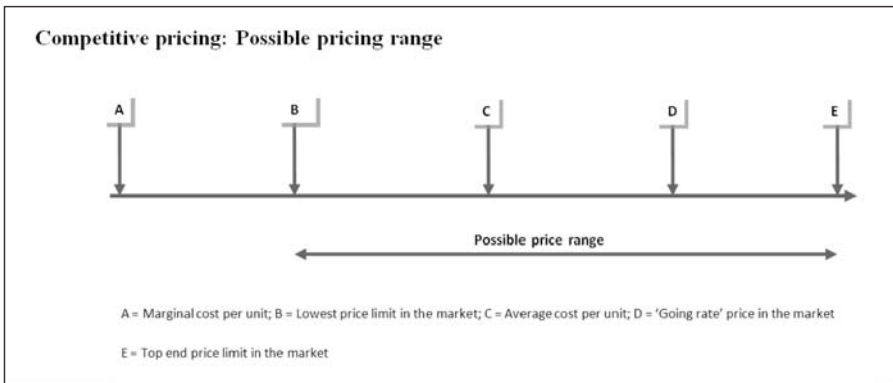
Value-based pricing reverses this process and starts with the customers' perception of the value of the product or service and then sets the price. The target value and price then drive the design of the product or service, as well as the costs that can be incurred. Pricing thus starts with an analysis of the customers' needs and the perceived value of the product or service that it creates for the customer. The price is then set to meet these needs and the value perceived by the customer.

Value-based pricing



(Nagle & Holden, 2002:4)

Competition-based pricing recognises the influence of competition in the marketplace, and prices are therefore based on what competitors charge for similar products or services. Organisations should think in terms of staying within a price range when setting the price, as illustrated below, when there are competitors in the marketplace.



(McDonald, 2002:377)

5. CONCLUDING REMARKS

This article demonstrates the use of statistical methods to determine a pricing strategy or combination of pricing strategies based on an organisation's pricing objectives and pricing determinants as related to an organisation's operations. The article argues that the pricing function in an organisation can be done through scientific means. The article also proposes that effective pricing management in any organisation can be achieved by adopting and implementing a comprehensive pricing plan that is in line with the overall strategies and objectives of the organisation, and which will address price setting, price implementation, and price management and control.

The article further argues that the use of statistical methods in selecting a pricing strategy, such as nonparametric statistical tests, is a valuable tool to assist an organisation's pricing committee in selecting the most suitable pricing strategies towards achieving the pricing objectives of the organisation.

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