QUALITY FUNCTION DEPLOYMENT: A COMPARISON OF METHODOLOGIES TO SERVICES INDUSTRIES

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Abstract. Quality Function Deployment (QFD) is showed as total quality technique to be applied to identify, prioritize and assure that the customer needs will be present on the product or service since its conception. This paper presents an exploratory research performed at the after market division of an aeronautical industry company. The procedure to construct the quality matrix, the first matrix to be constructed, considered the basic design tool of QFD and commonly known as house of quality (hoq), was arranged in three main parts and it was used to compare two Quality Function Deployment methodologies (Kaneko and Ribeiro) recommended when your product is a service. The case study was developed using as primary source a customer satisfaction survey performed during a technical conference sponsored by the studied company. Through the construction of the House of Quality, it was possible to identify similarities and distinction between both methodologies and it was shown that: both methodologies are able to reveal the customers needs, the dissimilarities between them do not imply significant differences on the actions recommended to satisfy the client and, one of the methodologies, results on a larger dispersion of priorities.

Keywords: Quality, Customer requirements, Customer services, Quality Function Deployment

1. INTRODUCTION

According to CAMPOS (1999) a quality product or service is the one that is applied perfectly (error-free design), on liable way (error free), on accessible way (low cost), on safe way (customer safety) and on time (deliver the right product, at the right time and at right place) the customer needs.

Garvin (1992) shows that, quality has been applied since a long time ago, but only recently has it emerged as formal management function and the most modern approaches to quality has emerged gradually, arriving through steady evolution rather than dramatic breakthroughs. Garvin (1992) still points out that quality approaches can be differentiated into five categories: the transcendent view (quality as "innate excellence"), the product-based definitions (quality as a precise and measurable variable), the manufacturing-based definitions (quality as conformance to the requirements), the value-based definitions (considered for low costs and prices) and the user-based approaches (based on customers' needs and expectations).

Kotler (1998) defines service as any act or performance that one party can offer to another, that is essentially intangible, does not result in ownership of anything and its production may or may not be tied to a physical product.

Albretch (1998) refers to the relationship between customer and company as special one and presents the term "Moment of Truth: when your product is a service". Albretch (1998) shows that these moments are, in fact, present at each interaction the customer has with the company. When moments of truth are not properly managed, the quality reaches levels near of the mediocrity (Albrecht, 2002).

To Albrecht (1998), the companies must avoid strategies based on old theories about customers and should constantly reevaluate the internal beliefs about customers behaviors.

Cheng (1995) recommends, to minimize the chance of misunderstanding during the process to reveal customer expectations, to observe the relationship between the subjective (customer satisfaction) and the objective (degree of achievement) product evaluation identified by Kano and his coworkers.

1.1. Kano Requirements

As stated by Lofgren and Wintel (2005), Professor Kano and his coworkers, to better understand how customers evaluate and perceive quality attributes, developed a theory of attractive quality to explain how the relationship between the degree of sufficiency and customer satisfaction with a quality attribute can be classified.

To Mazur (1993) there are three types of customer requirements to consider understanding how meeting their requirements (product degree of achievement) affects satisfaction (customer satisfaction), as showed at Fig. 1:

1.1.1. Revealed Requirements:

Revealed requirements are typically what get by just asking customer what they want. The presence of revealed requirements satisfies the customer and their absence dissatisfies. Akao (1996) and Cheng (1995) refer to these requirements as elements of linear quality.
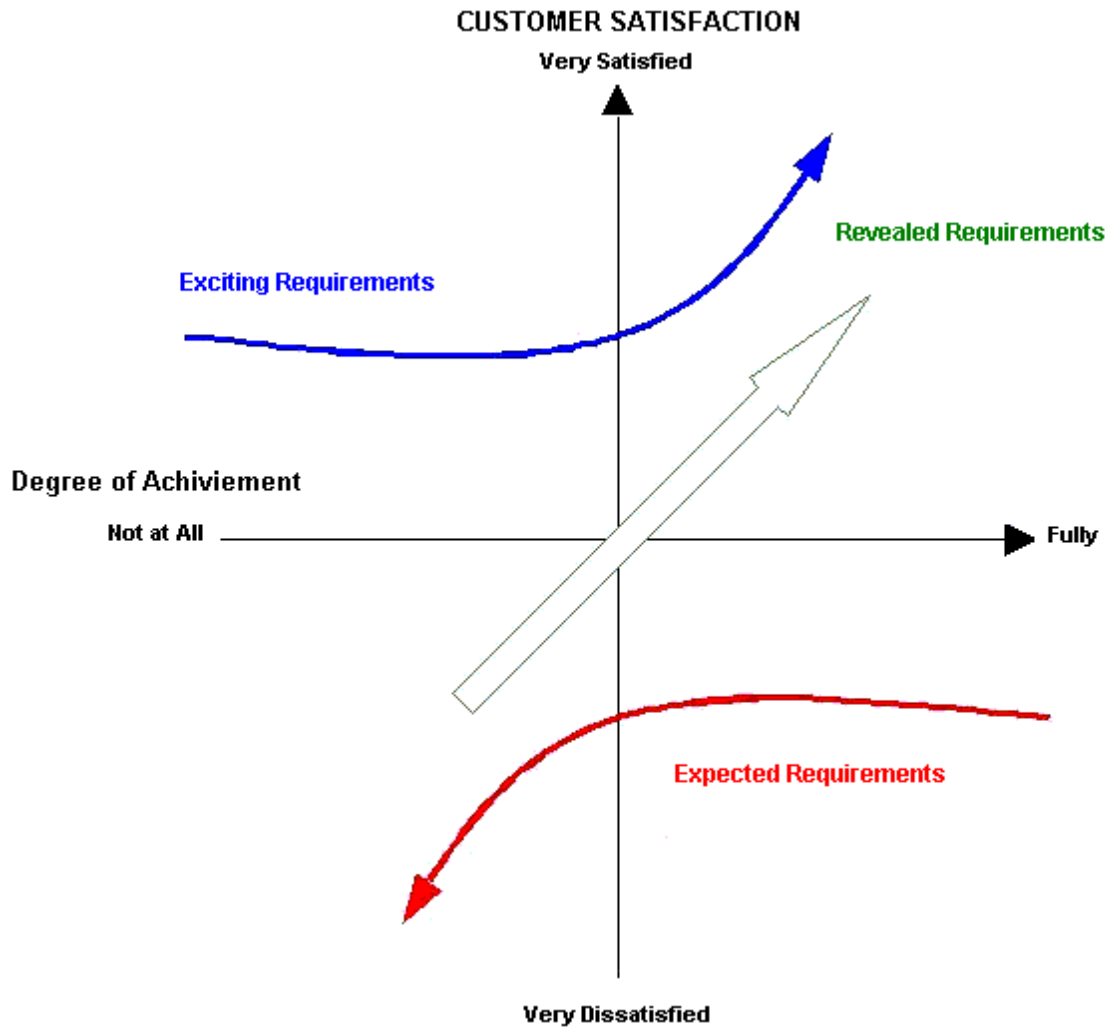
CUSTOMER SATISFACTION

Figure 1. Theory of Attractive Quality (Kano Requirements)
Adapted from Mazur & Bolt, 1999

1.1.2. Expected Requirements:

Expected Requirements are often so basic that the customer may fail to mention them. Meeting these requirements often goes unnoticed by most customers but their absence is very dissatisfying. Akao (1996) and Cheng (1995) refer to these requirements as elements of obvious quality.

1.1.3. Exciting Requirements:

Exciting Requirements are difficult to discover. They are beyond the customer expectations. Their absence doesn't dissatisfy, their presence excite. Akao (1996) and Cheng (1995) refer to these requirements as elements of attractive quality.

Cheng (1995) states that the traditional design process mainly considers the revealed requirements and these represent customers' basic needs. Cheng (1995) concluded his thought saying only that the attractive quality is able to surprise and marvel customers.

To Mazur, (1993) QFD, Quality Function Deployment, help the company assure that expected requirements don't fall through the cracks and points out opportunities to build in excitement.

1.2. Quality Function Deployment (QFD)

Akao (1997) explains that Quality Function Deployment is a literal translation of the Japanese words "*hinshitsu kino tenkai*". QFD was conceived in Japan in the late 1960s, during an era when Japanese industries broke from their post-

World War II mode of product development through imitation and copying and, moved to product development based on originality (Akao 1997).

As stated by Akao (1996) QFD has as objective to assure the quality during the initial phase of design, establishing the product quality based on customer requirements and translating theses requirements into procedures to ensure that the customers needs will be included in a product.

To Cheng (1995), QFD aims: 1- to support the product development, revealing, translating and transmitting customers' needs and desires; 2- to ensure quality during the product development process. This author still says that QFD can be so much applied on company products (stated here as goods or services) as on intermediate products between internals clients and suppliers.

To Hauser (1988), the House of Quality, QFD basic design tool, is a kind of conceptual map that provides the means for inter functional planning and communications.

Sassi and Miguel (2002), analyzing QFD applications from published cases in various Brazilian Conference proceedings, verified that the methodology is applied for services aiming to improve quality of the service delivered and, based on QFD statements, satisfy the customer. Sassi and Miguel (2002) still related that a diversity of applications of QFD, where QFD method is used for developing products and services.

The diversity mentioned above can be verified by analyzing the recent Brazilian Conference proceedings: Liphaus et al (2005) and Liphaus (2006) choose QFD to design a new product in small business. Amaral et al (2005) understand, after two years of research, that QFD actually helped an elevator company to be closer to the customer. Chiste (et al 2005) presents an application focusing the QFD management view in a food industry. Gilioli et al (2005) and Gilioli (2006) use QFD to identify and to show how to satisfy customer needs in a technical assistance of automotive industry. Oliveira Jr et al (2006) and Oliveira Jr (2006) use QFD as a proposal to evaluate company strategy for market segmentation of an after sales division of an aeronautical industry.

Guazzi (1999) considers that the Kaneko methodology is the choice when your product is a service. Ribeiro (2001) proposes a different approach to this industry.

According to Jesus (2001) Ribeiro methodology is largely used by Federal University of Rio Grande do Sul (UFRS) at industries researches; it is formed by three matrixes. Guazzi (1999) states that Kaneko methodology is formed by six matrixes. Both methodologies have been developed from Akao's model and they have as their first matrix the Quality Matrix (the House of Quality).

2. OBJECTIVE

The purpose of this paper is to verify similarities, dissimilarities and difficulties to construct of House of Quality following two QFD methodologies (Kaneko and Ribeiro). The present study is an exploratory research, based on a customer satisfaction survey performed during the technical conference sponsored by an aeronautical company in 2001.

3. METHODOLOGY

The studied aeronautical Company sponsors every three years a Technical Conference to discuss technical and logistics issues with its clients. At the end of the meeting, a customer satisfaction survey is performed to evaluate the Company after sales services. The 2001 Technical Conference data were analyzed in this paper.

It was analyzed the comments found on the customer satisfaction survey to reveal the voice of customer and to reach the proposal in this case study. With this data in hands, it was followed the methodologies recommended by Ribeiro et al (2001) and Kaneko (1991, apud Fiates 1995) to build the Quality Matrix (house of quality).

The steps described below were accomplished at the construction of the house of quality:

3.1. Quality Matrix by Ribeiro
3.1.1. Strategic evaluation of demanded quality (Ei)
3.1.2. Competitive evaluation of demanded quality (Mi)
3.1.3. Demanded quality prioritization (IDi*)
3.1.4. Deployment of the quality attributes (quality indicator)
3.1.5. Relationship between demanded quality and quality attributes (DQi)
3.1.6. Current specification of the quality attributes
3.1.7. Importance of the quality attributes (IQi)
3.1.8. Evaluation of difficulties to change the quality attributes (Dj)
3.1.9. Competitive evaluation of the quality attributes (Bj)
3.1.10. Attributes of quality prioritization (IQj*)
3.2. Quality Matrix by Kaneko
3.2.1. Competitive analysis (Current achievement degree)
3.2.2. Desired degree of achievement
3.2.3. Improvement rate
3.2.4. Sale points

3.2.5. Importance weight (Absolute importance - IDi*)
3.2.6. Quality element (Attributes of quality)
3.2.7. Quality Matrix (or relationship matrix)
3.2.8. Goal Value
3.2.9. Importance weight (Technical importance)
3.2.10. Costs evaluation
3.2.11. Technical comparison or Competitive analysis
3.2.12. Absolute importance (or score absolute)

4. RESULTS AND DISCUSSIONS

4.1. Voice of Customer

The voice of customer was revealed by analysis of the Technical Conference comments found in the customer satisfaction survey form. It were analyzed 88 comments, these information were considered as the primitive data.

Based on an affinity diagram, the primitive data were analyzed and arranged in groups based on their similarities. This process resulted in 24 groups, these groups were named to represents their data and each of the named group, called of tertiary level elements, is a Customer Demanded Quality.

Same process was adopted to arrange the second and the primary levels.

The importance weight of each tertiary element (demanded quality) was got during this analysis.

Table 1 presents the results of this analysis, the Tree of Demanded Quality or Customer Demanded Quality Deployment.

Table 1. Tree of Demanded Quality (Customer Demanded Quality Deployment)

Primary Level	Secondary Level	Tertiary Level
Product Support	Technical Visits	Technical visits efficacy
		Technical visits frequency
	Query Answer	Query answer solution efficiency
		Smaller time to answer a routine query answer
		Smaller time to answer an emergency query answer
	Communication	To increase the number of communication channels
		Frequently provide open issue status
	Relationship	Honest relationship
		Attitude to face customer problems
		Knowledge about customer
	Technical Publication	To issue error free maintenance procedures
		To issue electronic manuals
		To issue, more frequently, manuals revisions
		To detail the spare parts catalogs
		To issue specific manuals for each customer
		To improve Service Bulletin efficiency
	Training	To plan theoretical course according to customer needs
		To plan more time to on the job training
	Spare Parts	To improve parts quality
		To speed up the quotation issue
		To detail quotation and invoice data
		To reduce report of no parts on stock
		To improve warranty management
		To have cheaper parts price

During the Technical Conference, the voice of customer was collected through a form. It was noticed that this form presented demanded quality elements from distinct levels on the same level and elements that belongs to distinct group on the same group.

It was noticed too that the majority of the comments were made by one customer. This can be explained because this customer had more delegates at the Conference than the others customers had.

4.2. The House of Quality

To better analyze the methodologies and compare their results, the steps recommended to accomplish them were arranged in three major parts:

4.2.1. Demanded quality prioritization

This part refers to Ribeiro (from step 3.1.1 to 3.1.3) and Kaneko (from step 3.2.1 to 3.2.5).

At this part, the customer demanded quality items were prioritized, starting from the importance of each demanded quality item got through the analysis of the data of customer satisfaction survey.

It was possible to notice the following:
- Similarity between the "Strategic evaluation" (paragraph 3.1.1) and the "Desired degree of achievement" (paragraph 3.2.2).
- Similarity between the "Competitive evaluation of demanded quality" (paragraph 3.1.2) and the "Competitive analysis" (paragraph 3.2.1).

It is important to mention that, as consequence of the statements made above, it was necessary to verify the coherence between the analyses results.

This way, it was verified if a demanded quality judged very important in an evaluation was judged very important, too, in its similarity evaluation. As well as, if a demanded quality was judged less important in an evaluation, it should be considered less important in its similarity evaluation.

As main dissimilarities, Kaneko recommends more two analyses to get the prioritization than Ribeiro. The way that this prioritization is calculated is different, too. The equation suggested by Ribeiro can lead to results dispersion greater than the one get by using Kaneko methodology.

Table 2 presents the demanded quality in decreasing priority disposition to each of the methodologies. From Tab. 2 analysis it is possible to verify that:

Table 2. Demanded quality in decreasing priority

Priority Rank	Demanded Quality	
	By Ribeiro	By Kaneko
1*	Technical visits frequency	Technical visits frequency
2*	To issue error free maintenance procedures	To issue error free maintenance procedures
3	Query answer solution efficiency	To improve Service Bulletin efficiency
4	To improve Service Bulletin efficiency	Query answer solution efficiency
5*	Smaller time to answer a routine query answer	Smaller time to answer a routine query answer
6	To increase the number of communication channels	Smaller time to answer an emergency query answer
7	Knowledge about customer	To increase the number of communication channels
8	Smaller time to answer an emergency query answer	Knowledge about customer
9	Frequently provide open issue status	Technical visits efficacy
10	Technical visits efficacy	Frequently provide open issue status
11	To speed up the quotation issue	To plan more time to on the job training
12	To plan more time to on the job training	To speed up the quotation issue
13*	To issue, more frequently, manuals revisions	To issue, more frequently, manuals revisions
14*	To improve parts quality	To improve parts quality
15*	To plan theoretical course according to customer needs	To plan theoretical course according to customer needs
16*	To improve warranty management	To improve warranty management
17*	To reduce report of no parts on stock	To reduce report of no parts on stock
18	To issue electronic manuals	Honest relationship
19	To have cheaper parts price	Attitude to face customer problems
20	Honest relationship	To issue electronic manuals
21	Attitude to face customer problems	To have cheaper parts price
22*	To detail the spare parts catalogs	To detail the spare parts catalogs
23*	To issue specific manuals for each customer	To issue specific manuals for each customer
24*	To detail quotation and invoice data	To detail quotation and invoice data

- The first five demanded quality elements are the same, three of them at the same priority.

- The last three demanded quality elements got the same priority.
- Eleven demanded quality elements, indicated by an asterisk (*) in the table 2, got the same priority number in both methodologies.

Relevant statistical data can be found at Tab. 3. The values are showed in percentage of importance to compare de methodologies.

Table 3 shows that Kaneko methodology presents larger amplitude (difference between the highest and lowest important elements of demanded quality) than Ribeiro one.

Kaneko methodology presents, too, bigger data dispersion than Ribeiro methodology.

Table 3. Importance of the demanded quality

Importance	By Ribeiro	By Kaneko
Highest	12,09%	14,53%
Lowest	0,99%	0,78%
Standard Deviation	0,0278	0,0342
Amplitude	11,10	13,76

4.2.2. Quality attributes deployment

This part refers to Ribeiro (from step 3.1.4 to 3.1.6) and Kaneko (from step 3.2.6 to 3.2.8).

At this part the quality attributes and their specification were identified. The quality matrix was fulfilled at the end of this part. The results of this part are the same for both methodologies.

It was observed that some elements of demanded quality were not represented by a quality attribute (a quality indicator). This find become evident that some elements considered relevant to the customer were not monitored by the company. As consequence, these elements of demanded quality without a quality indicator did not have a goal value.

The stated above, make evident a gap at the company logistics system that can become on business opportunities, because shows the customers needs that are not properly treated by the company.

The matrix is an important tool to give visibility to the performed analysis.

4.2.3. Quality attributes prioritization

This part refers to Ribeiro (from step 3.1.7 to 3.1.10) and Kaneko (from step 3.2.9 to 3.2.12).

Part accomplished to reveal the quality indicators relevant to satisfy the customers. The prioritization was performed starting from technical importance of each quality attributes.

It was possible to notice the following similarities between the methodologies:

- Similarity between the way to reach the "Importance of the quality attributes" (paragraph 3.1.7) and the "Importance weight" (paragraph 3.2.9).
- Similarity between the "Evaluation of difficulties to change quality attributes" (paragraph 3.1.8) and the "Costs evaluation" (paragraph 3.2.10).
- Similarity between the "Competitive evaluation of quality attributes" (paragraph 3.1.9) and the "Technical comparison or Competitive analysis" (paragraph 3.2.11).

It is important to mention that, as consequence of the two last statements made above, it was necessary to verify the coherence between the analyses results.

This way, it was verified if a quality attribute judged very important in an evaluation was judged very important, too, in its similarity evaluation. As well as, if a quality attribute was judged less important in an evaluation, it should be considered less important in its similarity evaluation.

The way that this prioritization is calculated is different. The equation suggested by Ribeiro can lead to results dispersion greater than the one get by using Kaneko methodology.

Table 4 shows that Kaneko methodology presents larger amplitude (difference between the highest and lowest important quality attributes elements) than Ribeiro one. This methodology presents, too, bigger data dispersion than Ribeiro methodology.

Table 4. Importance of the quality attributes

Importance	By Ribeiro	By Kaneko
Highest	11,28%	12,09%
Lowest	0,19%	0,34%
Standard Deviation	0,0294	0,0308
Amplitude	11,08	11,75

Table 5 presents the quality attributes in decreasing priority disposition to each of the methodologies. From Tab. 5 analysis it is possible to verify that:

- The first four quality attributes elements are the same, three of them at the same priority.
- The last three quality attributes elements got the same priority.
- Fourteen quality attributes elements, indicated by two asterisks (*) in the table 5, got the same priority number in both methodologies.

Table 5. Quality attributes in decreasing priority

Priority Rank	Quality attributes	
	By Ribeiro	**By Kaneko**
1**	Technical representative training hours/year	Technical representative training hours/year
2**	Support Engineer training hours/year	Support Engineer training hours/year
3	Existence of a data base to query answers solutions	Technical Visits/year
4**	Maintenance Engineer training hours/year	Maintenance Engineer training hours/year
5	Technical Representative/client	Number of Communication Channels
6	Technical Visits/year	Existence of a system to provide open issue status
7	% of recurrent field problems/year	Existence of a data base to query answers solutions
8	Number of Communication Channels	Nº of customer satisfaction survey
9	Existence of a system to provide open issue status	Technical Visits evaluation
10**	Maintenance procedure deviation/year	Maintenance procedure deviation/year
11	Technical Visits evaluation	Nº of complaint about missing open issue status
12	Manuals revision/year	Technical Representative/client
13	Nº of complaint about missing open issue status	Manuals revision/year
14	Service Bulletin deviation/year	Nº of customer confidence survey/year
15**	% of training satisfaction	% of training satisfaction
16	% query answered before deadline - routine	% of recurrent field problems/year
17	Nº of customer satisfaction survey	% query answered before deadline - routine
18**	Theoretical training hour/on the job training	Practical training hour/on the job training
19**	% query answered before deadline - emergency	% query answered before deadline - emergency
20	Nº of customer confidence survey/year	Nº of company image survey/year
21**	Existence of total quality management program	Existence of total quality management program
22	Relationship between "Hard Copy"/Electronic manuals	Service Bulletin deviation/year
23**	% of invoice issue before deadline/month	% of invoice issue before deadline/month
24	Nº of complaints about parts deviations	Existence of system to structure parts price
25	Instructor training hours/year	Existence of a market analysis program
26	Nº of company image survey/year	Relationship "Hard Copy"/Electronic manuals
27	Existence of system to structure parts price	Instructor training hours/year
28	Existence of a market analysis program	Nº of complaints about missing specific customer information
29**	Nº of complaint about warranty process	Nº of complaint about warranty process
30**	% of warranties process closed before deadline	% of warranties process closed before deadline
31	Nº of complaints about missing specific customer information	Nº of complaints about parts deviations
32**	Nº of query about catalogs missing parts/month	Nº of query about catalogs missing parts/month
33**	% of customer order closed after dead line caused by no parts on stock report	Nº of information requested about invoice and quotation/year.
34**	Nº of information requested about invoice and quotation/year.	% of customer order closed after dead line caused by no parts on stock report

Table 6 shows that if the company concentrates its investments to improve the results of the first eleven quality attributes by Ribeiro methodology (around 32% of the items), it will be prioritizing the elements that represent, around, 70% of the total importance. These same eleven quality attributes represent, around, 67% of the total importance by Kaneko methodology.

Table 6. Quality attributes prioritizing (by Ribeiro)

Priority Rank	Quality attributes	Priority By Ribeiro		Priority By Kaneko	
		Level	Accumulated	Level	Accumulated
1	Technical representative training hours/year	11,3%	11,3%	12,1%	12,1%
2	Support Engineer training hours/year	11,1%	22,4%	12,1%	24,1%
3	Existence of a data base to query answers solutions	8,5%	30,9%	4,4%	28,6%
4	Maintenance Engineer training hours/year	6,8%	37,8%	6,6%	35,1%
5	Technical Representative/client	6,4%	44,2%	3,1%	38,2%
6	Technical Visits/year	4,9%	49,0%	9,7%	47,9%
7	% of recurrent field problems/year	4,6%	53,7%	2,1%	50,1%
8	Number of Communication Channels	4,4%	58,1%	5,3%	55,4%
9	Existence of a system to provide open issue status	4,2%	62,3%	4,9%	60,4%
10	Maintenance procedure deviation/year	3,7%	66,0%	3,3%	63,6%
11	Technical Visits evaluation	3,6%	**69,7%**	3,5%	**67,1%**
12	Manuals revision/year	3,3%	73,0%	3,0%	70,1%
13	Nº of complaint about missing open issue status	2,8%	75,9%	3,1%	73,2%
14	Service Bulletin deviation/year	2,7%	78,5%	1,2%	74,4%
15	% of training satisfaction	2,3%	80,9%	2,7%	77,1%
16	% query answered before deadline - routine	2,1%	83,0%	2,1%	79,1%
17	Nº of customer satisfaction survey	2,0%	84,9%	3,7%	82,8%
18	Theoretical training hour/on the job training	1,9%	86,9%	2,0%	84,8%
19	% query answered before deadline - emergency	1,7%	88,6%	1,6%	86,4%
20	Nº of customer confidence survey/year	1,5%	90,1%	2,8%	89,2%
21	Existence of total quality management program	1,4%	91,5%	1,3%	90,5%
22	Relationship between "Hard Copy"/Electronic manuals	1,1%	92,6%	1,0%	91,6%
23	% of invoice issue before deadline/month	0,9%	93,5%	1,1%	92,7%
24	Nº of complaints about parts deviations	0,9%	94,4%	0,5%	93,2%
25	Instructor training hours/year	0,8%	95,2%	0,7%	93,8%
26	Nº of company image survey/year	0,8%	96,0%	1,3%	95,2%
27	Existence of system to structure parts price	0,7%	96,8%	1,0%	96,2%
28	Existence of a market analysis program	0,7%	97,5%	1,0%	97,3%
29	Nº of complaint about warranty process	0,7%	98,2%	0,5%	97,8%
30	% of warranties process closed before deadline	0,5%	98,6%	0,5%	98,3%
31	Nº of complaints about missing specific customer information	0,4%	99,0%	0,6%	98,9%
32	Nº of query about catalogs missing parts/month	0,4%	99,4%	0,4%	99,3%
33	% of customer order closed after dead line caused by no parts on stock report	0,4%	99,8%	0,3%	99,7%
34	Nº of information requested about invoice and quotation/year.	0,2%	100,0%	0,3%	100,0%

In the same way, Tab. 7 shows that if the company concentrates its investments to improve the results of the first twelve quality attributes by Kaneko methodology (around 35% of the items), it will be prioritizing the items that represent, around, 72% of the total importance. These same twelve quality attributes represent, around, 70% of the total importance, by Ribeiro methodology.

The methodologies to prioritize the characteristics of quality provided relevant information to the company logistics system. The dissimilarities between them would not result in distinct actions to meet customer requirements.

5. CONCLUSIONS

The Technical Conference was judged proper to get the voice of customer, mainly because this event, usually, has high index of participation, but the instrument to collect the voice of customer should be modified to permit the statistical treatment of the data and, consequently, to obtain the best result from the used technique.

The matrix is an important tool to give visibility to the performed analysis because makes clear that some characteristic of quality (a quality indicator) were not monitored by the company. It means that some elements considered relevant to the customer were not monitored by the company and that customers' needs are not properly treated by their logistics system. This gap at the company logistics system can become on business opportunities.

The analysis results show that Kaneko methodology presents bigger data dispersion than Ribeiro methodology. The method suggested by Ribeiro can lead to results dispersion greater than the one get by using Kaneko methodology.

Despite of the above mentioned, both methodologies can provide relevant information. The dissimilarities between them would not result in distinct actions to meet customer requirements.

Table 7. Priorization of Quality attributes (by Kaneko)

Priority Rank	Quality attributes	Priority By Ribeiro		Priority By Kaneko	
		Level	Accumulated	Level	Accumulated
1	Technical representative training hours/year	11,3%	11,3%	12,1%	12,1%
2	Support Engineer training hours/year	11,1%	22,4%	12,1%	24,1%
3	Technical Visits/year	4,9%	27,3%	9,7%	33,9%
4	Maintenance Engineer training hours/year	6,8%	34,1%	6,6%	40,4%
5	Number of Communication Channels	4,4%	38,6%	5,3%	45,8%
6	Existence of a system to provide open issue status	4,2%	42,8%	4,9%	50,7%
7	Existence of a data base to query answers solutions	8,5%	51,3%	4,4%	55,1%
8	Nº of customer satisfaction survey	2,0%	53,2%	3,7%	58,8%
9	Technical Visits evaluation	3,6%	56,9%	3,5%	62,3%
10	Maintenance procedure deviation/year	3,7%	60,6%	3,3%	65,6%
11	Nº of complaint about missing open issue status	2,8%	63,4%	3,1%	68,7%
12	Technical Representative/client	6,4%	**69,8%**	3,1%	**71,8%**
13	Manuals revision/year	3,3%	73,2%	3,0%	74,8%
14	Nº of customer confidence survey/year	1,5%	74,7%	2,8%	77,6%
15	% of training satisfaction	2,3%	77,0%	2,7%	80,2%
16	% of recurrent field problems/year	4,6%	81,7%	2,1%	82,4%
17	% query answered before deadline - routine	2,1%	83,8%	2,1%	84,5%
18	Practical training hour/on the job training	1,9%	85,7%	2,0%	86,4%
19	% query answered before deadline - emergency	1,7%	87,5%	1,6%	88,0%
20	Nº of company image survey/year	0,8%	88,2%	1,3%	89,4%
21	Existence of total quality management program	1,4%	89,6%	1,3%	90,7%
22	Service Bulletin deviation/year	2,7%	92,3%	1,2%	91,9%
23	% of invoice issue before deadline/month	0,9%	93,2%	1,1%	93,0%
24	Existence of system to structure parts price	0,7%	94,0%	1,0%	94,1%
25	Existence of a market analysis program	0,7%	94,7%	1,0%	95,1%
26	Relationship "Hard Copy"/Eletrônico manuals	1,1%	95,8%	1,0%	96,1%
27	Instructor training hours/year	0,8%	96,6%	0,7%	96,8%
28	Nº of complaints about missing specific customer information	0,4%	97,0%	0,6%	97,4%
29	Nº of complaint about warranty process	0,7%	97,7%	0,5%	97,9%
30	% of warranties process closed before deadline	0,5%	98,2%	0,5%	98,4%
31	Nº of complaints about parts deviations	0,9%	99,0%	0,5%	98,9%
32	Nº of query about catalogs missing parts/month	0,4%	99,4%	0,4%	99,3%
33	Nº of information requested about invoice and quotation/year.	0,4%	99,8%	0,3%	99,7%
34	% of customer order closed after dead line caused by no parts on stock report	0,2%	100,0%	0,3%	100,0%

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7. RESPONSIBILITY NOTICE

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