Czech University of Life Sciences in Prague

Faculty of Economics and Management

Department of Statistics

Bachelor Thesis

Statistical analysis of factors influencing price of selected product

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BACHELOR THESIS ASSIGNMENT

Tereza Kamírová

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Statistical analysis of factors influencing price of selected product

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Objectives of thesis

The main goal of bachelor thesis is to evaluate factors incluencing final price of a chosen product in the company Kamír & Co s.r.o.

Methodology

The evaluation of final price of a chosen product and the impact of selected factors on the final price will be carried out by statistical analysis, such us exploratory data analysis, distribution analysis, and Monte Carlo simulation.

The proposed extent of the thesis

30 – 40 pages

Keywords

Price, price mechanism, factor, entrepreneurship, Monte Carlo simulation

Recommended information sources

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Declaration

I declare that I have worked on my bachelor thesis titled "Statistical analysis of factors influencing price of selected product" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any third person.

In Prague, 9 March 2018 _____

Tereza Kamírová

Acknowledgement

Statistical analysis of factors influencing price of selected product

Summary:

The aim of the thesis is statistical analysis of factors influencing the final price of a product and based on the knowledge of different price mechanisms also setting the price of the product. The thesis includes real data and factors from a Czech company Kamír & Co. spol. s.r.o. of a chosen product.

Based on these analysis the final price of the product is verified and identified, also in the practical part we may identify factors that burden the price the most. Factors will be analysed by the statistical method - Monte Carlo simulation and through sensitivity analysis. Final part of the work reflects results and recommendation based on the theoretical and practical knowledge. Also it describes and compares the theoretical framework and outcomes from the practical part with the current selling price of the product.

Based on both analysis we can state, that despite our assumption, the product is not sensitive to certain changes and according to the competitors and costs related to the product we can recommend to raise the selling price of the product.

Keywords: price, pricing mechanism, factor, entrepreneurship, Monte Carlo Simulation

Statistická analýza faktorů zatěžujících konečnou cenu produktu

Souhrn:

Cílem práce je statistická analýza faktorů ovlivňujících konečnou cenu daného produktu a stanovení konečné ceny na základě jedné nebo více cenotvorných metod. Práce obsahuje reálná data a vstupní faktory pro daný produkt vycházející z dat firmy Kamír & Co spol. s.r.o.

Na základě této analýzy je určena odpovídající a doporučená cena produktu a vyhodnoceny faktory, které tuto cenu nejvíce zatěžují. Jednotlivé faktory jsou analyzovány statistickou metodou simulace Monte Carlo a citlivostní analýzou a následně vyhodnoceny. Závěrečná část práce odráží výsledky a doporučení založené na teoretické a praktické znalosti vycházející z práce. Také popisuje a porovnává teoretický postup a výsledky praktické části s aktuální prodejní cenou produktu.

Z výsledků obou i přes původní domněnku vyplívá, že produkt není citlivý na změny vstupních faktorů, a také můžeme vzhledem ke konkurenci a nákladům doporučit navýšení prodejní ceny produktu.

Klíčová slova: cena, cenotvorba, faktor, podnikání, simulace Monte Carlo

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1. Introduction

Everyone in our society knows trade from a position of a buyer, we are waiting for the best price, comparing and selecting products. Our modern era offers us countless scale of possibilities, alternatives of many different products and services. However, we know the rule - our customer, our boss – the coin has two sides and the trade is not only a matter for the buyer, but maybe more for the seller.

The seller deals with questions like how much to produce, where, for whom and what will be the profit. The profit is the drive for the seller, because more is always better, and the profit is what matters in entrepreneurship. To gain profit, we need to have product with given price and the costs, the profit is the revenue free from total costs. And many managers deal the question, what should be the price for my product?

The price is an important indicator for both sides. And the price is affected by many factors, we need to identify these factors and try to verify them. This thesis has two parts and both are oriented on this topic.

First part describes the analysis of factors that may influence the price the most and what happens if we change conditions. The second part will take the analysis into consideration and the price is set based on real data.

Product chosen for this thesis are plastic posts for electric fencing from farming equipment, from Czech family company Kamír & Co. spol. s.r.o. The assumption is that the product might be sensitive to changes in key factors. The problem here is that the posts are sold for relatively low price, but they are costly, the product needs transportation, storage, manipulation and be shipping costs to the customer. All these factors are affecting the price and through the analysis we may see how sensitive is the profit to changes in input factors and also we can determine the proper selling price for the product.

2. Aims and methodology

The aim of this thesis is to create a formula for determination the final price based on costs. The final price will be based on identification and verification of the influence of input factors on the price and profit while considering possible changes. In case of input factors we will use data from Monte Carlo simulation and sensitivity analysis, which should show up the importance of input factors for the price and profit.

2.1 Methodology

The theoretical part of this thesis process knowledge gained in books, Internet sources and university textbooks. The practical part was based on real data gathered in Czech company Kamír & Co spol. s.r.o.

The thesis is divided into two parts. First part is focused on sensitivity of profit on changes of different input factors. This part is determines through sensitivity analysis and Monte Carlo simulation. Based on knowledge and values from both analysis we will set the formula for computing the final price of chosen product this formula was created on the basis of enterprise economics. Also we will use the data gathered in the first part of the thesis.

2.2 Sensitivity analysis and price mechanism

As Kirzner (1963, p.311) claims the market process is kept in move by entrepreneurial activity. This activity should gain profits and avoid losses. And the profit opportunity exists only when given product can be bought on the market at one price and sold for a higher price. Simply it is a situation where producer can sell his product for a value exceeding his costs.

2.2.1 Sensitivity analysis

The core of sensitivity analysis is to determine the sensitivity of profit to certain changes in key factors of a given product or project. The analysis describes how profit reacts on changes in sales or production volume, selling price, purchase price, exchange rates, materials, costs etc.

The basic analysis used in this thesis is single factor analysis, when the impact of changes is computed separately for each factor. Values used for this method are set as basic, optimistic and pessimistic or as deviations from the basic values. At the end are the

factors evaluated as important or less important for the product and the criterion describes the sensitivity of the profit to these changes. (Hnilica, Fotr, 2009, p.32)

2.2.2 Price politics

Generally respected expression *pricing* is commonly used to describe all activities with connections to price politics and price mechanism. The final price is important for the seller and also the buyer, the market situation in many cases influences the price. Usually the seller sets the price liberally, but the prices may be regulated or fixed, based on legislation.

Part of the marketing is also the strategy the company is going to follow besides strategy also the appropriate pricing method plays its role. (Peterová, Žídková, 2002, p. 55)

2.3 Profitability analysis

To determine whether the product is profitable or not, we will use Monte Carlo simulation. This simulation is a tool that determines the deviation of the profit based on certain input factors. The input factors will be determined through the sensitivity analysis. The output variables will describe the profitability in relation to chosen factors appointed into mathematical model.

Monte Carlo simulation is able to recalculate the scenarios in thousands of simulation steps and based on given data it describes the outcomes of the scenarios. The simulation is not able to describe the levels of data separately, but it describes the data as a whole with some certainty.

The analysis itself is processed by analytical tool – Crystal Ball in MS Excel. This platform is also capable to describe the data graphically and in percentiles. (Hnilica, Fotr, 2009, p. 71)

2.3.1 Monte Carlo simulation method

Simulation Monte Carlo is mainly used in companies while analysing the profit risk of the company or risk of new financial project. The most important part for the simulation is the choice of key risk factors, usually as the relevant unit are used two or three input factors, if we use more than three the model may not be appropriate. While analysing this model other inputs need to stay constant, we choose the most hypothetical values.

Also the key input factors should be the most sensitive ones to the changes we plan to estimate. Factors are divided into two groups. Discrete risk factors, those acquire only

several different values. And continuous risk factors, those acquire infinite different values. While considering continuous risk factors we have to diversify those factors into categories in accordance with given parameters. In some cases, for example while compounding with exchange rates, we may use given approximation of the data.

Single input factors of the analysis or project may or may not be statistically dependent on each other. Though we are not able during the simulation consider these relationships deeply, but they should be taken on mind as well. Dependency of the factors can be defined as time dependency or pair dependency.

When we come to the process itself, it is regularly done by computer program. The whole process is fold up from different periodically repeated simulating phases. In every single phase the program generates probability of the risk input factors. The outcomes of the program and of the different steps may be interpreted in graphical or numerical form.

2.3.2 Simulation process

When developing the model for Monte Carlo simulation, we always start with determining the key factors, which we want to analyse others stay constant. We need to estimate possible range of values for each input factor. We need to estimate the maximum value the unit might reach, in the worst possible situation, also the minimum value the factor can gain and the middle figure, most probable value for the individual factor. When we use a range of values instead of one single guess, the model tends to be more precise. Also the output will be a range.

The simulation itself is done through computer tool – Crystal Ball in MS Excel 2013. When we select the variables we want to analyse, we need number of simulating steps we want to implement. Based on the outcome, the user is able to describe some of the characteristics of the risk in the model. (RISKAMP, *What is Monte Carlo simulation*)

2.3.3 Creation of mathematical model

Profit before taxes (gross profit) is considered as basic financial criteria for the model. The model is constructed from four different relationships, that is gross profit (P), total revenue (TR), total variable costs (TVC) and total labour costs (TLC).

Formula 1: Mathematical model for Monte Carlo simulation

Total revenue (TR) can be expressed as a product of sales price (P) and quantity sold (Q).

$TR = P \, x \, Q$ (1)

Total variable cost can be defined as a product of purchase price (p) and quantity of goods sold (Q).

$$TVC = p \; x \; Q \tag{2}$$

Fixed costs are not quantifiable for our model, so they will be excluded from the model. Otherwise they need to be considered also costs for labour (TLC) compounded as a product of labour costs (LC) and quantity of goods sold (Q). We do not suppose that there are any leftovers on stock.

$$TLC = LC \; x \; Q \tag{3}$$

In the last part the model will define gross profit (P) before taxes as a difference between revenues and costs.

$$P = TR - (TVC + TLC) \tag{4}$$

2.3.4 Advantages and disadvantages of Monte Carlo simulation

Monte Carlo simulation can be useful tool for managers during an analysis of project or decision making processes. But as every type of analysis has its pros and cons which may affect the process and results.

The most important outcome from the manager point of view is the information about deep knowledge about the risk of input factors. Managers may deeply analyse relationships between individual factors of the project, recognize weaknesses and reciprocal impacts. Based on this information is the manager more likely to make profitable decision, recognize weaknesses or even shut down the project, if the risk is too high. If the risk is unacceptable the project needs to be remade.

On the other side of the simulation process itself may occur complicated and laborious. The determination of key factors and their relations may be ambiguous. Moreover, in some cases are the values of key factors unpredictable and we need to work on the presumption that the data tend to be as in past. When we use preceding data it can lead to quantification of incorrect values, because individual situations and factors may not be constant as in past. (Hnilica, Fotr, 2009, p. 80)

3. Theoretical part

3.1 Entrepreneurship and business components

3.1.1 Aims and functions of entrepreneurship

Entrepreneurship is an activity shaped by several important traits: The basic is the drive to increase the value of capital used. On the beginning the entrepreneur deposits its registered capital to the business, the amount of capital is based on the type of business. To increase a capital, the company needs to gain profit through products or services offered to the customers. The customer is the target of attention of the entrepreneur and we need to satisfy the needs of customer. While selling goods and services, the seller faces the risk. We are trying to keep strategies and politics of the business in order to minimize the risk.

Business is not only a matter for the owner, but also for everybody else. Business offers goods and services and serves to the society, to the customers, employees and others connected to the business. But to maximize profit is widely believed as the primary goal of the business. (Kislingerová, Synek, 2015)

3.1.2 Profit

Producers want to maximize the profit and they are often driven by the market competition. Profit is what we gain, calculated as difference between total revenue and total cost. Total revenue is equal to the market price multiplied by the quantity sold. Total costs are fixed costs and variable costs joined together. (Procházka, 2015, p.100)

Profit or loss are results of economic activities of a business. If we want to increase our profit, we can use two basic approaches – raising the revenue or decreasing costs. (Taušl Procházková, Jelínková, 2018, p.46)

Formula 2: Profit equation

PROFIT= Total Revenue – Total Costs (5)

TR = p x Q

TC = FC + VC

Where: *TR = total revenue; p = price per unit; Q = quantity; TC = total costs; FC = fixed costs; VC = variable costs*

Source: Procházka, 2015, p. 100

3.1.3 Costs

Costs are reflecting the amount of money used for the input factors – financial expression of the capital used to reach the output. (Peterová, Žídková, 2002, p. 3)

Costs can be divided in two cathegories – dependent on the amount of production. *Fixed costs (FC)* are stable and they do not change with the quantity produced (only in long-term period). Monthly paid mortgage is considered as FC. (Taušl Procházková, Jelínková, 2018, p.23)

Costs that do depend on the quantity produced are called *variable costs (VC)*. Workers paid by the company for an hour of work are considered as VC. When we add FC and VC together, we get *total cost (TC)* for certain quantity of output. TC includes all the costs connected with the production of a good or service. (Procházka, 2015, p. 89)

3.1.4 Break-even point

Break-even point analysis provides information to the producer. Simply is says how much does the producer needs to produce to gain profit, at which its sales exactly cover its expenses. The analysis shows up the relationships between expenses and revenues. Break–even point graph, describes a basic situation can be seen on Picture 1, also for computing the break-even point we can use an equation – Formula 3. (Accounting Coach, LLC., 2004)

Picture 1: Break-even point chart
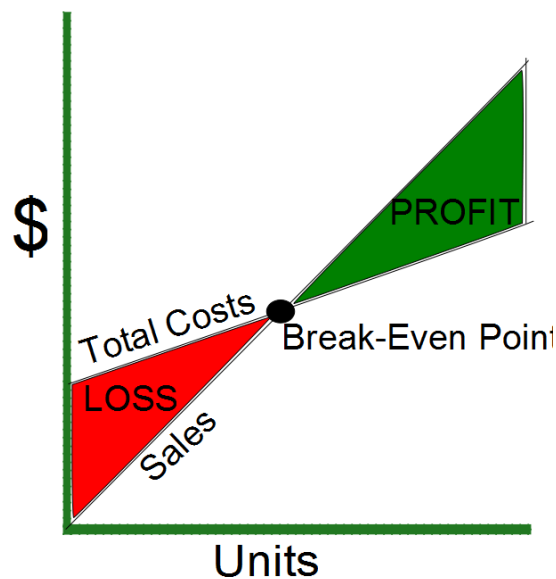
Source: Trailhead Accounting Solutions CPA, LLC., 2017

Formula 3: Break-even point equation

$$FC/ (p - VC) = BEP \qquad\qquad (6)$$

Where: p = price per unit; FC = fixed costs; VC = variable costs; BEP = break-even point
(in units)

Source: Trailhead Accounting Solutions CPA, LLC., 2017

3.1.5 Supply and demand

Arbogast and Eastin in Pinto and Piros (2013) define the demand and supply analysis as a study that examines how buyers and sellers interact to determine the transactions on the market. *Supply and demand analysis* is considered as the basic set of microeconomic tools and is widely used in private enterprise market economies.

Demand is defined as "the willingness and ability of a consumer to purchase a given amount of a good or service at a given price." Demand can be expressed by the demand function, graphically by the demand curve and describes the consumer's behaviour.

As the market price affects demand, it also affects the supply, which plays the opposite role on the market. *Supply* can be defined as "the willingness of a sellers to offer a given quantity of a good or service for a given price."

The ideal moment on the market comes when both are in equilibrium, in the point where demand curve crosses supply curve. In equilibrium we have potentially an infinite number of sellers and infinite number of buyers. (Pinto, Piros, 2013, p. 5)

3.2 Price, pricing strategy, factors influencing price

In marketing we can follow several patterns how to understand the term *price.* Price can be understood as the amount of money the customer is willing to pay for a product, the amount he is willing to sacrifice to meet his needs and wants. Also the price plays role while positioning and prestige of the product on the market. Price is what determines the product value, the firm's revenue, income or profit. Also it plays a key role between the supply and demand relationships. Price affects the components of trading goods and services the most. Price defines the profit gained through customers who have the economic value for the company. Lopez Santiago states, "*The set price should be able to achieve customer loyalty and yield the highest present value of the future stream of earnings.*" (Lopez, 2015, p. 85)

3.2.1 Dimensions of price

The price setting is an important tool in marketing it should be set in the context of:

- The benefits it offers.
- The product's position.
- The market type and business trends.
- The competition, differentiation and/or competitive advantage.
- Supply and demand forces.
- The product's life cycle

Generally, the higher price, the higher prestige and quality is expected from the product therefore the lower price has sets the product on the market to the worse position. But we need to be careful and set the price according to the target market, not to overvalue or undervalue the product. When the critical match between the factors mentioned above is not balanced the sales volume, market share and profitability may become affected. (Lopez, 2015, p. 86)

3.2.2 Price elasticity

Price elasticity describes how do buyers react when price changes. The price has an impact on the demand and the elasticity measures change between quantities demanded and change in price, both in percentage. Price elasticity can be expressed by an equation – Formula 4. (Lopez, 2015, p. 90)

Formula 4: Mathematical expression of the price elasticity

$$E = (\%_\Delta Q)/ (\%_\Delta P) \tag{7}$$

Where: *E = price elasticity; Q = quantity; P = price*

Source: Lopez, 2015, p. 90

Price elasticity can be a good indicator while setting the price, because when we have a product with zero percentage change, the product is perfectly *inelastic,* and the customer is not willing to buy it anymore. The exact opposite is a product with elasticity equal to infinity (when price changes, the quantity remains the same), in this case we call the product perfectly *elastic* and quantity does not change when we change the price. (Procházka, 2015, p. 56)

3.2.3 Pricing mechanism methods

Historically the prices were negotiated and based on agreement. Since ever the seller tend to set the price as high as possible while the buyer was searching for the lowest price. The agreement usually represented compromise in the trade. The idea with united price for everyone plays its role since 19th century.

There are many factors influencing the pricing, supply and demand are the key ones, also the economics strength and position on the market have an impact on the final price. Substitutes may also affect the price, but this does not work when talking about an exclusive goods.

Commonly we are not able to select only one single method while setting the prices for the whole scale of products, but the price politics is performed comprehensively. (Peterová, Žídková, 2002, p. 62)

Basic pricing methods:

1. **Pricing method with addition of individual unit costs**

The concept of price setting based on costs is a basic for the business. As a foundation we can take different part of costs and that differs the size of the final price. The weakest point in this method is a possibility of a wrong guess in quantity of future sales and production. Therefore the unit costs are higher and the percentage of profit from the market price descends.

2. **Pricing method with defined final return**

It comes out of the methods based on consideration of the costs. Firm sets a price in accordance to *ROI – Return of Investment*. The required return is determined as first and based on the break-even point is the price and quantity produced directed to the required amount.

3. **Pricing method oriented on the competitor**

Method oriented on the competitor determines the price to be able to compete the target market. Cost and demand is not usually taken on mind. The goal is to keep the position of the company on the market, not to change the share of demand. Sellers of prestige products are in competitive advantage on the market, also factors like locality or season may play role.

4. Pricing method with price quotation

The price is oriented on the market and usually is determined in a contract for an individual work. Firm sets the price on the basis of expected offers form the rival companies and does not consider costs. However there is a certain border, which limits the company, the project also needs to be profitable.

5. Price constructed based on value perceived by the customer

This price is perceived as demand-oriented price rather than market price. As the decision-making point is assumed the price perceived by customer, not costs. Usually the product is compared to the similar product on the market and the price is determined on the same level.

6. Pricing method oriented on demand

Comes out from the economic theory about supply and demand. The relationship between the price and quantity sold is inversely related, the independence of these variables is measured by price elasticity. Generally ordinal and necessary products are less elastic than luxury products.

7. Price constructed for a quantity or performed service

Price is constructed for a set of goods or services. Widely used in tourism, traveling agencies are selling the whole packages for the holidays and customer in usually not able to recognize individual prices of the components. Competitors are taken on mind, there works a competition on the market to reach more customers than the competitor. (Peterová, Žídková, 2002)

3.2.4 Price strategy

Management of the company must select appropriate strategy for the pricing mechanism. The decision is limited by the position of the business on the market. Strategy depends on the type of the business – monopoly, oligopoly, monopsony etc. Also the type of costs influences the pricing process.

April Maguire types of pricing strategies:

1. Pricing at premium
2. Pricing for market penetration
3. Economy pricing
4. Price skimming

5. Psychology pricing

6. Bundle pricing

   (INTUIT INC., *6 Different pricing strategies*)

3.2.5 Sale

The goal of the firm is not only to produce goods or services the goal is to bring it to concrete customer. The term for this action is a *sale*. Sale is characterized as an action when producer cede a product or service to another firm or individual for a particular price or material counter value.

In *command economy* is the sale based on decisions made before. The firm cannot determine the price or the trading partners, they are fixed. In this type of economy we can see that the demand is higher than supply, that places the buyer to disadvantageous position, because the buyer is forced to accept even bad conditions. This market is not based on marketing sale. Historically was this concept held in soviet countries.

In *market economy* is the system different. Here the buyer has a big potential to influence the sales and also prices. There is no shortage of products, services, raw materials or machinery, so it is harder to sell it than produce it. The sale is oriented on wants and needs of the potential buyers and the market becomes competition market. All activities that are associated with the sale and competition are described by one term – *marketing*. (Kislingerová, Synek, 2015, p. 241,242)

3.2.6 Marketing

Widely known marketing guru Kotler (2001, p.4) defines marketing as follows: "*Marketing is a societal process by which individuals and groups obtain what they need and want through creating, offering, and exchanging products and services of value freely with others.*"

Marketing manager needs to handle different skills and tools to be successful on the market. Some people say that marketing is a type of art and science, because it uses all types of marketing concepts and the manager needs to be able to choose the appropriate one. (Kotler 2001, p. 4)

Picture 2: Simple marketing system
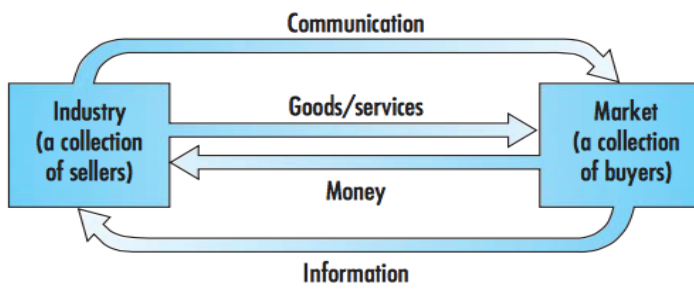
Source: Kotler 2001, p.5

For fully-fledged market with marketing operations in process we need to have appropriate base, marketing will not work without sufficient supply and demand. The seller needs a freedom in selling the products and also the buyer needs wide range of products to freely choose from. Also not only a freedom is important for the market, framework of law is essential to avoid unfair competition, protect customer and seller, to maintain hygiene regulations and others.

On the other side, the free and open market is not necessarily followed by marketing, it is just part of the sales. Firstly came out with this strategy companies like Henkel, Nestlé, BMW or Coca-Cola, and later on another businesses started to involve marketing into their sales. (Kislingerová, Synek, 2015, p.242)

3.2.7 Marketing plan

Kislingerová and Synek (2015, p. 243) define four basic steps of marketing plan: market diagnosis, market prognosis, planning of goals, planning a marketing mix, setting the budget. All of these steps have an impact on the outcome.

Market diagnosis informs the producer about the current market situation. Firm analysis how likely is the product profitable on the market. Managers also need to observe existing sales and competitors.

Market prognosis is the flowing step, which analyses current trends of the market. Its task is to estimate the future development of the market. Competitors, inflation or incomes can affect the future progress and need to be considered.

Kotler (2001, p. 9) defines *marketing mix* as follows: "*Marketing mix is the set of marketing tools that the firm uses to pursue its marketing objectives in the target market.*" To effectively apply these tools, we need to know the goals. *Planning goals* can formulate concrete business plan with concrete concept of sales. Based on this knowledge the 4P of marketing mix may be applied. (Kislingerová, Synek, 2015, p. 244)

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3.2.8 4Ps of Marketing

Marketing mix is a set of tools applied to reach marketing strategies. This set is also known as *4Ps of marketing*: Price, Promotion, Product and Place. Simple marketing structure may be seen on Picture 3.

Price represents the value the buyer has to invest to obtain product or service. *Promotion* is an activity related to the sale such advertising or personal sales. *Product* defines the subject of matter, design, its features or benefits. And *place* relates the distribution channels and the target market. (Lopez, 2015, p. 39)

Picture 3: 4Ps of marketing - structure

Source: Kotler, 2001, p. 10

Today is common to advertise and promote every product and we cannot ignore it even if we are not interested, therefore all of these activities have direct impact on the sales and demand. Marketing mix (4Ps) describes the marketing forces that have the influence on the market and individuals, not only microeconomical, but also psychological and sociological. (Lopez, 2015, p. 39)

3.3 Kamír & Co. spol. s.r.o.

3.3.1 History and basic information

Three brothers founded the company in 1991 and it works as a family company also today. Since beginning the company was focused on milking technologies and milking equipment, later on it has grown into a company that offers more and more. Today the firm

offers more than 6000 products in the market for farming, milking technologies, horse riding and also pet keeping. Besides that, they also offer non-stop service for milking farms. Currently more than 310 milking farms are kept in service.

The company started from scratch and grows continuously during the years. Based on the systematic work of specialists the company raised and finally in 2011 moved into new warehouse and has 7200m^2 of storage and selling space. Also the company has subsidiary shops all around Czech Republic and two in Slovakia and e-shop.

3.3.2 Market position and Competition

Current market position of the company in selling farming equipment can be evaluated as strong and high. We can deduce that from constant growth of customers and also from growth in revenues and profitability.

The company keeps its strong position on the market, because during the 26 years of existence the company developed trust in its products and services. *Branding* made its work and the company is known on the market for its good service and product quality for a reasonable price. According to Kotler (2001, p. 188) we can perceive branding as a challenge that develops a deep set of positive associations for the company and this helps while developing the positioning strategy for the business.

Main competitors on the market are mainly in disadvantage due to the number of products and services offered by the company and that implies good purchase price from its suppliers, so the company definitely drives the market in terms of price and quality. As well the company has very detailed and sophisticated e-shop, that gives the opportunity to the customer to simply made its purchases.

3.3.3 Price strategy and politics

Company's politics is based on good quality for a reasonable price, products are not sold under one pricing mechanism, prices are set individually based on the market average, quality, marketing purposes and on the experiences of the salesman. Prices are divided into three different categories based on margin computed from the purchase price – A, B and C. C stands for products with 25% margin, B products have about 35% of margin and A products have 45% and more, also the groups determine the price reduction for resellers. As well all the final prices include VAT – 21% or reduced VAT – 15% in case of feedstuff or vitamins. Some suppliers stand on keeping the recommended price, so the

price is based on margin that is given. Recommended prices are used mostly for luxury products and brands.

When the costs are calculated the salesman usually also takes on mind the actual situation on the market, purchase price, season or economic situation of the potential buyers. There is not enough scope to use just one pricing mechanism but based on personal experience the price is set by combining more pricing mechanisms together.

3.3.4 Plastic posts

Plastic posts are widely known product on the farming market, they can substitute the wooden posts, they are cheaper, lighter and can be moved. On the market we can see many different shapes, types and lengths.

This thesis analyses basic plastic post, 140cm long and very well sold. These "Standard" posts are manufactured and supplied by the French company Lacmé for the Kamír & Co. spol. s.r.o. and delivered into the Czech Republic. The purchase price is in euros – current purchase price is 0,86€.

Selling price in Kamír & Co. is 34,00Kč without VAT, so when we include the 21% high VAT the final price is 41,14Kč per piece. We can see it is the low-middle price level, it is not the cheapest one on the market for this type of a product, but it can keep its position. Different prices among the market are recorded in Table 1. According to our division of pricing mechanisms, we can see that the biggest share of pricing politics here is the pricing method oriented on the competitor.

Table 1: Price comparison of "Standard" 140 cm (without VAT) - January 2018
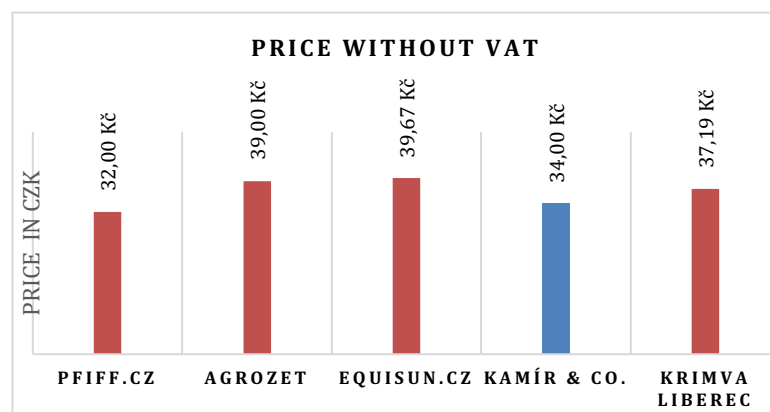
Source: Own sources

The final price for the posts needs to absorb all factors influencing the costs, the main factor determining the price is definitely the purchase price which is reliable on the exchange rate – Euro and Czech crown. Based on this we know that the purchase price

with proper exchange rate can be more profitable. When we determine the price it is also important to predict the sales volume, more the company sells, better price can offer to their customers.

Table 2: Sales volume of "Standard" 140 cm in Kamír & Co. spol. s.r.o.

TREND OF SALES VOLUME - FORECAST 2017

2012	20242
2013	32077
2014	42015
2015	47902
2016	52349
2017	64908
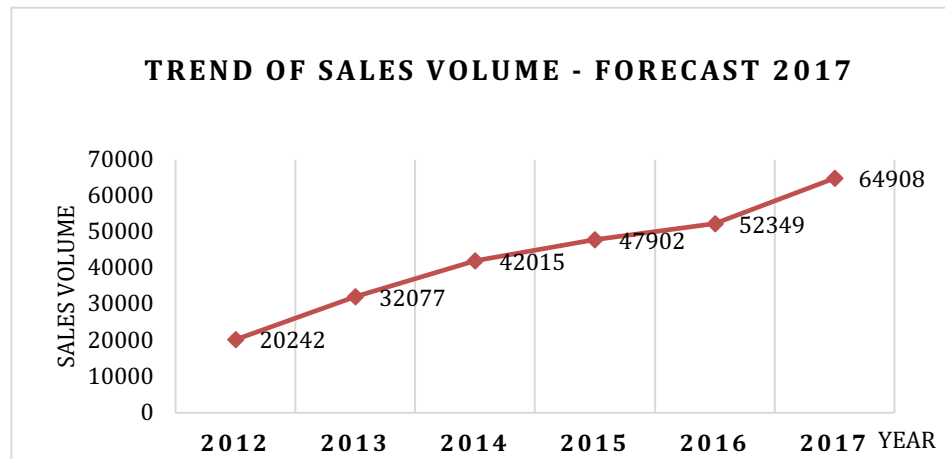
Source: Own sources

Table 2 describes the trend for sales volume of plastics posts from 2012 to 2017. The year 2017 is a forecast of sales and its estimated based on trend in previous years. The trend for 2017 is 64 908 pieces. This value for year 2017 will be used as a variable for the optimistic scenario of the analysis for practical part of the thesis. It cannot be used as a basic scenario for the calculations, because of the steep increase of sales in years 2012 – 2014 the forecasted value is higher than we can expect in reality, therefore it will be used as optimistic variable and the real sales of 2017 will be used as a base for the analysis.

4. Practical part

4.1 Sensitivity analysis

4.1.1 Key factors

Basic key factors influencing the sensitivity of profit in the model are sales volume, sales price, purchase price and labour costs, unfortunately there is not a possibility to measure all costs associated with the product, so they are excluded from the basic model. Purchase price of the posts also reflects currency rate, because the product is purchased in euros, but sold in CZK, so we may see fluctuations in purchase price even though the price from the supplier has not been changed.

Sales volume is an important factor to our model, because in practice we may assume that the more we sell, the lower are costs associated with our product. *Sales price* determines our revenue form the product and also covers all expenses, if not, there cannot be any revenue expected. *Purchase price* is significant factor that influences the sales price and also reflects the currency rate. Currency rate is not significant in small amounts, but its influence may be seen in higher quantities. The last factors taken into the model are *labour costs*, which cover manipulations, unloading and storage. The model should show us how sensible each factor is to defined changes.

4.1.2 Determination of distribution of key factors

Values used in the model are based on the values from the company Information System Karat, which contains all historical information about the product. The IS stores data about average price, last purchase price, average purchase price, sales volume, sales price and exchange rates. Data shown in the Table 3 are counted form the real data in the IS and compared with averages. As a base for labour costs were taken data from the 6.9.2017.

As an optimistic value for sales volume was used estimated trend for the year 2017 (Table 3) and real volume in 2017 was used as a base value. Sales price was based on the current sales price compared to rival companies, sales price is stated without VAT. Purchase price for the model comes out from the data in company IS Karat – lowest, average and highest price. And labour costs were measured based on time needed for storage and manipulation.

Table 3: Scenario of values of risk factors

Risk factor	Units	Situation		
		Pessimistic	Basic	Optimistic
1. Sales	Q/year	52 349	54 908	64 908
2. Sales price	CZK/pcs	32	34	38.62
3. Purchase price	CZK/pcs	22.4503	22.2647	22.1807
4. Labour costs	CZK/pcs	0.020	0.016	0.012

Source: Own data and elaboration

4.1.3 Sensitivity analysis of key factors

The task for sensitivity analysis is to evaluate sensitivity of the key factors to changes and estimate the impact of these changes on the business gross profit. According to the equation from chapter 3.1.2 (Formula 2) we can define the profit as a difference between total revenue and total costs.

Formula 5: Profit equation

$P = p \ x \ Q - [(c \ x \ Q) + (LC \ x \ Q)]$ (8)

Where:

- *P – gross profit (CZK/year)*
- *p – current sales price (CZK)*
- *Q – sales volume (pcs/year)*
- *c – purchase price (CZK/pcs)*
- *LC – labour costs (CZK/pcs)*   *Source:* Own data and elaboration

The most likely to be scenario covers values from the basic situation from Table 3 and these values can be insert into relationship (8) in order to estimate a year gross profit from our product.

Formula 6: Basic year profit calculation

P = 34 x 54 908 – [(22.2647 x 54 908) + (0.016 x 54 908)]

P = 643 483.32 CZK

The gross profit for the basic scenario is 643 483.32 CZK.

4.1.4 Pessimistic values of sensitivity analysis scenario

Next step for sensitivity analysis is to estimate values and its changes for separated crossing values of each factor from the most likely scenario to the value in the pessimistic

scenario. The model needs to be recalculated with respect to the new values. From the decrease in sales volume is determined the gross profit, with the assumption that all other factors expect the one that is being calculated stay constant on the basic values.

Formula 7: Pessimistic scenario profit calculation

P = 34 x 52 349 – [(22,2647 x 52 349) + (0.016 x 52 349)]

P = 613 493.64 CZK

There is evident decrease in gross profit from 643 483 CZK to 613 494 CZK. That is absolute decrease of 29 990 CZK and this relationship can be displayed as 4.66% relative decrease. According to this procedure we can estimate all other factors of our model, we will keep the calculation schema and insert other variables.

Table 4: Results of sensitive analysis - pessimistic scenario

Risk factor	Value of the factor		Decrease in profit	
	Basic	**Pessimistic**	**A - CZK**	**R - %**
1. Sales	53 628	52 349	29 990	4.66
2. Sales price	34	32	109 816	17.06
3. Purchase price	22,2647	22,4503	10 191	1.58
4. Labour costs	0.016	0.020	220	0.03

Where: A – CZK means absolute decrease of profit, R - % means relative decrease of profit

Source: Own data and elaboration

4.1.5 Optimistic values of sensitivity analysis scenario

The same formula for recalculating the scenarios as in chapter 4.1.4 is used for optimistic part of the model. Also we can use the formula (Formula 5) as in previous chapter for this step, we just need to change our values for the optimistic estimations.

Table 5: Results of sensitive analysis - optimistic scenario

Risk factor	Value of the factor		Increase in profit	
	Basic	**Optimistic**	**A - CZK**	**R - %**
1. Sales	54 908	64 908	117 193	15.41
2. Sales price	34	38.62	253 675	28.28
3. Purchase price	22.2647	22.1807	4 612	0.71
4. Labour costs	0.016	0.012	220	0.03

Where: A – CZK means absolute increase of profit, R - % means relative increase of profit

Source: Own data and elaboration

4.1.6 Results of sensitivity analysis

From the Table 4 (table with pessimistic scenario) is evident, that profitability of the product is the most sensible to changes in sales price from 34 CZK to 32 CZK, where the gross profit decreased by more than 17%. Second factor affecting the profitability of the product the most is sales volume, which decreased by 4,66% in the case of pessimistic scenario. Less significant values for the product is the purchase price, covering the currency exchange rate, and labour costs. From the model is evident, that labour costs in these amounts are almost irrelevant for the product.

Similar inference as in case of pessimistic scenario describes the opposite one, based on the data from Table 5, is evident, that biggest changes in profitability brings the change in sales price, from 34 CZK to 38,62 CZK, this increase means an increase of absolute profit by 253 675 CZK, (relative increase by 28,28%). Also the second model structured in Table 5 describes the sales volume as second factor that affects the profitability the most. Another two factors are less significant for our product.

From both models described in Table 4 and Table 5 is obvious, that the product is not overly sensitive to the changes and its profitability is permanent even during the unfavourable economic development.

This analysis is based on assumption, that we calculate each factor separately, so it does not consider possible dependences between the factors. The only option to avoid this discrepancy would be to use multiple factor analysis.

4.2 Monte Carlo simulation

Based on the information from chapter 4.1 sensitivity analysis, is assumed that the product is mainly affected by two different factors – sales price and sales volume. These two factors will be used in Monte Carlo simulation. First step is to create mathematical model (Chapter 2.4.3, Formula 1) in MS Excel and then process it by Crystal Ball system.

Work on the assumptions of this simple mathematical model we insert our data into MS Excel and using the analytical tools calculate the four-step procedure that affects the profit.

Based on created relationship is defined a table (Table 6), which has two parts, upper part shows input values of the model and bottom part describes output data of the model. Values in Table 6 correspond with the most likely to be situation in the Table 3 – chapter

4.1.2. Total revenue from the profit is 1 866 872 CZK, total costs are 1 223 389 CZK and year gross profit from the product is 643 483 CZK.

Table 6: Product distribution

Risk factor	Units	Basic
1. Sales	Q/year	54 908
2. Sales price	CZK/pcs	34
3. Purchase price	CZK/pcs	22,2647
4. Labour costs	CZK/pcs	0.016
Total revenue	CZK	1 866 872.00
Total variable costs	CZK	1 222 510.15
Total labour costs	CZK	878.53
Profit	CZK	643 483.32

Source: Own data and elaboration

4.2.1 Key factors for Monte Carlo simulation

To determine key factors for the Monte Carlo simulation model are used results from sensitivity analysis of the given product, which are introduced in chapter 4.1 or rather 4.1.6, Tables 4 and 5. From the results from sensitivity analysis, follows that most important factors are sales price of the product and sales volume. Purchase price and labour costs stand for less important factors for the model.

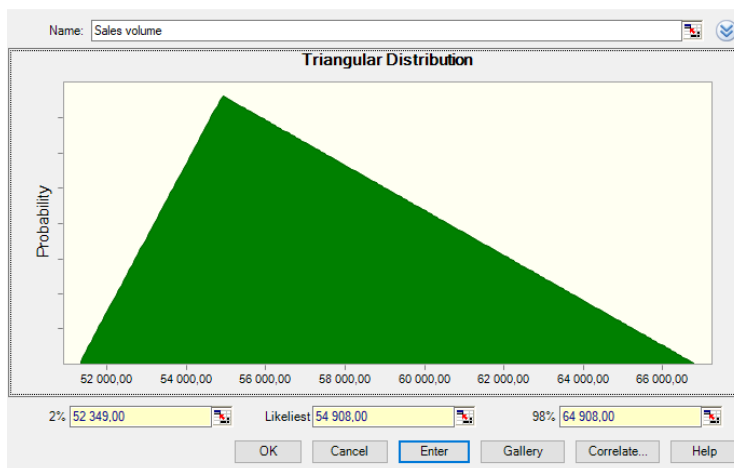**Picture 4: Distribution of factors for risk analysis**
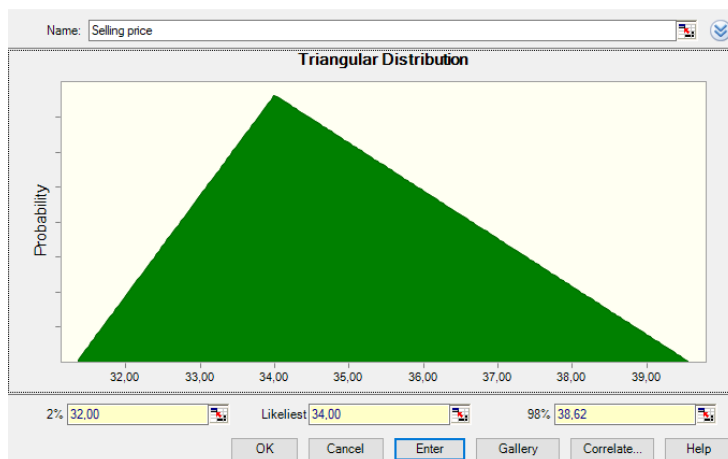
Assumption:

Sales volume

Triangular distribution with parameters:

2%	52 604.00
Likeliest	54 908.00
98%	54 908.00

The figure shows a Crystal Ball dialog box titled "Triangular Distribution" for an assumption named "Sales volume", with an X-axis ranging from 52 000,00 to 66 000,00 and a Y-axis labeled Probability. Parameter fields show 2% = 52 349,00, Likeliest = 54 908,00, 98% = 64 908,00.

Alongside:

Assumption:

Sales price

Triangular distribution with parameters:

2%	32.00
Likeliest	34.00
98%	38.62

Source: Own data and elaboration

Based on this assumption is obvious that first two factors should be respected in the simulation and the other two factors will be constant on the basic level of their values. Triangular distribution is used to represent deviation of the key risk factors. The graphical distribution has three parameters, where the most likely to be value determines the peak of the distribution.

4.2.2 Realization of Monte Carlo simulation

Profit is determined as a forecast variable, which will be considered in the simulation. Also to run the simulation properly, there need to be set the number of simulation steps – 10 000. Based on the mathematical model created in chapter 2.4.3 (Formula 1) we will use the relationship (4) The equation is similar to model used in sensitivity analysis – chapter 4.1.3.

4.2.3 Results of simulation

Results of the Monte Carlo simulation procedure are shown on graph with statistics characteristics (Picture 5). Crystal Ball tools in MS Excel 2013 ran the procedure.

Picture 5: Profitability deviation of gross profit with statistics characteristics
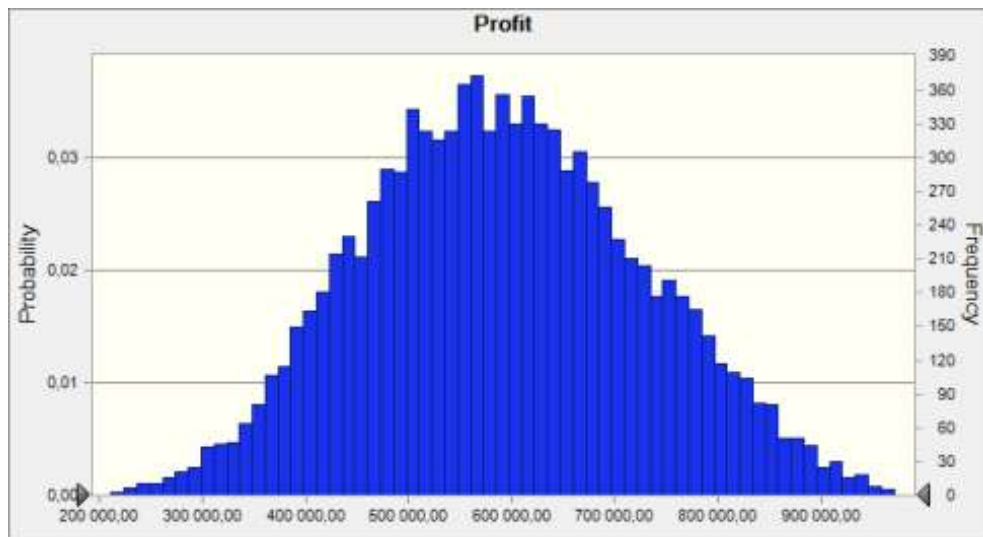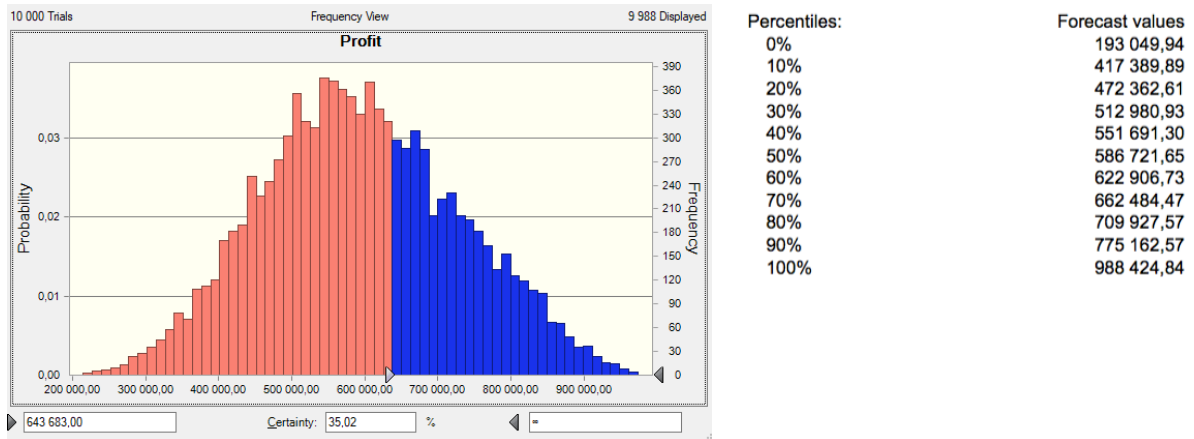

Summary: entire range is from 193 049.94 to 988 424.84 base case is 643 483.31 after 10 000 trials, the std. error of the mean is 1 356.02

Statistics:	Forecast values
Trials	10 000
Base Case	643 483,31
Mean	591 052,94
Median	586 743,74
Mode	---
Standard Deviation	135 601,50
Variance	18 387 767 728,73
Skewness	0,1084
Kurtosis	2,61
Coeff. of Variation	0,2294
Minimum	193 049,94
Maximum	988 424,84
Range Width	795 374,90
Mean Std. Error	1 356,02

Source: Own data and elaboration

Mean value of the profit of out project is 591 053 CZK, that is 53 430 CZK less than in our most likely to be (basic) situation. Minimum expected gross profit of the project is 193 050 CZK and maximum expected gross profit from the product is 988 425 CZK. The deviation of the profit is approximately symmetric, small skewness is notices in tendencies to the left side (0.1084). That means, the profit inclines to lower values of the profit, we may also see that trend on the graph in the Picture 5.

Picture 6: Probability deviation of profit with percentiles

Percentiles:	Forecast values
0%	193 049,94
10%	417 389,89
20%	472 362,61
30%	512 980,93
40%	551 691,30
50%	586 721,65
60%	622 906,73
70%	662 484,47
80%	709 927,57
90%	775 162,57
100%	988 424,84

Source: Own data and elaboration

On the picture 6 we may see the graphical evidence of our the most likely to be (basic) gross profit, which is 643 683 which has a certainty 35.02%. Percentiles are another possibility to interpret output data from the simulation. Based on the graph (Picture 6) we also know, that according to the level of input factors it would be difficult to reach 1 mil. gross profit. This target would be possible to reach only with better economic development in given input factors.

The trend of the values to incline to the left side can be explained as a difference in sales volume in forecast and in reality. The forecasted trend for sales volume in 2017 was higher than basic (real volume of sales) and pessimistic values, due to precipitous increase of sales in first 3 years 2012-2014.

4.3 Price setting

Based on the sensitivity and profitability information of the product and theoretical knowledge of pricing politics and company's preferences we may determine the price for the product, to be profitable and competitive.

Kamír & Co. spol. s.r.o. is a company located in Czech Republic, so it belongs to countries with open market economy, so we can determine the price under the pricing strategies the company tends to follow, and the decision is not limited by any restrictions, except it needs to follow Czech legislation. Also, there is no fixed pricing for this type of product and the market is mostly competitive, so the price will be oriented on the competitive offers.

Plastic posts are product bought from a foreign company and sold by the Kamír & Co, so it is a merchandise and there is no need to consider production costs, because these

are already included in the purchase cost, the company just adds a value according to chosen margin and sets the price based on its own additional costs.

4.3.1 Determining the formula for the price mechanism

According to a theoretical knowledge from chapter 3.2.4 we know, that is not necessary to follow strictly just one pricing method, so in this case we will combine the first and third pricing methods from chapter 3.2.4 – Pricing method with addition of individual unit cost and Pricing method oriented on the competitor. Competitive prices used for this decision are given in Table 1, chapter 3.3.4.

Selling price (SP) covers all costs and margin, so it can be expressed as a purchase price (p) with addition of margin (m) - 45% - group A and total labour costs (TLC), sum of these variables gives us a price without VAT, so to determine the final price for the customer, we need to add 21% to reach final selling price.

Formula 8: Pricing formula

$$SP = (p + (m \times p) + TLC) + 21\% \qquad (9)$$

Where: SP is selling price, m is margin, p is purchase price, TLC are total labour costs

We will install our variables from chapters 4.1 and 4.2 into the equation to determine the price. Purchase price average is p = 22.2647 CZK/pcs, from our sensitivity analysis we know, that even though the purchase price is in euro and exchanges rates are changing, these changes are not so important for the product. The product is in group A, profit margin is set on 45%. And from sensitivity analysis – Chapter 4.1 we know, that changes in the TLC are not significant, so we can install our basic TLC used in both analysis (Table 3) – TLC = 0,16. So if we install our variables into determined pricing formula (Formula 8), we get our final selling price.

$$SP = (22.2647 + (45\% \times 22.2647) + 0.016) + 21\%$$

SP = 32.30 CZK without VAT per piece

Final SP = 39.08 CZK per piece

4.3.2 Results and price determination

According to our pricing formula we got our final selling price at 39.08 CZK per piece including VAT, that is 2.06 CZK less than a current selling price in Kamír & Co. spol. s.r.o. The reason why, should be that we did not consider the competitive prices.

Price at 39.08 CZK per piece is based only on costs, but we can combine pricing methods and compare it also to the prices on the market.

If we use pricing method oriented on the competitor, we will compare our price from the pricing formula with other prices on the market. For this purpose, we can use Table 2 from chapter 3.3.4, where we may see current prices of the competitors. Because of our costs we cannot have the lowest range of price, but we also can see, that our price is very competitive on the market, so if we would like to, we can rise our price a bit, to reach better profit and still be very competitive. We can raise the price to 36 CZK per piece without VAT (43.56 CZK per piece including VAT) and we are still in competitive advantage. On the other side, there is a supplier with lower price, but because of the company reputation and the history we can set a higher price and still be preferred by the customers. As well we have a wider range of assortment than the competitor (Pfiff.cz), so even though the price is higher we can be more interesting for the customer, and also be more reliable and run the market.

4.3.3 Profitability

According to the knowledge gained in theoretical and practical part, the gross profit with the new price can be determined. For this purpose, can be used the equation form chapter 4.1.3, Formula 5. We will install into this formula our new price (P) (43.56 CZK per piece) with average purchase price (c = 22.2647 CZK per piece) and the basic sales (Q = 54 908) from Table 3.

P = p x Q – [(c x Q) + (LC x Q)]
P = 43.56 x 54 908 – [(22.2647 x 54 908) + (0.016 x 54 908)]
Net profit = 1 168 514 CZK
P = 753 299 CZK

New expected gross profit with the determined price (43.56 CZK per piece with VAT) is 1 168 514 CZK.

5. Results and discussion

From both analysis flows that the product is not very risky and as well it is not very sensible to changes in changes in labour costs and changes in exchange rate. The main factors determining the product profit are sales volume and selling price. The profit from the product is stable and even during the less favourable economic development the product does not make a loss. From our sensitivity analysis we may see, that slight increase in price can bring relatively high increase in gross profit.

And based on our price mechanism calculations (Chapter 4.3) we also know, that even though we raise the price, we are able to be competitive on the market. So, if we consider these two facts we have a great potential to increase the profit when we increase the selling price.

5.1 Recommendation

Due to the information we know about the competitors, we know (Table1), that it should not be a problem to raise the price, because just one competitor is on lower level of price of the product than is the current selling price in Kamír & Co. spol. s.r.o. now.

The only supplier with lower level of price is Pfiff.cz, we do not have to consider this price as competitive, because even though the price is lower, other prices on the market are similar to our new selling price. Distinctly different, lower price can act less trustworthy and can have a negative impact on the customer. Also one other factor that can convince the customer to buy it at the Kamír & Co. spol. s.r.o. rather than at the competitors, the company has wider range of assortment and can offer more to the customer. Besides that, the company has a long history and good reputation in terms of quality and service, so that also can be marketing move in the company's benefit.

6. Conclusion

As a basis for this thesis we had an assumption that the product used for the calculations inclines to be sensitive to changes in labour and manipulation costs due to the low price and lot of work associated with shipping and storage, as written in the introduction of the thesis (Chapter 1).

But according to the data gathered in practical part of the thesis (Chapter 4) we can assess that the assumptions about the product according to the results of both analysis were wrong. Because the labour costs associated with the product do not burden the product as much as we supposed. According to chapter 4.1, Table 4 and 5, we may see that the relative change in profit for labour costs as input factor is only 0.03% in both cases.

According to the analysis in practical part we cannot say why is it so, probably is it because of the size of the product. The product needs a lot of manipulation and storage, but also we can manipulate large amount of the product at once due to its size and compatibility, so the labour costs are disintegrated and do not burden the product. Also the shipping price from the supplier do not burden the price, because of large amount sold each year, the company has free shipping costs from the supplier. Probably we would get different results of these analysis if the product would be larger with low price, because our labour costs would be higher and the sensitivity of the product would be different. But unfortunately without proper calculation we cannot consider this statement as relevant.

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