National University of Science and Technology Politehnica of Bucharest

Doctoral School of
Industrial Engineering and Robotics

Doctoral field – Industrial Engineering

SUMMARY OF THE DOCTORAL THESIS

Contribuții privind evaluarea gradului de satisfacție a clientului pe durata de viață a produsului cu aplicare în industria de automobile

Contributions on assessing customer satisfaction over the product lifetime with application in the automotive industry

PhD Supervisor
Prof. Ph.D. Eng Irina SEVERIN

PhD student
Eng. Alina Ioana MITRACHE

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Content

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Introduction

The automotive industry includes all sectors associated with the production, sale and after-sales of vehicles, making it one of the largest industries worldwide. However, dynamic changes are transforming this industry, forcing it to develop from a homogeneous industry to an industry with an uncertain future. Electric vehicles, self-driving cars and the need for less carbon dioxide emissions impose huge costs to keep up with government regulations. Customers have higher and higher expectations, forcing the companies from this industry to invest in new services and inventions. Thus, the need to keep the customer engaged and connected with the product has intensified recently, each company is becoming interested in monitoring the level of customer satisfaction, as well as in creating a special experience during the use of the product.

In order to streamline the monitoring of customer satisfaction, the thesis proposes the development of a model for assessing the level of customer satisfaction over product lifetime, by highlighting it through a generic example.

* * *

The thesis consists of two parts divided into 7 chapters containing the necessary documentation and research to build the objective. The first part contains information on the field of study, the current status of the addressed topic and includes chapters 1 and 2. Part two, unfolds in chapters 3, 4, 5, 6 and 7 and covers the research process and personal contributions.

Chapter 1, "The research context of the doctoral thesis" outlines the cumulation of factors underlying the research: the necessity of the model, the objectives and the scientific importance.

Chapter 2, "Current status of customer satisfaction assessment methods" includes the study of methods for assessing customer satisfaction in the automotive industry: studying the most effective methods as well as presenting the advantages of their application throughout the life cycle of a vehicle.

Chapter 3, "Research methodology on measuring customer satisfaction in the automotive industry" presents the selection of specific methods and techniques for assessing customer satisfaction in the automotive industry. It highlights the structure stages for producing a vehicle: market prospecting, economic and commercial planning, financing, conception-design, development, manufacture, sale, life cycle, after-sales and end-of-life, highlighting the impact of customer satisfaction in each of these stages.

Chapter 4, "Consumption of resources required to apply surveys during the life cycle of a vehicle", highlights the consumption of resources required to apply the methods of Chapter 3, validating their selection through an analytical framework.

Chapter 5, "Design of the model for monitoring and measuring customer satisfaction", presents the construction of the model, as well as the structuring of stakeholders.

Chapter 6, "Validation of the customer satisfaction assessment model", presents the validation of the customer satisfaction assessment model by Kano method, applying the strategy of identifying essential factors by addressing multi-attributes in order to measure customer satisfaction.

In Chapter 7, " Concluding Remarks. Personal contributions. Research limitations. Perspectives and directions regarding the research field" highlights the synthesis of conclusions elaborated on the basis of research, personal contributions, limitations of research, perspectives and future directions regarding the research field. Finally, the list of publications produced is attached.

Chapter 1. RESEARCH CONTEXT OF THE DOCTORAL THESIS

The society of the XXI century can be described as being in a process of permanent development, creating an area of interest for the major industries of the world, but also a challenge in terms of population needs [***14]. In parallel with society, technology is also advancing by influencing the development of products and services [***35], [A02]. Thus, products can come to have convenient functions that can increase competitiveness on the market. The addition of more features, however, leads to a more complex experience and therefore products end up being neither convenient nor user-friendly [A11].

In order to solve this problem, it was necessary to create a unit for measuring the degree of fulfillment of customer needs, thus creating the concept of "customer satisfaction" meant to measure their experience in developing and operating products and services [***19], [***23], [***46], [B16], [B22], [M04], [M10], [W11].

Despite the progress and evolution of concepts related to measuring and monitoring customer satisfaction, as evidenced by an in-depth review of the literature [***16], [***32], [B08], [C06], [G05], there is no complete model that describes customer engagement at every stage of product development. Therefore, the need to create a comprehensive model was outlined through which customer satisfaction can be monitored and measured at any point of his experience. Customer experience is a vast concept that targets the physical and emotional customer experiences that companies provide when customers interact with their products and services, ultimately becoming a subjective experience involving customer opinions all the way back to the after-sales stage [***37], [A03], [T01], [Y03].

The interest of monitoring and measuring customer satisfaction in the automotive industry [***44], [B07], [G14], [H10] is given by the hypercompetitive environment in which companies must focus their attention on both current and potential customers. Thus, there is a need for full control over customer expectations, needs and wishes, constantly evaluating the conformity of products and services, their performance, quality of delivery and post-delivery activity, price, security, legal liability towards the product and the impact of the product on the environment.

In order to define the scope, the aim was to identify relevant studies, select, map, summarize and report the results. Consequently, the literature on defining concepts such as customers, level of complaints, customer orientation, customer satisfaction, customer experience and measuring customer satisfaction in the automotive industry [***04], [***28], [L01] has been revised.

Objectives of the doctoral thesis

The Customer Satisfaction Measurement Model (CSMM) is a key factor in developing a successful and lasting business. Adopting a system for collecting customer feedback helps companies align strategic decisions with customer interests. Their involvement, especially when it comes to the automotive industry, should be achieved at all levels in the development of a vehicle. This is where the application of CSMM comes in, considering that there is no complete tracking model that is reflected throughout the life cycle of a product.

The main objective **of this doctoral thesis is** *to create a model for measuring and evaluating customer satisfaction.* From this main objective derive five specific objectives as follows:

  OS1. **Identifying methods for assessing customer satisfaction in the automotive industry**: identifying the most effective methods used in the automotive industry and the advantages of applying them.

  OS2. **Conducting a study on the application of the chosen methods through concrete examples:** presentation of previously identified methods, used during the realization of a vehicle

according to the following structure: planning-exploration, design-development, manufacturing, performance measurement and improvement, after-sales assistance.

OS3. Conducting a study on the resources required in using the methods presented above: identifying the need for financial and human resources.

OS4. Development of the model for measuring and evaluating customer satisfaction specific to the automotive industry: the developed tool contributes to strengthening customer orientation.

OS5. **Validation of the customer satisfaction measurement and evaluation model using statistical methods:** tracking the interdependence of attributes important to customers using the Kano method.

The main objective and secondary objectives of the doctoral thesis were achieved by carrying out the following four steps:

1. Bibliographic and documentary research of the current situation regarding the importance of customer satisfaction in the general framework.
2. Bibliographic and documentary research of the most commonly used methods of measuring and monitoring customer satisfaction both in the general framework and specifically for the automotive industry.
3. Model design for measuring and monitoring customer satisfaction in the automotive industry.
4. Model validation for measuring and monitoring customer satisfaction in the automotive industry.

Scientific importance and relevance of the topic

Customer satisfaction cannot be summed up as a universal definition, because in essence, it represents exactly what it says – the level of customer satisfaction following the use of a product or service. Despite the lack of standardization, this concept still has measurable characteristics and in order to manage them properly, companies must treat them with priority, through a data-driven approach that allows them to manage the strategy to increase customer satisfaction. Customer retention is vital for almost any business, and attracting new customers is resource-intensive.

Companies should not rely on the false conclusion that after closing a transaction their relationship with the customer becomes irrelevant, it is preferable to aim for more interactions with an existing customer rather to pursue new customers. Prospecting new customers adds value, but without neglecting the existing portfolio. The importance of customer satisfaction has multiple consequences, while also contributing to the overall improvement of the business. By understanding customer perception, we can identify weaknesses and areas for improvement, but also strengths that, properly exploited, ensure business continuity and development. Customers are not passive observers, on the contrary, they play an essential role in the process by which a product or service is created. The strength of a relationship between the company and the customers is based on a number of factors, one of them being high quality. Quality is an attitude that is related to, but different from satisfaction [N02].

From the need to have total control and visibility over customer satisfaction, resulted the need for the doctoral thesis **"Contributions regarding the evaluation of customer satisfaction over the lifetime of the product with application in the automotive industry",** which presents the basis and evolution of the concept of "customer satisfaction", by gradually tracking it in a complete process of creating and selling a product, exemplifying a practical model for measuring and evaluating customer satisfaction, a model that represents the novelty brought by the doctoral thesis for the industrial field. The results of applying the model are validated by statistical methods using a specific tool called JASP Team 2022, version 0.16.4. The need to achieve this model arises from the impossibility of companies to fully integrate customer satisfaction into product development, its monitoring being only partially carried out in certain processes or studies.

The model is applied in this sentence as a generic example in the automotive industry but can be adapted to any product or service in another industrial sector.

The doctoral thesis develops in the first section the global vision of the main methods and techniques for measuring customer satisfaction, and in the following chapters proposes a selection based on a generic example, of certain techniques specific to the automotive industry [L03], [P01], [V03], considering the particularities and necessary resources for their application.

The purpose of the thesis is to highlight the real impact of customer satisfaction on the life cycle of a product, in a customer-oriented company, drawing the scheme of a model for measuring the level of customer satisfaction containing all the elements contributing to this process.

Chapter 2. THE CURRENT STATE OF THE METHODS FOR ASSESSING CUSTOMER SATISFACTION

Whether are products or services, today's complexity requires practical solutions in all industries, especially in the automotive industry, where vehicle manufacturers are performing related activities which need efficient models to properly measure and quantify customer satisfaction [C14], [J03], [S20]. It is known that each customer satisfaction is influenced by his experience with the organization, which starts from the awareness of the need for purchase and ends with the purchase followed by maintenance and repair services.

Business success and customer retention can only be achieved by knowing exactly which are the customer touchpoints with the organization and how to improve their experience. All the companies which aim to understand and improve their customer experience, should use a journey map with the chronologically touchpoints for the interaction between customers and the organization.

The map is the graphical customer experience visualization that helps the organization to identify, structure and evaluate the customer journey for continuous improvement of the customer experience. Figure 2.2 illustrates the customer experience journey map in the automotive industry.
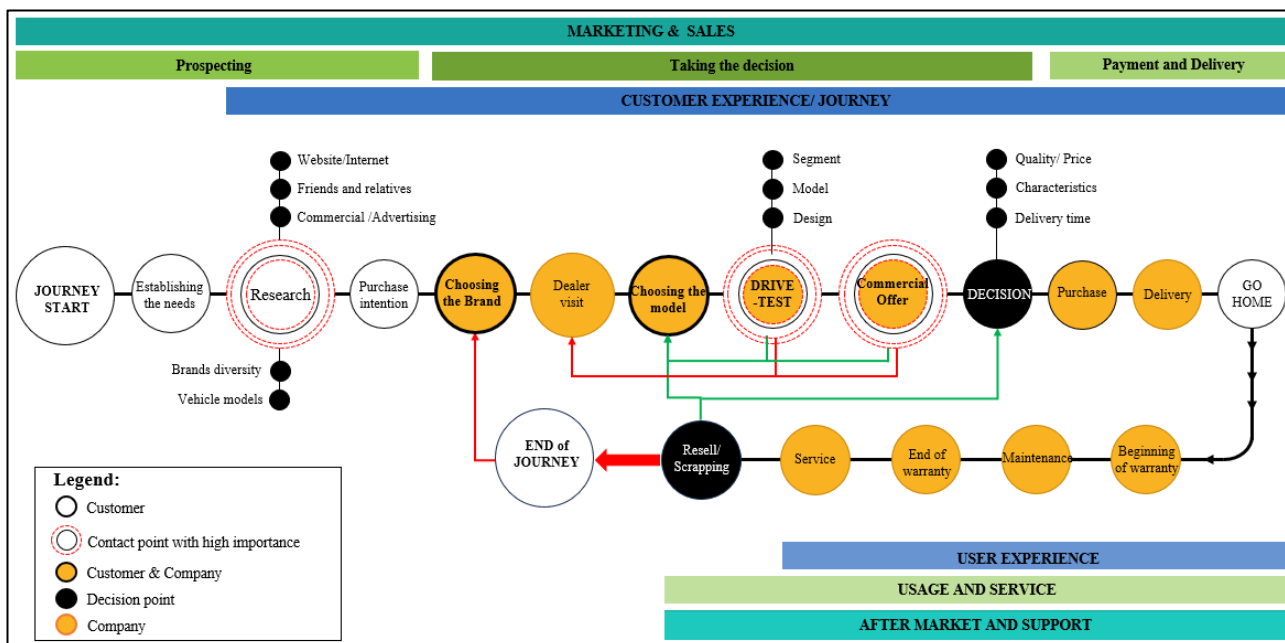
Fig. 2.2. Customer experience journey map in the automotive industry

The map presents the customer interaction with the organization from awareness phase to purchase phase and beyond, including initial research, test drive, purchase, service and ending with customer support for the brand vehicle.

The customer experience begins with the awareness that he needs a new vehicle, and the research starts from internet and friends. Once the customer has consulted various sources of information, he will start thinking about which model is more suitable for him: brand, vehicle, price, etc.

After several visits to one or more representative offices of different brands, the decision phase follows as the final step. Customers know exactly which vehicle meets their needs and now must choose from the different options offered. Next comes the launch of the order, payment and delivery of the vehicle. The after-sales stage (maintenance, repairs and spare parts) is an important stage in customer retention.

When customers move from purchase phase into the usage phase, the brand promise starts to come to life and the brand loyalty is created. Customers keep coming back and becoming brand promoters. But if there are points where customers feel disappointed, they can break out of the loyalty cycle. Not only will they leave the brand, but they may formulate adverse opinions, which will result in the loss of other potential customers.

Measuring customer satisfaction in the automotive industry

Satisfied customers return and repurchase the product, and more than that, they share their experiences with others. Studies in the field [D01], [D05], [E01], [G09], [L02] highlight the cost of acquiring a client, which is 5 times higher than retaining them, and 70% of abandonment cases are attributed to poor customer experience. Therefore, when a company gains a customer, it must focus its efforts on keeping it. Conducting a survey to identify customer satisfaction levels is a good way to measure loyalty ranking. The involvement of customer satisfaction surveys go far beyond the survey itself and will only be successful if they are fully supported by management objectives in building business strategy.

Collecting feedback by survey method is the most complex method, but knowing how to collect the date efficiently it is equally important [W12].

The current diversity of communication channels is increasingly effective and facilitates obtaining customer feedback. Among the most popular methods used in monitoring and measuring customer satisfaction are distinguished [***41]:

➢ Simple evaluation methods - consists of awarding stars or ratings and involves little effort on the part of the evaluator.
➢ Review-based evaluation method – implies certain responsibilities for participants, and the data collected is more complex providing more details;
➢ The sample survey methods or questionnaire feedback collection - covers all the details needed for full feedback [M26]. Among the most common ways for customers to access and fill the surveys are:
    ✓ Electronic/online way;
    ✓ Physical way, directly in the points of sale;
    ✓ Via wifi;
    ✓ By scanning QR code.

The methods presented below are based on the principle of collecting feed-back and are commonly used in the automotive industry.

➢ **NCBS** (New Car Buyer Survey) is a benchmarking survey use for the market research and the purchase of new vehicles [***33]. This type of survey provides a deep understanding of the market, customer behavior and attitude towards car brands after purchasing a new vehicle, including also their profiling.
➢ **NEVQS (**New European Vehicle Quality Survey) is also a benchmarking survey and uses feedback on the quality of the vehicle in order to improve it. The methodology of this survey is based on the use of several approaches to invite clients to participate in a detailed survey according to the accepted country-by-country method. Despite the friendliness of the invitation method (email, SMS/text), all customers are directed to a globally consistent reference survey
➢ **Fleet surveys** have an internal character and do not allow the comparison with competitors, they are used only in the context of collecting immediate feedback from employees who test the

vehicle before it reaches the customer. The main feature of this fleet is the identification of nonconformities by employees after vehicle usage.

➢ **Fast track surveys** are fast surveys that are applied after the first month of driving the vehicle. The questionnaires are built on a structure similar to those applied in fleet surveys (Annex 5), and the specificity of the survey derives from the typology of respondents who are, in this case, final customers. Such surveys shall include a sample of no more than 100 respondents.

Collecting feedback through surveys is an appropriate way to measure customer satisfaction, but the key to the methodology lies in asking the right questions to customers [B24], [C11], [C13]. Without the right questions, answers may not point to the right data, and without them, areas for improvement cannot be identified. For the validation of the results of this doctoral thesis, the following indicators were used:

1. **Net promotion score (NPS):** Helps measure loyalty by asking for brand or business referral intent. The measurement of NPS is shown in figure 2.7.

"Taking into account your experience with the company you will recommend it to your friends and relatives?".

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Not at all   **Very likely**

Fig. 2.7. NPS measurement

The surveys used for measuring NPS can be distributed across different customer experience touchpoints. Based on the score on each point, can be identified different areas for improvement. Based on the response the customers are classified as follows:

✓ **Detractors:** Respondents who gave an assessment with grades between 0 and 6. They are not loyal and are likely to disseminate negative feedback about the company.

✓ **Promoters:** Respondents who gave an assessment with grades of 9 and 10. They are the most loyal, actively promoting the company or brand.

✓ **Neutral:** respondents who gave an assessment with grades between 7-8. This category is included in the above categories, so they will neither willingly recommend the brand, nor will discourage others.

2. **Customer satisfaction with service (CSS):** measures customer satisfaction with after-sales service. This type of measurement can be applied through forms, pop-ups, live chat or online surveys. The constant use of CSS helps monitor trends and patterns over time, helping to easily identify areas for improvement. A model questionnaire used for CSS monitoring can be found in Annex 1.

3. **The dissatisfaction score,** expressed as a percentage **Ni%,** represents the number of problems registered as dissatisfaction, reported to the total number of respondents.

4. **Customer satisfaction score (CSAT):** measures the level of satisfaction or dissatisfaction with a product or service. Customers rate their satisfaction on a scale of 1-3, 1-5, or 1-7. The CSAT score can be an excellent measure to capture the evolution and trajectory of sales and later in making smart decisions. Questionnaires sent to customers target specific points of interaction and provide fairly reliable and accurate data containing authentic responses.

Customer satisfaction is an essential element of customer loyalty, and by measuring their experience, it is understood what likes and dislikes them. The quality of customer service is the base of every business.

Based on their own experience gained in the automotive industry, it can be considered that to create an effortless customer experience, companies should implement the following strategies:

➢ Increasing the adhesion of the self-service channel;
➢ Anticipating the next problem of the client;
➢ Creating a better service experience;
➢ Improved control.

Concluding, it can be said that organizations need to consider the entire customer experience and also anticipate their needs beyond any transaction. There must always be an assumption that every employee has the potential to impact the overall customer experience with every decision they make. Truly customer-focused companies can understand the true potential of customer importance. The main objective remains to minimize effort for customers and maximize their value.

Chapter 3. RESEARCH METHODOLOGY ON MEASURING CUSTOMER SATISFACTION IN THE AUTOMOTIVE INDUSTRY

Identifying stakeholders in the automotive industry contribute to the success of organizations and requires the application of carefully selected identification methods, techniques and tools [G13], [M01], [S04]. Vehicle manufacturers must implement and adopt various strategies to incorporate the needs and expectations of their customers into the development of a vehicle, since customers have a fundamental role to play in achieving the organization's performance. In order to start the research related to measuring customer satisfaction in the automotive industry, the first step was to identify the customers. The issues underlying the selection of clients as an interested party [***18], [***13] are:

- according to ISO 9001:2015, EFQM Principles of Excellence and Model of Excellence, organizations must be customer-oriented;
- the development of a vehicle is made for customers, manufacturers should have as mindset customer orientation, listening and meeting their needs and expectations.

Customer information and feedback are collected in key moments established by the manufacturer over the vehicle lifecycle: in the market prospecting study, in the design phase, before market launch, three months after launch and in the life cycle.

The customers are different and their reactions are having different impacts on the business. Consequently, the manufacturer must effectively explore customer opinions. This research is descriptive and integrates quantitative and qualitative elements that have been measured, classified, statistically validated and contributed to identifying customer patterns. The survey was used as a method of data collection, based on which questionnaires were found as enforcement tools.

In the present research, the method of investigation was chosen to be the survey, which is based on different techniques and tools of data collection in order to provide and supplement information on a certain situation or from different periods respectively key points of customer experience with manufacturers.

The tool from the base of survey was the questionnaire, which is structured by a series of logically organized questions for the purpose of gathering information from different people. Thus, in order to achieve the purpose of the research, the objectives of questionnaire-based surveys were established:

1. Determining customer satisfaction in the automotive industry
2. Identifying elements with impact on customer satisfaction.

Selection of methods and techniques for measuring customer satisfaction

Due to the place of the automotive industry in the european and national economies, car manufacturers face several obstacles that may affect their development. Price fluctuations, production costs and different difficulties in operational or administrative processes are just some of them that have been intensified by the Covid-19 health crisis and the global economic and financial crisis that followed it.

The development of a vehicle is carried out in stages over several years. All these steps have as starting point the market prospecting, continue with a fully industrial life cycle and end with the total exclusion of the vehicle from the market [N04]. The set of vehicle development stages can be visualized in Figure 3.1 and contains 11 stages grouped into the following five main phases:

- ➢ Exploration Phase:
  - Marketing study
  - Economic and commercial planning
  - Financing
- ➢ Upstream phase:
  - Conception
- ➢ Development Phase:
  - Development
  - Batch zero manufacturing
- ➢ Test Phase:
  - Manufacturing
  - Sale
- ➢ Marketing Phase:
  - Life cycle
  - After-sales
  - End-of-life

Fig. 3.1. Stages of development of a vehicle

In this process each customer consider that their experience is unitary, in reality each touchpoint have different impact and valence in the purchase decision. This is why manufacturers actively involve their customers in vehicle development, introducing data collection surveys at key moments in the

development process. Figure 3.2 visualizes the key moments chosen by manufacturers to assess customer satisfaction, where vehicles meet their needs and expectations.
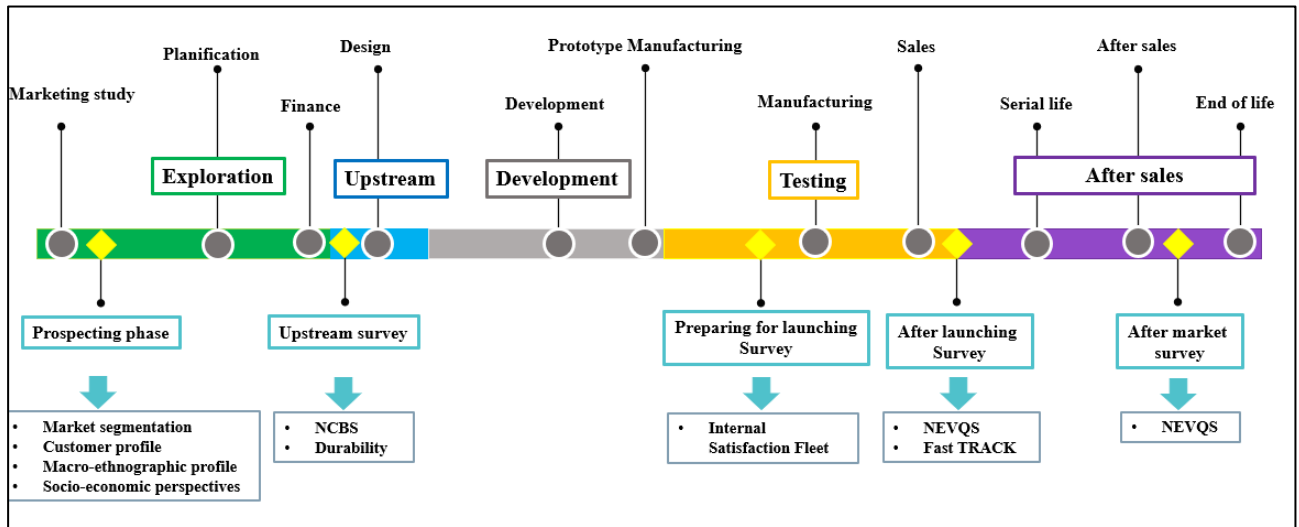

Fig. 3.2. Key moments for customer data collection

This stage presents the chosen method for polling customer satisfaction (type of survey) and the type of instruments (questionnaire) used in the development stages of a vehicle as follows:
- *The prospecting survey* shall be used in the exploration phase for market potential research.
- *The upstream survey* is conducted before the design phase begins and is based on the NCBS survey and the durability survey.
- *The launch preparation survey* is a Customer Satisfaction Fleets survey and represents a type of internal survey.
- *The post-launch survey* is conducted through NEVQS (previously described) and **Fast Track** surveys.
- *The Life Cycle Survey* aims to monitor customer satisfaction over a defined turnover period through the NEVQS survey

For a better understanding of the impact of measuring customer satisfaction in the process of developing and selling a new vehicle, all those factors that influence the process will be identified. Therefore, this study will take into account the two types of necessary information: provided directly by the client and internaly, resulting from studies and analyzes carried out on figures and costs.

Prospecting Survey
The selection of what type of vehicle model should be designed is a decision taken in the Exploration phase following the prospection investigation. At this stage, certain market studies and research will be considered to contribute for the identification and selection of the proposed vehicle model and segment.
In the generic example studied through the thesis, the following results can be identified:
➤ Exploration phase of the Romanian market, starting from the registrations in 2022 and 2023, customer preferences towards the DACIA brand can be distinguished.
➤ Taking into account the same time frames (2022-2023), the segmentation of vehicles by belonging class was pursued, highlighting preferences for segment B:
➤ The NCBS survey was used to identify customer profiles and needs as follows:
   ✓ The majority buyers are men aged 44-56, have no children and are interested in small cars with which they can move around the city.

✓ Their needs and preferences are focused on Price, Design and Durability in terms of standard vehicle performance. Basically, they want an economical vehicle, with a pleasant appearance and that maintains its performance over time.

Upstream survey

The design and development of the vehicle model is an activity that takes place in the Planning phase, following the upstream survey. The design and development of a vehicle model requires attention to several aspects. First, in developing a new vehicle, we start from existing models in the factory and analyze whether they contain similar components to the vehicle which will be developed. Most manufacturers use at least 40% of existing vehicle components, in order to not reach complex diversity of parts and to not waste resources for a new portfolio of suppliers.

The conclusion of the exploration phase investigation represents the starting point for the design and development of the new vehicle. The new model is planned to be designed starting from an existing vehicle in production, aiming that the modifications made to it on components do not exceed 50%. When choosing which components will be reused on the new model, it will be considered several factors, the costs and production capacity, the potential of suppliers to increase production volumes. Customers returns for the reliability and durability of the vehicle over time, as well if the technical progress and developments require a mandatory improvement of those components, including legislative regulations.

According to customer feedback, the main components and accessories that will be improved in the next project are the quality of paint, the material of carpet, the materials used inside the car, exterior windows, and body gaskets, as well as the use of an anti-corrosion protective layer for the components under the body.

At this stage, both components that will be retained from previous vehicles and components that will be improved for the newly developed vehicle model have been identified, with the objective of creating an economically affordable car.

After applying the NEVQS survey, a reappearance can be observed in terms of vehicle performance for durability. This appears in the TOP 1 as a major problem, which validates the results of the NCBS investigation applied at the prospecting stage.

Launch preparation survey

The manufacturing and validation of the new vehicle together with performance measurement and improvement, are activities that take place in the testing phase following the launch preparation investigation. Based on customer feedback from earlier phases, the vehicle reaches the manufacturing stage meeting customer expectations. These expectations cannot be met 100%, because priority will be given by legislative regulations and costs related to improvements.

In order to verify, validate and measure the performance of the new vehicle before reaching the customer, the internal Customer Satisfaction Fleets survey will be applied. This survey can often capture common aspects that can also be found in external customer surveys, but the general perception of a customer paying for a vehicle is different from one who will not pay for it.

The launch preparation survey allows the prototype vehicle to be internally evaluated by employees in order to highlight overall satisfaction and quality, focusing on strengths and weaknesses and opportunities for improvement. All of this is meant to contribute to validation, catching any problems or defects before launch.

After validating the prototype and improving the performance reported with problems following the application of the Customer Satisfaction Fleet, the vehicle is ready for market launch.

Post-launch investigation

For collecting the first customer feedback after the launch of the new vehicle model, three types of surveys will be used simultaneously.

The first investigation is made through incidents alerts recorded directly in car service repair units when functionality problems occur. The second investigation is "Fast Track" with fast tracking after the first month of driving the vehicle and which is carried out in parallel with the incidents investigation. The third investigation is NEVQS applied after three months of vehicle driving, also offering information about competitors together with a wealth of information about customer satisfaction.

To collect customer feedback at this stage, several types of specific surveys can be applied to for making the data received to be comprehensive. We can use incidents alerts recorded for functionality issues, "Fast Track" investigations with fast tracking and the NEVQS investigation that provide us a more diverse package of information.

Lifecycle survey and after-sales support

For having a better control of the information related to the level of customer satisfaction, their feedback is collected through constant NEVQS survey throughout the vehicle's life cycle.

Feedback can be requested after the first three months of vehicle usage by customer if a return of new performance is desired or for the period between 12 months and 36 months of vehicle usage when the input for durability and reliability is desired.

The application of the surveys proposed in this chapter supports the results of the study by highlighting the needs, dissatisfactions, but also the aspects generating satisfaction for the customers participating in the five surveys. Each survey has been included in key customer touchpoints in the design-development-life cycle process of a new vehicle, so that they effectively capture the contribution of customer satisfaction throughout all processes.

The selection of these methods and techniques for measuring customer satisfaction was carried out so that there is continuity of information between manufacturing stages and strengthens the typology of the proposed satisfaction measurement model. The multitude of questions used in each questionnaire covers several important issues such as the sales process, after-sales support, durability and quality of the vehicle. After collecting the responses of these surveys, a clear picture of customer needs and preferences can be obtained and areas for improvement can be identified. The results contribute to the improve of overall customer experience and increase his satisfaction. Prioritizing customer satisfaction leads to increased customer loyalty, positive oral marketing, and long-term commercial success.

Going through all the steps proposed in this chapter, is highlighted the essential impact of customer satisfaction in creating a vehicle. It is the customer who guides the entire vehicle development process according to his needs from the very beginning. It is known that customer needs always lead to the development of new vehicles and therefore manufacturers must incorporate these needs into internal processes, translating them into specific budgets and regulated laws of the automotive industry.

Chapter 4. CONSUMPTION OF RESOURCES REQUIRED TO CARRY OUT INVESTIGATIONS DURING THE LIFE CYCLE OF A VEHICLE

Value is known as an element of great importance that influences the success of a business [Z03]. Although it is well defined and documented in the literature, the concept of "value" is viewed through a wide variety of perspectives. There are specialists who define value as monetary [P02], while others define it as a non-monetary benefit such as relationships, knowledge, or time [W07], [S18]. The concept of value is also defined by Zeithaml as the complex result of valuation following the use of a product or service [Z03].

Every vehicle manufacturer has a well-established business model in which it simplifies all aspects of value growth considering internal and external costs [M13]. The dynamics of this business model

are important in the context of continuous market interchangeability. The testing of the dynamics of the model is carried out depending on the degree of visibility over transactions and activities of a financial nature, as well as on the evolution and innovation of the business model. As outlined in his paper, Pulles [P12] points out that the success of all production companies, public or private, is closely related to a very important factor, customer satisfaction.

Resource planning is a key aspect of the operational planning that takes place in the second stage of development of the new vehicle. For this reason, the manufacturer must allocate the necessary resources based on the following considerations:
- capabilities and constraints related to existing internal resources;
- the need to turn to external suppliers for non-existent resources or expertise internally.

The primary resources needed to successfully implement customer feedback surveys can be grouped into the following categories:
- Financial resources:
  - Funds for the payment of salaries;
- Human resources :
  - Team members;
  - Team leader;
- Material resources:
  - Space where desks and chairs will be arranged;
  - Equipment: laptops connected to the Internet network and phone line;
- Intangible resources :
  - Organizational knowledge;
  - Time;
  - Energy.

In the following, an analytical framework will be presented to assess the consumption of resources incurred by the vehicle manufacturer in generating customer satisfaction, going through the stages: Exploration, Upstream, Development, Testing and Commercialization.

In order to operate and achieve their objectives, the responsible teams will need primary resources, in this way survey results will have a direct impact on vehicle development and on future sales. Since the questioning activity needs to be approached critically, a schematic representation of the activity was used as shown in Figure 4.1.
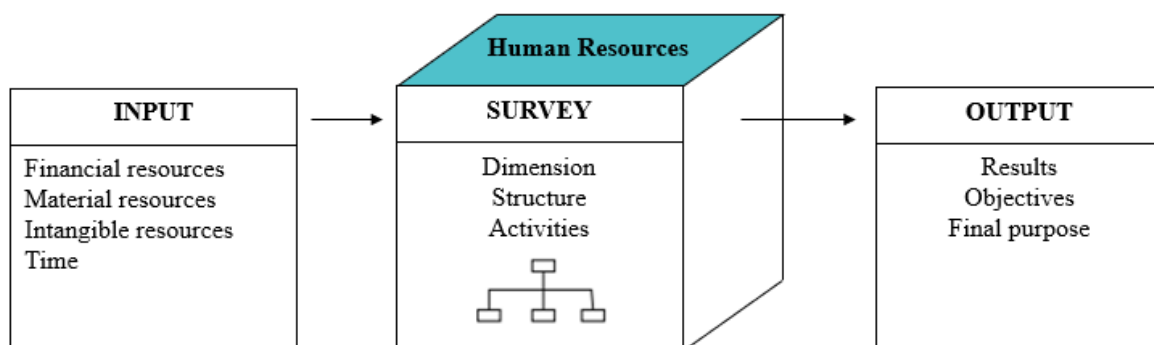

Fig. 4.1. Resource transformation process

The flowchart from Figure 4.1 is based on converting resources through surveys into results. Available resources are seen as inputs that through survey organization and survey activities are

transformed into outputs. Such a system records the necessary steps, activities and decisions, adding great value to the results.

The first step in determining the consumption of resources required to carry out life-cycle surveys of a vehicle, is to identify the type of resources used. The primary resources identified were grouped into the following categories: human resources, material resources, intangible resources and financial resources. After the first stage were established the methods for measuring the use of resources involved in the surveys. Tangible resources were assessed through utilization and efficiency rates, and intangible resources were assessed using the projected revenue method.

The usage rate measured whether the organization uses primary resources to maximize productivity, and the efficiency rate measured whether the organization efficiently manages resources to generate the desired results. The method based on projected revenues was used to indirectly measure the intangible asset.

The usage rate (HR) was calculated as the percentage of time out of total working hours in which resources were productive. The efficiency ratio (RE) was calculated as the percentage of cost between actual production and expected output of resources. Thus, the resources needed to carry out surveys in the Exploration, Upstream, Development, Testing and Marketing phases were determined.

The HR calculated for human resources at each stage of a vehicle's life cycle shows that:
- *in the Exploration phase* HR $_{employee\ 1/2/4}$ = 88% and HR $_{employee\ 3}$ = 50% show that employees 1, 2 and 4 are time efficient and generate value over time, while employee 3 is less productive and creates costs;
- *in Upstream and Development phases* HR = 88% shows that employees are time-efficient and generate value in conducting this survey;
- *in the Testing phase* HR $_{employee\ 1/2}$ = 88% and HR $_{employee\ 3}$ = 50% show that employees 1 and 2 are efficient and generate value, while employee 3 is less productive and creates costs;
- *in the commercialization phase* HR = 88% shows that the 3 employees are efficient and generate value in conducting the investigation.

HR calculated for material resources shows that:
- *in the Exploration phase* HR $_{employee\ 1/2/4}$ = 43% and HR $_{employee\ 3}$ = 21% show that the resources used by the 3 employees are unproductive and create costs;
- *in Upstream and Development phases* HR = 43% shows that the resources used by the 13 employees are unproductive and create costs;
- *in the Testing phase* HR $_{employee\ 1/2}$ = 43% and HR $_{employee\ 3}$ = 21% show that the resources used by the 3 employees are unproductive and create costs;
- *in the commercialization phase* HR = 43% shows that the resources used by the 3 employees are unproductive and create costs.

The RE calculated for human resources at each stage of a vehicle's life cycle shows that:
- *in the Exploration phase* RE $_{employee\ 1/2/4}$ = 64% and RE $_{employee\ 3}$ = 32% show that employees 1, 2 and 4 perform at the expected level but do not necessarily generate value over time, while employee 3 performs below the expected level;
- *in Upstream and Development phases* RE = 64% shows that employees perform at the expected level and generate value over time;
- *in the Testing phase* RE $_{employee\ 1/2}$ = 64% and RE $_{employee\ 3}$ = 39% show that they show that employees 1 and 2 perform at the expected level but do not necessarily generate value over time, while employee 3 performs below the expected level;
- *in the Commercialization phase* RE = 64% shows that the 3 employees perform at the expected level and generate value over time.

The RE calculated for material resources shows that:
- *in the Explore phase* RE $_{employee\ 1/2/4}$ = 58% and RE $_{employee\ 3}$ = 33% show that the resources used by employees 1, 2 and 4 perform at the expected level and generate value, while the resources used by employee 3 have low performance;
- *in Upstream and Development phases* RE = 58% shows that the resources used by the 13 employees perform at the expected level;
- *in the Testing phase* RE $_{employee\ 1/2}$ = 58% and RE $_{employee\ 3}$ = 33% show that the resources used by those employed 1, 2 and 4 perform at the expected level, while the resources used by employee 3 have low performance;
- *in the Marketing phase* RE = 58% shows that the resources used by the 3 employees are performant.

Chapter 5. THE MODEL DESIGN FOR MONITORING AND MEASURING CUSTOMER SATISFACTION

Customer satisfaction is a debated topic thosedays, despite his slow evolution in the speciality literature. After studying specific articles and papers, it can be stated that the development of the concept began around 2000 with the advent of online platforms for collecting feedback.

The evolution of the research for customer satisfaction has led to a much deeper understanding of the concept and for customer value, pushing the organizations to monitor customer complaints. In the new economy, compliance with quality remains important, although its no longer differentiates one supplier from another as was mandatory in the ancient economy.

Starting from the conclusions of this analysis, the need to develop a complete model for measuring customer satisfaction was outlined, allowing permanent tracking of customer influence and how is reflected throughout the life cycle of a vehicle.

For a better coverage of the complex problem of measuring customer satisfaction, different assessment models with various methods have been developed in the literature. The thesis proposes a model for assessing customer satisfaction based on the identification and use of essential determinants, as well as their impact in using resources to improve customer satisfaction.

The evaluation model is based on the strategy of identifying determinants by addressing multi-attributes to measure customer satisfaction. The method describes subjective assessment against a checklist of key attributes for a new vehicle, using multiple regression models to identify the impact of attribute performance on customer satisfaction.

The model proposed in this thesis is validated by the methodology described by Kano, by means of attributes using the survey method to investigate them. Since its appearance in 1984, the Kano model also called AQC (Attractive Quality Creation) has become popular in the study of the methodology to analyze the relational asymmetry between attribute performance and customer satisfaction. The model involves "creating a new product with a quality that can not only be distinguished from the qualities of current products but is also attractive to customers" [W10].

The design of the assessment model

The model is structured based on the life cycle of a product, exemplified by a vehicle, following the stages of Exploration, Prospecting, Development, Testing and Commercialization. The model can be visualized in figure 5.4.
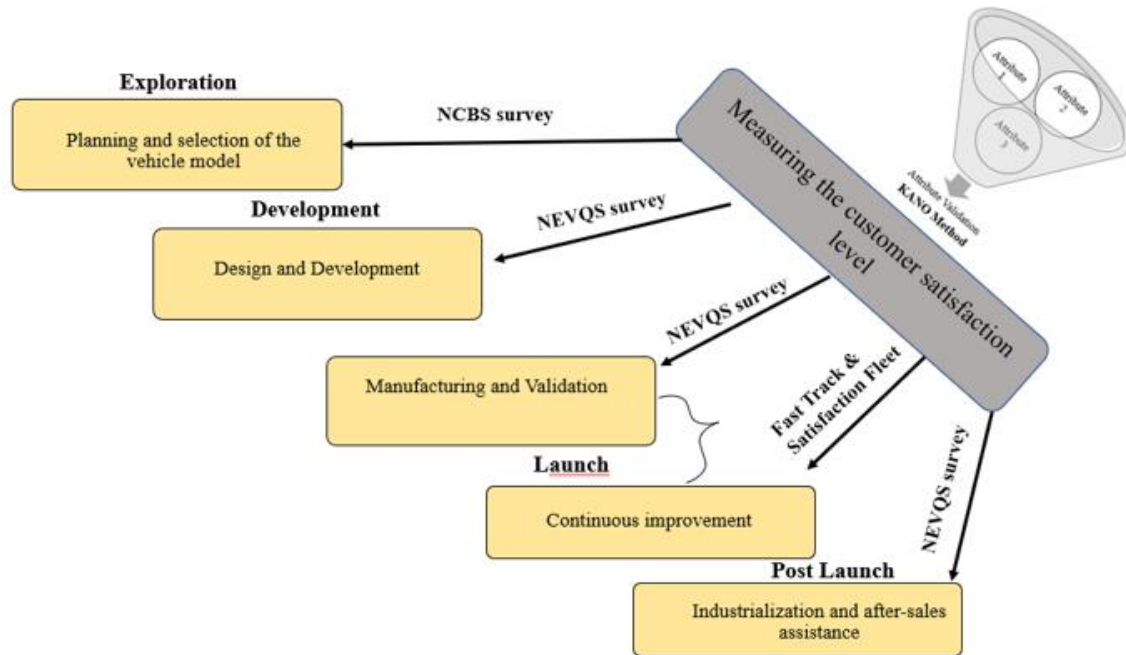
Fig. 5.4. Customer satisfaction assessment model

In the ***Planning - Exploration stage***, it is aimed to establich the vehicle model that will be carried out, taking into account certain market studies and researches that will contribute to the identification and selection of it, as well as of the belonging segment. Thus, we start from the analysis of the trend and market perspective in the automotive industry.

In the ***Market Study and Prospecting phase***, several sub-processes are distinguished, such as market segmentation, identification of macroethnographic profile and socio-economic perspectives. The NCBS investigation is proposed at this stage of information collection.

During the Development phase, it is necessary to identify the components of old projects that are preserved following the application of sustainability surveys. For this purpose, the NEVQS investigation is proposed.

In the ***Testing*** phase, two main processes are involved: launch preparation and performance measurement in which Customer Satisfaction Fleets and Fast Track surveys are used. Customer Satisfaction Fleets surveys are applied internally and are intended to be run by company employees or potential customers in order to receive internal feedback before the car reaches the final customer. Fast-track inquiries apply after the customer has had a month to run the machine.

In the ***Marketing*** phase, customer satisfaction is monitored during a defined turnover period through the NEVQS survey. The purpose of this type of investigation is to capture any defects omitted during the testing phase, but also to improve vehicle performance through customer perception.

Studying the importance grid

Starting from the Vavra's approach [V04], the grid of importance was used in identifying the first three satisfaction factors proposed by the Kano's method. An alternative to the imaginary scheme given by Kano, the importance grid is constructed according to the importance of the attribute derived explicitly or implicitly. Self-declared importance of the client is identified as explicit importance, which is the indicator of the potential generator of dissatisfaction of an attribute. As an indicator of

satisfaction, implicit importance is achieved indirectly by applying other techniques, such as regressing attribution-level performance versus overall satisfaction.

Depending on importance, the basic attributes of the rating grid are factors that have a negative impact on overall satisfaction with low-level performance but cannot have a positive impact on high-level performance. Thus, it can be considered that the minimum requirements of the product or service are of great importance in the directly derived valuation of attributes and of little importance in the indirectly derived valuation.

Starting from the Kano's model, the response surface method and importance grid analysis will be used to obtain the relative importance of attributes and classify quality factors. In the response surface analysis process, the Box – Behnken method will be used in building the profile to reflect a more real customer attitude towards attributes.

A three-point scale will be used to measure attribute performance: "below expectations", "at expectations" and "above expectations". Considering that performance ratings have a direct relationship with the comparative outcome of customer expectations, it can be seen how satisfaction is associated with performance that meets expectations.

The proposed experiment model uses three factors, each with three levels resulting in 27 approaches, making it complicated for customers to complete. Thus, a simple method will be selected, Box-Behnken (BBD), which is evaluated as a very effective design method for researching the relationship between variables.

The selection of methods used in the classification of attributes

The response surface method is a statistical and mathematical technique used in product development, improvement and optimization [M30]. In the last years, this method has also been used in research on the importance of attributes, customer satisfaction and job satisfaction [S06], [W01].

When the range of a local optimum is reached by experimental verification, the movement in the direction of maximum slope is considered to have ended. When this phase is reached, the statistical simulation specialist must decide whether further experimentation is necessary, a decision that depends on the type of problem to be solved. In the most common cases, the decision is to continue the experiment with the use of a higher-order program. The purpose of continuing the experiment is to estimate the best possible optimal area and to determine the exact coordinates of the stationary point of the objective function.

The fictive variable regression approach is used to assess the non-linear impact of attribute performance on overall satisfaction. Before performing the analysis, attribute performance ratings are coded to form false variables so that "high performance" is coded (1.0), "low performance" (0.1), and "average performance" (0.0).

Based on the results of the surveys used to track the impact of customer satisfaction over the life cycle of a new vehicle, three defining factors for customers were differentiated: price, design and durability. In order to validate the relationship between the 3 attributes, the questionnaire was chosen as an investigation tool, which for financial reasons and other advantages is the most often used tool in research. For the design of the questionnaire, a primary analysis was considered, containing:

- the importance of information related to the issue in question;
- detailing the sampling range;
- identification of the key population;
- estimation of the time resource needed to develop the questionnaire

Another important part in building the questionnaire was documenting the specific elements that can be [***41]:

1. Detailing the information of interest. This type of information will be found in the content of research objectives.
2. Identify the method of collecting feedback. Information on administration, data gathering, level of methodical structuring is described.

3. Establishing questions taking into account: "content and type, symmetry, clarity and simplicity of formulation, dynamics and precoding of questions".

4. The structure of the questionnaire taking into account the recommendations aimed at "sectioning the questionnaire, organizing the questions and general aesthetics".

5. Validation and testing of the questionnaire.

The customer satisfaction assessment model proposed in this chapter is based on essential elements for implementing a customer-oriented culture. It incorporates elements resulting from research carried out in the automotive industry. In order to evaluate these elements have been developed the evaluation criteria and the grids.

The model fully supports the needs of automotive industry organizations by defining the evaluation framework of the factors which are influencing the customer satisfaction. The conclusions from this evaluation highlight the importance of applying the model which lead to improved customer relationships by changing the value of the attributes. Also, the proposed methodology can be applied to assess customer satisfaction in other areas.

The implementation of the model ensures a tracking of the level of customer satisfaction starting from the market prospecting phase for a vehicle and throughout its lifecycle, thus ensuring complete visibility into the customer experience at key moments of interaction with organizations.

By developing the proposed evaluation model, the author made important conceptual and methodological contributions, integrating knowledge from areas such as customer management, financial management, engineering, mathematics, but also through professional experience.

The research in Chapter 5 will be the subject of a national, international scientific publication or a journal article.

Chapter 6. Validation of the customer satisfaction assessment model

For the development of the assessment model, three main steps have been taken up to this stage: data collection, centralization and review. The fourth stage is represented by the statistical validation of the developed research model, which, like other research tools, "must describe in a simple and precise manner the studied problem, allowing its measurement and demonstrating its resistance to change in the face of time wear" [G01].

The stages for data collection, analysis and validation must clearly and correctly design the customer satisfaction and allow an adequate interpretation of the elements that influence it. This step presents how to analyze and interpret the data, as well as the types of analytical interpretations which need to be used [L04], [O02], [V01]. Figure 6.1 shows the main methods of analyzing the survey data.
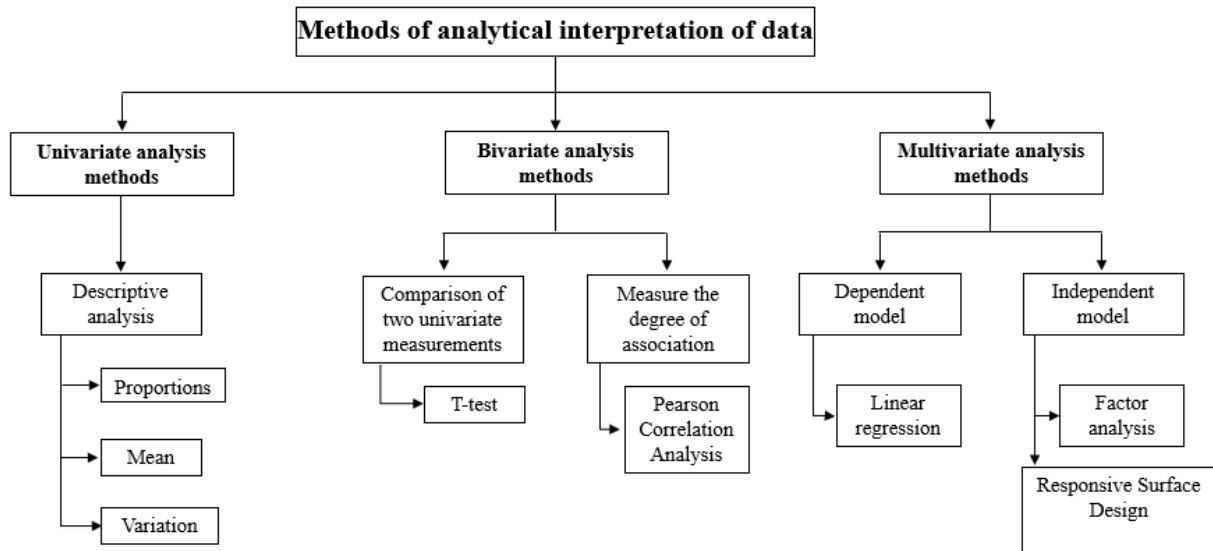
Fig. 6.1. Methods for analytical interpretation of customer satisfaction data [D05]

Establishing the model validation

The current chapter presents all aspects for statistical processing of data used in research with the help of JASP statistical analysis software. JASP (Jeffrey's Amazing Statistics Program) is a free open-source multiplatform statistics package developed by a group of researchers at the University of Amsterdam. The JASP package includes both classical and Bayesian statistical techniques, offers a simple and intuitive user interface and is a placeholder for more complex statistical programs such as SPSS. JASP version 0.17.3, under the GNU Affero GPL v3, was used for statistical analysis and data processing.

The study to validate the customer satisfaction assessment model was conducted in 2023, for a sample of 100 people. Following the 100 questionnaires launched online, 74 responses were received.

As the proposed topic is quite complex, namely the study of customer satisfaction, the representative sample was therefore determined to ensure the obtaining of adequate research data, according to the recommendations of the literature [B01], [B23], [D04], [G06]. The population parameters and sample statistics are shown in Table 6.1.

Table 6.1. Population parameters and sample statistics [B01]

Parameter	Customer sample
Population size (N)	22000
Sample size (n)	381
Correction of sample size (nc)	375
Sample mean (m)	188
Dispersion (σ^2)	0.09
Standard deviation (σ)	0.3
Permissible error (E)	0.03
Number of questionnaires sent	100
Number of questionnaires received	83
Number of validated questionnaires	74

The size of the statistical population (N) represents the total customers that organizations in the automotive industry register. The population purchasing a new B-segment vehicle was targeted.

From the same literature [B01] was taken the value of the 95% representing the confidence level, corresponding to a margin of error of +5% and a standard deviation of 0.3. These values represent the conditions of a probability of guaranteeing results. In Table 6.2 can be visualized the data associated with the 95% probability of guarantee of results.

Table 6.2. Confidence interval for sample mean [B01]

Level of trust	α	z	σ
95%	0.05	1.96	0.3

Given the characteristics, advantages and limitations of each sampling method available in the literature [R04], probabilistic (random) sampling was used. The questionnaires were sent to the statistical sample, the completed questionnaires were checked, and finally some of them were canceled. Duplicate or incomplete questionnaires were cancelled and removed from the analysis.
The answers from the 74 validated questionnaires were centralized in an Excel worksheet (Questionnaire centralizator.xlsx) and converted with the help of JASP into CSV worksheet (Questionnaire centralizator.csv), being the only format supported by the application.

The development of the questionnaire as a tool for assessing customer satisfaction over the lifetime of the vehicle was a difficult task that required a logical approach based on various criteria, methods and methodologies. The collected data, based on the validated questionnaires were subjected to statistical processing through JASP statistical analysis software. Thus, descriptive analysis, T-test, correlation analysis, linear regression, and Box–Behnken factorial design provided a clear picture of the significance of the questionnaire.

The validation methodology and criteria used may be applied in the automotive industry and may also be transferable to different sectors or industries which are relevant. The actual steps taken in statistical validation were sending questionnaires, collecting answers, centralizing responses and performing statistical validation analysis.

The questionnaire used as an evaluation tool aimed to validate the main attributes "Price", "Design" and "Durability" that have a direct influence on customer satisfaction over the lifetime of the vehicle. The statistical analysis performed validates the previously identified main attributes.

The T-test determined the influence of Design, Durability and Price attributes on customer satisfaction. The T-value, the degree of freedom *df* and the p-value provide the statistical significance of the test. P's values of 0.003 (Design and Customer Satisfaction), 0.002 (Sustainability and Customer Satisfaction) and 0.001 (Price and Customer Satisfaction) less than 0.05 show that the analyses are statistically significant. Based on this convention, null hypotheses (H0) of no effect are rejected and alternative hypotheses (Ha) are validated. The T-test showed that the odds of randomly drawing a sample are 0.3 (Design and Customer Satisfaction with T=-3.044), 0.2 (Durability and Customer Satisfaction with T=-3.210) and 0.1 (Price and Customer Satisfaction with T=-3.676) with a number of degrees of freedom df=73.

The correlation analysis determined the associations between the three independent attributes "Price", "Design" and "Durability" by testing the null H0 hypothesis that there is no association between the attributes Price-Durability, Price-Design, Durability-Design. Low standard deviations of each attribute (Durability – 1.07, Price – 1.034, Design – 0.881) indicate that the data values are close to the average, while the small values of the variation coefficients (Durability – 0.477, Price – 0.458, Design – 0.413) indicate that the estimate is more accurate. High values close to 1 of the Pearson coefficients (rP Price/Durability=0.872, rP Price/Design=0.784, rP Durability/Design=0.872) indicate that there is a strong positive correlation between attributes, and p<.001 shows very significant correlations. Based on these considerations, the null hypothesis is rejected.

Linear regression determined the hypothetical model of the relationship between "Price", "Design" and "Sustainability" and examined variance in the created model. The correlation R between variables is large (0.784), and the R2 variance of 0.614 (adjusted R2 = 0.579) shows that 57.9% of the total variation is explained by the predictor model. The Durbin-Watson value equal to 2.145, is in the range (-1, +3) and thus validates the tested predictor model. F-statistically is significant by p=0.002 and concludes that the model is a significant predictor. Even though the ANOVA shows that the model is significant, none of the predictor regression coefficients are significant. The VIF tolerance value of 1.036 shows that the hypothesis is not violated.

The three-factor, three-tiered Box-Behnken *Design Surface methodology* determined the relationship between the dependent variable "satisfaction" and the three independent attributes "Price", "Design" and "Durability". In order to provide an adequate approximation for the functional relationship between these variables and the response surface, the Box–Behnken model required 12 experimental runs and three central point experiments.

Although customer satisfaction has been at the heart of research in various studies over time, and various techniques and methods for improvement have been developed and implemented, satisfaction has not always shown an increase directly proportional to the improvement of key attributes. This phenomenon arises because of the asymmetric relationship between the performance of the independent attributes "Price", "Design" and "Durability" and customer satisfaction over the lifetime of the vehicle.

The research in chapter 6 will be the subject of a national, international scientific publication, or of a journal type article, respectively.

Chapter 7. CONCLUDING REMARKS. PERSONAL CONTRIBUTIONS. RESEARCH LIMITATIONS. PERSPECTIVES AND DIRECTIONS REGARDING THE FIELD OF RESEARCH

Integrating customer satisfaction into the business strategies assured the success for many organizations over the past decade. Today, the level of implementation and success of customer management contributes to business success handling an important part of organizational problems. Customer orientation and customer satisfaction represent the new philosophy of organizations in performing on the market in a competitive context.

The doctoral thesis includes research and contributions from the fields of industrial engineering, statistics and management. Chapter 7 structured in four sections presents the essence of scientific research and the steps taken in the six years of research as follows:

- Elaboration of final conclusions reflecting significant aspects related to the proposed theme;
- Stating the main personal contributions: theoretical, practical, empirical and methodological;
- Stating the limitations of research;
- Elaboration of future research directions.

The structure of the thesis as well as its content support the author's efforts to elaborate a relevant and original scientific research in relation to the proposed topic. Thus, the thesis consists of two parts:

- Part I "Current status of methods for assessing customer satisfaction" describing the area researched by literature review, comprises Chapter 1 and Chapter 2. In this first part, the contributions of specialists in the field were correlated with the author's own documentation regarding the integration of customer satisfaction throughout the life cycle of a product, exemplified by a vehicle. Part I also clarified important aspects related to customer satisfaction and measurement, customer management and associated concepts, as well as customer experience.

Research conducted in the automotive industry has given rise to research opportunities. Following the bibliographic investigation carried out, it can be concluded that customer satisfaction can be translated as representing the emotional state of customers regarding the total experience felt by them from the first interaction with the product or service to the actual use. It has been observed that in order to collect as much information as possible related to their customer experience, organizations use customer suggestions, complaints and feedback to identify potential problems, assess customer loyalty to the brand, and examine competitors costs and performance.

The studied literature also shows that the repurchase rate of a lost customer is 5 times higher than the costs of keeping it.

The information related to customer satisfaction obtained through intensive literature review was the basis for the development of this doctoral thesis, which had the main objective of developing a model for measuring and evaluating customer satisfaction. This thesis highlights the fact that organizations must make the most of opportunities by monitoring and evaluating their customers satisfaction.

The above-mentioned aspects provided the research direction for which Part II identified, analyzed and explained the factors influencing the occurrence of customer satisfaction.

- Part II "Contributions to the Development of the Customer Satisfaction Assessment Model in the Automotive Industry" describing the author's practical contributions comprises Chapter 3, Chapter 4, Chapter 5, Chapter 6 and Chapter 7.

In this second part, the results of the research within the selected organization are presented and the three main factors that influence customer satisfaction are highlighted. The influence of these three factors (Price, Sustainability and Design) is presented in the form of a statistically validated conceptual model. Final conclusions, personal contributions, research limitations and future research prospects are also highlighted.

Part two begins with the description of methods and techniques for measuring customer satisfaction and results from the application of selected feedback collection methods in the life cycle of a vehicle: Exploration-Prospecting, Development-Design, Testing and After-Market. The three main factors identified (Price, Durability and Design) were validated through the expectations confirmation/rejection model. The proposed model involves three aspects that directly contribute to creating customer satisfaction: the generation of influencing factors, the process of satisfaction formation and the consequences of satisfaction. Thus, the thesis proposes a new approach for evaluating the priorities of product attributes, by presenting a model for assessing the degree of customer satisfaction.

Within Chapter 6, the data collected by applying the developed model were subjected to statistical processing, validation that thus restored the validity of the questionnaire applied to customers. For descriptive, bivariable and multivariable validation of collected data, JASP software specific to statistical data analysis was used. The conclusions of the validation process highlighted the validity of the model, allowing it to be used by automotive industry organizations.

Personal contributions

Through the present research that took the form of doctoral thesis, the author brings a series of important contributions in the field of research. Personal contributions made at theoretical, methodological and practical levels make the model for assessing customer satisfaction over the lifetime of the product a scientific endeavor relevant both for organizations in the automotive industry and for other scientific researchers. Thus, the personal contributions emphasized by the doctoral thesis are presented below.

Theoretical contributions:

The research topic was established, the analysis framework of customer satisfaction in the automotive industry was presented. The context, main objective and secondary objectives of the research were highlighted.

✓ A bibliographic study was conducted to identify the most commonly used methods of measuring and monitoring customer satisfaction in the general framework.

✓ A bibliographic study was conducted to present the methods previously identified by concrete examples.

✓ The study methodology, research and documentation of the current situation regarding the importance of customer satisfaction, especially in the automotive industry, was conceptualized.

✓ A self-study of the impact of customer satisfaction on the lifecycle of a new product was conducted through a generic example.

✓ An additional research was undertaken in order to document the volume of resources needed to apply each type of survey and questionnaire, achieving a concrete flow through its own vision.

Methodological contributions:

✓ Selection of the methodology for data collection necessary to achieve the intended purpose

✓ A new model for measuring and evaluating customer satisfaction specific to the automotive industry has been developed, by drawing a map containing the key moments of customer experience.

✓ A methodology for validating the model for measuring and evaluating customer satisfaction using statistical methods has been developed.

✓ The results of the study can be used in the development of other studies or models to assess customer satisfaction.

Empirical contributions:

✓ Research directions have been established in order to develop the model for assessing the degree of customer satisfaction.

✓ NCBS, NEVQS, Satisfaction Fleets and Fast Track survey questionnaires were applied to identify relevant customer satisfaction information.

✓ The results and conclusions of the research were drawn and highlighted by graphical representation, following the administration of questionnaires

✓ The three main identified factors that participate in the development of customer satisfaction in the automotive industry were discussed.

✓ The interdependence of the three attributes (Price, Design and Sustainability) previously identified was tracked through statistical analysis.

✓ The results obtained by statistical processing were analyzed, highlighting the risk areas.

Data collection:

✓ The questionnaires applied in the NCBS, NEVQS, Satisfaction Fleets and Fast Track surveys were compiled, each based on relevant performance and profile criteria.

✓ The stage of establishing the questionnaire criteria, the actual design stage of the questionnaires and the stage of collecting information were planned and carried out, as a total contribution of the author.

✓ All collected information were interpreted, processed, ethically examined and analyzed.

✓ The model for measuring and evaluating customer satisfaction with statistical analysis has been validated.

Research limitations

The benefits of implementing customer satisfaction monitoring systems are numerous, the concept being found in more and more companies, especially those with specific services where customer satisfaction is their marketing objective being regularly tracked and evaluated.

However, there are also several limitations to monitoring customer satisfaction, such as: large databases that are created over time, the diversity of collected data and the resources needed to exploit them.

Four types of limitations of the methodology for measuring and monitoring the level of customer satisfaction can be distinguished:

- Influence of new customers that can mislead expectations
- Current customers who can change their expectations based on new needs
- Simultaneous use of several types of questionnaires and feedback collection, which can lead to an overlap and an overestimation of the level of satisfaction that does not necessarily represent the quality level of a product or service
- The measurement of satisfaction is carried out to the extent of expectations and not based on the overall quality of products or services

The limitations are build based on the lack of a mechanism that can quantitatively measure relationships with different customers also measuring satisfaction and not their commitment. Another limitation is done by the impossibility of making the difference between a satisfied customer from a loyal one and his long-term relationship with the product. Feedback on satisfaction is temporary and project-specific, but a relationship is about unity, loyalty and rational respective behavioral aspects are not considered.

The assessment models do not consider customer culture and demographics, taking into account that some clients are traditionally very conservative. Current customer assessment methods are proving to be ineffective due to the lack of a tracking mechanism and different points of contact with customers and through different environments.

The respondent level is not used as a parameter to track MMSC, and there is a possibility that at the project level the mood of the client in general is not truly reflected. An improvement is needed in the correlation between the risk level of the project with complaints and customer escalation, proactively tracking risks and keeping them as parameters.

Moreover, the concept of MMSC does not guarantee maintaining customers' desire to repurchase the product. Studies show that out of a sample of 75% of customers satisfied with a service or product, about 20% will be lost each year, becoming a serious problem for large companies that try by various means to keep their customer portfolio.

A product or service will remain in the customer's preferences as long as it meets his needs, and when another brand appears and offers him the same things, the customer will quickly make the transition, the company's strategy must go beyond the standard needs and move on to something more, something that can delight the customer, convincing him to remain loyal.

Perspectives and directions regarding the field of research

Future studies can maintain study variables, changing only the scope in which the study shall be conducted. The proposed model can extend from the automotive industry to other industrial / economic sectors, apply to other sectors, adapting the questions and the type of questionnaires.

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