

Application of estimation method of customer's satisfaction in enterprise focused on quality

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ABSTRACT

Purpose: A new approach to the requirements of customers and customers strategy in enterprise have been presented.

Design/methodology/approach: The possibility of application the Quality Function Deployment method are connect with better understanding the customer needs.

Findings: At the present time the enterprises should integrate quality management system and strategy of enterprise with customer's requirements. Such kind of activity will enable to achieve success for these companies.

Research limitations/implications: Described quality methods can be employed in companies in the whole product life cycle.

Practical implications: Quality Function Methods is a very important tool. This method should be employed in companies for a new product, production process and customer's needs. Aim of QFD is identification of the affirmative features of product, of the range of interest in product on market and also definition of the method of accomplishments of these aims. The example of implementing QFD shows product design and development technique that compares the fit between customer needs and product features. Usage of this method allow to keep a customer focus, reduction in the product development cycle, increasing customer satisfaction, providing opportunities for cost reduction.

Originality/value: Usage of Quality Function Deployment Method in polish companies have been presented. It helps define what the customer is really looking for in the way of market driven features and benefits.

Keywords: Quality management; Customer's requirements; QFD method

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1. Introduction

A quality of products is nowadays one of basic factors having an influence on results of conducted activity. Requirements on for enterprises by customers with reference to the quality still grow.

Fulfilment of these requirements, and what is directly associated with it maintenance of good economic results is possible through the constant improvement in the quality [1,2].

The quality management system compatible with standard ISO 9001:2008 guarantees the organization stable positions on the market and permanent progress. The quality management system

implemented in the enterprise gives possibilities of development, shaping of new better profile of the enterprise and increasing its competitiveness on the market. According to the quality management system should not treat the quality in categories of surviving, but in categories of development, expansion, success of companies and consequently economies [3,4].

Treating a quality certificate by customers as the requirement at delivering products caused, that enterprises had noticed next benefits of its implementation. New purposes became [5-7]:

- better contacts with suppliers and customers.
- greater confidence from customers
- getting the competing majority, by constant examining satisfaction and monitoring growing requirements of customers.

In this paper main relations between customer and enterprises have been presented. The attention is focused on functioning and improving the enterprise, in which the quality and customer satisfaction the constitute the priority. A need of monitoring and researching level of customer satisfaction and meeting his requirements have been shown, by using the QFD method as the so-called "Voice of the Customer". Various aspects have been discussed on the example enterprise of the engineering industry.

2. The customer's strategy of enterprise

Customer's requirements

Nowadays companies face increasing competition. An increase in the significance of the function of the quality is one of the most important phenomena of our times. Customers can choose from the wide range of products and services. Sellers are forced to deliver products of acceptable quality, otherwise will lose their customers to the competition. Customers make choice on the basis of own perception of quality and values offered them. The value delivered to the customer is a difference between the total value of the product and total costs which he must pay. The customer chooses these offers which maximise the delivered value. On the market this producer will get the majority which listens to the voice of the customer, knows his needs and is able quickly to react, fulfilling or even exceeding customer's expectation [7-10].

Incorporating the customer is significant and essential at every stage of coming into existence and the life of the product. So, necessary is using the opinion of customers at the stage of the product design or of the organization of the service [8].

It is also important in order not to leave the customer on one's own. After cashing the transaction many companies forget about their customers. The quality spiral begins on the customer and on it finishes [11-12].

We can say, that the quality is the most important weapon in the market competition, international trade, is a strategic purpose. It is a good warranty of acquiring the loyalty of the customer. A quality is a notion functioning in many fields of the human activity, includes the quality of the product, the work and the life [8,13].

The qualitative competition is a main deposit in making a profit, as well as a basic condition of staying on the market. Incessantly

one should aspire to the improvement, searching for more effective ways of fulfilling requirements and expectations of consumers. Every money spent on the improvement in the quality of the product, of work and preventing mistakes pays repeatedly, as a result of lowering costs by the producer [8,13-14].

For example, the improvement can resist the quality on so-called 5 R, letting create the effective system of the management [8,13-14].

The 5 R embraces [8,14]:

- Requirements and needs of the customer (*Requirements*).
- Amendment to a way of thinking and proceedings (*Redesigning*).
- Awarding for good results (*Rewarding*).
- The measurement of happening events and their analysis (*Reviewing*).
- Repeating action in aspiring at the intended target (*Repetition*).

Designing the quality management and assurance system one should pay special attention to the customer, should be treated in the priority way. According with standard ISO 9000:2005 one of the eight quality management principles is [15]:

Customer focus

"Organization depend on their customer and therefore should understand current and future customers needs, should meet customers requirements and strive to exceed customer expectations".

The satisfied customer pushes a company to market successes.

All modern enterprises should aspire to keep the customer. Costs of satisfying the present customer are five times lower than costs of recruiting new customers, because offensive marketing is more expensive costlier than defensive marketing [7].

Consciously or unwittingly the customer always asks himself, which determine five quality aspects.

According to the traditional approach a quality is simply „compliance with the specification". Today, the quality demands that the customer is pleased with the reply to the following questions [16-18]:

- *What can I expect, buying the product ?* - the specification of the product or services.
- *Is it what I expected ?* - compliance with functional attribute of the product given by the producer.
- *All the time does he measure up to my expectations ?* - the reliability or the permanent compliance with expectations.
- *How much to pay ?* - i.e. the real value of goods towards the price.
- *When will I get it?* - the fast and punctual delivery, the punctual accomplishment of orders and tasks.

According to N. Kano customers put the product three kinds of requirements (Fig. 1) [8,19]:

- Defined and threshold requirements: customer doesn't change them, these requirements must be fulfilled because are obvious for him; *basic properties*.
- Requirements the type „the more the better": fulfilling them is expected by the customer, these requirements should be clearly formulated in the specification and fulfilled; *optional level*.
- Requirements associated with something unexpected: they have tools for marking trees for distinguishing them from

competing products, the product is perceived as new and innovative. These attributes are positive surprises, they cause the admiration, but with time can happen threshold; *additional equipment*.

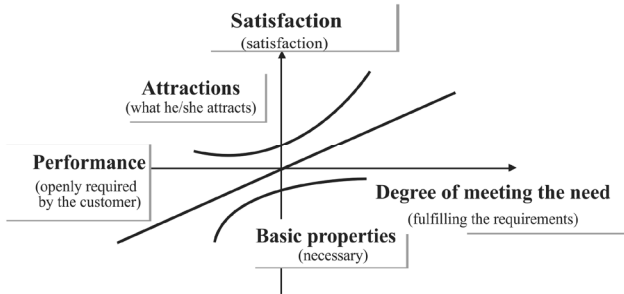


Fig. 1. Model of Kano [8,19]

The customer formulates his requirements before using the product, each customer form a pattern in its own mind [8,15,20].

In order to satisfy existing needs the consumer carries out specific action and the trials associated with the purchase of the product and services. It isn't the one-time act of the purchase, it consists of many phases [21]:

- Making aware of the need.
- Identification of ways of meeting the need.
- Evaluation of the possibility of the product.
- The purchase and price.

The model of proceedings of customers with reference to products has been described in Fig. 2 [20].

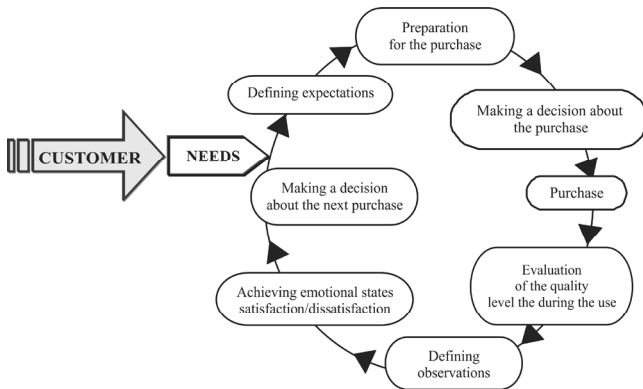


Fig. 2. Model of the conduct of customers with reference to products [20]

Many experts say about fulfilment of the customer needs both now and in the future. One should go out to meet the customer on their way, to predict his needs with a several years advance, in order to in the moment, when the one he will express his wish, it turned out that you had already predicted them and you can fulfil them immediately, before a competition warns you [17,22].

One should understand requirements of the customer as the need to concentrate on what indeed the customer expects, rather than on what a company wants for him to offer [17].

So, meeting requirements of the customer requires listening to it and reacting to what demands and to what will be established.

The comprehensive quality, experienced by the customer consists of many elements (Fig. 3). This quality is an effect of many incentive, bound both with product, services as well as circumstances in which it is provided to the customer [23].

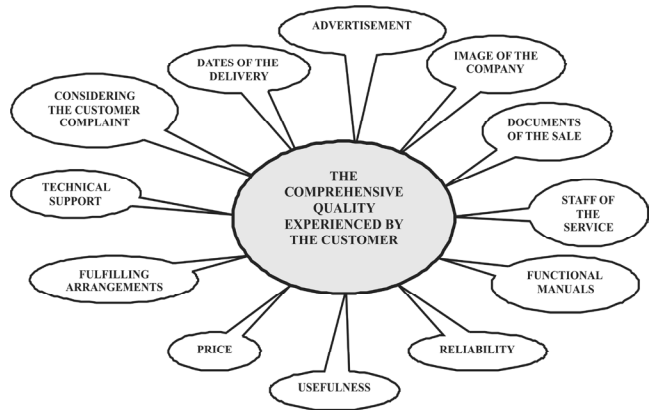


Fig. 3. The comprehensive quality experienced by the customer [23]

“Education” of the customer

The best project or final product is worthless, if the customer doesn't have enough knowledge to judge it's advantages, or when this project doesn't fulfil needs of the customer. Educating the customer plays an important role in the politics of the sale. Educating the customer regarding the following aspects [8,24]:

- One should make sure why the customer wishes himself given product.
- To deliver technical details about the product, to enclose also prospectuses of advertisements.
- To make the customer interested in this particulars data.
- To explain meaning of technical data into the simple, accessible way.
- To pay attention to entered innovations, of improving the product and to explain their meaning.
- To prepare the commercial staff to conversations with customers.
- To answer questions in relation to technical data.

The product which is aimed at ones targets can be worthless or simply dangerous at other also related applications. One should not think that the customer is conscious of differences between products [8,13,24].

The real value of products is included in technical data and in parameters. Sometimes it is hard for a customer to obtain technical data. Therefore we often encounter the phenomenon, in which products backed up with the advertisement take control of the market, while other products better and cheaper are not interesting because customer doesn't know their advantages [24,25].

Ways of gathering information from customers, market and marketing examination.

The deciding influence on managing the satisfaction of customers has a way in which measurements of satisfaction consumers are conducted. A reliability of the collected information is significant. Above all one should come up to examinations in the subjective way, in harmony with the specificity of the company [8,26,27].

In the modern marketing concept of business administration of the company a system of the marketing information serves improving the operations of enterprise (Table 1). This system lets prevent appearance of problems or in time solve them [8,10].

It is structure in frames which is possible for [10]: establishing what information is needed for making a decision, gathering the information, data processing, storing and comparing the used information.

The information about requirements and expectations of consumers gets through to the quality manager by two roads: through market researches which are carried out for the purposes of the quality management, analysis of the stream of quality customer complaints. They both refer to product after sales [8,22,28].

In accordance with customer's strategy the scheme of planning market researches consists of the following stages [29]:

- Analysis and determining the research problem.
- Selection of the trial for examinations.
- Choice of forms of the measurement.
- Choice about methods of the data analysis.
- Planning the examination and determining costs.
- Determining values of the information obtained from the examination.

Drawing up research proposals.
Three basic types of measurements are distinguished in the area of client examinations [19,29]:

- primitive - sounding;
- secondary - based on secondary sources;
- in the form of experiment - based on primitive sources.

We distinguish two groups of measuring instruments applied in market researches [19,22]:

- natural measuring instruments: senses,
- artificial measuring instruments: conventional, mechanical.

Methods and techniques of collecting data concerning customers are [10,35]:

Secondary sources

1. Secondary examinations:

- internal data: reports of the sale, invoices, balances, accounts of costs and the performance;
- outside data: government reports, statistical reports, publications, encyclopaedias.

Primal sources

1. Indirect examinations:

- questionnaire forms: postal, press, telephone, radio, television, computer, packaging, lecture, general, direct;
- heuristic methods: brainstorming, delphic method, method of assessments of experts;
- other indirect soundings: telephone interview.

2. Direct examinations:

- interview: direct (personal), depth, focussed, group;
- projection methods: test of word associations, supplements to sentences, drawing, of acceptance of product, acceptance of the price, economic situation;
- observation: direct, indirect, open, concealed, participating, not participating;
- other direct soundings: physiological measurements, the tasting and evaluations of samples, the registration and the list (containers).

3. Experiment:

- laboratory: lecture test,
- field: market test standard, market test controlled;
- methods of the simulation: manual, computer, mix up.

Table 1.

The example of information get in marketing researches [29]

USERS	TYPES OF THE INFORMATION
Sales department Sale	Accessing new competitors to the market
	Amendments to competing products
	Profits from the sale and sizes of the market
	New effects of the competition
Division of the production	Amendments to local economies
	Action of consumers
	Amendments to the technology
Division of the promotion	Activity of the government (legislation)
	Effectiveness of the own promotion
	Promotional concepts of competitors
	Effective using mass media
	Legal aspects of the promotion
Director to cases of marketing	Commercial and popular publications
	New products of the competition
	Amendments on markets
	Characteristics of new competitors

The customer's satisfaction

Satisfaction of the customer is a mental state, emotions expressing satisfaction or displeasure at the product or services chosen by him. When the product accomplishes his expectation him he is pleased, however when disappoints them is dissatisfied. Satisfaction of the customer can be gradable, can be satisfied only to some extent or from certain tools for marking trees for cutting of the mark, whereas dissatisfied from other. This mental state affects decisions during another purchase of the product. Therefore marketing and customer's strategy of enterprise dedicates a lot of attention to diagnosis and strengthening satisfaction of the customer [17,19,22].

The customer formulates his requirements before using the product, using his personal pattern. While having right of usage he compares his observations with expectations and one of three levels attains pleasures [20].

So satisfaction of the customer arises from being up to his standard or exceeding them. Ideas of the product are an effect of the advertisement as well as the information which the consumer receives from other users e.g. of relatives and acquaintances, and sellers [7].

And so, the customer's satisfaction depends on [21]:

- Expectations towards the mark.
- Quality of the product.
- The price and conditions of the purchase (e.g. competence and the politeness of the seller, availability of the product in the shop, information about the product available in the place of the purchase).

A very direct relation between satisfying customers and their loyalty appears. If the consumer is satisfied, it is probable, that will buy the product again and will make it constantly. Loyalty of customers becomes stale be also from the number of marks on the market. The lower loyalty appears when the number of marks grows. However satisfying the customer doesn't settle about the loyalty to the mark, but only supports it. To the connection between the loyalty and satisfying the consumer the following factors affect [7]:

- Type of the product.
- Price.
- Frequency of the purchase.
- Individual and situational factors.

According to research findings conducted by the American Civil Service as part of the Technical Assistance Survey program [20]:

- The 4% of the customers dissatisfied with the product only about the low price files complaints.
- 65-90% customers never again will purchase the product of the given company and will notify ten other persons on average of his dissatisfaction.
- Two thirds of reasons letting identify for leaving the mark by the customer isn't associated with very product, but from his use.
- One third of cases of dissatisfaction is associated with the product, two thirds whereas with mistakes committed in the trial of the communication with the customer.
- In five cases on six the customer changes the supplier, since is dissatisfied with the quality of the service, rather than from very product.

Studying the satisfaction of the customer according to W. Schneider fulfils three posts firmly connected with oneself in the operations of the enterprise [5]:

1. *The repair function* - its aim is removing single cases. This function searches for individual cases of dissatisfaction towards the product and the mark and tries to change these opinions of these consumers towards the enterprise or these of services; The repair function uses such treatments as: a cut in price, the exchange, repair, compensations, the return of money and advisory services, presents, nursemaids as well as the apology of the customer;
2. *The function of teaching* - its aim is exquisitely of repair material. This function acts according to the base of the learning on mistakes; one should improve the productivity of the enterprise so that a lack of the satisfaction of consumers doesn't appear; this action requires unabridged documentation, analysis and discussing negative situations;

3. *The function of incentives* - its aim is due managing the staff; if somebody argues that higher satisfying the customer will bring significant economic benefits to the enterprise, must let employees for participating in the success of the company, on the base of shared good relations.

One should point out that there are no excellent methods of the measurement of the satisfaction of the customer. Every measurement is burdened with the mistake, because it is hard to measure emotional reactions of the man. Enterprises usually apply the unit of methods of the measurement of the satisfaction of the customer, their choice depends on the specificity of the enterprise. Best is to use few methods of measurement customer's satisfaction mutually complementary. Each of methods provides satisfaction with other information about customers and their step of fulfilments of requirements [5,30].

Ken Cusack (Director Sorbus UK) which company took back huge success in the computer service centre, doesn't let tell about "satisfaction" of the customer in the company: „our purpose is setting the customer into the admiration, rather than only a satisfaction". These proceedings are compatible with the Deming's statement: „won't be enough customers only to be satisfied" - claims - "the dissatisfied customer will go to other company. The satisfied customer of these unfortunately can go somewhere else according to base, that little loses, and can make a profit. In businesses regular customers provide with profits, so which praise your products and services, and which bring one's friends" [17].

3. Quality Function Deployment method (QFD) - "Voice of the Customer"

Analysis is well-known to QFD for 20 years. It is ranked among determined tools of Quality - Engineering - Tools. QFD is applied above all in the initial stage of coming into existence of the product or the service [13].

This method transfers requirements of the customer on technical specification of the product (characteristics or attributes) that is establishing the determinants fitting of product to needs of the customer [19,32].

This method is often called „House of Quality" because the graphic representation of this method resembles structures of the house. The Japanese name sounds *Hin Shitsu* (Quality) *Ki No* (Function) *Ten Kai* (Deployment) [13,19,31-32].

This method is particularly useful at the stage of designing the system including the expression of required materials and components and technology. QFD can also be used to existing products, in order to determine their weak points, which require structural amendments, in order to satisfy needs of the customer [19,32].

On account of poor spreading in Poland it doesn't have explicit translation of QFD name. The following names appear in literature [31]:

- Fitting of the Quality Function.
- The Expansion of a Function of the Quality.
- Controlled designing by the Customer.
- House of the Quality.

This method underlines how collecting and analysis of information about needs of customers are significant for the entire manufacturing trial and how is important on the stage taking them into account already and how important is developmental works. For them later the enterprise will become interested in a problem of the quality, with it will incur material and social expensiveness for providing for enterprise. In the area of QFD method contain [14,19,31-33]:

- Inspecting the market.
- Developmental examinations.
- Invention.
- Designing new concepts.
- Testing prototypes.
- Testing the final product.
- Service after the sale.

A main factor to the development of the QFD method was realizing that the customers decide of financial position of companies. The QFD method allows to solve the problem appearing in case of serial production or the mass-production, when enterprises have a small possibility to a direct contact with the customer and what's more if products are more and more advanced technologically, more over satisfy a lot of needs simultaneously. Examining the needs of the recipient becomes more and more complicated and requires the knowledge and qualifications of many persons [9,19,32].

According to American Supplier Institute definition of QFD sounds [31]:

“QFD is a system for transferring requirements of the customer into right requirements of the enterprise at every stage, starting from examinations and the development through the design and the production, until marketing, the sale and distribution. It consists defining stamps of the product in their interrelationship and guaranteeing so that these guildhalls are included at multistage developmental works, in trials of productions and finally in the product.”

However Danish Technological Institute gives so definitions [31]:

„QFD is a tool - system which involves all functions of the enterprise applied in order to assure, through all phases of the development of the production from the idea after the supplier requirements of the customer will be met”.

A point departure of QFD is so-called „voice of the customer” (opinion) or inspected product, final product. The trademark is main concentration on needs of the market. One should set values perceived by the customer, to establish technical parameters of the product (and of his units), and parameters of trials constructing for producing it, and in case of the service to design it in line with expectations of the consumer. However QFD is a tool which doesn't rule out applying known and already tested solutions [3,19,31].

Conducting full QFD proceedings is a very labour-intensive task. Ruthlessly it requires the team work. Into the team work should access chosen persons of all divisions of enterprise. In order to avoid using too much subjectivism, in assigning evaluations to requirements, one should use right quality tools especially from „new quality tools” and all standard tools: Pareto analysis, diagram of Ishikawa, as well as from such quality methods like analysis of the value, studying the opinion and the like [6].

A purpose of the QFD team work is determining needs of the market and translating them are in the way understood to language of organizational aims being active in an enterprise. A close and tying cooperation together in the team work must exist, in particular between chosen persons representing: operating function; design; marketing [14,19,31-33].

The QFD team work has the task of finding and analysing replies to the following questions [14,19,31-33]:

- „who?” - one should identify who is a customer;
- „what?” - one should identify needs of the customer, they make it with interviews with the customer, questionnaire forms, questionnaire forms or based on the knowledge, experience or the judgement of team members;
- „as?” - one should interleave requiring the customer to tools for marking trees for cutting of the product with in order to learn how we can best accomplish expecting them. The reply must consider a lot of product's attributes which should proper characterize it.

The functioning of the QFD team work is based on the following principles [31]:

- One should seek new answers being aware of the criticism and making an appraisal.
- One should ensure the possibility of free shaping ideas.
- Before setting about acting one should at first understand.
- One should accept critical comments attentively into the positive way.

Thanks to the QFD method we can obtain the information constituting a point of departure at the realization of other useful solutions sure about trials and proceedings with which they provide in the QFD trial.

It is possible to present concepts to QFD total with the outline presented in Figure 4 [14,19,31-33].

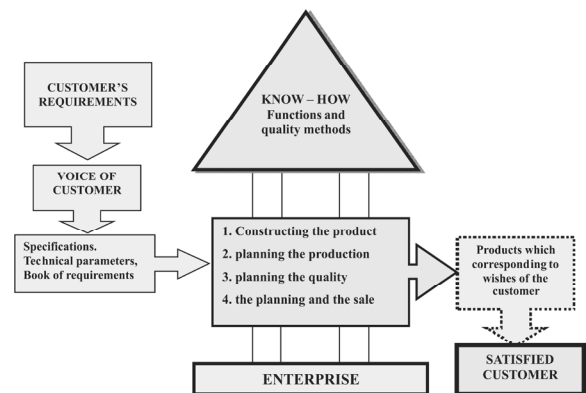


Fig. 4. QFD - total concept [19]

QFD analysis has a very wide application. This quality method can be used in [8,14,31-33]:

- for the preparation, constructing and starting production of new products;
- clear determining trials applied at the stage of the design;
- for preventing the bad quality of the product;
- for solving conflicts concerning adopted purposes;
- the improvement in the productivity and the increase in the quality of the product and the competitiveness on the market;

- better using strong points of the enterprise and spotting and restricting weak points;
- better planning costs and the quality;
- for reducing problems resulting from the bad transport inside the enterprise;
- for noticing advantages of products offered on the market by other competitive companies;
- reducing problems in relation to the coordination of tasks (departments, modules, elements).

QFD method appears in different industries existing on the market. For example analysis the ones it is possible to apply [8,14,19,31-33]:

- at preparing different services at banks and the Health Service;
- in drawing new computer systems up both in the equipment as well as the software;
- at drawing up new techniques of the medium of the information;
- in the pharmaceutical industry when drawing new substance up is necessary;
- in the car industry when entering new parts, elements, products is necessary;
- in the building industry;
- in the trade and the commodity broking at seeking innovative products;
- in the education system;
- by advisers within the scope of the improvement in organizational structures in the enterprise;
- in the food industry at the production of new products.

House of the Quality - construction and the way of creating

QFD analysis is most often carried out in four stages (Fig. 5) [33]:

1. It relies on the transformation of requirements of the customer to requirements of the project, technical requirements, characteristics of the product. *This is so-called planning the product.*
2. Transferring requirements of the plan for characteristics of an elements, of individual retails. *This is so-called phase of developing the project.*
3. Transferring characteristics of sub-assemblies into basic parameters of the production process and the research process. *This is phase of planning the process.*
4. Transferring the operation date tools into production specifications, specific operating instructions, instructions of examinations and proceedings. *This so-called planning the production.*

Before building the quality house we should get the information about the market. The next step - define groups of customers at which we direct the product (age structure, sex, purchasing power, mentality). To get the right information to the subject: of market, groups of purchasers, degree of the market saturation with given product, of requirements of a sales department, competition, pointers originating from salesmen [31].

The QFD diagram contains specially defined fields. Their number depends on character of the complexity of the objective and from the destination he has which to be achieved with the house of the quality [19,31-33].

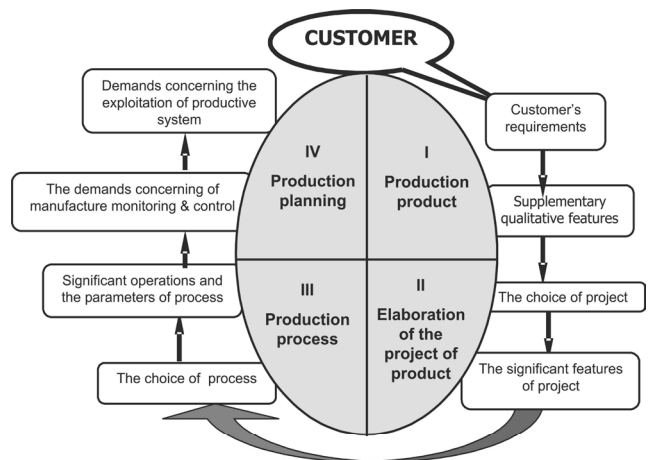


Fig. 5. Implementing of customer's voice in company [33]

Among them we can distinguish [8,14,19,31-33]:

I. Requirement of the customer.

Here needs and expectations of the customer are put (replies to questions what?). This information comes from market researches, enrolls them with non-technical language, notions used by recipients are applied. All requirements are used even if are general or difficult for the transposition to physical parameters of the product. Depending on the product or the service and the effectiveness of the research technique the number of requirements takes out from several dozen to even 100.

II. Evaluation of the importance of requirements of the consumer.

The requirements we should divide on account of the importance of their attributes, because not all have the same meaning for the consumer. A scale is most often applicable from 1 to 10 (from unimportant to very important).

III. Technical parameters of the product.

These parameters are characteristic of a product from the point of view of the designer. They must be so well-matched in order to how best requirements of the customer fulfilled the requirements (expressed in his language), parameters should be measurable and real for getting in the production process. Designers and technologists fill this field up, using the appropriate technical terminology. They assign to every requiring the customer one or more technical attribute of the product.

IV. Determining the relation between technical parameters and requirements of the customer.

Filling this part up requires the significant commitment on the part of analysts and is very time-consuming. The relation between requirements and technical parameters settles on the basis of functional analysis, experience, analysis of the customer complaint, product given to the history of repairs. The proper scales is acceptable with symbols or figures or value. We distinguish: strong interacting (determined e.g. 9 or with defined symbol), average influence (3 or defined symbol), poor interacting (1 or defined symbol). This scale is individual choice of the designer.

V. Quality purposes, measurable values and their tolerance.

Measurable values are assigned to individual technical parameters. As far as possible one should establish accurate data concerning these values (e.g. the maximum fluctuation of the temperature).

VI. Optimization of technological attributes.

VII. Technical problems.

One should examine possibilities of cashing folded properties of the product.

VIII. Identification of influences between technical parameters.

Occurring relations between parameters can be inventoried with graphic or specific symbol values.

IX. Evaluation of the situation on the market from a point of view of the customer.

Before purchasing the potential customer often compares offered products through competition. One should so get on up to the attention: meaning of the requirement and implementations towards the products present at the market. The right needed information can come from conducted expert opinions or directly from a sales department or theses from the service. We use a marking scale here for example from 1 to 5 (1 - of the evil, 3 - average, 5 - of the good).

X. Technical Meaning.

Establishing technical meaning takes place on the basis of calculating of technical parameters. The result puts its name down in the space absolute value.

XI. Evaluation of the technical competitiveness.

We compare individual target parameters of our product, with the same parameters of the competing product from the same industry on the market. This comparison is important for designers, because displays the place of the product in the picture. Data included in this field can serve the division of marketing in drawing the strategy up of promotion of the product. Data should come from inspections of competing products with regard to the own product. One should take into account target values of parameters, as well as requiring customers. The scale looks as follows: 1 - bad condition, 3 - average state, 5 - good state.

XII. Significance of the service.

If to the success of the product a service enjoys considerable influence, then one should judge and take note of its meaning and the role.

XIII. Chosen characteristics, special attributes.

In the last step we should choose and mark quality characteristics which should farther be considered in QFD analysis. Characteristics of not having bigger meaning for the product not have to be included in further QFD analysis.

Benefits from application QFD method in enterprises

Conducting the QFD process is a task very time-consuming, requiring the work of many people, however in the end very profitable what many advantages of this method affect. We rank among basic benefits [8,14,19,31-33]:

- satisfaction of the customer - the satisfied customer will most probably purchase the product one more time;
- increase in the quality, permanent improvement in the quality of the product;
- more effective planning costs of the quality;
- increase in the productivity even by the 200%;
- creating the uniform organizational structure;
- transforming requirements of the customer into specific requirements scientifically - developmental in the enterprise;
- flow of information about requirements, expectations of the customer through the entire structure of company;

- lower costs of starting production;
- getting to know the own advantages and defects towards other competitive companies;
- possibility of using at strategic planning the production;
- systematic collecting the knowledge, useful for the accomplishment of next design tasks;
- reduction in the time of releasing the product on the market even about the 33%;
- smaller amount of structural amendments and these entered into productions process;
- structural amendments are effected earlier still before beginning the production;
- shortening the time of lasting the cycle of the development of the final product;
- placing the control according to the schedule of works;
- initiating team works amongst different employees of divisions in the company;
- breaking barriers between divisions;
- possibility of predicting the level of meeting expectations of the customer;
- increasing the potential of the company in the full realization of requirements;
- removing many costs and losses of the time;
- taking the right decisions in the support about assembled knowledge.

4. Analysis of customer's satisfaction in the chosen polish enterprise

This company is an ownership of the Italian family, specializes in sub-assemblies production for the automotive industry and home appliances. The enterprise has been presented in Poland since 1997. Components produced in it for the automotive industry are exported almost in the 80% to Italy, about 7% is sold in Poland. Main are their recipients including but not limited to: Fiat, the Toyota, the Mercedes, the BMW and Renault. 42% of sub-assemblies for home appliances a German comes the market across, 32% to hair, but the 21% on Polish.

The aim of defining the algorithm of the process of examination the customer's satisfaction and applying the QFD method in the chosen organization have been pay attention for "Customer's Voice". Understanding customer's needs provide to fulfilments his expectations, and what is combined with it of rise in profits of the enterprise, in this case the chosen X enterprise of engineering industry.

Process of examination of satisfaction of the customer in the chosen X enterprise

Chief customers taken into consideration at the evaluation of satisfaction are chosen on the basis of two factors: creating 80% of turns of the enterprise (in the decreasing order); customers having a ppm indicator, that is so, of which defective parts are returned to analysis through quality checks of supplies or the assembly: ppm = (amount of defective pieces /amount of sent pieces) * million. Input data needed for the completion of the

process of examination of the customer's satisfaction: customer complaints, returns, reports of meetings, visits of customers. praise.

In the X enterprise it is possible to describe the general process of examination of the customer's satisfaction with the algorithm (Fig. 6).

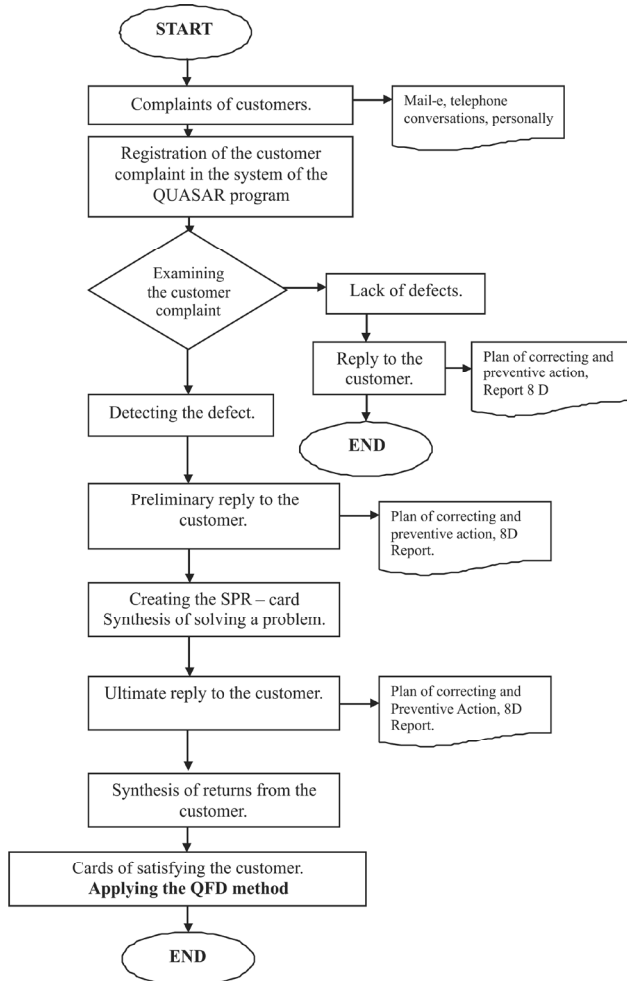


Fig. 6. Algorithm of research of customer's satisfaction

Construction of the house of the quality (QFD) in the enterprise of the X engineering industry

The house of the quality was drawn up for the rotational commutator produced by mentioned above company. This commutator is produced for the ELDOM sector. It is applied in washing machines, dishwashers, electric stoves, etc. The stages of creating Quality House are the following:

I. THE CUSTOMER'S REQUIREMENTS.

„The voice of the customer” i.e. requirements in relation to the product bequeathed to „language” of the customer (Table 2). This data it: customer complaints; returns; reports of meetings; visits of customers; praise; mails, phones, faxes to customers.

Table 2.

Requirements of the customer

Preserving appropriate dimensions
Appropriate angles of rotation
Appropriate electric characteristics
Efficient connector
Reliability
Low costs
Good material

II. EVALUATION OF THE IMPORTANCE OF REQUIREMENTS OF THE CONSUMER.

The requirements was assigned scale of their importance. They applied following scales (maximum 10 points), where:

- 10 - very substantial requirements
- 1 - of requiring very little essential

III. TECHNICAL PARAMETERS.

The technical parameters were drawn up at the cooperation of technologists, so that determined technical attributes of products allow to meet demanded requirements (Table 3).

Table 3.

Technical parameters

Axial symmetry of the shaft the commutator
Switching force
Value of the resistance
Correct gauge of pins
Damage trial
Domestic materials (price)
Math. Non-inflammable, self-distinguish

IV. DETERMINING THE RELATION BETWEEN TECHNICAL PARAMETERS AND REQUIREMENTS OF THE CUSTOMER.

It was drawn up on the basis of analysis of the customer complaint, of history of repairs of the product. They saw patients following scales :

- 9 - strong interacting
- 3 - average influence
- 1 - poor interacting
- 0 - lacks interacting

V. OBJECTIVE QUALITY AIMS, MEASURABLE VALUES AND THEIR TOLERANCE.

Measurable values of technical stamps were determined. They are well-matched in the way enabling to reach them in the trial of the production (Table 4).

Table 4.

Determining target parameters for technical attributes

Axial symmetry of the shaft the commutator	
Switching force	5 N
Value of the resistance	Sum of the resistance
Correct gauge of pins	Symmetrical, in one plain
Damage trial	5000 cycles
Domestic materials (price)	
Math. Non-inflammable, self-distinguish	Pa66 polyamide

VI. SHOWING DIRECTION OF OPTIMIZATION OF TECHNICAL ATTRIBUTES OF THE PRODUCT.

VII. TECHNICAL DIFFICULTIES.

Scales were accepted spot from 1 to 10 where (Table 5):

1 - straight lines for the accomplishment

10 - very difficult for the accomplishment

Table 5.

Mechanical problems

Mechanical problems	4	3	1	3	5	1	3
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VIII. IDENTIFICATION OF INFLUENCES BETWEEN TECHNICAL PARAMETERS.

In order to indicate appearing influences between individual technical parameters a scale was taken from - 2 to +2 where:

-2 = very negative correlation

-1 = negative correlation to a little extent

0 = lack of influences

+1 = positive correlation to a little extent

+2 = very positive correlation

IX. EVALUATION OF THE SITUATION ON THE MARKET FROM A POINT OF VIEW OF THE CUSTOMER.

The information comes from a sales department, mass media, service division. We take into consideration meaning of very requirement and his realization towards products competing, existing on the market.

X. TECHNICAL MEANING.

Establishing technical meaning takes place on the basis of calculating rates importance of technical parameters. The result puts its name down in the space absolute value. However the relative value is appointed in %. Taking the sum of the absolute value as the 100% (Tables 6-12).

Table 6.

Enumerating absolute values of the sum for the technical attributes: axial symmetry of the roller of the commutator

Of requiring the customer	Evaluation meaning	Value of links between requirements and technical attributes	Indirect sum
Preserving appropriate dimensions	10	9	90
Appropriate angles of rotation	8	3	24
Appropriate electric characteristics	9	0	0
Efficient connector	8	0	0
Reliability	9	3	27
Low costs	4	0	0
Good material	7	0	0
		Sum	141

Table 7.

Enumerating absolute values of the sum for the technical attributes: power of switching

Of requiring the customer	Evaluation meaning	Value of links between requirements and technical attributes	Indirect sum
Preserving appropriate dimensions	10	1	10
Appropriate angles of rotation	8	1	8
Appropriate electric characteristics	9	0	0
Efficient connector	8	0	0
Reliability	9	3	27
Low costs	4	0	0
Good material	7	9	63
		Sum	108

Table 8.

Enumerating absolute values of the sum for the technical attributes: value of the resistance

Of requiring the customer	Evaluation meaning	Value of links between requirements and technical attributes	Indirect sum
Preserving appropriate dimensions	10	0	0
Appropriate angles of rotation	8	0	0
Appropriate electric characteristics	9	9	81
Efficient connector	8	1	8
Reliability	9	3	27
Low costs	4	0	0
Good material	7	0	0
		Sum	116

Table 9.
Enumerating absolute values of the sum for the technical attributes: right gauge of pins

Of requiring the customer	Evaluation meaning	Value of links between requirements and technical attributes	Indirect sum
Preserving appropriate dimensions	10	9	90
Appropriate angles of rotation	8	0	0
Appropriate electric characteristics	9	1	9
Efficient connector	8	9	72
Reliability	9	3	27
Low costs	4	0	0
Good material	7	0	0
		Sum	198

Table 10.
Enumerating absolute values of the sum for the technical attributes: attempt to live

Of requiring the customer	Evaluation meaning	Value of links between requirements and technical attributes	Indirect sum
Preserving appropriate dimensions	10	0	10
Appropriate angles of rotation	8	3	24
Appropriate electric characteristics	9	3	27
Efficient connector	8	3	24
Reliability	9	3	27
Low costs	4	0	0
Good material	7	0	0
		Sum	112

Table 11.
Enumerating absolute values of the sum for the technical attributes: domestic materials (price)

Of requiring the customer	Evaluation meaning	Value of links between requirements and technical attributes	Indirect sum
Preserving appropriate dimensions	10	0	0
Appropriate angles of rotation	8	0	0
Appropriate electric characteristics	9	0	0
Efficient connector	8	1	8
Reliability	9	3	27
Low costs	4	9	36
Good material	7	9	63
		Sum	134

Table 12.
Enumerating absolute values of the sum for the technical attributes: non-inflammable, self-stalling material

Of requiring the customer	Evaluation meaning	Value of links between requirements and technical attributes	Indirect sum
Preserving appropriate dimensions	10	0	0
Appropriate angles of rotation	8	0	0
Appropriate electric characteristics	9	0	0
Efficient connector	8	3	24
Reliability	9	3	27
Low costs	4	9	36
Good material	7	9	63
		Sum	150

Table 13.
Enumerating the technical significance

Technical meaning	ruthless	141	108	116	198	112	134	150	Sum 959
	relative	14.7	11.3	12.1	20.6	11.7	14	15.6	100%

Sum of the line: technical ruthless meaning takes out 959 what is equivalent values of the 100%. On this base it is possible to appoint technical meaning in interests (Table 13).

XI. EVALUATION OF THE TECHNICAL COMPETITIVENESS.

Target parameters of our product were compared with the same parameters of the competing product. This date become from inspections of competing products with regard to the own product. They used a marking scale from 1 to 5, where:

- 1 - bad condition
- 3 - average state
- 5 - good state

The X industry was denoted \blacklozenge , competing company \square (Table 14).

Table 14.
Competitiveness in the technical scope

Competitiveness in the technical scope	5	\blacklozenge	\blacklozenge	\blacklozenge	\blacklozenge	\square	\blacklozenge
	4	\square	\square	\square	\square	\square	\square
	3				\blacklozenge		\square
	2					\blacklozenge	
	1						

XII. CHOSEN CHARACTERISTICS AND SPECIAL TECHNICAL ATTRIBUTES.

Quality characteristics which should still be considered as part of QFD analysis were chosen.

The last step it is presenting the elaborated House of the Quality (Figure 7).

5. Summary

At increasingly developing markets and international competition, it is more and more difficulty to reach the customer.

Wanting to know the step by satisfaction of customers by offered products, it is necessary to ask them about it, to collect the right information. It is also essential in their application, taking correct conclusions and repairing mistakes.

Studying the satisfaction of the customer isn't still popular in Polish enterprises.

In this respect on the Polish market many organizations conduct action, but these are usually foreign companies, well realizing meaning one should put which for satisfying the customer.

In the analysed enterprise applying the method of Quality Function Deployment, which lets for converting expectations of the customer into technical requirements and establishing priorities in the support, were proposed about benchmarking and other tools. Thanks to these examinations effectively they can rectify their mistakes, to get the confidence and loyalty of customers, and hence to increase one's share on the market.

Such action should be an inspiration for every enterprise, because it is a basic condition for being a successful enterprise and stay at the competing market.

Each organization must value the importance of that measurement and in long perspective try to work out its own tools and methods of the measurement of customer's satisfaction.

However, before the organizations acquire such capital of knowledge, they have to use existing methods such as QFD (Quality Function Deployment) or CRM (Customer Relationship Management), or different methods which allow improve customer's strategy in enterprise.

The organization's task is to form the strategies of the definitions of the customers priorities and the measurement of their satisfaction based on the quality criterion. This form of activity is connected with designing and manufacturing of product, which marks corresponding optimum level of quality determined by customers.

Relations between the quality management systems and customers reflects the model of process-based quality managements systems.

According to ISO 9000:2000 organizations rely on customers. Therefore: organizations must understand customer's needs, Organizations must meet customer requirements, Organizations must exceed customer expectations.

Improving each element of the proquality strategies in organization, it is worth to mention the words of E. W. Deming [18]: "Each organization has its own client. If someone does not know who the customer is, what his expectations are, the one does not understand own work".

Direction of the optimization • ↑ ↓		Technical characterization							Significance of the service	Evaluation by the customer						
		Evaluation, meaning	Axial symmetry of shaft the commutator	Switching force	Value of the resistance	Correct gauge of pins	Damage trial	Domestic materials (price)		Math. Non-inflammable, self-distinguish	Bad		Good			
The customer's requirements		10	9	1	0	9	0	0	0							
Preserving appropriate dimensions		8	3	1	0	0	3	0	0						□	
Appropriate angles of rotation		9	0	0	9	1	3	0	0						□	
Appropriate electric characteristics		8	0	0	1	9	3	1	3						□	
Efficient connector		9	3	3	3	3	3	3	3						□	
Reliability		4	0	0	0	0	0	9	9						◆	
Low costs		7	0	9	0	0	0	9	9						□	
Good material				3	1	3	5	1	3						◆	
Mechanical problems										1	2	3	4	5		
Objective quality aims				5 N	Sum of the resistance	Symmetrical plane	5000 cycles		Pa66 polyamide							
Competitiveness in technical scope		5	◆	◆	◆	◆	□		◆							
		4	□	□	□	□										
		3							□							
		2							◆							
		1								◆						
Technical meaning	ruthless		141	108	116	198	112	134	150	The Sum: 959						
	relative		14,7	11,3	12,1	20,6	11,7	14	15,6	100%						

Fig. 7. The House of Quality for Switch produced in X enterprise

References

- [1] S. Tkaczyk, M. Dudek, Quality continuous improvement of production process in aspect of usage quality researches and estimation methods, Proceedings of the 11th Scientific International Conference "Achievements in Mechanical and Materials Engineering", AMME'2002, Gliwice-Zakopane, 2002, 567-570.
- [2] I.J. Chen, R.L. Coccari, K.A. Paetsch, A. Paul, Quality managers and the successful management of quality: an insight, *Quality Management Journal* 7/2 (2000) 46-52.
- [3] M. Dudek-Burlikowska, Aspects of improving the organization directed to the quality, *Archives of Materials Science and Engineering* 43/2 (2010), 101-108.
- [4] H. Bieniok, Basic rule of company management, AE, Katowice, 2003 (in Polish).
- [5] L. Nieżurowski, A. Kobyłański, B. Pawłowska, The measurement of the satisfaction of customers and its meaning for enterprises - research problems, *Quality Problems* (2003) 8-11.
- [6] R. Nowosielski, A. Kania, M. Spilka, Integrated recycling technology as a candidate for best available techniques, *Archives of Materials Science and Engineering* 32/1 (2008) 49-52.
- [7] P. Kotler, Marketing. Analysis, the planning, implementing and the control, Gebethner & Ska, Warsaw, 1994 (in Polish).
- [8] E. Skrzypek, Quality and efficiency, UMCS, Lublin, 2000 (in Polish).
- [9] M. Dudek-Burlikowska, Using of quality function deployment as a factor of improving of quality management system in university focus on student, Proceedings of the Scientific International Conference „Quality of life” UMCS, Lublin, 2007, 11-18 (in Polish).
- [10] Z. Kędzior, K. Karcz, Market researches in practice, PWE, Warsaw, 1996 (in Polish).
- [11] T. Karkoszka, D. Szewieczek, Risk of the processes in the aspect of quality, natural environment and occupational safety, *Journal of Achievements in Materials and Manufacturing Engineering* 20 (2006) 539-542.
- [12] M. Roszak, Chosen aspects of evaluation of productive processes on the example of productive chains of gear, *Journal of Achievements in Materials and Manufacturing Engineering* 14 (2006) 184-189.
- [13] A. Tabor, A. Zając, M. Rączka, Quality Management, Volume II, Cracow, 2000 (in Polish).
- [14] A. Hamrol, W. Mantura, Quality Management. Theory and practice, PWN, Warsaw, 2005 (in Polish).
- [15] Standard EN ISO 9000:2005, Quality management system - Fundamentals and vocabulary.
- [16] S. Tkaczyk, M. Dudek, Methodology research of quality in industry, Proceedings of the 7th Scientific International Conference "Achievements in Mechanical and Materials Engineering" AMME'1998, Gliwice-Zakopane 1998, 513-516 (in Polish).
- [17] J. Bank, Total Quality Management, Gebethner & Ska, Warsaw, 1996 (in Polish).
- [18] E.W. Deming, Quality, productivity and competitive position, University of Cambridge, 1982.
- [19] A. Hamrol, Quality management. Science and practice, PWN, Warsaw-Poznań, 1998 (in Polish).
- [20] W. Prussak, Quality Management - Chosen elements, Poznań, 2003 (in Polish).
- [21] L. Garbarski, Marketing, PWE, Warsaw, 1995 (in Polish).
- [22] M. Dudek-Burlikowska, Quality research methods as a factor of improvement of preproduction sphere, *Journal of Achievements in Materials and Manufacturing Engineering* 18 (2006) 435-438.
- [23] L. Wasilewski, Bases of quality management, PWN, Warsaw, 2002 (in Polish).
- [24] H. Drummond, In pursuit of the quality. Total Quality Management, ABC, Warsaw, 1998 (in Polish).
- [25] B. Krupińska, D. Szewieczek, L.A. Dobrzański, Improvement of technological processes by the use of technological efficiency analysis, *Archives of Materials Science and Engineering* 28/12 (2007) 751-756.
- [26] J. Michalska, D. Szewieczek, The improvement of the quality management by the activity-based costing, *Journal of Achievements in Materials and Manufacturing Engineering* 21/1 (2007) 91-94.
- [27] M. Dudek, D. Szewieczek, Usage of quality methods: Failure Mode and Effect Analysis (FMEA) and Statistical Process Control (SPC) as a element of continuous improvement of production process, Proceedings of the 12th International Scientific Conference "Achievements in Mechanical and Materials Engineering" AMME'2003, Gliwice-Zakopane, 2003, 317-321.
- [28] K. Mijanovic, J. Kopac, Environmental management inside production systems, *Journal of Materials Processing Technology* 162-163 (2005) 759-765.
- [29] S. Kaczmarczyk, Market researches. Methods and techniques, PWE, Warsaw, 2003 (in Polish).
- [30] J. Łańcucki, Quality management in the enterprise, TNOIK, Bydgoszcz, 1997 (in Polish).
- [31] K. Czauderna, QFD - Quality Function Deployment. Practical of quality management, Alfawela, Warsaw, 1999 (in Polish).
- [32] S. Tkaczyk, M. Dudek, Usage of QFD - Quality Function Deployment in polish metallurgical industry, Proceedings of the 10th International Scientific Conference "Achievements in Mechanical and Materials Engineering" AMME'2001, Gliwice-Zakopane, 2001, 583-589.
- [33] M. Dudek-Burlikowska, D. Szewieczek, Customer's satisfaction the element of proquality strategies of organization, *Journal of Achievements in Materials and Manufacturing Engineering* 28/1 (2008) 91-94.