

Product Strategic Development (PSD) in the Aviation Segment

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***Abstract.** This paper presents the Product Strategic Development (PSD). This process focus on the alignment between customers and company, or in a more detailed perspective, between customers' needs and company strategy, since it comprehends the integration of both information through the usage of the QFD Matrix "0". The development of the PSD process was initiated with a survey of best practices in the academic realm, specifically, the Balanced Scorecard (BSC) and Quality Function Deployment (QFD) methods. Once all this information was gathered, the QFD matrix "0" was structured to the specific particularities of the PSD process. After the elaboration of matrix "0", the PSD process incorporated a way to assimilate changes in the company's strategy, translating its impacts on the product development initiatives that belong to the company's portfolio. A case study has been made up to exemplify the Product Strategic Development (PSD) model proposed herein for an aeronautical manufacturer. The most significant results obtained so far are the creation of the QFD matrix "0" and its integration to the Product Development Process. The usage of this matrix might provide companies to have a systematic way to (1) incorporate their strategic objectives into new product development initiatives and (2) to analyze the impacts of modifications in the company strategy. The implementation of this process and its correct utilization allows the integration between customers' needs and senior managers' necessities. Consequently, the likelihood of a company to develop a product that fulfills most of market requirements and company strategic objectives at the same time increases substantially.*

Keywords: strategic objectives, product development process, QFD matrix 0, Balanced Scorecard.

1. Introduction

The constant market evolution, the new technology development, the raise in the number of competitors, and the creation of new products and services in shorter times have forced organizations to follow up and revise their strategies more often.

The question is: how do companies deploy strategy revisions to their development teams? And how does it work throughout Product Development Process?

Until now, it's known that companies guarantee this deployment through early communication between senior managers and project managers or product development teams. Although, there is a lack of systematic methods that guarantee the effective incorporation of those strategies into product development initiatives and its project teams.

Revisions in those strategies impact directly in the portfolio management. The strategic objectives of the organizations must be aligned to new products development plans, that is, new products "road map".

How should companies then ensure that product development initiatives and business strategic plans or strategic objectives definition are in alignment?

It is essential that companies guarantee the link between the strategic objectives and the strategic plan of new products development. Companies need a method that facilitates the definition, communication, and control of product and business strategy relationship.

2. Objectives

The contribution of this paper is to present the Product Strategic Development process (PSD). This process provides to companies a systematic way to (1) have their strategic objectives considered throughout the product development process and (2) analyze the impact of strategy modifications into new product development initiatives.

The final result is the elaboration of a method that integrates two largely used methods: the Balanced Scorecard (BSC) and Quality Function Deployment (QFD). This method comprehends the elaboration of a matrix that relates both BSC strategic objectives and customer needs used for new products development. This matrix will be called herein as the QFD Matrix "0". This matrix will be also used to analyze the impacts of strategy modifications at new product development initiatives.

Its main benefit is to guarantee the correct association between strategy and product, that is, to guarantee that the products that will be developed are aligned to the strategic objectives defined by senior managers.

3. Theoretical Background

3.1 Balanced Scorecard – BSC

According to Kaplan and Norton (1992), the BSC is a tool that translates the company vision and strategy through a consistent set of performance measures. Its usage is justified for articulating the company strategy, communicating this strategy and supporting the alignment of individual and organizational initiatives, in order to achieve a common result.

To Piemonte (2002), the methodology structures the strategic objectives according to several perspectives related to the financial, marketing, internal processes, people, and environmental aspects, among others.

Its main objective is to analyze all these objectives conjointly, in order to obtain a more balanced vision of the organization status. These objectives are grouped in “cause / effect” diagrams, which indicate the relationship among them.

According to Kaplan and Norton (1992), in a general way, the objectives and measures focus on the organizational performance under four perspectives: financial, customers, internal processes and learning.

Still according to the authors, the objectives and measures used by the BSC are not limited to financial and non-financial doubtful group of measures, since they are derived from a hierarchical process which top has the mission and the Business Unit strategy.

Basically, the BSC provide answer to four questions:

1. Which objectives must be achieved to satisfy shareholders?
2. Which values must be offered to customer to achieve the financial objectives defined previously?
3. To conceive the values defined at the customer perspective, in which processes the organization must be excellent?
4. How the company must learn and innovate to achieve the targets?

The BSC must translate a Business Unit mission and strategy into tangible objectives and measures. The measures represent the balance among the external indicators, directed to shareholders and customers, and the internal indicators of critical business processes and learning and innovating.

The monitoring of the objectives achievement depends on the definition of performance indicators, targets, and action plans with respective responsible.

Kaplan and Norton (1992) identified four specific barriers to an efficient strategy implementation:

1. Non executable strategy and vision
2. Strategies not associated to team, individuals or departmental goals
3. Strategies not associated to resources allocation both in the short and long term
4. Tactical feedback, not strategic.

3.2 Quality Function Deployment – QFD

According to Guinta and Praizler (1993), Quality Function Deployment is a simple and logical method, which is implemented through a set of four matrices. The QFD matrices help to determine exactly what the customer wants, how the competitors meet the customer’s needs and where there are opportunities niches to be filled out. Moreover, the QFD technique is useful to check whether the company has the necessary resources to fulfill successfully the market niches with the correct quality levels.

Peixoto and Carpineti (1999) pointed out that QFD should be used throughout the product development process and has the aim of assisting the design team to fit the real customers’ needs into products or services. Through the matrix set, the requirements posed by the customer are deployed and converted into technical specifications of the product. The QFD matrices can be seen as a mean to support the teamwork as they allow for registering the discussions, evaluating and ranking the requirements. Finally, the matrices are a valuable source of information where the product development process can recur.

- Extraction, relation and conversion are the basic operations carried out by the QFD matrices. These operations are explained below:
- Extraction means to draw a table from an existing one, that is, to use the elements of a table as a reference to obtain the elements to the other.
- Relation is the process of identifying the liaison intensity between two tables a matrix is composed by.
- Conversion means to weigh the relative importance of data from one table in relation to the liaisons previously established with other table.

Akao (1990) states that QFD is the conversion of the customer’s requirements into quality characteristics. This is done through a systematic deployment that starts of from requirements and ends up with product characteristics. The total quality of the product is, therefore, the outcome of this relation network.

The first QFD matrix, which is known as “The House of Quality”, is also the most important one, according to Peixoto and Carpineti (1999). Within this matrix, the deployment of the customer’s requirements into product technical specifications takes place. The performance goals of the product, which are related to those characteristics, can also be recorded in this matrix.

3.3 Product Development Process

Many authors and case studies have stressed the strategic importance of the product development process for the companies' competitiveness. According to Clark and Fujimoto (1991), the development of new product has become the focal point of the worldwide competitiveness. A number of evidences show that the effective development of new products has an outstanding impact onto costs, quality, customer's satisfaction and companies' competitive advantage.

The Product Development Process (PDP) can be defined (Clark and Fujimoto, 1991) as a process by which an organization transforms market opportunities and technical possibilities data into information and resources necessary to the manufacturing of a commercial product. At the end, this process covers marketing, product engineering and manufacturing functions as well as almost the remaining areas of a company

PDP is typically structured into several phases or stages. A number of authors present different structures for the PDP. The differences are due to the specificity of the process and the particular needs of each case.

Wheelwright and Clark (1992) depict a classical four-phase sequence. These are: conceptual development, product planning, product and process engineering and pilot production followed by the production ramp up.

Hameri and Nihtila (1998) propose a product lifecycle for "one-of-a-kind" projects. This cycle is constituted by the following phases: conceptual phase, design phase, manufacturing and operation phases.

The Product Development Process phases of the case study company are shown in figure 1.



Figure 1. Product Development Process phases of the case study company

The initial phases of the lifecycle, whatever model is adopted by the companies, are essential for the alignment between organization strategy and product initiatives.

IPD – Integrated Product Development is the name given to the product development process at the case study company. IPD starts with a fuzzy stage, which is regarded as a non-official phase of IPD. This is detailed further below. Then, the Preliminary Studies is the first, official phase of IPD. This phase encloses technical viability and economical competitiveness analyses of the product under development. These analyses have already been done preliminarily in the fuzzy phase of the process. At Preliminary Studies, however more details are brought into the analysis. An important outcome of this phase is to check whether a new proposal is aligned with the strategic goals of the company. To this end, a number of studies are conducted, such as: restrictions imposed by the regulatory authorities, technological capability, manufacturing and materials constraints, only to name a few.

The next phase, Pre Design, is characterised by strong engineering trade-offs. The product is detailed at this phase, based on a definitive configuration; otherwise the development of systems proposals could not take place.

The Pre Design Team, that is composed by specialists of several areas such as product engineering, manufacturing, certification, customer service and quality assurance, proposes solutions for the product in accordance with the customers requirements.

The description of the remaining IPD phases can be found at Araújo and Cruz (2000).

4. The Product Strategic Development Process

The Product Strategic Development (PSD) process, at the beginning of the Product Development Process, comprehends the elaboration of a matrix that relates the BSC strategic objectives and the customer needs used for new products development. This matrix will be called the QFD Matrix "0", since it precedes the elaboration of the first QFD matrix, Product Planning, also known as the House of Quality. The creation of this matrix must occur throughout the initial phases of the Integrated Product Development process – Preliminary Studies and Pre Design.

To create the Matrix "0", the company board, senior managers and business planners must structure its BSC financial and customer perspectives, defining the strategic objectives, indicators and measures. The process and learning perspectives are not considered for the matrix "0", since their correlation to customer needs are not as strong as for the customer and financial perspectives.

Essential to the success of this method is to determine the strategic objectives and measures of a specific Business Unit (BU), so the customer needs identified are all related to the same product portfolio. For each measure, the involved team must define both actual and target values.

These measures will fulfill the Matrix "0" lines. Each measure must have its importance level (IMP) specified and its improvement rate (IR) calculated. The former indicates, qualitatively, how important a specific measure to the companies' strategy is. The importance level is defined using a 1-3-5 scale, where 1 means not so important, 3 means important, and 5 means essential. The latter is the relation between the desired value and the actual value of a specific measure.

The second activity of the proposed process is to survey and gather the needs of the prospect customers. It is essential that these needs are aligned with the Business Unit (BU) capabilities and know-how, so they can be related later on to the products and technologies the BU can conceive. The information collected should be stored in a systematic way, without any interpretation. Key to the success of this activity is to write exactly what the customer has said, word-by-word.

None of the information should be directly related to a specific product. The more generic the customer needs are stated, the better will be the Matrix "0" usage and results. Once all customer needs are gathered, they must be prioritized by the customers, considering a 1-3-9 scale, where 1 means not so important, 3 means important, and 9 means essential. This prioritization will be called herein preliminary customer needs importance level (PCN). Customer needs and its respective importance level will be placed at the columns of the Matrix "0".

The next step is the fulfillment of the correlation matrix according to the relation between the customers needs weights or prioritization and the strategic objectives or measures of each product.

After all necessary information has been defined, the next step is the calculation of the final customer need importance level (FCN) of each customer need considering its importance for each BSC measure. The equation (1) to obtain the FCN is described bellow:

$$FCN_j = \sum I(IMP_i * IRI_i * PCN_j) \quad (1)$$

Where j indicates the column related to a customer need, and i indicates the BSC measures placed at the lines.

Customer needs with higher final customer need importance level represent the most important customer needs identified, considering customer prioritization, strategic objectives (measures) importance to the company and its desired improvement rate, due to companies strategy. These customer needs will be then used in the first QFD matrix: product planning.

5. Case Study

A case study has been made up to exemplify the Product Strategic Development (PSD) model proposed herein. The objective is to simulate the integration between the strategic objectives and a new product development initiative inside a world-class product development company.

The company used as an example for this case study is an aircraft manufacturer. The products developed are grouped, mainly, in three categories: regional, executive and military aircrafts.

The strategic objectives of the financial and customer perspectives related to the aviation segment are presented herein:

- **Financial strategic objective:** to guarantee the portfolio competitiveness throughout the innovating capacity maintenance, revenues income and profitability. The financial indicators and measures are presented in table 1.

Table 1. Indicators and measures of the financial perspective of an aeronautical manufacturer.

Indicators:	Measures:
Innovation rate	% of new executive aircraft sales / total sales of new aircrafts (Actual) 20% (Target) 20%
	% of new regional aircraft sales / total sales of new aircrafts. (A) 50% (T) 60%
	% of new military aircraft sales / total sales of new aircrafts. (Actual) 30% (Target) 20%
Revenue increase due to new products launch	% of revenue from launching new executive aircrafts / total revenue from new aircrafts. (A) 30% (T) 35%
	% of revenue from launching new regional aircrafts / total revenue from new aircrafts. (A) 40% (T) 50%
	% of revenue from launching new military aircrafts / total revenue from new aircrafts. (A) 30% (T) 15%

- **Customer strategic objective:** to be a reference as a concept and product innovating company, guaranteeing the best value proposition for the products developed (quality and price) in order to fulfill customer needs.

Table 2. Indicators and measures of the customer perspective of an aeronautical manufacturer.

Indicators:	Measures:
Market Share increase	Market share percentage in the executive aviation segment (A) 10% (T) 15%
	Market share percentage in the regional aviation segment (A) 30% (T) 40%
	Market share percentage in the military aviation segment (A) 5% (T) 4%

Maintenance services increase	Increase in maintenance services for fleet in the executive aviation segment. (A) 70% (T) 75%
	Increase in maintenance services for fleet in the regional aviation segment. (A) 35% (T) 55%
	Increase in maintenance services for fleet in the military aviation segment. (A) 10% (T) 13%

Once customer needs related to the aviation segment are gathered and prioritized by the customers considering the 1-3-9 scale, the columns of QFD matrix “0” can be structured. This initial information, called *preliminary customer needs importance level* (PCN), is presented in figure 2.

		Customer needs prioritization per Business Unit (BU)																			
		Customer needs																			
Aviation	BU Products	Preliminary customer needs importance level																			
	Executive Aircraft	3	9	9	9	9	3	9	9	1	1	3	3	9	9	9	9	9	9	9	
	Regional Aircraft	9	9	9	9	9	3	9	3	9	9	3	9	3	1	1	1	9	3	1	9
	Military Aircraft	1	9	3	1	1	3	3	1	1	1	1	1	1	1	1	1	9	1	1	1

Figure 2. Customer needs prioritization vs. Business Unit products

The *preliminary customer needs importance level* presented in figure 2 will be then transposed to the correlation matrix of the QFD matrix “0”, according to the relation between the customers needs weights or prioritization and the strategic objectives or measures of each product. The complete QFD matrix “0” is presented in figure 3, where “●” represents, qualitatively, the customer need weight equal to 9, “o” represents weight 3, and “V” the weight 1.

QFD		QFD MATRIX "0"																				
		Customer needs																				
BSC	MEASURES	CUSTOMER NEEDS																				
	FINANCIAL PERSPECTIVE	% of new executive aircraft sales / total sales of new aircrafts. (Actual) 20% (Target) 20%	3	1,00	o	●	●	●	●	o	●	●	o	o	o	o	o	o	o	o	o	o
% of new regional aircraft sales / total sales of new aircrafts. (Actual) 50% (Target) 60%		5	1,20	●	●	●	●	●	o	o	o	o	o	o	o	o	o	o	o	o	o	
% of new military aircraft sales / total sales of new aircrafts. (Actual) 30% (Target) 20%		1	0,67	o	●	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	
% of revenue from launching new executive aircrafts / total revenue from new aircrafts. (A) 30% (T) 35%		3	1,17	o	●	●	●	●	o	o	o	o	o	o	o	o	o	o	o	o	o	
% of revenue from launching new regional aircrafts / total revenue from new aircrafts. (A) 40% (T) 50%		5	1,25	●	●	●	●	●	o	o	o	o	o	o	o	o	o	o	o	o	o	
CUSTOMER PERSPECTIVE	% of revenue from launching new military aircrafts / total revenue from new aircrafts. (A) 30% (T) 15%	1	0,50	o	●	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	
	Market share percentage in the executive aviation segment. (A) 10% (T) 15%	5	1,50	o	●	●	●	●	o	o	o	o	o	o	o	o	o	o	o	o	o	
	Market share percentage in the regional aviation segment. (A) 30% (T) 40%	5	1,33	●	●	●	●	●	o	o	o	o	o	o	o	o	o	o	o	o	o	
	Market share percentage in the military aviation segment. (A) 5% (T) 4%	1	0,80	o	●	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	
	Increase in maintenance services for fleet in the executive aviation segment. (A) 70% (T) 75%	3	1,07	o	●	●	●	●	o	o	o	o	o	o	o	o	o	o	o	o	o	
Increase in maintenance services for fleet in the regional aviation segment. (A) 35% (T) 55%	5	1,57	●	●	●	●	●	o	o	o	o	o	o	o	o	o	o	o	o	o		
Increase in maintenance services for fleet in the military aviation segment. (A) 10% (T) 13%	3	1,30	o	●	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o		
FINAL CUSTOMER NEED IMPORTANCE LEVEL (FCN)			298,47	448,69	413,49	401,76	401,76	149,56	413,49	241,12	264,05	264,05	137,83	298,47	241,12	187,57	187,57	187,57	448,69	241,12	187,57	401,76

Figure 3. QFD matrix “0”

Customer needs with higher final customer need importance level are detached in figure 3 with a green color. They represent the more appropriate customer needs to be used throughout the development of a new product, considering

customer prioritization, strategic objectives (measures) importance to the company and its desired improvement rate, due to company strategy. These customer needs will be used in the first QFD matrix: product planning.

A Pareto diagram is built to determine which customer needs will be used in the following matrix. The customer needs selected (see blue columns in figure 4) represent 45% in quantity and 60% in value of all customer needs. Figure 4 presents customer needs selected, in blue columns, customer needs discarded, in yellow columns, and the threshold line. Customer needs cut by the threshold line will be used in the following matrix: product planning.

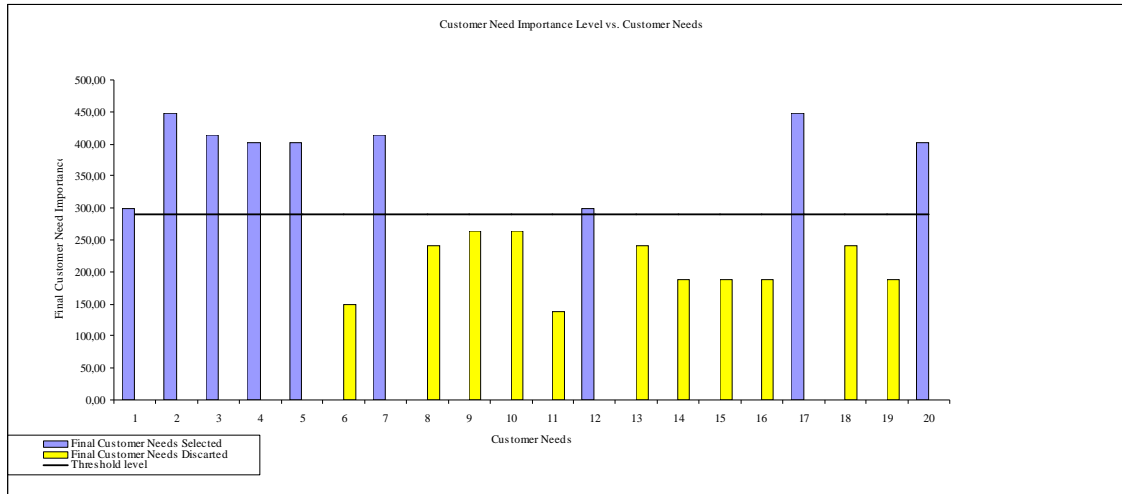


Figure 4. Customer needs importance level vs. customer needs.

A simplified QFD matrix 1 was built to exemplify customers' needs deployment into product requirements. The same symbols used in matrix "0" are used herein, where "●" represents, qualitatively, a strong relation between a customer need and a product requirement, "o" represents a medium relation, and "▽" represents a weak relation. QFD matrix 1 for the case study is presented in fig. 5.

QFD MATRIX 1	
CUSTOMER NEEDS	PRODUCT REQUIREMENTS
	1- Aircraft range superior to 9500 km, at 0,8 Mach cruise speed
	2- Take-off distance at maximum take-off weight (sea level, ISA, 14 PAX + 500 Kg baggage compartment + fuel for a mission of 18500 m) < 1,500 m;
	3- Landing distance (14 PAX + 500 Kg baggage compartment + fuel for a mission of 92,6 m) < 1,250 m;
	4- Paris noise level requirements (Charles de Gaulle airport): STAGE IV
	5- Paris airport pollution emission requirements: 15 grammes of NOx per burned fuel kg
	6- Engine thrust: 10.000 lb
	7- Passenger cabin internal noise level: 70 dBA
	8- Seat width: 20 inches
	9- "Schedule Reliability" superior than 95 %
	10- "Completion Rate" superior than 90 %
	11- Large maintenance intervals: Check A: 700 FH/FC - Check C: 7000 FH/FC
	12- Low maintenance cost: US\$ 200 / FH
	13- Time necessary for removing and installing LRU (line replaceable unit): 30 minutes
	14- Maximum take-off weight: 33.000 kg
1- Aircraft capable to fly from Rio de Janeiro to Paris, non stop	● o o
2- Aircraft must comply within Rio de Janeiro and Paris airport noise level requirements	▽ ●
3- Aircraft must comply within Rio de Janeiro and Paris airport pollution emission requirements	●
4- Aircraft capable to operate at Santos Dumont airport: obstacle presence and short runway	▽ ●
5- Aircraft must provide maximum confort to all 14 passengers: seat width, legrest, lumbar adjustment, executive chairs, low internal noise level	▽ ● ●
7- Aircraft with low maintenance costs	o o ● ●
12- Internal arrangement flexibility (seats vs. class)	●
17- Fast removal and installation time for maintenance items that affect despachability	● ●
20- Low engine operating cost (DMC)	▽ ● ▽ ▽

Figure 5: QFD matrix 1

One of the advantages matrix "0" brings is its dynamic characteristic. It allows managers and development teams to analyze the impacts of strategy modifications in an easy and fast way. Senior managers and team leaders can create scenarios to visualize the impacts that a change in strategy can result in the attendance of customer needs. They can also deploy, rapidly, these changes to product characteristics or requirements level. In the case study presented, the aircraft

manufacturer performed a major modification on its strategy, moving its focus from the regional to the executive aircraft segment. This strategy adjustment altered the output of the initial matrix “0” presented before in fig. 3. The matrix “0” with a scenario modification is presented in fig. 6.

QFD BSC		QFD MATRIX "0" - SCENARIO MODIFICATION																				
		MEASURE IMPORTANCE LEVEL (IMP)	MEASURE IMPROVEMENT RATE (IR)	CUSTOMER NEEDS																		
FINANCIAL PERSPECTIVE	% of new executive aircraft sales / total sales of new airplanes. (Actual) 20% (Target) 30%	5	1,50	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	% of new regional aircraft sales / total sales of new airplanes. (Actual) 50% (Target) 50%	3	1,00	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	% of new military aircraft sales / total sales of new airplanes. (Actual) 30% (Target) 20%	1	0,67	∇	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	% of revenue from launching new executive aircrafts / total revenue from new aircrafts. (A) 30% (T) 40%	5	1,33	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	% of revenue from launching new regional aircrafts / total revenue from new aircrafts. (A) 40% (T) 45%	3	1,13	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
CUSTOMER PERSPECTIVE	% of revenue from launching new military aircrafts / total revenue from new aircrafts. (A) 30% (T) 15%	1	0,50	∇	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	Market share percentage in the executive aviation segment (A) 10% (T) 15%	5	1,50	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	Market share percentage in the regional aviation segment (A) 30% (T) 40%	3	1,33	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	Market share percentage in the military aviation segment (A) 5% (T) 4%	1	0,80	∇	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
	Increase in maintenance services for fleet in the executive aviation segment. (A) 70% (T) 72%	3	1,07	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Increase in maintenance services for fleet in the regional aviation segment. (A) 35% (T) 55%	3	1,57	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
Increase in maintenance services for fleet in the military aviation segment. (A) 10% (T) 13%	3	1,30	∇	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
FINAL CUSTOMER NEED IMPORTANCE LEVEL (FCN)			216,31	412,53	377,33	365,60	365,60	137,51	377,33	275,06	166,55	166,55	125,78	216,31	275,06	244,88	244,88	244,88	412,53	275,06	244,88	365,60

Figure 6. QFD matrix “0” – scenario modification.

7. Conclusion

A Product Strategic Development (PSD) process has been preliminarily presented. This process is extremely focused on the alignment between customers and company, or in a more detailed perspective, between customers’ needs and company strategy, since it comprehends the alignment of both information through the usage of the matrix “0”.

The Product Strategic Development (PSD) process integrates two largely used methods: the Balanced Scorecard (BSC) and Quality Function Deployment (QFD). This method comprehends the elaboration of a matrix that relates both BSC strategic objectives and customer needs used for new products development.

The implementation of this process and its correct utilization can allow the integration between customers’ needs and senior managers’ necessities. Consequently, the likelihood of a company to develop a product that fulfills most of market requirements and company strategic objectives at the same time increases substantially.

The strategic objectives modification impact analysis is also an important issue that can be supported by matrix “0”. Senior managers and team leaders can create scenarios to visualize the impacts that a change in strategy can result in the attendance of customer needs. They can also deploy, rapidly, these changes to product characteristics or requirements level.

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