



LOSS OF SALES DUE TO INCORRECT FORECASTING OF DEMAND

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Abstract:

The main objective is to gather and document the information about the solution process a Mexican company followed. The problem was the loss of sales due to a forecasting error in demand. The company determined a supposition of what they thought was the cause to their problem was forecasting error in demand. There are different methods and techniques that can be used in solving such problem. They performed different stages of a known methodology, known as Total Quality Management. This methodology requires to measure, calculate, evaluate, plan and improve processes or tools in order to achieve, the set goal. In the end, results were very positive, although the use of a more robust forecasting method was necessary to be more successful.

Keywords: Action, demand, forecasting, quality, sales.

Document development

Introduction:

The company studied in this article requires to keep its name and financial information private, we were allowed to explain in detail the entire process they followed and how well this exercise ended for them.

It is a direct sales leader company in Mexico, dedicated to sell products for decorating houses, and make them look very good, home decor, furniture, garden furniture and accessories, kitchen accessories, plaques, and holidays decoration (Christmas, Halloween, etc.) and jewelry. They sell by catalog and their products are produced by providers in China, India, United States and Mexico; logistics becomes a key activity in order to bring their products to all of Mexico.

When we approached the company, it was brought into our attention that we should work, analyze and document a problem within the operations management group. We had several meetings with the operations director, quality assurance engineer and demand planning manager

in order to document all the information required to completely understand the problem, their solution approach and their end results in order to make our conclusions.

The hypothesis was determined once the company, specifically the lost sales team, asked themselves many questions with the information gathered and therefore the possible causes to this issue would be established.

Also the theoretical framework was included from which was considered in depth and accuracy those aspects of the problem, i.e., the different methods the company could use that may be useful in the analysis and obviously in the resolution of the problem.

The methodology was also documented the processes involved and the process used by the company in order to accomplish the objectives required, i.e., TQM (Total Quality Management), and the one technique they used with the different stages that comes with it, stages such as: Project , Current Situation, Analysis, Actions, Execution, Verification, Standardization and Ideas for improvement were analyzed.

The main conclusions were included in this document and once the company applied the corrective actions they needed to take and what were their results once they did all this, the final results were analyzed, and this is where we can see if they were right with the decisions they made along the entire process.

Through the investigation of different forecasting techniques was observed that there are many of them, from the simplest method to a more developed and complicated one, depending on the precision you want to get, as the method becomes more complicated it's results are more precise.

And as it can be observed through this investigation, forecasting demand is one of the major problems in a company, and it's mainly because even though you try to calculate how much people will buy a product, this information would not be correct, you may calculate correctly sometimes, but future is unpredictable, and therefore it is a problem always present in every company.

Problem:

The main problem in this Company was the loss of money due to lost sales they have had, which is the main reason why a multidisciplinary team of people from different areas was created, in order to find out the reasons behind this issue, to determine an hypothesis of what are the reasons for the problem and what to do to minimize their lost sales, saving money and improving the income of the company.

Hypothesis:

Once the company identified the problem, many suppositions about the main causes for this problem were being established. Many questions were asked like: why do they have lost sales? What could have caused it? why they had lost sales? which products caused the greatest percentage of lost sales? Does the location from where they came from caused those lost sales? Does the season catalog contributes to lost sales?

The main supposition was the lost sales issue is due to a forecasting error in demand.

Theory:

Forecasting can be understood as the method companies use to plan the future purchases of either, raw materials to produce their products and finished products. (Inc encyclopedia, 2015).

Jacobs & Chase (2011), Explain that there are two types of forecasting depending on the level of demand analysis, which are: strategic forecasts and tactical forecasts.

Strategic forecasts are useful when related to the capacity, production, process design, overall strategy, sourcing, location and distribution design and service process design (p.520).

Tactical forecasts are useful to estimate demand in a short period of time, like a few weeks or a few months. (p.520).

Also (Chambers, Mullik, & Smith, 1971) mentions that the selection of the method the company will use, depends on many factors: “The context of the forecast, the relevance and availability of historical data, the degree of accuracy desirable, the time period to be forecast, the cost/ benefit (or *value*) of the forecast to the company, and the time available for making the analysis” And there are many methods like the ones we will mention next.

Jonsson & Mattsson (2005) mentions that usually a small amount of a company’s products or customer is a major part of the company’s total revenue ration. By categorizing the products and customer for example after their revenue ratio, a company can identify their most profitable ones. (Arnold, Chapman, & Clive 2007) explain that this method is called ABC Analysis or even sometimes referred as to Pareto’s law.

By using the ABC Analysis products are usually divided into three categories, A, B and C, sometimes even more categories (Arnold, Chapman, & Clive, 2008). (as cited in Dugic & Zaulich, 2011).

Forecasting technique: Qualitative techniques:

This kind of technique is basing the customer demand on judgment and perception (Arnold, Chapman, & Clive, 2008). Olhager (2000) mention that this technique is a subjective method and that the demand is based for example upon, experts opinion, market research’s and a method

called Delphi. The Delphi-method means that a jury of experts makes assumptions regarding the demand where the goal or objective is to conclude a united decision. Qualitative techniques are mostly used for large product categories for a longer time period (Arnold, Chapman, & Clive, 2008). (as cited in Dugic & Zaulich, 2011).

(Jacobs & Chase, 2011) explain the panel consensus method and emphasize its main idea “...two heads are better than one”.

“Market research is used mostly for product research in the sense of looking for new product ideas, likes and dislikes about existing products...” (Jacobs & Chase, 2011). This method is also commented in the Introduction to materials management book. (Arnold, Chapman, & Clive, 2008).

According to Accounting finance and tax (2014), the sales force polling method is a simpler forecast method that uses specialized knowledge from different people working in the sales department of a company, this in order to get accurate forecasts on demand, since sales people usually know customers.

Forecasting technique: Extrinsic techniques

“Examples of such data would be housing starts, birth rates, and disposable income” (Arnold, Chapman, & Clive, 2008, p.223).

The author explains that a number of variables have the possibility to affect each other's development. To clarify his statement he mentions an example, meaning that if the gasoline price is being raised, people will start to buy more fuel-efficient cars than before. (as cited in Dugic & Zaulich, 2011).

Forecasting technique: Intrinsic techniques

This method uses historical data to predict its forecast (Arnold, Chapman, & Clive, 2008). Olhager (2000), who calls this method quantitative, explain that the method is based on quantitative models. An example of quantitative technique is a method called time-series components. By using this method companies are including different components which effects then demand. (as cited in Dugic & Zaulich, 2011).

According to Arnold, Chapman, & Clive (2008), the moving average is a simple forecasting method used to get the average demand for the last 3 to 6 periods, depending on how accurate is expected to be.

And finlly the last one is exponencial smoothing method, which "... may be the most logical and easiest method to use" (Jacobs & Chase, 2011). And Arnold, Chapman, & Clive (2008), also agree with this statemnt and explain the procedure to calculate it.

Collaborative forecasting

Principally, the benefits resulting from collaborative forecasting are higher accuracy due to more valuable information processed. Additional market knowledge is gained as each company has different methods of acquiring and interpreting information. (Ballou, R. 2004, p.315) (as cited in Solveig, Zinnert, 2010).

In a collaborative forecasting effort, forecast of all time-horizons need to be produced using inter-organizational information and exchanged via supply chain effort. If the forecast long-term demand development implies wide-ranging consequences for any company's business, simulations have to prove to what extend the supply chain design is affected. (Chopra & Meindl, 2007, p.191). (as cited in Solveig, Zinnert, 2010).

Finally the insights have to be shared, decisions forged and supply chain adaption precociously initiated. (Engeler, G., 2004, p.213) (as cited in Solveig, Zinnert, 2010).

Waller, Dabholkar, & Gentry (2000), mention that by using speculation strategy a company adds value to the order before it is received and Pagh & Cooper (1998), explains that speculation is the opposite system towards postponement. (as cited in Dugic & Zaulich, 2011).

Bucklin (1966), considered that speculative inventories increase the average inventory cost per unit of product, but that they also facilitate an overall cost reduction by shortening delivery times. (as cited in Katsuyoshin Takashima, 2010)

Bucklin's postponement-speculation model is limited to inventory postponement speculation, but this study focuses on a modified version that can be applied to form postponement-speculation. Some researchers have conducted studies on postponement strategies that combine both geographical dimensions and upstream/downstream dimensions in relation to form postponement such as customization

(Van Hoek, 1999). For example, Feitzinger and Lee (1997), focused on Hewlett-Packard's printer manufacturing operations. (as cited in Katsuyoshin Takashima, 2010)

Exponential smoothing is similar to a moving average, but it places more weight on the most recent data. The weight on early periods drops off exponentially, so that the older the data, the less their influence. This weighting makes good sense and is supported by empirical studies (e.g., Ash and Smyth, 1973; Pashigian, 1964). (as cited in LONG-RANGE FORECASTING - From Crystal Ball to Computer).

Numerous alternatives to exponential smoothing can be used. One possibility is subjective or "eyeball" extrapolations. ADAM and EBERT 119761, and CARBONE and GORR (1985), found

objective methods to be a bit more accurate; however LAWRENCE et al. (1985), found the accuracy of subjective extrapolations to be good relative to objective methods:

In LAWRENCE et al. (1985), three alternative judgmental methods were compared with extrapolative methods in forecasts for the 111 time series (MAKRIDAKIS, et al, 1982). No information was available to the judges other than the historical data. In general, the judgmental extrapolations ("eyeballing") were at least as accurate as the extrapolation methods. For longer lead times, the quantitative extrapolations were superior. "I believe this may be due to the dampening of the trend factor that occurs with judgmental extrapolations" (as shown in EGGLETON, 1982) Surprisingly, subjects provided with tables gave slightly more accurate forecasts than those provided with graphs. (as cited in LONG-RANGE FORECASTING - From Crystal Ball to Computer).

Marketing practitioners regard forecasting as an important part of their jobs. For example, Dalrymple (1987), in his survey of 134 US companies, found that 99% prepared formal forecasts when they developed written marketing plans. In Dalrymple (1975), 93% of the companies sampled indicated that sales forecasting was 'one of the most critical' aspects, or a 'very important' aspect of their company's success. (Jobber, Hooley and Sanderson, 1985), in a survey of 353 marketing directors from British textile firms, found that sales forecasting was the most common of nine activities on which they reported. (as cited in LONG-RANGE FORECASTING - From Crystal Ball to Computer).
Forecasting methods: Structured analogies:

To use the structured analogies method, administrator prepares a description of the target situation and selects experts who have knowledge of analogous situations; preferably direct experience. The experts identify and describe analogous situations, rate their similarity to the

target situation, and match the outcomes of their analogies with potential outcomes in the target situation. The administrator then derives forecasts from the information the experts provided on their most similar analogies. There has been little research on forecasting using analogies, but results are promising. Green and Armstrong (2005), found that structured analogies were more accurate than unaided judgment in forecasting decisions in eight conflicts. (as cited in Armstrong & C. Green, 2005).

Expert systems forecasting involves identifying forecasting rules used by experts and rules learned from empirical research. One should aim for simplicity and completeness in the resulting system, and the system should explain forecasts to users. (as cited in Armstrong & C. Green, 2005).

Collopy, Adya, and Armstrong (2001), in their review, found that expert systems forecasts are more accurate than those from unaided judgement. This conclusion, however, was based on only a small number of studies. (as cited in Armstrong & C. Green, 2005).

Now, a table synthesizing forecasting techniques mentioned, as well as authors expert on the topic will be shown, in order to present all of them in an organized way so it's easier to analyze them.

Table 1: Forecasting techniques used in the calculation of demand.

Techniques.	Authors.
Forecasting qualitative techniques.	(Arnold, Chapman, & Clive, 2008). (Jacobs & Chase, 2011, p. 543)
The Delphi-method.	(Arnold, Chapman, & Clive, 2008, p. 223) (Jacobs & Chase, 2011, p. 546) (Olhager,2000).

Executive opinion or panel conscious.	(Accounting finance and tax, 2014). (Jacobs & Chase, 2011)
Sales force polling	(Accounting finance and tax, 2014)
Consumer surveys or market research	(Accounting finance and tax, 2014). (Jacobs & Chase, 2011)
Usage of qualitative techniques.	(Arnold, Chapman, & Clive, 2008). (as cited in Dugic & Zaulich, 2011).
Forecasting extrinsic techniques.	(Arnold, Chapman, & Clive, 2008, p.223).
Forecasting intrinsic techniques.	Arnold, Chapman, & Clive, (2008).
Time-series components method.	(Jacobs & Chase, 2011). (Olhager, 2000).
Average demand	(Arnold, Chapman, & Clive, 2008, p.225).
Exponential smoothing	(Accounting finance and tax, 2014). (Arnold, Chapman, & Clive, 2008, p.227). (Jacobs & Chase, 2011, p.524)
Moving average	(Accounting finance and tax, 2014). (Arnold, Chapman, & Clive, 2008, p.225).

After the information has been analyzed and understood, it's time to compare the theory gathered with the procedure followed by the company to solve the issue, in this way conclusions about it will be easier to determine.

Methodology:

The methodology used in this investigation is a study case, not exploratory, not correlational, transactional, made by observation and compilation of documents, depth interviews applied to people which had knowledge of the issue in the company, and numerical data to be able to quantify in percentage the quantities needed to develop the investigation, and this helped in the understanding of the main problem in the company.

When the new order process was established, it included a measurement of lost sales through measuring which products were requested and were not delivered to the customer. This provided first sight of the problem. Once team was build out, real work started.

First, information related to each single product they sell was gathered and analyzed. The Pareto tool was used to analyze and then classify data into:

Caused and non-caused lost sales. Caused lost sales refer to products no longer to be purchased due to performance (usually within a SALE promotion). Non-caused lost sales refer to products that continue to be sold but for some reason were not available in the inventory.

And then by catalog to which each product belongs to. The company launches three main catalogs, and three holiday catalogs along the year. It was important to determine to which of these catalogs belong the lost sales.

Category of the product, like furniture, kitchen accessory, bath accessory, candle, etc. By provider, to know if lead times were an issue for them.

For each one of these analysis they calculated the total amount of money they lost per category and then calculated the percentage of lost money each product has in proportion to the total amount of money lost.

They followed an empirical methodology, which is the TQM (Total Quality Management), since they have been using it for a very long time and was standardized into their projects and processes. They used graphs, tables, and diagrams like the ishikawa or fish diagram which is part of the methodology.

Operations director of this company explained that this methodology consists of eight stages, which are:

Project: Here they determined the main information of the project which includes the 5w's/1h technique. This is a table that includes what they had to do, why they had to do it, how they were going to do it, who had to do it and finally when and where they were going to do it. It also includes which indicators and macro processes are involved, which persons are part of the team and which are the rules the team will follow to work during the duration of the project.

By doing this they assure the team doesn't has loose ends through the project because they determine everything about the project of the problem.

Current situation: In this stage they establish current situation quantitatively for the last period of time. Since it was 2010 and a complete cycle of sales was one year of duration, they decided to use sales and lost sales of 2009, and determined that for this year they had two different types of lost sales (Caused and not caused lost sales).

Since caused lost sales cannot be changed because they refer to obsolete products no longer in any catalog, they decided to focus on the not caused losses only and the active products they have. Then, from those products, they established the following information:

Total amount of articles they sell (574) and total products that generated lost sales (143) which is their total population they reduced it to 143, and this is the sample.

Total sales for 2009 and total lost sales compared them with the active products for that year they established a fulfillment rate of 92.27%, which means they had a total of 7.73% of lost sales for this year due to the active products.

And finally for this stage in the project they established a goal they would like to reach at the end of the process or the goal they expect they can meet, which is 96.14%.

This company deals with more than 450,000,000 million of pesos by year, so when we are talking about a decrease in lost sales of 3.87%, we know that we are talking about an important amount of money although it might seem like it's nothing.

Analysis: the causes for lost sales were determined due to the root-cause method, i.e. each product was analyzed from the sample.

Among all the probable causes for the lost sales they previously determined by brainstorming at the beginning then they could prove that 10 of them were true and finally the focus fell over the next ones:

1. Incorrect forecasts of demand.
2. Delay sending goods by the supplier.

They mainly focused on the first one because is the one considered as the main cause or vital cause that must be reduced.

Then the next ones were identified as the main forecasting reasons for the lost sales:

1. Incorrect forecast of new lines
2. Incorrect forecast of regular line (Change of catalog).

Another important factor found it was causing lost sales was the shipping of products from other parts of the world, due to different providers the company have.

For delays in traffic they analyzed all the containers that arrived to Mexico's ports: Laredo and Manzanillo from China's ports: Xiamen and Chiwan as well as in how many days they arrived in 2009 and compared them to the ones of 2010

The company, in 2009 calculated that a shipment coming from China to be delivered in 30 days maximum. As the graphic shows in the results, most of the delayed shipments, which are the ones that were delivered after the 30 days established, were coming from the Xiamen port in China.

Actions: In this stage of the process they established which actions they are going to take. They decided to apply the 5W's/1H technique in order to cover all of what they can about designing the actions to be made.

Execution: in this stage of the process the actions developed in the previous stage were executed or implemented.

Verification: all the stages of the process were reviewed just as each one of them was developed and checked every detail of it in order to make an objective decision about the effectiveness of their process. Also the final decisions about the actions that were going to be made were checked and its results, which will be mentioned later, to determine if the next stage of the process can continue.

Standardization: the new processes or methodologies developed for the company in order to avoid losing sales, in this case, for the vital causes discovered with the help of this technique were standardized.

Ideas for improvement: the things that could have been done better were observed to get a better result, a discussion related to the elaboration of another cycle of this process, i.e. if this

technique was needed to be applied again in order to keep the processes and methodologies improvement in order to have better a fulfillment rate.

Results:

The next graph shows the percentage of lost money each of the selected products had proportionate to the total quantity of money lost:

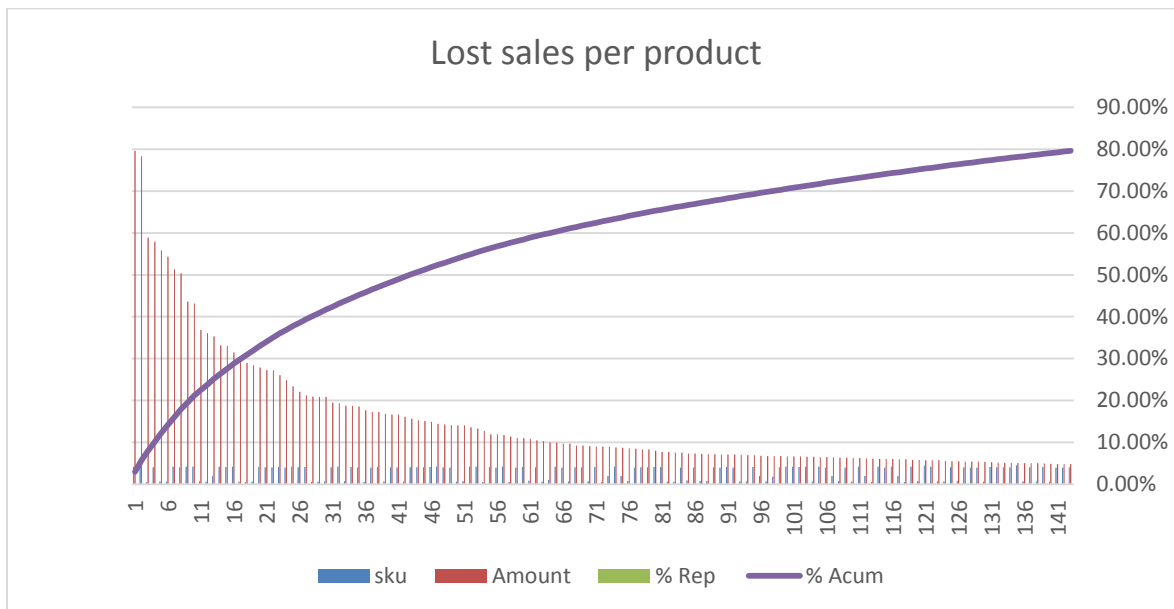


Figure 1 Columns Graph: Total lost sales in percentage by product. Adapted from company's data.

The next graph shows the main causes the company could determine after doing an analysis of all the data:

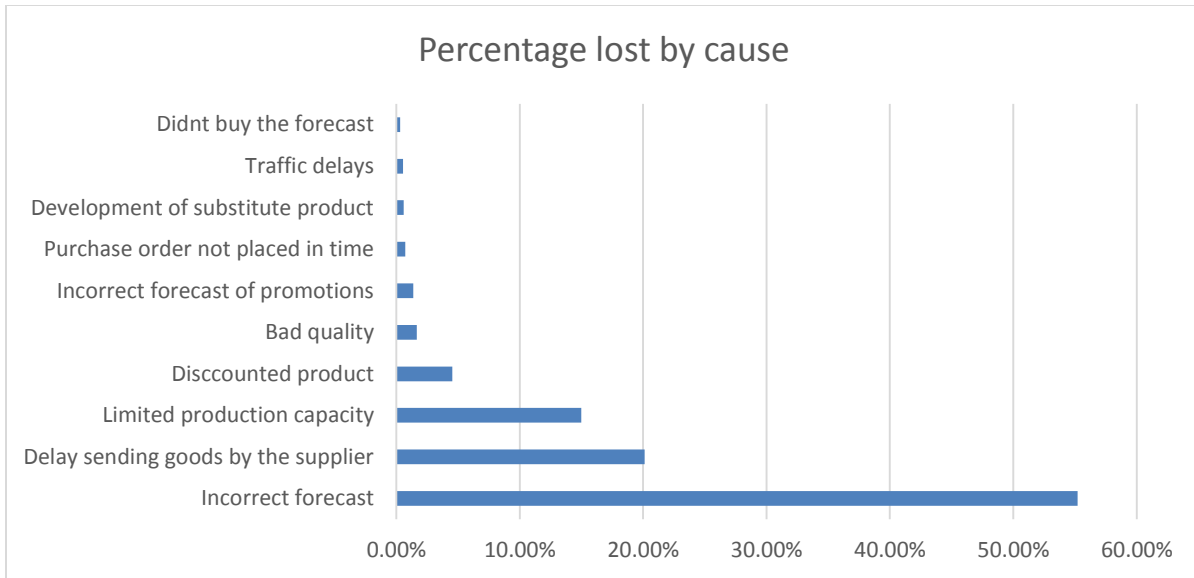


Figure 2 Main causes determined and arranged from the most important to the least important one. Adapted from company's data.

More than the 50% of their losses in active products is due to the incorrect forecast they did, therefore it was decided to go deep in this cause and divided it in different causes in order to know exactly what kind of forecasting was done wrong in the company.

The next graph shows the two main reasons in forecast that cause the loss of sales:

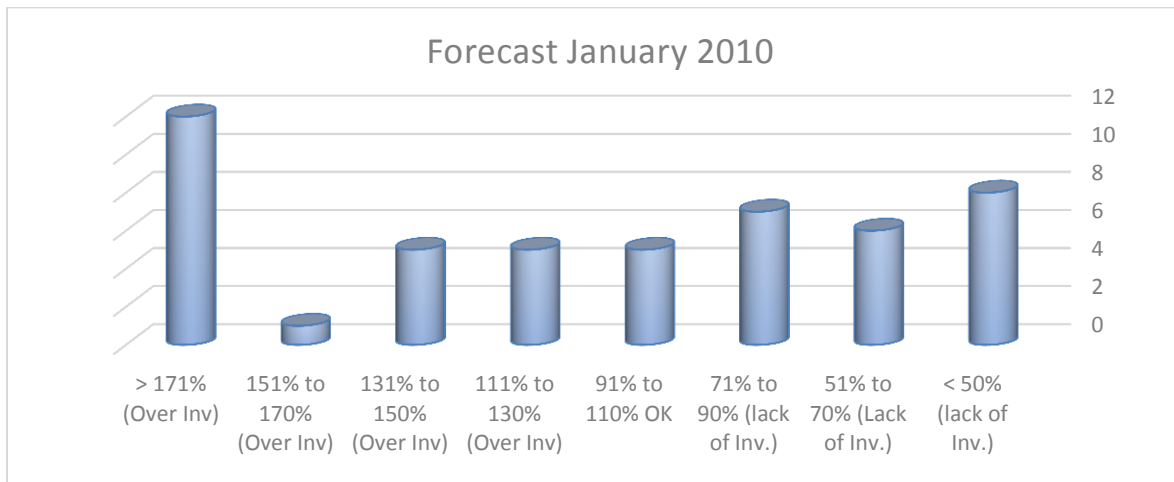


Figure 3 Types of forecast used in the company ad level of certainty for 2010. Adapted from company's data.

This cause was determined as a main cause and the statistical results were analyzed just to realize that the products that mostly caused lost sales came from China, which is the next cause on the main causes they developed due to the root-cause method mentioned before, as it is shown in the following graph:

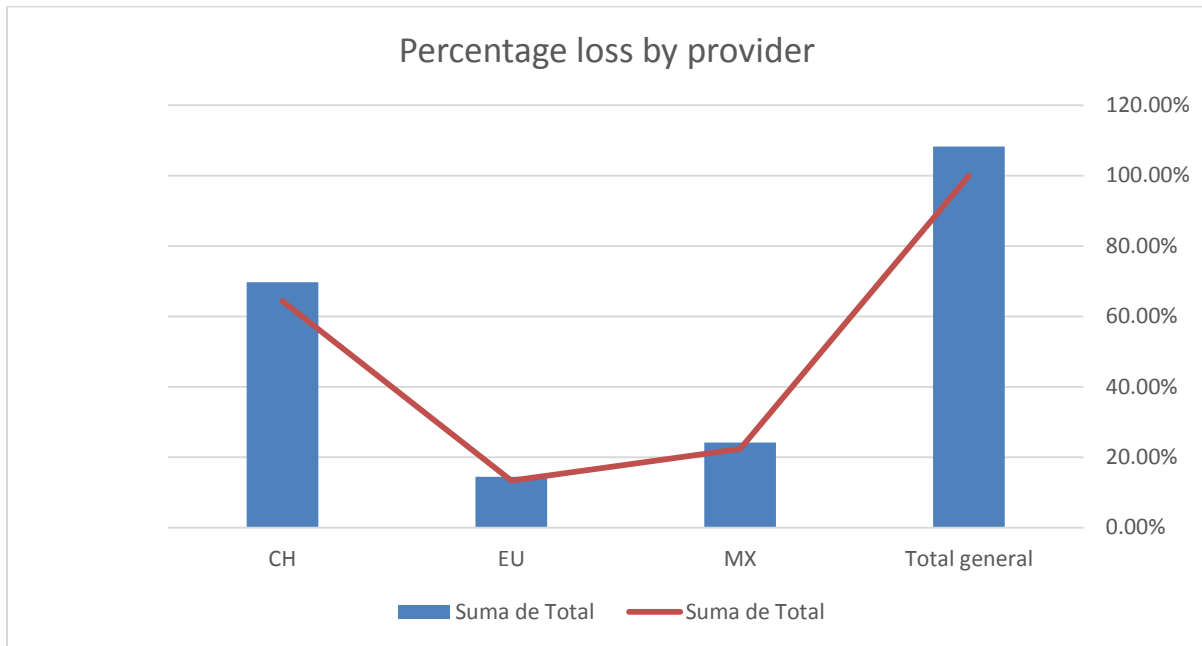


Figure 4 Percentage loss of money caused by delays in providers shipments

More than the 60% of the lost money comes from products sent from China, since shipments delayed.

The second main cause of lost sales also was studied based on the information gathered, and was determined that products coming from Xiamen port were the ones that took so long to come in two different occasions, as is shown in the following graph:

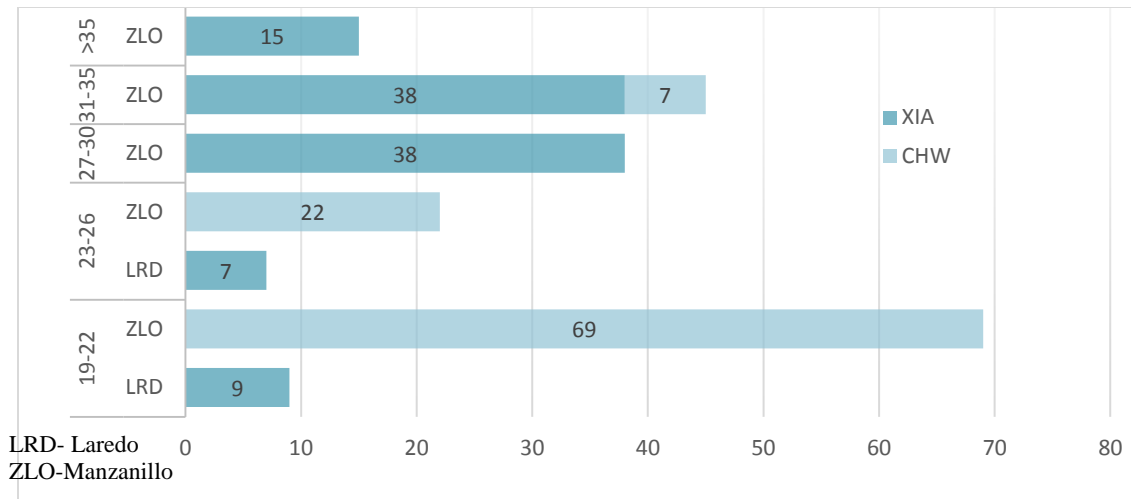


Figure 5 Shipments sent from different ports to the company. Adapted from company's data

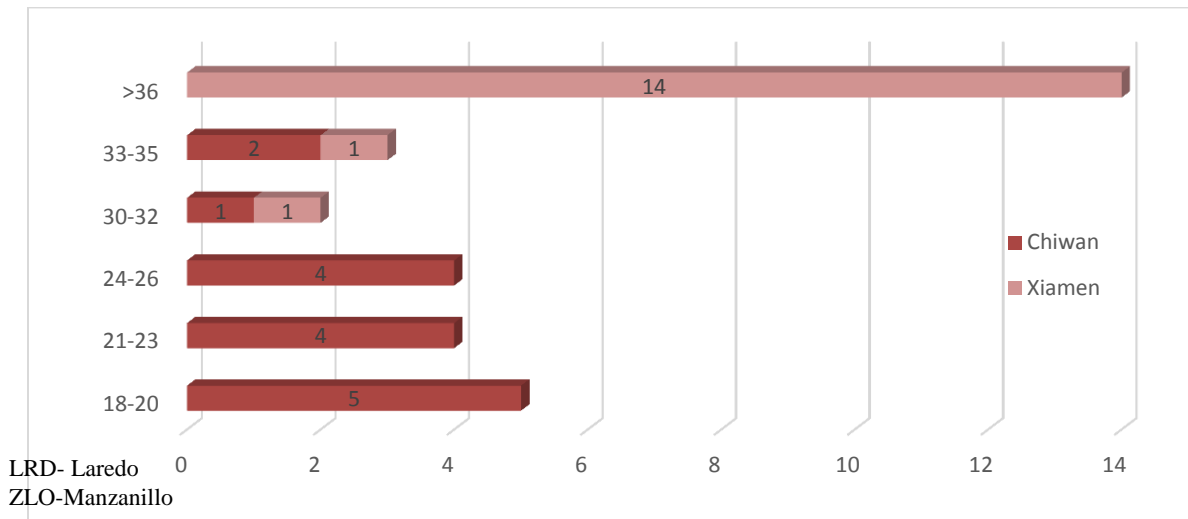


Figure 6 Shipments sent from different ports to the company adapted from company's data.

The actions to be made for the different main causes are:

Vital Cause 1: Incorrect Forecast in new lines:

Redefine the criteria to consider in the development of the Forecast, and modify the methodology currently used for calculating forecast. By analyzing: supplier, catalog distribution, degree of commercialization and logistic, evaluating the different methodologies to forecast in order to define the best one and considering the catalog distribution, to forecast the demand.

Vital cause 2: Incorrect Forecast in regular line:

Update the way in which reorder point is calculated, and the parameters that are required to suggest a PO (Purchase Order), by modifying the formula which defines the reorder point considering all the factors affecting future demand for each item.

Vital cause 3: Late Traffic by Port of Xiamen:

Find another option for Shipping Xiamen port and define a procedure to evaluate providers shipments and customs brokers, by hiring a shipping company that shipments departing directly from Xiamen to Manzanillo and documenting the evaluation process of suppliers (shipments and customs brokers).

At the end of the cycle, the company could see that the goal they established, which is the 96% wasn't accomplished as we can see in the next graph:

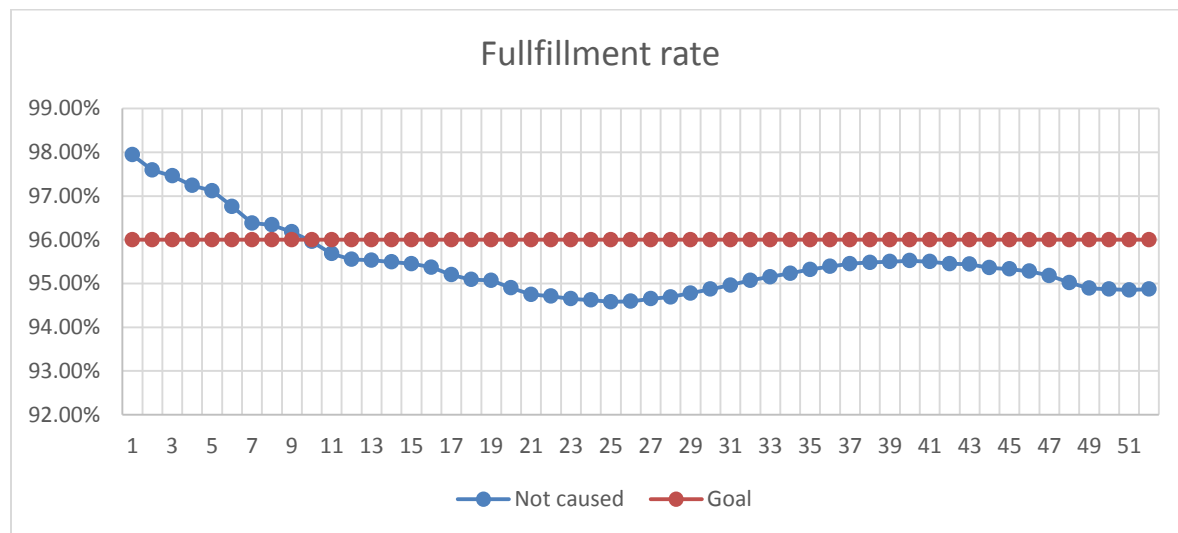


Figure 7 Fulfillment rate for sales in 2010 according to the goal set. Adapted from company's data.

It was known already that the goal wouldn't be accomplished because the goal was set very high in order to elevate the fulfillment rate of the products as much as it could be done, and indeed it was, a 95.47% of fulfillment rate was reached for the products in average.

As a result certain actions needed to execute were determined in order to achieve the original goal of 96%:

1. Improve the methodology of the calculation of the Forecast.
2. Measure the Error of the Forecast to consider it for the next calculations.
3. Calculate a safety stock by product based on a Formula they learned in a seminar.
4. Evaluate a software they already have for the calculation of the forecast, since excel is too risky for them.
5. Plan the demand, not only forecasting it, to reach the sales Goal

Conclusions:

In figure 1 is shown that the 80% of total lost sales was only caused by 143 products from all the ones that they have caused them lost sales, this is why their sample was formed by this 143 products specifically. So the question stated on the introduction was answered, the ones which had more importance where determines and studied.

Figure two represents the percentage of lost money each cause they determined has and the reason of why the ,aim attention was focused on the first two is because they are the ones that if they solve at least to decrease the percentages by half will beneficiate the company a lot, then the other causes would be attacked as well.

As it can be observed on figure 5 and figure 6 is shown from where does the products which cause lost sales come from, the majority are from china, although china´s supplier is the biggest one the company buys from, so the problem with this is that there is not being implemented an established method which can help in the calculation of the lead time for the products coming from china.

On the products analyzed because of lost sales there weren't taken into account seasonal products like Christmas, Halloween, among others, since these kind of products tend to cause many lost sales due to promotions, so these products do not form part of the lost sales percentage taken into account.

Getting real information, based on data gathered and really understand what is the current situation and the consequences of the issue is a very good and reliable strategy, in order to know what to expect more or less in the results and to know better what decisions to take or make in the company so that you can reach the best benefit.

The company's results were very positive, and did showed they had control over the problem but it is recommended applying a developed method for forecasting as well as other different methods to calculate the average time in which one of the products will get to México is the best option to solve the problem exposed in this investigation.

Also establishing a very high goal to reach is a great idea, since it makes every employee involved to really focus and try to meet the goal and at the end goals are fulfilled or almost fulfilled.

The hypothesis established at the beginning turned out to be correct and there where actions taken in order to get more accurate results at the time forecasting for demand of each product is calculated, this in order to avoid losing money in big quantities, like it has been happening.

Table 2: Answers to the questions stated in the hypothesis.

Main conclusions:	
Questions:	Conclusions
Why do they have lost sales?	Because forecasts on demand of products are wrong by a big difference, either there are products with very small inventory in the company that people asks very much or products with big quantities on inventory that no one buys.
What could have caused it?	The lack of a reliable methodology precise enough to calculate the most accurate forecasting on demands, as well as the lack of a control to calculate the lead time of products that come from China to Mexico, since the majority of the products managed by the company are from China.
Which products caused the greatest percentage of lost sales?	It was observed that 143 of the total products managed by the company caused the 80% of the total lost sales.
Does the location from where they came from caused those lost sales?	Certainly it does but the error is found on the calculations made by employees to know when the products arrive since the

majority of the products come from China.

Does the season catalog contributes to lost sales?

It doesn't, products from seasons like Christmas or Halloween weren't taken into account since the majority of them case even more lost sales but are provoked and expected by the company.

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