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Master's Degree Thesis

IMPROVEMENT OF CUSTOMER SATISFACTION ANALYSIS IN FIAT CHRYSLER AUTOMOBILES

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Announcement

Abstract

This thesis aims to present a proposal to improve the analysis of customer satisfaction in Fiat Chrysler Automobiles company, specifically it was developed in the Marketing vehicle importers for Light Commercial Vehicles area. Since customer satisfaction has become a key factor for the growth and success of a company in the last few years, FCA is concerned about having a reliable analysis of not only their position in their market but also going beyond that to understand how customers perceive them and the reasons behind their satisfaction or dissatisfaction with their products/services.

The analysis of customers perception is a broad subject that takes into account several dimensions as customer satisfaction, dissatisfaction, loyalty, quality of the products/services, etc. The characteristics being measured to assess customers' perceptions change from one sector to another, specifically this thesis was developed in the automotive sector. Some guidelines for the creation of the questionnaires will be presented and statistical tools such as, descriptive statistics, correlation test and regression analysis will be described, which will help to analyze the collected information.

This document describes the theoretical basis including marketing, customer satisfaction and statistical analysis theory, as well as internal guidelines used in FCA to evaluate customer experience. Based on this information two questionnaires were developed for the assessment of sales and after sales customer experience. Additionally, this theory and guidelines were crucial in the establishment of the procedure to verify the quality of the questionnaires and data collected. Finally, the steps toward the implementation of the proposal will be presented, including also the guidelines to extract the information from the raw data.

Key words: *Marketing, Customer satisfaction, Statistical analysis, Questionnaires.*

Content

Acronyms and abbreviations

ALI Advocacy Loyalty Index

CSI Customer Satisfaction Index

FCA Fiat Chrysler Automobiles

FRFT Fixed Right First Time

LCV Light Commercial Vehicles

NPS Net Promoter Score

NSC National Sales Company

SEM Standard error of the mean

Glossary

Benchmarking: Refers to testing a product or service against a reference point to quantify how much better or worse it is compared to other products. Benchmarking is the standard way of comparing one product with another. With technology in particular, benchmarking against competing products is often the only way to get an objective measure of quality. This is because many tech products increase rapidly in measures such as speed and storage size when compared to the previous version from the same company, making comparisons between the versions virtually useless (Techopedia, n.d.).

Importer: "A person or organization that brings goods or services into a country from abroad for sale" (oxforddictionaries, n.d.).

National Sales Company: Entity that takes care of marketing, commercial, logistics and sales activities in countries in which the FCA has a big market (Fiat Chrysler Automobiles, 2018)

Trader: A trader is an individual who engages in the buying and selling of financial assets in any financial market, either for himself or on behalf of another person or institution. The main difference between a trader and an investor is the duration for which the person holds the asset. Investors tend to have a longer-term time horizon, while traders tend to hold assets for shorter periods of time to capitalize on short-term trends (Investopedia, n.d.).

1. Introduction

The role of customers has evolved through the years, passing from a passive actor who is just meant to buy products to an active role in which customers have the actual will to decide whether they buy from a given company or either not buy at all. This means, that customers actually have the power to make a company grow or go to bankruptcy.

In the last few decades companies have started to care about how customers see them, how customers feel and whether they are or not satisfied with their products or services. Companies has changed its focus, they have evolved from standard products and massive sales to customized products directed for specific segments of customers. In some extend this is due to the ever-increasing number of companies offering the same/similar products and services that every day enter in the market. But it is also due to the huge amount of information presented on internet and the ease of accessing it, customers can now compare products from different companies doing just one click.

Companies compete for winning customers' loyalty, they create all kind of strategies aiming to construct relationships with their customers, because nowadays it is well-known that customer satisfaction and loyalty are key factors for a company to grow and increase its profit. For this reason, FCA is interested in improving its customer satisfaction analysis in those countries where the importer is the one representing them.

This thesis is divided in seven chapters, which are described as follows: in the second chapter, the description of the research problem and objectives for the thesis are detailed. The third chapter contains a general description of the company and specifically details the Marketing vehicle importers for Light Commercial Vehicles area.

In the four chapter the theoretical Framework is stablished, this chapter describes general concepts as marketing and customer satisfaction. It also details how to construct questionnaires, which are the key aspects of surveys, characteristic an item should have, the possible response formats, how to write the introduction and how to select the questions. Later, it explains how to perform the sampling, detailing the different methods and key concepts. After that, it describes how to verify the reliability and validity of the information collected when administering the

questionnaire and the types of customer loyalty. Then, it explains the several statistical tools that can be used to process and analyze the raw data. Finally, it details how the customer satisfaction is measured, processed and analyzed in FCA.

The fifth chapter covers the description of the current situation in the three different markets analyzed for this thesis. The sixth chapter comprehends the description and explanation of the questionnaires proposed and the seventh chapter details how to perform the implementation of the questionnaires proposed, explaining how to verify the quality of the questionnaires, how to verify the quality of the information, how to analyze the information and key aspects to look at during the analysis. Finally, the last chapter details the conclusions of the work done during the thesis.

2. Description of the research problem

The success of a company is determined by its capacity to satisfy and retain its current customers and to attract new ones. To grow and strengthen relationships with customers is basically the reason why Marketing was born. Marketing, more than any other business function, deals with customers; its objective is to satisfy customers' needs, to create customer value and capture value in return from them. In order to do it, companies have to listen customers' voice, understand if its clients are satisfied or dissatisfied and why, and based on this information, take actions and create improvement plans.

Customer satisfaction has not always been the focus of companies; corporations used to focus on increasing market share through massive sales and cost reduction. A few years ago, companies produced standard products without market segmentation with the objective of reaching as much clients as possible, there were just a few competitors in the markets or none and clients did not have access to information so easily. For the previous factors, customers' opinions were left in the background, companies did not care much about customers' experience, because at the end even though clients did not like too much the product, they ended buying it due to lack of variety and information, or simply because there was not a similar product to buy.

However, times have changed, nowadays there are many companies selling similar products. Clients can easily change from one product to another without incurring in large expenses. Customers have access to a lot of information to compare and decide which product is the one that better fits them. Customers can also share their experiences with friends and many other people using social media and this factor is in fact one of the most important ones. If a customer has a good opinion about a product, other people may hear it and want to buy it, but if a customer share a bad review regarding a product other possible customer may reevaluate his interest in buying it and even current customers may stop buying it. In this way, due to a comment, review or just a publication a company may earn or lose new clients, which will impact in the money they earn or lose. Considering the foregoing, companies have changed their focus and nowadays the majority of them care about customer's opinion.

We can say that in our current market, the customer is the one with the power to make a company grow or take it to bankruptcy and that is the reason why these days customer satisfaction is so important. Different studies show that higher levels of customer satisfaction lead to an increase in customer loyalty, which in fact is traduced in better company performance. That is why companies are so interested in analyzing customers' perception. For this and many other reasons, Fiat Chrysler Automobiles is highly interested in the analysis of customer satisfaction.

In order to monitor customer satisfaction FCA has created a department called Customer Experience with the purpose of following customers' evaluations. This department works with countries that have the presence of the NSC and in the recent years has started to work with some countries in which the NSC is not present. However, this department has not covered all of them yet.

In the Importers and Traders division has born the need of knowing how the FCA is positioned in those markets that are not part of the NSC, in this way the FCA can monitor not only the customers' perception regarding the brand but also the quality of the traders, which are the ones selling the vehicles. This thesis was developed with the aim of creating a general customer satisfaction questionnaire to collect information from the customers, define a standard procedure to process the information collected and evaluate its quality.

2.1. Objectives

The general and specific objectives within which this study was developed were:

2.1.1. General objective

Propose a new survey design to improve the quality of the evaluation of customer satisfaction in countries that do not have the presence of the National Sales Company.

2.1.2. Specific objectives

- Perform a preliminary analysis, to compare the dimensions (areas) some markets take into consideration to evaluate customer satisfaction and the procedure used to process the data against the dimensions and analysis procedure the National Sales Company has as standard for this evaluation.
- Define the dimensions and questions in the questionnaire and the procedure with which the information collected will be processed to improve the evaluation of customer satisfaction in countries that do not have the presence of the National Sales Company.

3. Company description

This chapter contains a general description of the company and specifically details the area in which the thesis was developed.

3.1. General description of the company

Fiat Chrysler Automobiles is the result of the merge between two companies: Fiat Group and Chrysler accomplished in January of 2014. Creating in this way a multinational organization with presence in more than 140 countries and employs nearly 236,000 people.

Fiat Group was an Italian company founded at the end of the 1800s. In 1906, the company expanded its production to trucks, buses, trams and marine engines. After the First World War, the company introduced the concept of industrialized production and the assembly line. In the eighties, the company started to produce electric and natural gas showing its interest for the environment. In the first years of 2000s, the company focused on looking emerging markets to expand its global presence and launching new models to innovate its portfolio of product.

Chrysler was an American company founded in the late 1800s. At the beginning of the 1900s, Dodge Brothers between other pioneers introduced the mass production, reducing the vehicles cost, expanding in this way the consumer base. During the great depression, many smaller companies were forced out of business, but thanks to the wide portfolio of products at different prices, the company survived this period. During the 1900s, the company focused its efforts on the design innovation, redesigning what a customer expected from a car.

Currently, Fiat Chrysler Automobiles has 159 production plants, 87 Research and Development facilities and invest more than 4.3 billion of euros in Research and Development.

The company designs, engineers, manufactures and sells vehicles and related parts and services, components and production systems worldwide (Fiat Chrysler Automobiles, 2018).

3.2. Marketing vehicle importers for Light Commercial Vehicles

The thesis was developed in the EMEA region, in the Sales subdivision, inside the Africa, Importers and Traders perimeter, specifically in the area of Marketing for Light Commercial Vehicles, LCV in abbreviation. The term LCV stands for commercial vehicles with a gross vehicle weight of no more than 35 tons.

This subdivision takes care of countries where there is not the presence of the National Sales Company. The National Sales Company takes care of countries in which the FCA has a big market, speaking in economic terms. To do so, a group of several persons follows one country. On the other hand, in the subdivision of Africa, Importers and Traders, one person follows several markets, because the economic entrance that each country represents is not as large as the one of the countries that are part of the NSA (Fiat Chrysler Automobiles, 2018).

4. Theoretical Framework

This chapter contains a description of the theory on which the thesis was based and specifically details how the FCA handle this topic.

4.1. Marketing

Marketing is the process through which a company engage customers and build profitable customer relationships with them, creating value and capturing it from its customers in return. The main marketing objectives are to attract new customers and build strong relationships with them by offering superior value than competitors and keep, grow and strengthen relationships with current customers by delivering value and satisfaction (Kotler et al., 2018).

4.2. Customer satisfaction

The level of satisfaction that a customer has regarding a product depends on its performance expectations. For this reason, it is important that companies set the right level of expectation at the moment of advertising a product. If the company set product's performance expectations too low, they may satisfy those customers who buy the product, but it will fail to attract more customers. If the company set product's performance expectations too high, customers will be disappointed and will not buy the product again. If product's performance match customer expectations or exceed them, the customer will be satisfied or delighted.

A satisfied or delighted customer will buy company's products again, talk favorably to others about the product, buy other products of the company and be less sensitive to changes in price and competitors offers. This is traduced in a performance improvement for the company. Hence, companies aim to promise only what they can deliver and then deliver more than they promise, increasing in this way customers' satisfaction levels and strengthen relationships (Kotler et al., 2018).

4.3. Questionnaires

There are four phases to construct a customer satisfaction questionnaire: 1) Defining the items/questions to be included in the questionnaire, 2) Determining the response format, 3) Writing the introduction to the questionnaire and, 4) Defining the content of the final questionnaire (Select the items that best represent the dimensions to be assessed).

4.3.1. Questions or items

It is important that items in the questionnaire possess certain characteristics, so writing them can be difficult.

Items should appear relevant to what you are trying to measure. Items that do not appear to measure anything relevant to the service or product might confuse respondents, especially if the instructions indicate that the questionnaire is designed to assess the quality of the service or product.

Items should also be concise. Items that are too long can make the questionnaire too long and difficult to read. Superfluous words should be discarded.

[…]

Items should be unambiguous. The respondent should be able to understand precisely what items are asking. Any ambiguity in the items can lead to equivocal responses. Items that are vague and imprecise should be avoided.

[…]

A good item will contain only one thought. That is, the item should ask only a single question. If an item asks more than one question, the respondent may be frustrated trying to respond affirmatively to one part of the question and negatively to the other part.

[…]

The fifth characteristic of a good item is that it should not contain a double negative (Hayes, 2008, pp.60-61).

4.3.1.1. Measurement scales

There are four types of scales: nominal, ordinal, interval and ratio. The difference between the scales lies in the operations that can be done within each one of them.

A nominal scale is used to categorize objects. In this scale, numbers, symbols and letters serve to tag objects reflecting that they are different from each other. However, the degree of difference between them is unknown. The only arithmetic operations that can be used in this scale are equality and inequality.

An ordinal scale uses numbers to order objects with respect to some characteristic, however the distance between the objects with respect to the characteristic being measure is unknown. The arithmetic operations that can be used with this scale are equality, inequality and rank ordering.

An interval scale uses numbers to order objects with respect to some characteristic and shows the exact difference between the values. The arithmetic operations that can be used with this scale are equality, inequality, ordering operations and subtraction.

A ratio scale is similar to interval scale, with the difference that in this scale a meaningful zero point is included. See in Table 1 a summary of the characteristics of measurement scales (Hayes, 2008).

Table 1. *Types of measurement scales and the functional uses of each (Hayes, 2008, p.207)*

		Functional uses			
		Establish Equality/inequality	Establish rank ordering	Establish equal differences between scale points	Establish zero point
Scale types	Nominal	Yes	No	No	No
	Ordinal	Yes	Yes	No	No
	Interval	Yes	Yes	Yes	No
	Ratio	Yes	Yes	Yes	Yes

4.3.2. Response formats

The second step when constructing a questionnaire is to determine how customers will respond to the items in the questionnaire by selecting the response format. This step is extremely important since determines how the data from the questionnaire will be used. There are different response formats, the two most important are Checklist format and Likert-type format.

In a Checklist Format, the customer is asked to respond to the item "yes" or "no". In case, the item reflects the service or product they received, they should answer "yes", otherwise if the item does not reflect the service or product, they receive they answer is "no". i.e.

	Yes	No
I could get an appointment with the doctor at a time I desired.	____	____

Likert-Type Format has been designed to allow customers to respond in different degrees of satisfaction to each item that describes the service or product. There are different response formats, a few examples are illustrated in the Figure 1 below (Hayes, 2008).

Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1	2	3	4	5
Very Dissatisfied	Dissatisfied	Neither Satisfied nor Dissatisfied	Satisfied	Very Satisfied
1	2	3	4	5
Very Poor	Poor	Neither Poor nor Good	Good	Very Good
1	2	3	4	5

Figure 1. Examples of Likert-type response formats (Hayes, 2008, p.64).

4.3.3. Introduction to questionnaires

When constructing a survey, the third step is to write the introduction to the questionnaire. The introduction should be brief, describe the purpose of the questionnaire, explain how to complete the items and how the data will be used (Hayes, 2008).

It is important to highlight that the instructions about how to complete the questionnaire must be consistent with the response format chosen. If you use agree-disagree continuum as response format, the instructions should ask respondents to indicate the extent to which they agree or disagree with the statements in the questionnaire. When you use the satisfaction continuum as the response format, the instructions should ask respondents to indicate the extent to which they are satisfied (Hayes, 2008, pp.66-67).

4.3.4. Item selection

The last step to construct a questionnaire is to select the items to be used in the final questionnaire. In step one, you formulate the possible questions to be used, but in this phase, you select between all possible items those ones who best fit the dimensions we want to measure. To do so, there are two methods that will help you in the selection process; the first method is based on human judgment and the second on mathematical indices (Hayes, 2008).

4.3.4.1. Judgmental item selection

Items selected with human judgment should try to include those items that best represent customers' requirements. One way to do so it is to ask two people independently to select a specified number of items from a list of all possible questions, and retain those items chosen by both people (Hayes, 2008).

4.3.4.2. Mathematical item selection

In order to select items using mathematical indices a questionnaire with all the questions should be administer to some customers and after that, an analysis should be conducted with the data collected. You may analyze this data using correlation analysis and factor analysis and retain those items with equal means and high correlation. This method is more complex than judgmental item selection, but you will have the certainty of knowing that the items selected are statistically reliable (Hayes, 2008).

4.3.4.2.1. Correlation analysis

Correlation analysis evaluates the correlation between the item and the overall dimension score to which the item belongs (without including the one item under analysis). This analysis shows the degree of which the item is linked to the overall dimension score with which it should be highly correlated; otherwise, this item should be dropped from the questionnaire (Hayes, 2008).

4.3.4.2.2. Group differences

A good item is judged by its capacity to discriminate between different levels of customer satisfaction. Based on this statement, another way the items can be selected is to ask two groups of people, each group representing the extreme of the attitude measured by the scale, to answer the questionnaire. Then a difference score is computed for each item, subtracting the mean of the lower extreme group to the mean of the higher extreme group. Therefore, the difference in scores reflects how much an item was able to discriminate between the two groups with opposite attitude respecting the dimension being measured. If an item was not able to distinguish between the two groups, we will obtain a score of zero. These items should be dropped from the questionnaire, because they are not measuring what they are designed to measure (Hayes, 2008).

4.3.4.2.3. Factor analysis

Another statistical technique is factor analysis. This method shows which items are more highly related to the underlying dimension they are designed to measure. If an item loads highly on the factor for what it was intended, means it is measuring what was designed to measure; if an item loads highly on other factor different from the one for which it was designed, this suggest that the item might best be combined with other items; lastly, if an item does not load highly on any factor, this suggest the item does not discriminate between high and low group attitudes.

This method shows which items are measuring a certain dimension; however, a disadvantage of this method is that it requires to collect a large number of data to obtain reliable information. The number of respondents should be five to ten times the number of items in the questionnaire (Hayes, 2008).

4.4. Sampling methods

To have a reliable illustration of customer satisfaction it may not be necessary to survey all company's clients. Since surveying the entire population requires tons of resources, companies may want to select a sample of customers and generalize results to the whole population. This process is referred to as sampling.

There are three types of sampling: census sampling, judgment sampling, and statistical sampling (Hayes, 2008).

4.4.1. Census sampling

Companies using this approach administer surveys to all of its customers. This method may be used when the database is small enough that surveying the entire population is financially feasible, also when due to the nature of the product, a company may be interested in knowing the perception of all of its customers. However, the major disadvantage of this approach is the high costs associated with it (Hayes, 2008).

4.4.2. Judgmental sampling

In this approach the selection of the sample of people who is going to fill the survey is up to the decision of the person conducting the study, i.e. the researcher can decide which cases include or not include. This method is used when a few cases are required to illustrate researcher's point. However, the major disadvantage of this method is the inability to generalize results to the entire population, due to the lack of objectivity of the study (Hayes, 2008).

4.4.3. Statistical sampling

This approach uses random selection to determine which cases are included in the sample. It is possible to find an appropriate sample size and statistically determine the probability that our sample is not representative of the population. This method has several advantages, it allows us to generalize results to the population from which the sample was taken, it requires less resources to be performed compared to census sampling and is the most reliable method to provide useful and reliable information about the population.

There are different types of statistical sampling: simple random sampling, stratified sampling, and, cluster sampling (Hayes, 2008).

4.4.3.1. Simple random sampling

This approach is the simplest one to determine which cases are to be included in the sample. Every case in the population has an equal chance of being included in the sample; so, to generate our sample we randomly select people (the quantity of people is defined by the sample size, which will be explained later) and measure their satisfaction level (Hayes, 2008).

4.4.3.2. Stratified sampling

This method divides people into two or more strata (groups) and after that a simple random sampling is conducted within each strata. Each strata or groups must be mutually exclusive, that means being in one stratus implies that you cannot be in the other, i.e. you can stratify by gender, by annual income, location of residence, etc. We may prefer this approach, when we believe there are differences in the various strata and if one of them contains a relative smaller number of cases compared to the others (Hayes, 2008).

4.4.3.3. Cluster sampling

This approach conducts the selection process at the group level rather than at the individual level. This means, the individual cases within the population are clustered into groups such as office locations, products, etc. and we will randomly select a cluster from our population (all the clusters) (Hayes, 2008).

4.4.4. Sampling size and sampling error

As mentioned previously, we can measure satisfaction level of the sample and generalize the results to the population. When generalizing about the population, statistics are used (numbers calculated from the sample) as estimators for the parameters (numbers calculated from the population of customers) (Hayes, 2008).

4.4.4.1. Sampling error

Supposing we have customer database of 500 customers (population) and for illustrative purposes, let's set our sample size to equal 10 […]. If we randomly select a sample of size 10 many times, we would probably get different results each time we calculate the mean of that particular sample. This variation from sample to sample is referred to as sampling error […], is expected and considered to be random (Hayes, 2008, p.91).

4.4.4.2. Standard error of the mean

As mentioned before, if we randomly select a sample of a fixed size from the population many times, we would probably get different means from each sample. If we plot these means, we will find a distribution of sample means, with its own mean and standard deviation; this distribution of means is referred to as a sampling distribution of the mean.

The standard error of the mean (sem) is essentially a measure of the degree of sampling error. It can be calculated with the following equation:

$$Standard\ error\ of\ the\ mean\ (sem) = \sigma/\sqrt{n}$$

Where n is the sample size and σ is the population standard deviation, but sample standard deviation can be used to estimate the "sem" in case that σ is unknown (Hayes, 2008).

4.4.4.3. Sample size

When using statistical sampling we can make generalizations of our population from the sample results. Nevertheless, an important characteristic that has to be taken into account is the degree of precision (degree of sampling error) of our generalizations.

Several factors must be considered when determining the sample size:

- *Standard deviation of the characteristic being measured (s):* It shows the variability of the characteristic being measured
- *Confidence level (t):* It shows the degree of confidence we have that the sample statistic we obtain from our sample is close to the population parameter. This value is operationalized by a t-value, that can be seen in a t-value table.
- *Tolerable error (TE):* It shows the desired level of precision.

To calculate a simple size, we can use the following equation:

$$n = (t^2 \times s^2)/TE^2$$

Two factors must be established: the confidence level (t) and the amount of tolerable error (TE). The standard deviation is estimated with existing data (s) (Hayes, 2008).

4.4.4.3.1. Response rates

When evaluating customer satisfaction using a survey, it is unlikely that all customers to which you send the questionnaire will answer it. For this reason, when you are estimating the sample size, you must consider this factor so that you can ensure enough data in your final sample to maintain the level of confidence and tolerable error established previously. The equation to recalculate the sample size taking into consideration the response rate is shown below (Hayes, 2008).

$$Distribution\ size = \frac{Needed\ sample\ size}{Response\ rate}$$

4.5. Reliability and validity

When developing a questionnaire to assess customer attitudes and perceptions toward a product, it is necessary to ensure that scores obtained reflect accurate information about the underlying dimensions. In order to do so, we evaluate reliability and validity of the information collected (Hayes, 2008).

4.5.1. Reliability

Reliability is defined as the extent to which measurements are free from random-error variance. Random error decreases the reliability of the measurement. If we want to feel confident that scores on our questionnaire reliably reflect the underlying dimension, we want the questionnaire to demonstrate high reliability. There are three general forms of reliability: test-retest reliability, equivalent form reliability, and internal consistency (Hayes, 2008, p.35).

4.5.1.1. Stability and Test-Retest reliability

Test-Retest reliability is an index that shows the stability of the scores over time. This means that, if we administer the same survey to the same sample of customers at two different times, we would get different results; this index would show the correlation between the scores for time 1 and time 2. It is important to highlight that the stability of customers' scores might depend on the interval of time between one questionnaire and the other.

If after administering the questionnaire at two different times we obtain a low correlation between the scores, it means that: 1) the customer has changed his satisfaction perception, 2) the

customer questionnaire is not highly reliable, or 3) both. For practical purposes, this method could not be the most appropriate due to the resources needed to carry it out (Hayes, 2008).

4.5.1.2. Equivalence and Parallel Forms Reliability

The main goal of evaluating a dimension with a questionnaire is to be able to generalize from the specific items the performance of the whole dimension. To evaluate if we can generalize the information collected from specific items to the whole dimension from where they were drawn, we use the parallel forms reliability index, which assess the extent to which scores are free from error associated with a particular set of items.

To evaluate equivalence, two questionnaires have to be developed, each one with slightly different questions measuring the same underlying dimension of interest. These questionnaires are administered to the same set of people and if the correlation between the two sets of scores is high, it means that the error associated with the selection of the specific items within each questionnaire is low. Otherwise, a low correlation would mean that it is not possible to generalize the results to the whole dimension (Hayes. 2008).

4.5.1.3. Internal consistency

In customer satisfaction questionnaires, usually we use different items to measure the same dimension and then we combine those items to get a single score of that dimension. In order to ensure that the items we are combining are measuring the same quality dimension, we evaluate internal consistency, otherwise if the items are not measuring the same thing then the overall score would be meaningless (Hayes. 2008).

There are two methods to evaluate internal consistency in a questionnaire: 1) Split half reliability estimate and 2) Cronbach's Alpha Estimate.

4.5.1.3.1. Split-Half Reliability Estimate

This method estimates internal consistency by dividing the questionnaire into halves, i.e. first half of the questionnaire vs the last half of the questionnaire and calculating the correlation between them. A high correlation indicates that the two halves yield consistent information, which means that a person who rate high on one-half of items, also rate high the other half; this leads to conclude that the questionnaire is measuring the same thing.

When using this method, it is necessary to include a correction factor, because the length of the questionnaire affects the reliability (more items on the questionnaire, imply higher reliability). Therefore, to correct the reliability the following equation is used.

$$r_{cc\prime} = (nr_{12})/(1 + (n-1)r_{12}$$

Where $r_{cc\prime}$ is the corrected reliability estimate of the questionnaire, r_{12} is the correlation between the two halves of the same questionnaire, and n is the number of items in the overall scale divided by the number of items in each of the halves (Hayes, 2008, p.46).

4.5.1.3.2. Cronbach's Alpha Estimate

This method also tells us the degree of correlation between the items in our questionnaire. Usually, it is used when a questionnaire has many items. Generally, calculation of Cronbach's is done with a statistical package, but can also be calculated using the correlation between the items with the following equation.

$$r_{xx\prime} = \left(\frac{K}{K-1}\right) \times (1 - \left[(\sum x_{ii}) / (\sum x_{ii} + \sum x_{ij} \; where \; i \neq j)\right])$$

Where x_{iis} are the elements in the covariance matrix or correlation matrix, and K is the number of items within a given dimension. The numerator,$(\sum x_{ii})$, indicates that the elements in the diagonal of the covariance (correlation) matrix are to be added together. The denominator, $(\sum x_{ii} + \sum x_{ij})$, indicates that all the elements in the covariance (correlation) matrix are to be added together (Hayes, 2008, p.46).

4.5.1.4. Factors affecting reliability

Several factors might affect the reliability estimate of a questionnaire:

Number of items in the scale: The length of items used in a questionnaire might affect the reliability of a questionnaire. The more items a questionnaire has, the more confident we are that observed scores are accurate reflections of the customers' perception.

Sample of people: A sample of customers with similar levels of satisfaction might yield to low reliability estimates of the questionnaire, because we are not basing our analysis in a heterogeneous sample (Hayes, 2008).

4.5.1.5. Multiple items to measure a dimension

We use multiple items to measure a dimension to ensure that the overall score is a reliable reflection of the customer perception. If we use only one item to measure a given dimension, we run the risk of obtaining unreliable information, i.e. suppose you want to assess mathematical ability. To do so, you can ask people to solve a mathematical problem; but it does not seem reasonable to assess an ability based only on one question. Customer satisfaction as mathematical ability are unobservable constructs measured by tools, in our case questionnaires. Therefore, if we want to determine how reliable an indication of customer satisfaction is, we have to ask more than one item to assess each dimension, in this way, we can be confident that the overall scores of the questionnaire are consistently related to customers' perception (Hayes, 2008).

4.5.2. Validity

Validity refers to the degree to which evidence supports the inferences made from scores derived from measures, or the degree to which the scale measures what it is designed to measure. For example, if we make the inference that scores on a measure reflect levels of customer satisfaction, we need information to assess how well that inference is supported (Hayes, 2008, p.53).

There are methods to evaluate validity: 1) Content-Related strategy, 2) Criterion-Related strategy, 3) Construct-Related strategy.

4.5.2.1. Content-Related Strategy

When constructing a questionnaire several items can measure a specific dimension; we cannot include all of them, so we select those who best represent the dimension.

This method analyzes the content of the questionnaire, to assess the degree to which the items on the questionnaire are the ones that best represent the dimension to be measure. To perform the analysis, an expert or people familiar with the purpose of the questionnaire is required; they will be the ones who will judge if the items included on the questionnaire are the most appropriate (Hayes, 2008).

4.5.2.2. Criterion-Related Strategy

Criterion-related strategy is concerned with examining the systematic relationship (usually in the form of correlation coefficient) between scores on a given scale and other scores it should predict. […] We would expect to find some dimensions of quality (as perceived by the customer) to be related to endorsement behavior with that product. The higher the quality the more frequent the endorsements (Hayes, 2008, p.54).

4.5.2.3. Construct-Related Strategy

This method examines the correlations between measures, analyzing that the scale correlates with items that should correlate and that the scale does not correlate with items with which it should not correlate (Hayes, 2008).

4.6. Customer loyalty

The measure of customer loyalty it is usually performed using four loyalty questions:

- Overall, how satisfied are you with Company Name?
- How likely are you to recommend Company Name to friends or colleagues?
- How likely are you to continue purchasing the same product and or service from Company Name?
- If you were selecting a company (within the industry) for the first time, how likely is it that you would choose Company Name? (Hayes, 2008).

Hayes (2008) illustrates an experiment where he used in a questionnaire the four questions to assess customer loyalty. First, he found that the four questions have a high correlation, which means the customers responded in a consistent manner to the four questions. Second, he performed a factor analysis, where he found that the correlation between each question and its underlying factor was high, which means the four questions were measuring one underlying construct: customer loyalty. Third, he evaluated the reliability of the information with the Cronbach's Alpha and found a high reliability on the information collected which indicates that there is little measurement error when all four questions are used together. Finally, supported on the analysis descripted before, he concludes that the four questions can be averaged to get a more reliable measure of loyalty, in this case, he refers to this average as Advocacy Loyalty Index (ALI).

Hayes (2008) concludes that use the ALI in customer loyalty management is better than use any single question because individual survey questions have inherent measurement error and aggregate different questions to measure the same dimension is a useful way to provides a more precise measure of loyalty than any of the four questions used alone.

Moreover, Hayes (2008) affirms that customer loyalty questions should appear at the start of the survey, before business attribute questions are presented. Presenting loyalty questions at the start of the survey ensures that responses to those loyalty questions reflect the respondents' general perceptions regarding their relationship with the company.

4.6.1. Types of loyalty

"There are three types of customer loyalty: advocacy, purchasing, and retention.

- Advocacy Loyalty Index (ALI): Reflects the degree to which customers will be advocates of the company (average across satisfaction, recommend, choose against, purchase same).
- Purchasing Loyalty Index (PLI): Reflects the degree to which customers will increase their purchasing behavior (average across purchase different, purchase increase, purchase frequency).
- Retention Loyalty Index (RLI): Reflects the degree to which customers will remain with a given company (single defection item, reverse coded)" (Hayes, 2008, p.114).

4.6.2. Net Promoter Score (NPS)

The Net Promoter Score is a loyalty measure used to monitor and manage customer relationships. According to Satmetrix (n.d.), "Loyal customers are more efficient and less costly to serve because they need less support than disgruntled customers. They are also less price sensitive, willing to pay more for the value your brand delivers" (p.4).

NPS is based on the idea that recommendation is the sincerest expression of customer and brand loyalty, so, to understand customer's degree of loyalty a company just have to ask its customers for the likeliness to recommend them on a numeric scale.

The NPS is calculated based on a single loyalty question: "How likely is it that you would recommend Company Name/Product to a friend or colleague?" This question is valuated in a scale from 0 (Not at all likely) to 10 (Extremely likely), based on the rating the customer gives to this

question, it can be classified into three categories: a detractor (ratings from 0-6), a passive (rating from 7-8) and a promoter (rating from 9-10). See Figure 2.

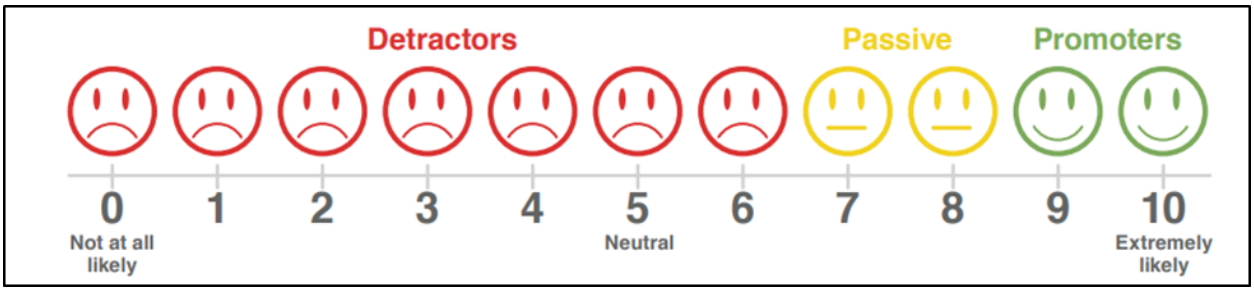

Figure 2. Net Promoter Score Scale.

A company calculate its Net Promoter Score by subtracting the percentage of detractors from the percentage of promoters. See Figure 3.

Figure 3. Net Promoter Score Equation.

After the feedback is processed, if the customer gave a high score, the marketing team should receive a notification to offer these promoters the possibility to share their positive experience in social media. On the other hand, if the customer gave a low score the appropriate employees have to be notify in order to handle the detractor complaint. If a company do not have the resources to response to every detractor, you can focus your resources on those clients that responded with 5's and 6's, because to change the opinion of those who rated below 5 companies will have to use a ton of resources.

Moreover, this measure can also help companies to understand what they have already done well by asking promoters "what do you like most?" and to understand what can be improved by asking detractors "What's the one thing we can do to improve?" (Satmetrix, n.d.).

4.7. Statistical tools

Some statistical tools can be useful at the moment of analyzing a data set and the quality of a questionnaire. Some of them are detailed below.

4.7.1. Descriptive statistics

Descriptive statistics help us to describe basic features of a large data set in a study and present it in a summarized form. There are two types of indices that help us understand the data: central tendency and variability.

Central tendency measures allow us to determine roughly the center of the scores in the data set. There are three measures that describe central tendency: mean, median and mode. The first one, mean, is the average of all the scores in the data set. The second one, median, is the number at which half of the measurements are more than that number and half of the measurements are less than that number. The last one, mode, is the measurement that occurs more often in the data set.

Variability measures the extent to which scores are consistent or packed together versus spread out. To measure the variability, we can evaluate the variance, s^2and standard deviation, s. To calculate the variance, we can use the following equation:

$$s^2 = \frac{\sum(x_1 - \bar{x})^2}{n - 1}$$

The numerator is the sum of the squared deviations about the mean and the denominator is the number of scores in the data set minus one, which is also known as degree of freedom. To compute the standard deviation, we simply find the square root of the variance, s. The larger the standard deviation, the larger the spread in the data (Hayes, 2008).

4.7.2. Regression Analysis

Regression analysis is used to measure if the independent variable "X" is related to the dependent variable Y and the degree to which it explains it. This relationship can be described by the following equation.

$$Y = a + bX + e$$

Where b and a are constants representing the slope (change in the dependent variable given a unit change in the independent variable) and intercept of the regression line, respectively. The error associated with the prediction is labeled as e (Hayes, 2008).

4.7.2.1. Degree of fit

It is important to evaluate how well the regression line represents or fits the data set. To do so, we find an index known as $Pearson\ r^2$.. This index can be calculated using the equation below.

$$r^2 = \frac{[n\sum x_i Y_i - \sum x_i Y_i]^2}{[n\sum X_i^2 - (\sum X_i)^2][n\sum Y_i^2 - (\sum Y_i)^2]}$$

This index varies from 0 to 1. It approaches 1.0 as the data lie closely near the regression line and approaches 0 as the data are widely dispersed around the regression line (Hayes, 2008).

4.7.2.2. Pearson r

The $Pearson\ r^2$ index explained previously, does not detail the direction of the relationship between the two variables. In order to know it, we determine the $Pearson\ correlation\ coefficient\ r$, which can be calculated with the equation below.

$$r = \frac{n\sum x_i Y_i - \sum x_i Y_i}{\sqrt{[n\sum X_i^2 - (\sum X_i)^2][n\sum Y_i^2 - (\sum Y_i)^2]}}$$

The Pearson r index indicates the strength and direction of relationship between the variables and it varies from -1 (perfectly negative relationship) to 1 (perfectly positive relationship) (Hayes, 2008).

4.7.2.3. Testing significance of fit

To test the significance of r we first transform the r statistic to a t statistic with the following equation.

$$t(n-2) = \frac{r\sqrt{n-2}}{r\sqrt{1-r^2}}$$

Then, we stablish our hypothesis test, being in this case:

$$H_o: \rho_{xy} = 0$$

$$H_a: \rho_{xy} \neq 0$$

The null hypothesis H_o: ρ_xy=0, means there is no correlation between the variables and the alternative hypothesis H_a: ρ_xy≠0, means there is a correlation between the variables. Subsequently, with the degrees of freedom (n-2) and confidence level we proceed to search in a critical value of the t statistics table the values that determine the rejection/acceptance area, and finally if the t value is on the rejection area or not, we can proceed to accept or not the null hypothesis (Hayes, 2008).

4.7.2.4. Multiple regression

In the regression analysis, we examine the relationship between two variables. We might want to examine the relationship between more than two variables simultaneously. In that case, we can use multiple regression analysis.

Multiple regression analysis is used to measure if the independent variables are related to the dependent variable and the degree to which they can predict it, i.e. it is possible that five independent variables are related to the dependent variable. However, a multiple regression analysis may show that only one of them account for a unique portion of variance in the dependent variable. The other factors, due to overlap with the first factor, may not add any explanation to the prediction of the dependent variable.

There are various methods of multiple regression analysis: forward selection, backward elimination and stepwise selection. The difference between them lies on how the factors are included or retained in the final regression equation (Hayes, 2008).

4.7.2.4.1. Forward selection

The variable that has the highest correlation with the dependent variable is entered into the equation first. Next, the factor that explains the greatest and unique amount of variance (after the first factor has been entered) is entered into the equation and tested for its significance. If the factor is significant, it remains in the equation and the next factor that explains the greatest and unique

amount of variance (after the first two factors have been entered) is entered in the equation and tested for significance. This process is conducted until the remaining factors do not contribute any significant variance to the prediction of customer satisfaction (Hayes, 2008, p.261).

4.7.2.4.2. Backward elimination

All factors are included into the equation from the start. Each factor's unique contribution to the explanation of the dependent variable (after controlling for the other factors) is tested. The factor whose unique variance does not account for a significant amount of variance and explains the least amount of variance in the dependent variable is dropped from the equation. Each factor is again tested to see if its unique variance accounts for a significant amount of variance. The process of elimination is iterated until all factor in the equation account for a significant amount of variance in the dependent variable (Hayes, 2008, pp.261-262).

4.7.2.4.3. Stepwise selection

In stepwise selection, both forward selection and backward elimination procedures are used. In the first step, the variable that has the highest correlation with the dependent variable is entered into the equation. Next, the factor that explains the greatest and unique amount of variance (after the first factor has been entered) is entered into the equation and tested for its significance. In the next step, however, the first variable that was entered into the equation is tested to see if it explains a unique amount of variance in customer satisfaction after the second variable has been added to the equation. If the first variable does add unique explanation to the dependent variable, it remains in the equation. If it does not, it is dropped. This process is conducted with the remaining variables. With this method, it is possible to determine which factors were initially good at predicting customer satisfaction at the early stages of the analysis but may have lost their usefulness at later stages after more variables have entered the equation (Hayes, 2008, p.262).

4.7.3. Hypothesis testing

Hypothesis testing involves determining the extent to which the differences between our samples is not likely due to sampling error. When the difference is likely due to sampling error, we do not reject the null hypothesis; the two samples are likely from the same population. When the difference is not likely due to sampling error (difference is large), then we reject the null hypothesis in favor of the alternative hypothesis (Hayes, 2008, p.238).

4.7.4. Analysis of variance

This analysis is used to compare two or more than two groups simultaneously. Suppose we have four independent sets of data. We can calculate the variance of the observations with two methods: pooled variance estimates (s_p^2) and variance of the means (s_x^2).

The first method is to calculate the variability within each group. Four separate variances, one for each group, can be calculated. These four separate variances are each an estimate of the same variance. Therefore, we can get an overall variance measure by averaging these four variances. This average variance is the pooled variance estimate s_p^2.

The second method is to calculate the variance of the means (s_x^2). The variance of the means, however, is dependent on the sample size. As sample size increases, the variance of the means decreases. Thus, to correct for sample size, we multiply the variance of the means by the sample size for each group. This estimate now reflects the variability of the group means corrected for sample size (ns_x^2).

[…] In ANOVA, we are comparing these variance components. If the variance calculated using the means is larger than the variance calculated using individual scores within groups, this might indicate that there is a significant difference between the groups (Hayes, 2008, p.247).

4.7.4.1. Testing ANOVA

The F value is a ratio of the variance of the means corrected for by sample size to variance within the groups. A large F value indicates that the between-group variance is larger than the within-group variance. Like the t statistic, the F value can also be described by a distribution, the F distribution. The F distribution has two different degrees of freedom, one associated with the estimate of the variance of the means (k – 1) and the other associated with the variance within groups (N – k) […].

The concept of testing in ANOVA is the same as the testing using the t-test. We compare the observed F value from our study to a critical F value. This critical F value is a cutoff point, above which the probability of obtaining an F value is only .05 if the null hypothesis is true. Therefore, an observed F value above the critical value, because it is such an unlikely event, would

lead us to believe that the different groups in our study do not come from the same population (Hayes, 2008, p.249).

4.7.5. Factor analysis

Factor analysis is a statistical technique used in questionnaire development. Firstly, it identifies the number of factors or underlying dimensions that best represent the observed correlations between the initial set of items. Secondly, it determines which items fall within their respective factors or dimensions.

Since this technique allows us to identify the number of underlying dimensions we are measuring in our questionnaire and determine which items are measuring similar things, it is often used as a method for data reduction (Hayes, 2008).

4.8. Customer satisfaction in FCA

A description of the dimensions that are evaluated in the FCA's questionnaires to measure customer satisfaction and a general picture of the procedure used to analyze it is detailed below.

4.8.1. Questionnaires used in FCA

Currently the FCA has four different types of surveys: Lead Feedback, Shopper Feedback, Customer Feedback Sales and Customer Feedback Service. In total, during the year FCA collects information from approximately 1,000,000 people.

The Lead Feedback survey was designed with the purpose of tracking dealer promptness in managing leads, re-distribute hot leads and measure the satisfaction. This survey is administered by mail and it applies for six brands: Fiat, Fiat Professional, Abarth, Alfa Romeo, Jeep and Lancia.

The Shopper Feedback survey was created with the objective of revamping sales opportunities, understand the reasons behind lost sales and measure the customer satisfaction with pre-sales cycle. This survey is administered by phone and mail and it applies for fix brands: Fiat, Fiat Professional, Abarth, Alfa Romeo, Jeep and Lancia.

The Customer Feedback Sales survey was intended with the aim of measuring satisfaction with the sales experience and understand reasons behind satisfaction or dissatisfaction. This

survey is administered by phone and mail and it applies for fix brands: Fiat, Fiat Professional, Abarth, Alfa Romeo, Jeep and Lancia.

The Customer Feedback Service survey was designed with the purpose of measuring the satisfaction with the service experience and understand the reasons behind satisfaction or dissatisfaction. This survey is administered by phone and mail and it applies for seven brands: Fiat, Fiat Professional, Abarth, Alfa Romeo, Jeep, Lancia and Chrysler (FCA, 2018).

Below in Table 2 a summary of the four types of surveys mentioned previously is presented.

Table 2. *FCA Surveys: Scope and coverage (FCA, 2018)*

Survey	Scope	Channel
Lead Feedback	▪ Track dealer promptness in managing leads. ▪ Re-distribute hot leads. ▪ Measure the satisfaction.	Mail
Shopper Feedback	▪ Revamp sales opportunities. ▪ Understand the reasons behind lost sales. ▪ Measure the satisfaction with pre-sales cycle.	Phone Mail
Customer Feedback Sales	▪ Measure satisfaction with the sales experience. ▪ Understand reasons behind satisfaction/dissatisfaction.	Phone Mail
Customer Feedback Service	▪ Measure the satisfaction with the sales experience. ▪ Understand reasons behind satisfaction/dissatisfaction.	Phone Mail

4.8.1.1. Presales

In the Presales category are contemplated two types of surveys: lead feedback and shopper feedback. Below in Table 3 a summary is presented.

Table 3. *FCA Presales surveys summary (FCA, 2018)*

	Lead Feedback	**Shopper Feedback**
Scope	▪ Lead through FCA Corporate websites. ▪ Timing: *Mail* +3dd; *sms* +4dd	▪ Shopper walk in showroom requiring for a quotation. ▪ Timing: *Mail* +8dd; *sms* +2dd; *phone:* +7dd
Goal	▪ Monitoring of Lead Follow Up by dealer. ▪ Hot lead re-distribution.	▪ Adoption of sales process at dealer level. ▪ Undecided management / win-back campaign to support sales. ▪ Marketing and brand intelligence.
Survey	▪ Lead Follow Up. *«* Have you been contacted by your dealer with regard to your request? *»* o Yes. o No, but I am still interested. o No, I am no more interested.	▪ Profiling questions (model of origin, hesitation, rejection). ▪ Shopper Satisfaction (NPS). ▪ Process dive: Need analysis, Financing offer, Trade In, Car Presentation, Test Drive Execution, Follow Up after quotation.

Lead feedback survey, as mentioned before, monitors the lead follow up by dealer and the hot lead re-distribution. Three days after customer's mail or message, he/she is contacted by mail to ask him/her if his/her request has been solved by the dealer (Have you been contacted by your dealer with regard to your request?). If after four days, the client does not respond the mail he/she is contacted again by sms to ask him/her the same.

Shopper feedback survey monitors the adoption of sales process at dealer level, reasons behind undecided customers, marketing and brand intelligence. Eight days after customer visit to the showroom, he/she is contacted by mail to ask him/her about his/her experience regarding the following aspects: need analysis, financing offer, trade in, car presentation, test drive execution, follow up after quotation. If after two days the client does not respond the mail, he/she is contacted again by sms with the same questions; if after seven days client is still not responding, he/she is contacted again by phone with the same questions (FCA, 2018).

4.8.1.2. Sales

This category includes the Customer Feedback Sales survey. This questionnaire monitors dealers' process, customer satisfaction and reasons of detraction and detractor's management by dealer. Fourteen days after picking up, customer is contacted by phone or mail asking him/her about his/her experience about: salesman capabilities, contact before pickup, delivered by date promised, warranty / maintenance offer, handover of vehicle, explanation features and controls, ability to correct faults, follow-up delivery. Below in Table 4 a summary is presented (FCA, 2018).

4.8.1.3. After Sales

This category includes the Customer Feedback Aftersales survey. This questionnaire monitors dealers' process, customer satisfaction and reasons of detraction and detractor's management by dealer. Five days after picking up, customer is contacted by phone or mail asking him/her about his/her experience about: ease of getting appointment, willingness to understand problems, provision of quotation, satisfaction with mobility service, FRFT (Fixed Right First Time), explanation of charges, ability to keep promised timings, condition of the car, follow-up. Below in Table 5 a summary is presented (FCA, 2018).

Table 4. *FCA Sales surveys summary (FCA, 2018).*

	Customer Feedback Sales
Scope	▪ Customers who buy a new vehicle. ▪ Timing: 14 days after picking up.
Goal	▪ Dealer process monitoring. ▪ Customer Satisfaction with the touch-points and reasons of detraction. ▪ Detractors' management by dealer/ close the loop process.
Survey	▪ Customer Satisfaction (KPI: NPS - Net Promoter Score). *«* Based on your experience with the showroom/workshop at the time this work was done, how highly would you recommend the workshop to your friends and family? » 1/10. ▪ Process dive: «Salesman capabilities», «Contact before pickup», «Delivered by date promised», «Warranty / Maintenance offer», «Handover of vehicle», «Explanation features and controls», «Ability to correct faults», «Follow-up delivery».

Table 5. *FCA Aftersales surveys summary (FCA, 2018).*

	Customer Feedback Aftersales
Scope	▪ Customers who need a service intervention (maintenance, repair warranty or customer pay). ▪ Timing: 5 days after picking up.
Goal	▪ Dealer process monitoring. ▪ Customer Satisfaction with the touch-points and reasons of detraction. ▪ Detractors' management by dealer/ close the loop process.
Survey	▪ Customer Satisfaction (KPI: NPS - Net Promoter Score). « Based on your experience with the showroom/workshop at the time this work was done, how highly would you recommend the workshop to your friends and family? » 1/10. ▪ Process dive: «Ease of getting appointment», «Willingness to understand problems», «Provision of quotation», «Satisfaction with mobility service», «FRFT», «Explanation of charges», «Ability to keep promised timings», «Condition of the car», «Follow-up».

4.8.2. Analysis of the information in FCA

During the last year, the FCA worked on the analysis of the relationship between the NPS levels and the revenues/profits and discovered that highest levels of NPS lead to revenues/profits increase and lowest levels of NPS lead to revenues/profits losses. For this reason, all the analysis and the efforts the FCA undertake are committed to increase the NPS in such a way that the company grows.

There are three types of analysis the company performs to process the data collected:

1. *Correlation analysis:* This analysis focuses on understanding which KPIs have a higher and lower impact on the NPS, in such a way to focus improvement efforts and resources on those ones that can strongly affect the NPS.
2. *Regression analysis:* This analysis has basically the same objective of the correlation analysis. It focuses on understanding which KPIs have a higher and lower impact on the NPS, but it also analyze if there are internal correlation between the independent variables (KPIs). For this test, the three types of correlations are performed: forward, backward and stepwise.
3. *NPS per KPI:* This analysis calculates the NPS for each KPI; this takes the number of promoters minus number of detractors of each KPI. The bigger the difference more important is that KPI for the client, meaning that resources and improvement efforts should be focus on improve that KPI because is affecting the growth of the company.

To perform all the tests detailed previously, FCA uses two programs: SAS and RStudio (FCA, 2018).

5. Description of the current situation

This chapter details the description of the current situation of three different importer markets. Due to privacy reasons we will not reveal the real name of the countries, so we will refer to them as Market A, Market B and Market C. We will explain what the countries are currently doing regarding the measurement of customer satisfaction, how they measure it or whether they use an external agency to manage this information.

5.1. Market A

Currently the Market A is measuring customer satisfaction in pre-sales, sales and after sales.

5.1.1. Pre-Sales

To measure customer satisfaction in Pre-Sales the Market A is using an external agency. This agency sends experts in dealership presentation and customer service to visit the dealership pretending being a customer. During the visit, the experts ask for a specific product and behave in a certain way. At the end of the visit, they fulfill a form evaluating the service received from the dealership, all of this without evidencing to the dealer staff that they are actually evaluating the service provided. This agency provides the analysis of results of the visits performed by its personnel each quarter. The questionnaire/form used for these visits can't be shown for privacy reasons.

5.1.2. Sales

To measure customer satisfaction in sales, the dealers collect the information and send it to another company, which is in charge of processing it. The customer is usually contacted 2 days after purchasing the vehicle. The questionnaire/form used can't be shown for privacy reasons.

5.1.2.1. Sampling

Currently Market A is surveying around 12% of their population for sales. This situation is explained because they believe the information provided by the customers after purchasing the vehicle is not highly reliable due to the excitement of having a new vehicle. For this reason, they

based their decisions of what things should improve on the analysis provided by the external company in the Pre-Sales inspection.

5.1.3. After Sales

The Market A is measuring customer satisfaction in after sales using an online tool that sends an email with a link to the customers three days after the visit, this system was created and is managed internally by themselves. This survey tool has different options, such as: making survey templates, creating companies and users, selection of different languages, uploading contacts can be done by dragging the file on one button or direct import from dealer management system. It also has a report module and a "to do" basic module to track tickets.

The results of customer satisfaction are in dealers' employees' motivation, that means that depending on the results, advisors and managers get or do not get extra bonus for quality of work.

At the moment, the Market A is analyzing six general factors using the after sales questionnaire: Overall satisfaction, Loyalty, CSI, Customer Mobility Service, FRFT and Follow-Up. The questionnaire/form used can't be shown for privacy reasons.

5.1.3.1. Sampling

The Market A is not using a sampling strategy, they send an email to every customer asking to answer the questionnaire, not all the customers choose to answer it but approximately the response rate is 65%.

5.2. Market B

Currently the Market B is measuring customer satisfaction in test drive, sales and after sales.

5.2.1. Test Drive

After performing the test drive, the customer is asked by the attendant to compile a questionnaire to assess customer satisfaction. This survey requests some information about the client regarding: personal data, the impression of the vehicle tested, how did he/she hear about the vehicle, the current vehicle and when is he/she planning to change his/her vehicle. Later, this information is processed internally. The questionnaire/form used can't be shown for privacy reasons.

5.2.2. Sales

After purchasing the vehicle, the customer is asked by the attendant to compile a questionnaire to assess customer satisfaction. This survey requests some information about the client regarding: overall satisfaction with the vehicle, important factors at the purchasing moment, general impression of the sales salon, impression of the sales staff, information about guarantee, satisfaction with the seller, general service aspects and personal data. Later, this information is processed by themselves. The questionnaire/form used can't be shown for privacy reasons.

5.2.3. After Sales

Currently the Market B to measure customer satisfaction is using the NPS. In order to measure it, the dealer sends the information of all the clients who gave the authorization to process his/her data to an external agency, which is the one in charge of communicating with the customers and processing the information collected. Customers are contacted by phone one week after his/her visit.

Loyalty is being assessed with an information system. All the important data regarding the sold vehicles is store in a central system and in that way the dealer can keep track of how many times a customer has visited their offices during the year, how much he/she has spent, etc. Based on this information, they send an invitation to all the customers who have not come previously and should visit the dealer and do maintenance to their vehicles, if customers do not go, they are re-contacted by phone a first time by the office and then if they do not go again they are called a second time by the central office.

5.2.3.1. Sampling

The Market B does not apply sampling, customer satisfaction is assessed with all customers who have a regular service.

5.3. Market C

Currently the Market C is measuring customer satisfaction in after sales, to do it, they are using an application. In order to collect the information, at the time of service invoice payment customer is asked to answer four questions using a panel/path. This path stores the information automatically in a database.

In case, a customer gives a negative feedback the application generates an alert that is sent immediately to the dealer's staff, the client is contacted briefly by them to understand the situation and the reasons for his negative feedback in such a way that a solution for his dissatisfaction can be found.

The dimensions evaluated are respectively: *Customer's perception on service quality, Marketing programs and promotions implementation, Customer's perception on dealer's personnel, Degree of recommendation (NPS).*

To answer the questions, customers have to select an icon, like the ones present in the Figure 4.

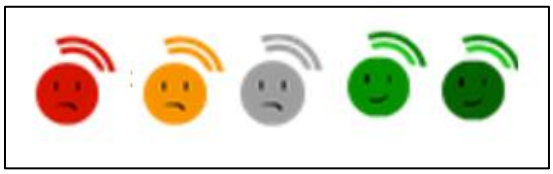

Figure 4. Response scale of Market C.

5.3.1. Sampling

The Market C is not using a sampling strategy, they ask to every customer to answer the questionnaire, not all the customers choose to answer it but approximately the response rate is 63%.

5.3.2. Statistics

As mentioned previously, the Market C has implemented an application. This application is handled by themselves, so there is not an agency that support them with the process of customer satisfaction evaluation.

To analyze the information collected in the interface of the application the user can select a specific dealership, the period of time and the type of report he/she wants to see. There are six types of reports: Today's Dashboard, Questions, Time slot, Top, Alerts and Suggestions and contact data.

Today's dashboard shows four graphs, all of them for the period of time specified on the upper part of the dashboard. The first graph shows the MV Index, for its calculation the NPS

question is not considered. The second graph illustrates the NPS, the third one shows in a pie chart the percentages of satisfaction levels and the last one illustrates in a table the total number of answers collected per each satisfaction level.

Questions dashboard shows four graphs, each one of them for each question presented in the questionnaire. The graphs illustrate the percentages of satisfaction levels for each question in the period of time specified on the upper part of the dashboard.

Time slot dashboard shows two types of graphs. One graph shows the average satisfaction levels for all responses during a specific period of time. The second type of graph illustrates in four graphs the satisfaction levels during the period of time specified on the upper part of the dashboard, each graph correspond to one question of the customer satisfaction questionnaire.

Top dashboard shows five types of graphs: alerts level per questions, questions by MV Index, area by alerts, areas by MV Index and areas by NPS. The first one, alerts level per questions, shows the top of questions with negative answers of all the data collected in the country. The second type, questions by MV Index, shows the top of questions with positive answers of all the data collected in the country. The third type, areas by alert, shows the top of areas with negative answers. The fourth type, areas by MV Index, shows the top of areas with positive answers. The last type, areas by NPS, shows the top of areas with highest NPS.

Alerts dashboard shows cases in which the customer gave a low score in a question to the dealer. This dashboard reports the question that received a low score, the dealer and how the alert was sent. Finally, the *Suggestions and contact data dashboard* reports the date, the customer ID, phone, comments and scores a customer gave to each question in the survey. The equations and questionnaire/form used can’t be shown for privacy reasons.

6. Questionnaires

In this chapter the proposed surveys are described. These questionnaires are based on the theoretical framework described previously and, on the guidelines currently followed by FCA to evaluate customer satisfaction in markets where there is the presence of the NSC.

6.1. Sales

The questionnaire is divided in seven parts and it contains twenty-two questions assessing customer experience. First, a brief *introduction* to the survey is shown, explaining the purpose of the questionnaire. Here the retailer thanks the customer for his/her purchase and asks him/her in a kind manner to answer the questions, highlighting that the provided information will be used to identify in which aspects the company can improve its services. Sentences like "this take a few minutes" or "this take just a moment" are helpful to push clients to answer the survey, since in many cases clients try to avoid this step thinking it will take too much time.

Secondly, some *personal data* is request, including: name, surname, telephone, email, gender and age. This information serves two objectives, on one hand it can be used to contact the client and on the other hand this is useful to do segmentation of customers at the moment of analyzing the data. Later, some *vehicle information* is requested, like: brand, model, date of purchase and retailer address. This information is used to identify the retailer and it is also useful for segmentation purposes.

After that, it can be found five *loyalty questions*. The first one refers to the Net Promoter Score (NPS), which is measured in a scale from 0 to 10, where 0 means that "you would not recommend the retailer at all" and 10 that "you would absolutely recommend it". In the second question, a clarification of the main reason for the NPS score is request, i.e. "if you score was lower or equal to 6, select the most important reason why you provided the low score; if you score was 7 or 8, select the aspect that in your opinion could be improve to get a 10; if you score was 9 or 10, select the aspect that you have appreciated the most". The third question evaluates the overall satisfaction with the purchasing experience. The fourth question asks customers about the likelihood of continue purchasing the service from the retailer and the fifth question evaluates the probability that customers were choosing this retailer for the first time, in case they had never

purchased a service from them. As mentioned in section 4.6, loyalty questions are presented at the start of the survey in order to ensure that the responses to those questions reflect the respondents' general perceptions regarding their relationship with the company. It is also remarkable that the four loyalty questions shown in section 4.6 were used, which as explained there, provide a more reliable measure of the customer loyalty through the Advocacy Loyalty Index.

Next, *business attributes questions* are presented. These questions were designed to evaluate customer satisfaction in nine aspects: *test drive, salesman capabilities, contact before pickup, delivered by date promised, warranty/maintenance offer, handover of the vehicle, explanation of features and controls, ability to correct faults and follow-up delivery*. Each aspect was assessed with a maximum of three questions. This because having several questions per aspect is important to increase the reliability of the results while we also need to limit the length of the questionnaire. There are some aspects that are very specific, so one or two questions were used to evaluate them, this with the purpose of not including unconcise items.

Finally, the last two parts consist of a *comments* section in which the customers can leave any additional comments they may have and a *future contact* section in which the customer is asked if he/she wants to be contacted by the retailer regarding his/her responses.

The questionnaire uses three types of response formats. In almost all of the questions the Likert-Type response format is used, allowing customers to respond in different degrees of satisfaction, as mentioned in section 4.3.2. All of the questions that uses this response format, are in a scale from 1 to 5, where 1 means "strongly disagree" and 5 "strongly agree"; except for the NPS questions which uses a scale from 0 to 10 (as explained above). The 1 to 5 scale was chosen to simplify the questionnaire and avoid the customers to get confused or overwhelmed with so many options to choose. There is one question which uses the multiple option format, asking customers to select one answer between a list of options. There is also one question which uses checklist format, where customer is asked to respond to the item "yes" or "no". The questionnaire/form used can't be shown for privacy reasons.

6.2. After Sales

For the case of after sales the designed survey is very similar to the one described previously for sales. The questionnaire is divided in seven parts and it contains twenty-one questions assessing

customer experience, in which the first two parts are the *introduction* and *personal data* sections, as described before for the sales case. After that, the data related to the *visit information* is requested, like: brand, model, date of visit, retailer address and reason of the visit. This information is used to identify the retailer and it is also useful for segmentation purposes. In the same way, the *loyalty section* is equal to the one described previously for the case of sales whit the difference that in question 2, the answers have been adapted to the after sales framework.

Next, *business attributes questions* are presented. These questions were designed to evaluate customer satisfaction in nine aspects: *easy of getting an appointment, willingness to understand problems, provision of quotation, satisfaction with mobility service, Fix Right First Time (FRFT), explanation of charges, ability to keep promise timings, condition of the car and follow-up.* Again, a maximum of three questions per aspect was used, in order to limit the length of the questionnaire and increase the reliability of the results. There are some aspects that are very specific, so one or two questions were used to evaluate them, this with the purpose of not including unconcise items.

Finally, the last two parts consist of a *comments* section in which the customers can leave any additional comments they may have and a *future contact* section in which the customer is asked if he/she wants to be contacted by the retailer regarding his/her responses.

The questionnaire uses three types of response formats. In almost all of the questions the Likert-Type response format is used, allowing customers to respond in different degrees of satisfaction, as mentioned in section 4.3.2. All of the questions that uses this response format, are in a scale from 1 to 5, where 1 means “strongly disagree” and 5 “strongly agree”; except for the NPS questions which uses a scale from 0 to 10 (as explained above). The 1 to 5 scale was chosen to simplify the questionnaire and avoid the customers to get confused or overwhelmed with so many options to choose. There are four questions which use the multiple option format, asking customers to select one answer between a list of options. Particularly, for the factor of *ability to keep promised timings* we will consider a numerical scale in the following way: N/A =5, Few hours=4, One day=3, Few days=2, More than one week=1, this scale will be used just with analysis purposes. There is also one question which uses checklist format, where customer is asked to respond to the item “yes” or “no”. The questionnaire/form used can’t be shown for privacy reasons.

7. Implementation

This chapter describes and details some recommendations to do a successful implementation of the questionnaires proposed previously in section 6. Considering the information provided for the three different markets, we will first analyze and choose one pilot market in which the surveys can be implemented to observe the behavior of the proposed questionnaires, all the statistical steps that should be done to test the quality of the surveys will be also described, and finally we will propose some statistical tests that can be used to analyze the information collected once the implementation is done.

7.1. Pilot market

By observing the information provided in section 5, we can see that the Market A has the most complete system for assessing customer satisfaction among the three analyzed markets, both for sales and after sales. However, as mentioned in section 5.1.2.1 the Market A pays special attention to the pre-sales part instead of sales, since they think its results proved to be more reliable, this because at the moment of the purchase the customer does not have an objective opinion due to the emotion of having a new vehicle. In the light of these facts, it results that the Market A is not the best candidate to choose as pilot market since they already have a very well stablished system.

On the other hand, we have the Market C which is not measuring customer satisfaction in sales and has a stablished system for the after sales part. Among all the analyzed markets this is the least developed market in terms of customer satisfaction assessment, which make it a bad choice as a pilot market due to the extra effort that would imply implementing all the sales part.

Finally, we can see that Market B, is the best option as pilot market. This because it has already implemented the measurement of customer experience in sales and after sales, but it is not as complete as the case of the Market A, so it can be improved. The fact that the Market C has something already implemented to measure customer perception in sales facilitates the realization of the proposal. Moreover, they have manifested their interest in updating their questionnaires to improve their measurements of customer satisfaction.

In the following we will present the statistical analysis to test the quality of the proposed questionnaires, assuming as pilot market the Market B.

7.2. Sampling

The sample size is calculated to satisfy a given confidence level (t) and tolerable error (TE). As stated in section 4.4.4.3 is given by the following equation:

$$n = (t^2 \times s^2)/TE^2$$

Where s is representing the average standard deviation of all the items being measured.

The values of t and TE must be chosen such that the sample size is big enough to make inferences about the population but not too big such that collecting the information becomes too expensive. For our particular case, we have decided to use a 95% confidence level (t=2) and a tolerable error (TE) = 0.2. Since each question is answered in scale of numbers ranging from 1 to 5, a precision error of 0.2 seems to be acceptable. This is also true for the case of NPS question in which the scale, from 1 to 10 is even bigger, so this error is negligible.

In order to obtain s, which is an estimation of the standard deviation of the items in the questionnaire we need to use historical information about the previous survey used by the retailer. This value is obtained by first computing the standard deviation of each item in the previous survey and then calculating the average of the standard deviations. After the verification of the questionnaires step, the value of s can be updated using the new data collected during this period.

Once we have the sample size (n), we need also to take into account the response rate, since as mentioned in section 4.4.4.3.1 it is unlikely that all the customers will answer the questionnaire, so in order to guarantee the tolerable error and confidence level stablished previously the sample size must be adjusted using the following equation:

$$Adjusted\ sample\ size = \frac{Sample\ size}{Response\ rate}$$

Customers must be contacted 14 days after picking up for the case of sales and 5 days after picking up for the after sales case. It is important to highlight that the sample of customers must be done randomly.

7.3. Verification of the questionnaires

For this section we will consider the theory discussed in section 4.3.4. The main goal is to verify the reliability of the questions used in the surveys. Since we want to avoid the use of purely human judgment, as proposed in the *judgmental item selection method,* due to its lack of objectivity, the proposed method for the verification will be the *mathematical item selection method* by means of a *correlation analysis test*.

The reason for choosing correlation analysis as the most suitable test is that: on the one hand, we have the *group differences test* which requires one to find a group of very satisfied and unsatisfied customers, which will do the questionnaire to perform the test. Since an average customer may in general not belong to any of these groups, this testing phase may take too much time and effort for the retailer to obtain a significant quantity of customers from the two groups, making this testing method complex to perform. On the other hand, the *factor analysis test* seems a very good tool for the statistical analysis but, as stated before in section 4.3.4.2.3, it requires to collect a large number of data to obtain reliable information, making this testing method expensive. In contrast, correlation analysis can be performed indiscriminately to all the customers and does not require a huge amount of data.

To perform the correlation analysis test, we need to define first the sampling size as explained previously in section 7.2. After determining the sample size for each case, sales and after sales, we can proceed to do the implementation of the questionnaires. As stated in section 7.2, customers are contacted 14 days after pick up for the case of sales and 5 days after pick up for the after sales case and it is also remarkable that the customers must be chosen randomly.

Finally, when the sample size is reached, we can proceed to do the correlation analysis test. To do so, we need to take into account the underlying factors that were measured. For sales the factors being measured are:

- Loyalty (5 items).
- Test drive (2 items).
- Salesman capabilities (3 items).
- Contact before pickup (1 item).
- Delivered by date promised (1 item).

- Warranty/maintenance offer (2 items).
- Handover of the vehicle (2 items).
- Explanation of features and controls (2 items).
- Ability to correct faults (2 items).
- Follow-up delivery (2 items).

For after sales, the factors being measured are:

- Loyalty (5 items).
- Easy of getting an appointment (2 items).
- Willingness to understand problems (1 item).
- Provision of quotation (2 items).
- Satisfaction with mobility service (2 items).
- Fix Right First Time (FRFT) (2 items).
- Explanation of charges (1 item).
- Ability to keep promised timings (3 items).
- Condition of the car (2 items).
- Follow-up (1 items).

As a first step, we would like to verify that each item is linked to its respective overall dimension. This is done by using *item-total correlation,* which will be performed for each factor (Excluding Loyalty, since we already know that the questions included are highly related, as stated in section 4.6). Given a single factor, the idea is to construct a table which includes the item-total correlation for each item, the item-total correlation is obtained by computing the correlation coefficient of a single item with a composite of the other items. For example, suppose the case of after sales, take the factor of *ability to keep promise timings* and assume that the sample size of the population is n=5, and that the data shown below in Table 6 was collected.

Table 6. *Example of data used to compute the item-total correlation.*

	Data 1	Data 2	Data 3	Data 4	Data 5	Mean
Q1	4	4	5	3	1	3.4
Q2	4	4	5	3	1	3.4
Q3	5	3	5	4	2	3.8

Recalling the equation for the computation of the correlation coefficient:

$$r = \frac{\sum xy}{\sqrt{(\sum x^2)(\sum y^2)}}$$

Where *x* and *y* are the random data centered at the origin, i.e. $x = X - \bar{X}$ and $y = Y - \bar{Y}$.

To compute the item-total correlation for question Q1, we assume the variable *X* defined by the data of Q1 and the variable *Y* by an average between the data in Q2 and Q3, hence obtaining the information shown in Table 7.

Table 7. *Values obtained for "X" and "Y".*

	Data 1	Data 2	Data 3	Data 4	Data 5	Mean
X	4	4	5	3	1	3.4
Y	4.5	3.5	5	3.5	1.5	3.6

After the calculation of X and Y, we proceed to calculate x and y as explained previously, $x = X - \bar{X}$ and $y = Y - \bar{Y}$. We obtain the values for "x" and "y" shown in Table 8.

Table 8. *Values obtained for "x" and "y".*

	Data 1	Data 2	Data 3	Data 4	Data 5
x	0.6	0.6	1.6	-0.4	-2.4
y	0.9	-0.1	1.4	-0.1	-2.1

We can further proceed using the previous equation to compute the correlation coefficient for Q1, and this procedure should be repeated for Q2 (correlated with Q1 and Q3) and Q3 (correlated with Q1 and Q2). For this example, we obtain the results presented in Table 9 and Table 10.

Table 9. *Values used the correlation equation.*

	Data 1	Data 2	Data 3	Data 4	Data 5
x^2	0.36	0.36	2.56	0.16	5.76
y^2	0.81	0.01	1.96	0.01	4.41
x*y	0.54	-0.06	2.24	0.04	5.04

Table 10. *Item-total correlation results.*

Item-total correlation	
Q1	r = 0.96
Q2	r = 0.96
Q3	r = 0.81

This result can be used to determine the extent to which each item is able to measure the dimension to which it is linked. In general, we should reallocate from one dimension to another or drop from the questionnaire those questions which are not correlated to the overall dimension, i.e. with a "small" correlation coefficient. The cutoff coefficient to determine what "small" means here depends in general on the study and the measure being developed, and in our case, we will take this value to be 0.80. Hence, those questions with an item-total correlation below 0.80 must be either reallocated in another dimension that may be more suitable (in this case the item-total correlation coefficient should be computed again in the new dimension to verify this assumption) or dropped from the questionnaire.

Another test that can be performed is the correlation matrix, which consist of the correlation coefficients between all the items. To construct the matrix, we simply use the equation to compute the correlation coefficient as shown above, and we compute the correlation between all the different items. For example, suppose the case of after sales and assume that the sample size is n=5, and that the data presented in Table 11 is collected.

Table 11. *Example of data used to compute the correlation matrix.*

	Data 1	Data 2	Data 3	Data 4	Data 5
Q1	9	7	6	9	10
Q2	-	-	-	-	-
Q3	4	4	3	5	5
Q4	4	3	2	4	5
Q5	4	3	2	5	5
Q6	5	3	1	5	5
Q7	4	4	3	4	5
Q8	5	4	3	4	5
Q9	5	4	4	5	5
Q10	4	4	3	5	5
Q11	5	4	4	5	5
Q12	4	4	3	5	5
Q13	5	4	5	5	5
Q14	-	-	-	-	-
Q15	4	4	4	5	5
Q16	4	4	4	5	5
Q17	4	4	4	5	5
Q18	4	4	3	5	5
Q19	4	4	4	4	5
Q20	5	4	4	5	5
Q21	5	4	3	5	5

Questions Q2 and Q14 are not included in the correlation analysis because they have segmentation purposes and do not provide results that can be traduced in numerical values.

The correlation matrix can be easy to compute with statistical analysis tools. For example, with excel through the data analysis tools and selecting the correlation option, one can directly obtain the matrix from the values presented in the previous table. See Table 12.

Table 12. Example of Correlation matrix using the values given in the Table 11.

	Q1	*Q3*	*Q4*	*Q5*	*Q6*	*Q7*	*Q8*	*Q9*	*Q10*	*Q11*	*Q12*	*Q13*	*Q15*	*Q16*	*Q17*	*Q18*	*Q19*	*Q20*	*Q21*
Q1	1																		
Q3	0.873	1																	
Q4	0.987	0.891	1																
Q5	0.957	0.963	0.942	1															
Q6	0.953	0.869	0.932	0.943	1														
Q7	0.861	0.845	0.930	0.813	0.791	1													
Q8	0.873	0.643	0.891	0.733	0.869	0.845	1												
Q9	0.944	0.764	0.881	0.910	0.919	0.645	0.764	1											
Q10	0.873	1.000	0.891	0.963	0.869	0.845	0.643	0.764	1										
Q11	0.944	0.764	0.881	0.910	0.919	0.645	0.764	1.000	0.764	1									
Q12	0.873	1.000	0.891	0.963	0.869	0.845	0.643	0.764	1.000	0.764	1								
Q13	0.408	0.134	0.294	0.343	0.250	0.000	0.134	0.612	0.134	0.612	0.134	1							
Q15	0.722	0.873	0.721	0.840	0.612	0.645	0.327	0.667	0.873	0.667	0.873	0.408	1						
Q16	0.722	0.873	0.721	0.840	0.612	0.645	0.327	0.667	0.873	0.667	0.873	0.408	1.000	1					
Q17	0.722	0.873	0.721	0.840	0.612	0.645	0.327	0.667	0.873	0.667	0.873	0.408	1.000	1.000	1				
Q18	0.873	1.000	0.891	0.963	0.869	0.845	0.643	0.764	1.000	0.764	1.000	0.134	0.873	0.873	0.873	1			
Q19	0.612	0.535	0.686	0.514	0.375	0.791	0.535	0.408	0.535	0.408	0.535	0.250	0.612	0.612	0.612	0.535	1		
Q20	0.944	0.764	0.881	0.910	0.919	0.645	0.764	1.000	0.764	1.000	0.764	0.612	0.667	0.667	0.667	0.764	0.408	1	
Q21	0.953	0.869	0.932	0.943	1.000	0.791	0.869	0.919	0.869	0.919	0.869	0.250	0.612	0.612	0.612	0.869	0.375	0.919	1

The correlation matrix is useful to observe the correlation between all the items, in such a way that one is able to determine when a question in a given dimension is highly correlated with questions in other dimensions. Hence, if for example in the previous step one question was demonstrated to be uncorrelated with the factor for which it was intended, this matrix serves as a guide to determine if another dimension is suitable for this question.

7.4. Analysis of the information

After applying the survey to the sample (defined in the section 7.2), the data collected can be analyzed to make inferences about population's behavior, so that actions can be done from the side of the company to improve customer perception. In the following we will explain the different statistic tools that can be used to analyze the information: starting from the *Reliability and Validity Tests* and moving to the use of *Descriptive Statistics* and *Regression Analysis*. The main goal of this section is to provide the company some guidelines to infer practical information from raw data. This section is based on the theory presented in section 4.

7.4.1. Estimation of Reliability

Reliability measures the extent to which measurements are free from error, as explained in section 4.5.1. For this work we have decided to measure reliability by means of the *Internal Consistency Test* performed on each of the single dimensions. By internal consistency, we assess how well a set of questions are able to measure a given dimension. However, this has been previously done in the verification of the questionnaire, described in section 7.3, so at this point the reliability will be assumed.

Concerning the other two tests for reliability, *Test-Retest Reliability* and *Parallel Forms Reliability,* we will avoid performing them due to their complexity. The former, as explained in section 4.5.1.1, is not worthwhile for practical purposes; and the later, as explained in section 4.5.1.2 requires the creation of a second questionnaire which implies the use of more resources.

7.4.2. Validity

Validity refers to the degree to which inferences can be made from the scores obtained in the questionnaire, which means that there exists evidence that support such inferences. For our case we want to verify that the items of the questionnaire allow to make inferences over their respective dimension. There is not a mathematical score that provides a measure of validity, but instead validity is assessed by means of these three strategies: *Content-related strategy, Criterion-related strategy, Construct-related strategy.* In our case we have chosen to follow a *Content-related strategy* to construct the questionnaire, which basically means that for each dimension we have chosen a set of representative questions that, due to the way they are written, are able to provide a valid inference over the customer satisfaction in the given dimension.

7.4.3. Correlation matrix and Stepwise regression analysis

Once we have collected all data, we proceed to extract the statistical indices that will allow us to extract information from them. The first two statistical indices that need to be taken into account are the mean and the standard deviation, which need to be extracted both per question and per dimension. Consider an example implementation in which sample size is assumed to be n=10, the mean and the standard deviation of the items/dimensions would be as shown in Table 13 and Table 14.

The second step will be to identify the most important customer requirements, i.e. those dimensions that influence most in the Loyalty dimensions. To do it, we will use the regression analysis and the correlation matrix. The correlation matrix is computed in the same way as was explained in section 7.3, but in this case we will compute it for each dimension, confronting them with each one of the loyalty questions (Excluding the second one). In order to group the information per dimension, we will calculate the average per dimension of each questionnaire (data) as shown in Table 15. Below in Table 16, we find the correlation matrix computed for the data shown in Table 13.

Table 13. *Mean and standard deviation per item.*

	D.1	D.2	D.3	D.4	D.5	D.6	D.7	D.8	D.9	D.10	**Mean**	**Std**
Q1	9	7	6	9	10	3	5	6	9	2	6.60	2.716
Q2	-	-	-	-	-	-	-	-	-	-	-	-
Q3	4	4	3	5	5	2	3	3	4	1	3.40	1.265
Q4	4	3	2	4	5	2	3	4	5	1	3.30	1.337
Q5	4	3	2	5	5	1	4	4	4	1	3.30	1.494
Q6	5	3	1	5	5	2	3	4	5	1	3.40	1.647
Q7	4	4	3	4	5	2	4	5	5	2	3.80	1.135
Q8	5	4	3	4	5	3	2	4	4	3	3.70	0.949
Q9	5	4	4	5	5	4	4	4	4	4	4.30	0.483
Q10	4	4	3	5	5	4	4	4	5	5	4.30	0.675
Q11	5	4	4	5	5	5	5	5	5	5	4.80	0.422
Q12	4	4	3	5	5	5	5	5	5	5	4.60	0.699
Q13	5	4	5	5	5	4	3	5	5	2	4.30	1.059
Q14	-	-	-	-	-	-	-	-	-	-	-	-
Q15	4	4	4	5	5	4	4	3	3	2	3.80	0.919
Q16	4	4	4	5	5	3	5	3	4	2	3.90	0.994
Q17	4	4	4	5	5	4	5	3	4	2	4.00	0.943
Q18	4	4	3	5	5	5	4	3	4	2	3.90	0.994
Q19	4	4	4	4	5	4	4	5	5	4	4.30	0.483
Q20	5	4	4	5	5	4	4	4	4	4	4.30	0.483
Q21	5	4	3	5	5	4	4	5	5	4	4.40	0.699

Table 14. *Mean and standard deviation per dimension.*

Mean per dimension			
Dimensions	**Items**	**Mean**	**Std**
Loyalty	Q1;Q3;Q4;Q5	4.150	2.248
Ease of getting an appointment	Q6;Q7	3.600	1.392
Willingness to understand problems	Q8	3.700	0.949
Provision of quotation	Q9;Q10	4.300	0.571
Satisfaction with mobility service	Q11;Q12	4.700	0.571
FRFT	Q13	4.300	1.059
Explanation of charges	Q15	3.800	0.919
Ability to keep promise timings	Q16;Q17;Q18	3.933	0.944
Condition of the car	Q19;Q20	4.300	0.470
Follow-up	Q21	4.400	0.699

Table 15. *Information used for the calculation of the correlation matrix dimensions vs loyalty questions.*

Dimensions	**D.1**	**D.2**	**D.3**	**D.4**	**D.5**	**D.6**	**D.7**	**D.8**	**D.9**	**D.10**
Q1	9.00	7.00	6.00	9.00	10.00	3.00	5.00	6.00	9.00	2.00
Q3	4.00	4.00	3.00	5.00	5.00	2.00	3.00	3.00	4.00	1.00
Q4	4.00	3.00	2.00	4.00	5.00	2.00	3.00	4.00	5.00	1.00
Q5	4.00	3.00	2.00	5.00	5.00	1.00	4.00	4.00	4.00	1.00
Ease of getting an appointment	4.50	3.50	2.00	4.50	5.00	2.00	3.50	4.50	5.00	1.50
Willingness to understand problems	5.00	4.00	3.00	4.00	5.00	3.00	2.00	4.00	4.00	3.00
Provision of quotation	4.50	4.00	3.50	5.00	5.00	4.00	4.00	4.00	4.50	4.50
Satisfaction with mobility service	4.50	4.00	3.50	5.00	5.00	5.00	5.00	5.00	5.00	5.00
FRFT	5.00	4.00	5.00	5.00	5.00	4.00	3.00	5.00	5.00	2.00
Explanation of charges	4.00	4.00	4.00	5.00	5.00	4.00	4.00	3.00	3.00	2.00
Ability to keep promise timings	4.00	4.00	3.67	5.00	5.00	4.00	4.67	3.00	4.00	2.00
Condition of the car	4.50	4.00	4.00	4.50	5.00	4.00	4.00	4.50	4.50	4.00
Follow-up	5.00	4.00	3.00	5.00	5.00	4.00	4.00	5.00	5.00	4.00

Table 16. *Correlation matrix per dimension vs loyalty questions.*

	Q1	*Q3*	*Q4*	*Q5*	*Ease of getting an appointment*	*Willingness to understand problems*	*Provision of quotation*	*Satisfaction with mobility service*	*FRFT*	*Explanation of charges*	*Ability to keep promise timings*	*Condition of the car*	*Follow-up*
Q1	1												
Q3	0.957	1											
Q4	0.893	0.841	1										
Q5	0.854	0.870	0.895	1									
Ease of getting an appointment	0.874	0.833	0.981	0.934	1								
Willingness to understand problems	0.768	0.667	0.692	0.541	0.687	1							
Provision of quotation	0.525	0.509	0.533	0.554	0.554	0.582	1						
Satisfaction with mobility service	-0.053	-0.049	0.294	0.263	0.319	0.022	0.599	1					
FRFT	0.780	0.730	0.714	0.568	0.647	0.652	0.130	-0.215	1				
Explanation of charges	0.588	0.746	0.416	0.534	0.382	0.306	0.275	-0.135	0.525	1			
Ability to keep promise timings	0.660	0.795	0.594	0.667	0.555	0.231	0.344	0.068	0.482	0.909	1		
Condition of the car	0.784	0.704	0.855	0.766	0.825	0.804	0.724	0.384	0.630	0.380	0.417	1	
Follow-up	0.620	0.553	0.808	0.723	0.849	0.704	0.757	0.650	0.420	0.138	0.278	0.818	1

*Q1: NPS; Q3: Overall satisfaction; Q4: Probability of purchasing again; Q5: Probability of purchasing for the first time.

Correlation matrix from Table 16 allows us to relate the quality dimensions with different aspects of the overall quality perception of the customers: a high correlation (as defined before, in section 7.3, this means a value over 0.8) indicates some relation between the quality aspects and the dimensions. The values above this threshold have been highlighted in red. It is important to remember that several studies including FCA experience have demonstrated that the profit of a company is directly related with the customers loyalty, reason for which is so important to understand which are the factors that most affect it.

For example, is easy to observe that, for our particular case, the dimension *Ease of getting an appointment* highly influence all of the four loyalty indicators, and by extension, the perception of customers about the quality of the aftersales service. On the other hand, the dimension *Satisfaction with mobility service* has a small influence in any of the loyalty indicators. This means that if the company wants to improve the way in which customers perceive the quality of their services/products, they should invest their effort in the *Ease of getting an appointment* dimension.

One interesting fact that can be observed in the correlation matrix is the negative correlation between the *Satisfaction with mobility service* dimension and loyalty questions Q1 and Q3, it seems like in this case decreasing the quality of the mobility service would increase the NPS and the Overall Satisfaction. However, this inference does not make sense and is just the result of the small number of samples considered, as the magnitude of the correlation is small. It is also interesting to observe from the correlation matrix is the influence of each dimension with each individual loyalty question: we can observe that the dimension that most influence Q4 (probability of purchasing again) and Q3 (overall satisfaction) is the *Ease of getting an appointment.*

Overall, at this stage, the group in charge of the analysis of the information should take the most relevant aspects with the highest values of correlation (which result to be the most important from the customer standpoint), so a deeper analysis can be performed.

Other method much more sophisticated that can be used to relate the single effect of all the dimensions in the loyalty indicators is the multiple regression analysis. In fact, this method allows us to determine the dimension that best predict customer satisfaction, by accounting for the factor that most influence the variability of the loyalty indicators. It

becomes a much more helpful tool in the cases where, when the correlation matrix has been computed, several dimensions have been detected to influence customer satisfaction, and the company must decide just few of them (or maybe one) to invest in the short term.

Here we will present an example of the stepwise multiple regression analysis (as explained in section 4.7.2.4.3) made in MATLAB with the data shown in Table 13. To perform this analysis in MATLAB we have used the function "stepwiselm", as shown below:

```
mdl = stepwiselm(dataDim, dataQQ(:,1), 'constant', 'Criterion', 'rsquared', 'PEnter', 0.001,...
        'PRemove', 0.0005, 'Upper', 'linear', 'VarNames', VarNames)
```

The data presented in Table 15 for each dimension (excluding loyalty questions: Q1, Q3, Q4 and Q5) was stored in the columns of the matrix dataDim, and the results from question Q1, Q3, Q4 and Q5 in the columns of the matrix dataQQ. Different parameters have been used to setup the analysis:

- *'constant'* indicates MATLAB to start the fitting procedure from a constant model (i.e. at each iteration of the stepwise procedure, the program adds one variable to the model);
- *'Criterion','rsquared'* indicates the program to use the change in R^2 (degree of fit) as criterion to add or remove variables from the model;
- *'PEnter', 0.001, 'PRemove', 0.0005* are the cutoff values used for Matlab to decide whether a variable will be added or removed (i.e. if $\Delta R^2 > 0.001$ we include this variable in the model, and if $\Delta R^2 < 0.0005$ we remove this variable from the model). It is important to remember that ΔR^2 shows the effect size of the given dimension, i.e. the higher ΔR^2 is, the most important is the variable in the regression model.
- *'Upper','linear'* is used to indicate the program to avoid including higher order terms (powers or cross-products of the independent variables) in the fitting model, and finally;
- *'VarNames', VarNames* give names to the variables according to the strings stored in the vector VarNames.

The result of the simulation is a series of steps in which the program adds sequentially one variable at a time to the fitting model, until the degree of fitting is high enough to produce a good fit of the dependent variable. It worth to mention that, at each step, the program checks the collinearity (correlation) of the dependent variables, so if they provide redundant information, they are eliminated from the model. The variable *pValue* is also important since it indicates whether the included independent variables are representative of the variations observed in the dependent variable, and we would like to obtain small values, smaller than 0.05 (5%). Below in Figure 5, we observe the output shown by MATLAB, were the *stepwise multiple regression* analysis was performed using just Q1 as response variable.

```
1. Adding Ease_App, Rsquared = 0.76396
2. Adding Sat_Mov, Rsquared = 0.88662
3. Adding Prov_Quot, Rsquared = 0.96523
4. Adding Prom_time, Rsquared = 0.98003
5. Adding FRFT, Rsquared = 0.98948
6. Adding Exp_Charges, Rsquared = 0.99666
7. Adding Cond_Car, Rsquared = 0.99929

mdl =


Linear regression model:
    NPS ~ 1 + Ease_App + Prov_Quot + Sat_Mov + FRFT + Exp_Charges + Prom_time + Cond_Car

Estimated Coefficients:
                   Estimate      SE        tStat      pValue
                   ________    _______    _______    _________

    (Intercept)    -2.2862      1.1004    -2.0776      0.17335
    Ease_App       0.92059      0.1025     8.9812     0.012171
    Prov_Quot        2.209     0.21159      10.44    0.0090504
    Sat_Mov        -2.7037     0.15635    -17.292    0.0033277
    FRFT           0.46221     0.10326     4.4763     0.046457
    Exp_Charges    -1.0711     0.20701    -5.1743     0.035381
    Prom_time       1.4531     0.21456     6.7725     0.021114
    Cond_Car         1.197     0.44054     2.7172      0.11295


Number of observations: 10, Error degrees of freedom: 2
Root Mean Squared Error: 0.154
R-squared: 0.999,  Adjusted R-Squared 0.997
F-statistic vs. constant model: 401, p-value = 0.00249
```

Figure 5. Stepwise Multiple Regression Analysis using NPS (Q1) as dependent variable.

We can see in the upper part of Figure 5 the steps performed by the software when searching for the linear regression model. We can see also that two variables have been excluded from the model: *Willingness to understand problems* and *Follow-up,* since their

ΔR^2 was lower than 0.001. From this graph we can notice that the most important variable is Ease of getting an appointment, as its ΔR^2 is the highest one. Table 17 summarizes the values of ΔR^2 and P-values presented in Figure 5 for all the different dimensions.

Table 17. Summary of the values of ΔR^2 and P-values.

Dimensions	R^2	ΔR^2	P-value
Ease of getting an appointment	0.764	0.764	0.012
Satisfaction with mobility service	0.887	0.123	0.003
Provision of quotation	0.965	0.079	0.009
Ability to keep promise timings	0.980	0.015	0.021
FRFT	0.989	0.009	0.046
Explanation of charges	0.997	0.007	0.035
Condition of the car	0.999	0.003	0.113

Finally, from Table 17 we can see that the final R^2 has a high value indicating that the regression model represents a good fit of the dependent variable, which in this case is NPS (Q1). This procedure should be performed again for the other loyalty questions Q3, Q4 and Q5, and can be also done with the overall loyalty score (an average between Q1, Q3, A4 and Q5) in order to have a complete picture of the most important variables for customers loyalty. It is also remarkable that this type of analysis can also be performed using other statistical software like Rstudio, SAS, etc.

The main conclusion of the above analysis is that *Ease of getting an appointment* is the most important dimension in terms of customers loyalty/satisfaction, since it has the highest value of ΔR^2, so for the next period, in this particular example, improvement strategies should be focused on this dimension to maximize results.

7.4.4. Data representation

In this final section we want to suggest a couple of ways in which the information can be represented to observe what is the situation of the company in what refers to customer satisfaction. A first graph is the histogram that shows the total number of answers from all the customers and from which one can observe, on average, what would be the most likely score a question from the questionnaire would get. For this example, we are still using the information presented in Table 13. See Table 18 and Figure 6.

Table 18. Frequencies and percentages for all the data.

Score	*Frequency*	*Cumulative %*
1	6	3.33%
2	13	10.56%
3	23	23.33%
4	73	63.89%
5	65	100.00%
Total	180	

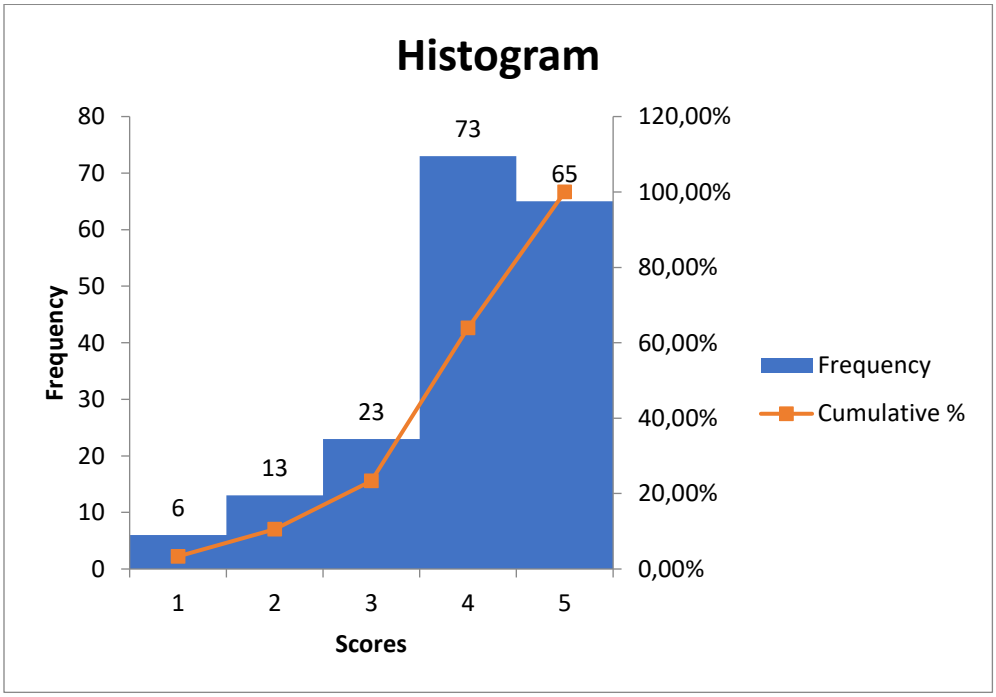

Figure 6. Histogram for all the data.

Another graph that would be interesting to look at is the Histogram of the NPS, which is shown in Figure 7. This is an important graph since it allows to graphically observe where are located most of the customers, i.e. the frequency of detractors, passive and promoters. It is also important to observe the cumulative frequency curve, since show us the change in the percentages of customers between the different scores: in this case, 50% of the customers are detractors, 10% of the customers are passive and 40% of the customers are promoters. As we have mentioned before, the company should focus on keeping its promoters satisfied and create strategies to improve customers' perception, especially with the passive clients, in order to transform them in promoters. Detractor customers are important as well, but if the company have limited resources using them in the detractors could be worthless, since in many cases change the opinions of these customers requires a lot of resources. See Table 19 below.

Table 19. Frequencies and percentages for NPS.

Scores	*Frequency*	*Cumulative %*
0	0	0.00%
1	0	0.00%
2	1	10.00%
3	1	20.00%
4	0	20.00%
5	1	30.00%
6	2	50.00%
7	1	60.00%
8	0	60.00%
9	3	90.00%
10	1	100.00%
Total	10	

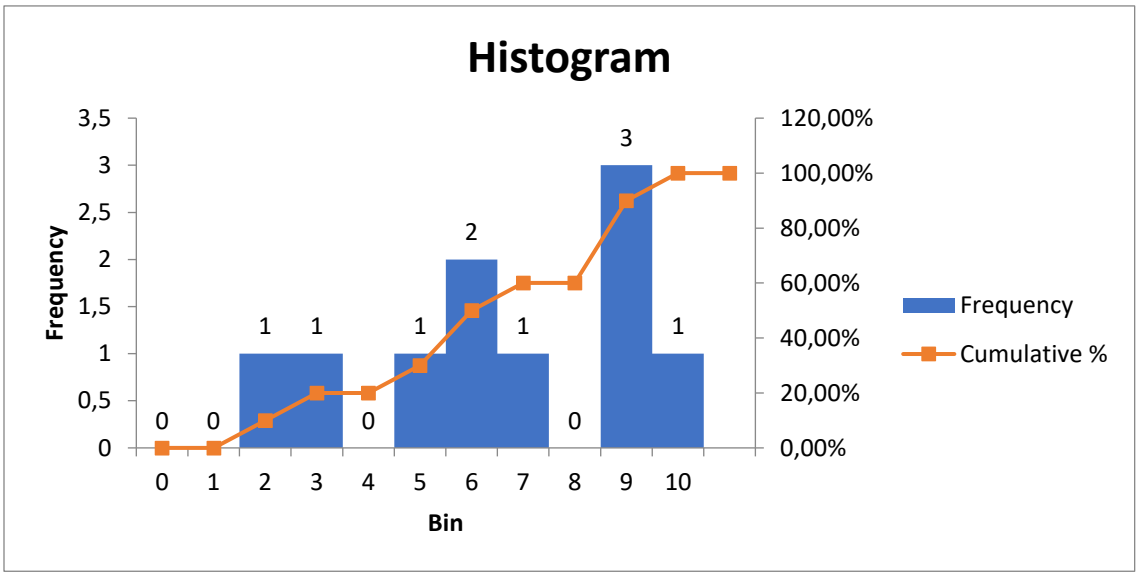

Figure 7. Histogram of NPS.

The previous histogram can also be done on segments of the population, such as: gender, age, brand, dealership, etc. This is important to observe in which segments of the population are the detractors/passives/promoters located and if there exist any special trend that can lead us to improvement strategies.

7.4.5. Recommendations

For the implementation of the present proposal we recommend doing a join work between the marketing and the customer experience department. This is a key aspect, since people from the customer experience department has the expertise and the experience in the implementation of proposals directed to the customers satisfaction improvement. Moreover, they have the adequate knowledge regarding statistical aspects that can be complex for someone who is not habituated to work in this environment. A clear understanding of all the statistical parameters is key to determine what kind of actions can be performed. The department of after sales (MOPAR) can also be involve in this implementation, since they have already started dialogues with the market, asking them for some general statistics about loyalty, CSI and NPS.

Other important recommendation is to make the analysis in a monthly base, this means that the sample of customers must be taken among all the customers in a month. It is important also for the dealers to present a short monthly report to FCA in which they include a summary of the statistics explained before, i.e. Mean and standard deviation per dimension, histograms, results of the regression analysis and possible improvement strategies. This is important, since FCA can also take part in the improvement solutions for each dealer.

In what digital tools concern, Market A has already developed a complete system to measure customer satisfaction in after sales. They manifested their interest in selling this tool to other markets in which no other tool is available. During my work in the thesis I started dialogues with them to share this software with the other markets, but due to difficulties in the communication I could not finalize the dialogues.

Finally, Figure 8 shows a general flow chart which describes the steps for the implementation of the proposal.

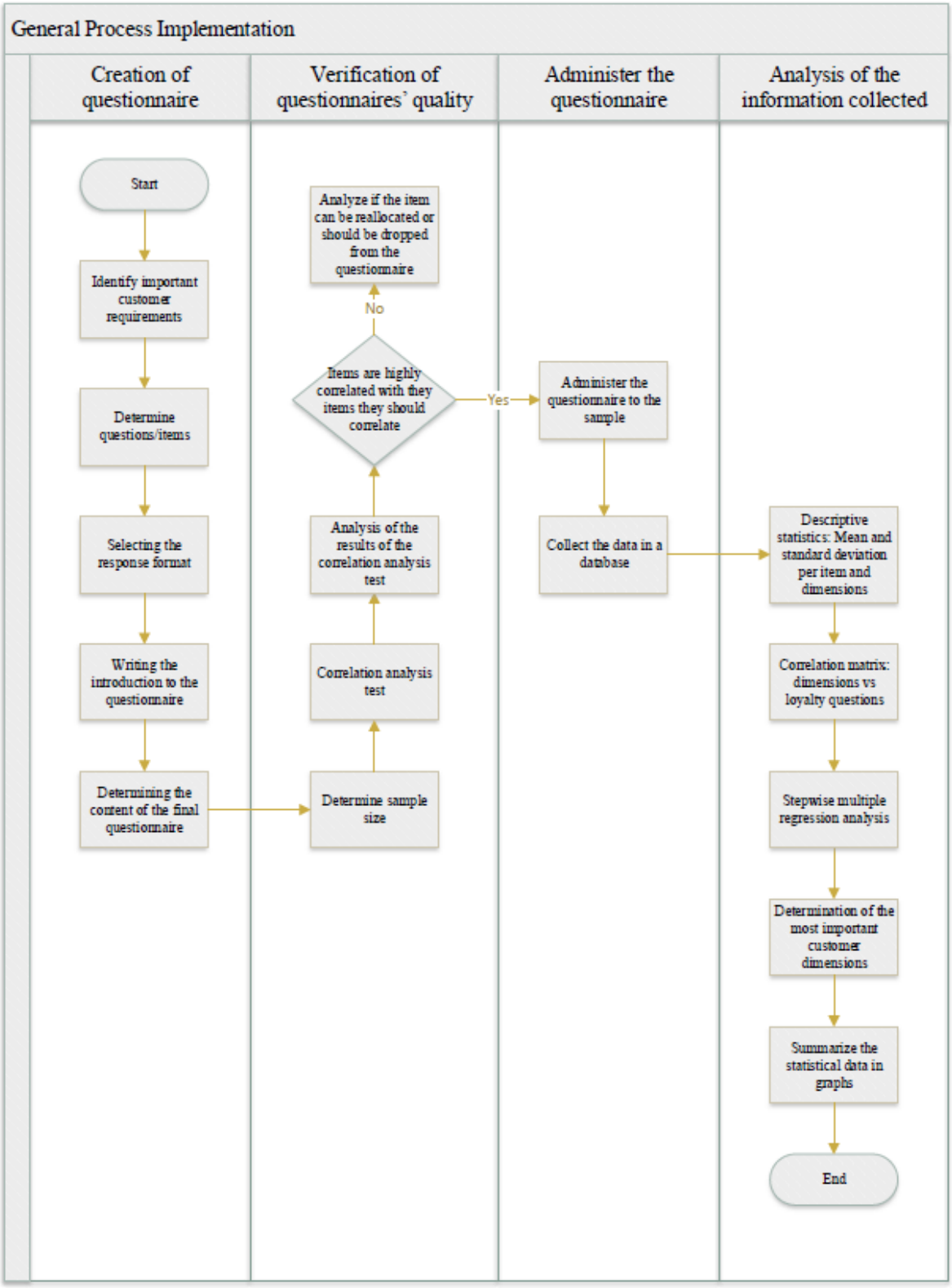

Figure 8. General process implementation.

8. Conclusions

In this thesis we have presented a proposal to improve the measurement of customer satisfaction along with the procedure to process and analyze the data collected in the Marketing vehicle importers for Light Commercial Vehicles department. As a main step we have introduced all the theory related to marketing, customer satisfaction and statistical tools, needed to develop a proper model for the measurement in a real environment.

An analysis of the company and the most important markets in the importer's LCV department was also presented, since the proposal needed to be focused to these markets this step serve to understand how their current performance regarding customer satisfaction measurement was. Through the analysis we could understand that the Market A has a very good system for the measurement and is mainly focused to the pre-sales and after sales part, and the after sales system can be sold to the other markets. Regarding the Market C, we found that it has a simple and easy to manage system that helps them monitor customer experience for after sales through a physical device located at the retailer's offices. For its part, Market B use a survey to assess customer satisfaction for test drive and sales, and for after sales they are currently measuring the NPS.

After the pre-analysis of the markets was done, we decided to choose Market B as the pilot market for the implementation of the proposal. On the one hand, Market A has already a well stablished and developed system to measure customer satisfaction, so there was not too much to improve. On the other hand, Market C has a system only for after sales, so the implementation of the presented model would require more resources. At the end of the analysis Market B was the best choice, since there are several things that can be done to improve their measurement system, and they are already measuring customers opinions in sales and after sales, so the implementation of the proposal will not take too much time and resources as would had happen in Market C.

The final proposal given in this work contains two questionnaires to evaluate customer satisfaction, one for sales and one for after sales. The questionnaires comprehend all the key aspects currently measured by FCA in other markets and some questions have been added in order to complement the assessment of the customer experience and to obtain more reliable results. It also details the procedure to analyze the data collected and to verify its quality.

The main statistical tools that we described to analyze the information are based on the theory presented in the theoretical framework. We have detailed in this work just the main indicators that will help to understand in which aspect should the company focus its efforts to increase the overall customer satisfaction level, as well as the loyalty indicators, which have proven to be related with the growth and profit of the companies. Finally, the proposal contains a few recommendations to follow in order to perform a success implementation of the model.

9. References

Fiat Chrysler Automobiles (2018). FCA: History. Retrieved from: https://www.fcagroup.com/en-US/group/history/Pages/default.aspx

Fiat Chrysler Automobiles (2018). FCA: Internal documents. Torino, Italy.

Kotler, P., Armstrong, G., Opresnik, M.O. (2018). Principles of Marketing. Harlow, United Kingdom: Pearson.

Hayes B.E. (2008). Measuring Customer Satisfaction and Loyalty (Third Edition). Milwaukee, Wisconsin: ASQ Quality Press.

Satmetrix (n.d.). How to improve customer experience. Retrieved from: http://cdn2.hubspot.net/hub/268441/file-220371862-pdf/eBooks/eBook_%20_Satmetrix_Customer_Experience_Guide.pdf

Techopedia (n.d.). Benchmarking. Retrieved from: https://www.techopedia.com/definition/17053/benchmarking

Oxforddictionaries (n.d.). Importer .Retrieved from: https://en.oxforddictionaries.com/definition/importer

Investopedia (n.d.). Trader .Retrieved from: https://www.investopedia.com/terms/t/trader.asp