

## THE VALUE EQUATION

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### ABSTRACT

Value, from the point of view of customer, is defined as the customer's subjective evaluation, adjusted for cost, of how well a good/service meets or exceeds expectations. Nevertheless, some aspects must be considerate, such as: quality, speed, and flexibility; these factors are considered in the value equation. In this work are explained what it is the value equation.

Keywords: value, operations management, performance, value equation.

### INTRODUCTION

Value is defined as the customer's subjective evaluation, adjusted for cost, of how well a good/service meets or exceeds expectations. By the previous explanation, value could define what a product can do against what it costs; nevertheless, some aspects must be considerate, such as: performance and cost (Christopher, 1991).

Value starts with the customer. The concept of value, however, applies everywhere, though its implementation and expression vary widely among markets and customers. It is essential that the value has an important role to make operations management a value-driven of process because having identified the expectations of customer; the operations manager must next describe value for that person and determine how the Operations Management function can affect the perceived value of the firm's goods/services (Steven, 1996).

Every firm faces two critical tasks. First, it must create customers, and then it must keep the customers it creates. Both of these tasks are major undertakings that tax the firm's ingenuity and its resources. To create and keep customers, a firm cannot simply provide a good/service; it must offer those customers something that they value.

It can do this by giving customers an existing product for a lower price. As an alternative, it can try to attract customers by emphasizing performance.

### DEVELOPMENT

Every approach amounts to an attempt to offer customers a product that embodies something that they value. Given the importance of the concept of value, it must be defined carefully. Customers want to maximize value. They buy products that offer the highest levels of value. The Operations Management System (OMS)

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must design, build, and deliver goods/services that customers perceive as offering more value than competitors' products. How they achieve this depends on traits or attributes that shape value:

- Value is ultimately defined by the customer.
- Managers face a critical task of articulating the demands and expectations of the customer.
- Value is dynamic.
- Value is best understood through a value equation.
- Value combines four major traits: speed, cost, quality, and flexibility. The importance of each of these traits depends on the customer's expectations.
- Value changes the way in which managers view and structure the delivery process.
- Value requires the operations manager to determine how well the firm can resolve the demands and expectations of the customer with the capabilities of its operations management system.

The value equation offers one convenient way of approaching this task. The notion of the value equation was developed to describe the relationship between the various attributes of value. This equation can be written as follows (Edwin, 1992)

$$Value = \frac{Performance}{Costs} \quad (1)$$

Eq. (1) expresses value as a comparison of what a product can do against what it costs. Performance describes what the good/service does for the customer. Cost measures all costs (objective and subjective) that the customer incurs to acquire, use, and arrange of a product.

Typically, performance is described in terms of three traits: quality, speed (lead time), and flexibility. Quality represents how well the good/service meets or exceeds the expectations of the customer at the time of purchase. Speed describes the time needed to deliver the good/service to the customer or the time that the firm needs to design and produce the good or service. Flexibility reflects how easily the firm can change the product to more closely match the needs of the customer (e.g., by adding or dropping options).

The product must satisfy a real need, it must perform as promised, and it must offer the features that the customer wants. This condition underlies all expressions of value. Value-based competition must always create or enhance functionality by improving the other elements of value.

The three components of performance in eq. (2) do not always carry equal weights. Rather, performance is a weighted sum of these variables based on subjective weights that reflect customers' priorities:

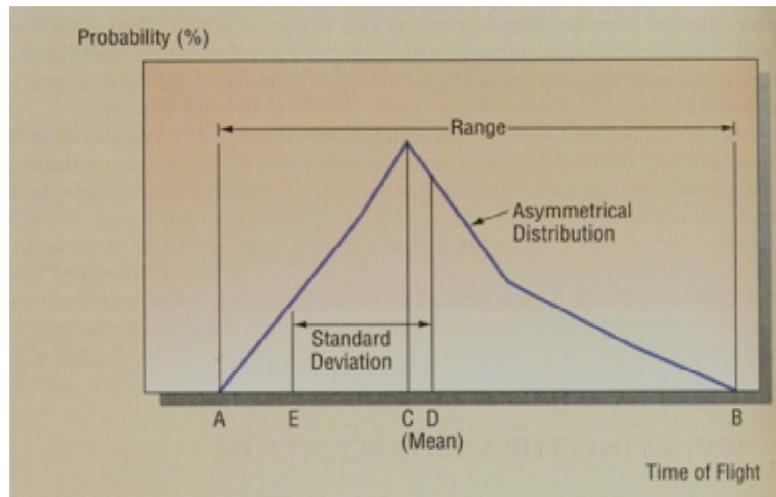
$$Performance = \beta_1 * Quality + \beta_2 * Speed + \beta_3 * Flexibility \quad (2)$$

Many factors influence the values that customers assign to these parameters. These weights can change with customers' income or education levels or their cultures or nationalities.

More important, these weights often reflect customers' order winners, order qualifiers, and order losers. Using these three concepts, customers may well weight characteristics they see as order winners more heavily than order qualifiers or less important traits.

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Cost, the denominator in eq. (1), shows the influence of the value equation on a set of guidelines to effective value marketing (see figure1).



**Figure 1. Lead Time Distribution.**

- Mean (point D) denotes the expected value in the distribution. The mean differs from the mode (point C), which has the most observations (mode).
- Standard deviation (interval between points D and E) measures the degree of variability associated with a variable, which in this case is lead time.
- Range (interval between points B and A) indicates whether the distribution is open end (with no finite end points such as A or B) or closed ended (with finite ends that define both the lowest and highest values).
- Shape describes the form of the distribution and it can be classified as symmetrical and asymmetrical.

### *Lead time*

Many authors describe the notion of lead time using terms like speed, responsiveness (Nigel, 1983), quickness, and reliability (i.e., how closely an order's arrival time approaches the expected time); these terms describe various traits of lead time. More generally, lead time can be defined as the interval between the start and end of an activity or series of activities.

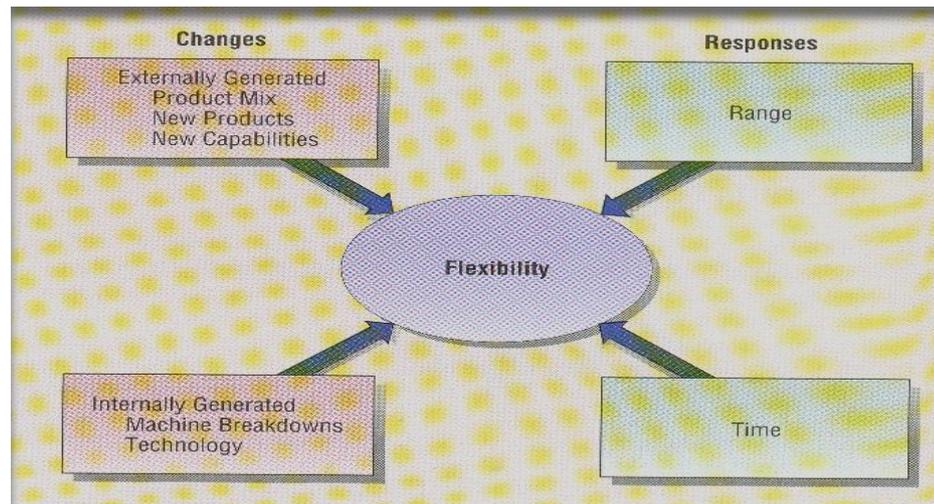
Managers can study lead times in two ways. They can look at them as individual events, perhaps evaluating how long the OMS takes to fill a specific order or design a specific product. Alternatively, they can look at the distributions of lead times (figure 1).

Changes in lead time tend to enhance value when they reduce its expected duration or its variability or both. As a result, operations managers typically focus efforts to improve lead times first on reducing mean lead time and then on reducing variance.

Flexibility represents a relatively new strategic tool to enhance value and to promote effective competition in the marketplace. Flexibility is described on terms of responsiveness, speed of response, and adaptability. Flexibility means the ability of an OMS to respond quickly to changes. These changes can be generated externally, as when the market begins demanding a different mix of products and a firm changes its schedule to provide the desired product mix. Change can also be generated internally, as when a machine breaks down and operations managers must rearrange the flow of products through the system to avoid disappointing customers.

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The responsiveness of the OMS can be described in terms of range and time. Range describes the number of different possibilities that the OMS can handle. After range, time is the second critical element of flexibility. This characteristic represents the amount of time a system needs to respond to a change with a new range of possibilities. As this response takes less time, the system becomes more flexible. Together, internally and externally generated changes along with a system's range and response time form the framework for understanding flexibility (see figure2).



**Figure 2. Conceptual Framework of Flexibility.**

Flexibility attracts customers because it helps both them and the firm itself to deal with uncertainty. Competitors' actions can cause uncertainty, as when a competitor introduces a new product. To remain competitive, other firms must either match or beat this new product. Uncertainty can result when a customer wants the firm to accommodate changes in product mix or volume. Uncertainty can also derive from internal causes such as variances in material or equipment availability (Donald, 1993):

- Market acceptance of product types.
- Lengths of product life cycles.
- Specific product characteristics.
- Aggregate product demand.
- Machine or equipment downtime.
- Employee absenteeism.
- Materials characteristics.
- Rate of introduction of new processes and technologies.

Flexibility depends on two traits: range and time. By lead times, different range and time characteristics create many different types of flexibility. It is important to explore seven categories of flexibility (Donald, 1993):

1. Mix flexibility. In the marketplace, a firm always faces uncertainty regarding mix of products that customers want. As a result, firms typically offer multiple product lines. It is the ability of the OMS to present a wide range of products or variants with fast setups.
2. Change over flexibility. In addition to the uncertain reception for a product among customers, a firm must also resolve doubts about the length of a

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product's cycle. It is the ability to introduce a large variety of major design changes quickly within existing facilities.

3. Modification flexibility is the ability of the transformation process to implement minor product design changes.
4. Volume flexibility is the ability of the transformation process to accommodate variations in production quantity.
5. Rerouting/program flexibility is the ability of the OMS to reduce uncertainty of equipment availability by changing the route (i.e., the sequence of machines) through which a job flows.
6. Material flexibility describes the ability of the transformation process to adjust for unexpected variations in inputs.
7. Flexibility responsiveness measures the ease and speed with which the firm can change its strategic objectives to respond to changes in the marketplace or in any other type of flexibility.

Quality is defined as the integrity in delivering what a customer has a legitimate right to expect in view of what was promised at the time of the agreement to purchase.

Identifying every attribute of quality for a product would not describe that product's quality level. Six general attributes contribute to quality:

1. Functionality gives a yes/no type of answer to the question whether or not a good/service performs as expected at the time of use.
2. Reliability measures how long a product performs before it fails. A package of light bulbs lists average lumen hours as such an indicator.
3. Durability, like reliability, measures a product's performance over time, but with emphasis on performance under adverse conditions.
4. Safety measures the likelihood of harm from a good or service.
5. Serviceability measures such service-related traits as speed, courtesy, competence, and ease of repair.
6. Aesthetics reflects a highly subjective assessment of how a product appears, feels, sounds, tastes, or smells (David, 1988).

Operations managers evaluate cost, for its contributions in three important roles:

1. Reporting performance.
2. Managing and evaluating operations.
3. Enhancing value.

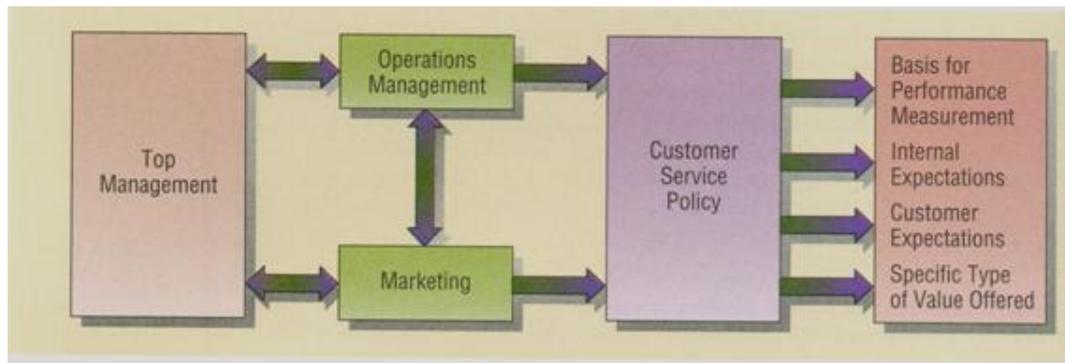
Cost information supports comparisons even between systems that produce different outputs and compete in different ways.

Like lead time, flexibility, and quality, the term "cost" describes a variety of different elements. For example, a mention of costs could refer to one or more of several categories: (a) acquisition cost, (b) repair costs, (c) maintenance costs, (d) operating costs, (e) salvage/resale costs, and (f) disposal costs.

The customer service policy bridges the gap between corporate strategy and the customer; it defines exactly how the firm will compete and the specific type of value that it will offer to its customers. The customer service policy performs four specific roles (figure 3):

- a) Customer service defines the specific type of value that the firm will offer.
- b) Customer service helps to share customer expectations. .
- c) Customer service communicates to people within the firm the type of value should try to deliver.
- d) Customer service forms the basis for evaluating performance.

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**Figure 3. Roles of a Customer Service Policy.**

In the following section are show how the Value equation can help companies to reduce logistic cost.

### *Case*

The Operations manager of a big company dedicated to offer products targeting baby care made operations reports; he could find many problems, especially in areas such as: Purchasing, Distribution and Supply Chain Management.

The Chief Executive Officer (CEO) of the company had an important operation meeting, where he explained that the profits and the customers felt, that the services had been reducing everyday, and that the company needed to reach two principal goals, increase the performance of the operations areas, and reduce the cost, because the owners request raise annual profits.

The Operations manager applied value in the three problematic areas. Operations coordinated a meeting with areas such as Marketing, Sales, Warehouse, Distribution, Finance, Accountancy, and the CEO. After the meeting, they agreed to prepare the diagnostic, and apply the Value Equation approach for these needs, they made an operations plan, which including the following steps:

- The Firm made a previous Diagnostic to get: Demand Error, Straits of the Performance, the Logistical Cost, Profit and Value, in 2008.
- It can be appreciate in table 1 that the months of February, May, August, October, November and December must be model with extremely care because inventories tend to have no enough pieces to cover the purchase orders and it have an important risk and probability to fail in deliveries in anytime.
- The Planning department prepared table 2 with the value of Speed, Flexibility and Quality, and determinate the Performance (including Betas). The performance compared with the expectative of the customers is low; for example, the customer waits of 97.5% of performance in Speed, and Speed is 53%. It has 43.88% for make changes to increase the effectiveness.

In tables 2 and 3 are shown the costs for purchasing raw material and packages in 2008. Moreover, in table 4 are shown the Costs of Distribution of the Traffic department of (including pays to Transportation and Forwarding expenses).

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**Table1. Demand Analysis.**

Months	Forecasting Sales 2008 (Units)	Sales 2008 (Units)	Difference (Units)	Abs Difference
January	150,000	140,000	-10,000	10,000
February	160,000	120,000	-40,000	40,000
March	145,000	150,000	5,000	5,000
April	180,000	160,000	-20,000	20,000
May	200,000	165,000	-35,000	35,000
June	170,000	170,000	0	0
July	190,000	190,000	0	0
August	120,000	150,000	30,000	30,000
September	160,000	170,000	10,000	10,000
October	190,000	165,000	-25,000	25,000
November	210,000	190,000	-20,000	20,000
December	220,000	200,000	-20,000	20,000
<b>Total</b>	<b>1,005,000</b>			<b>215,000</b>
% Error		<b>21.39%</b>		

**Table 2. Elements of Performance Analysis.**

Concept	Speed	Flexibility	Quality
Lead Time	0.55		
Mix		0.40	
Changeover		0.45	
Modification		0.50	
Volumen		0.55	
Rerouting/program		0.60	
Material		0.67	
Responsiveness		0.70	
Indifferent			0.35
Expected			0.80
One-dimensional			0.45
Exciting			0.50
Total Cost of Purchasing			
Total Cost of Distribution			
Total Cost Of Planning SCM			
Factors	55.00%	1.39%	6.30%
Betas	0.975	0.95	0.99
<b>Total</b>	<b>0.53625</b>	<b>0.013232835</b>	<b>0.06237</b>
<b>Performance</b>	<b>0.53707533</b>		

**Table 3. Purchasing Cost Analysis.**

<b>Cost of Purchasing Before Analysis</b>			
INCOME STATEMENT			
Sales		\$6,285,000.00	
Cost of Goods			
Purchases	\$2,514,000.00		
Other Expenses	\$251,400.00		
Cost of Purchasing		\$2,765,400.00	44.00%

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**Table 4. Distribution Cost Analysis.**

Distribution Cost Without Analysis			
Sales after Analysis		\$6,285,000.00	
Cost of Distribution			
Transportación	\$1,169,010.00		
Other Expenses	\$251,400.00		
Distribution Costs		\$1,420,410.00	22.60%

The Supply Chain department made the analysis of the Planning Cost, including: inspections, evaluation, and simulation activities (see tables 4 and 5).

**Table 5. Planning Supply Chain Management Analysis.**

Planing Supply Chain Management			
Sales after Analysis	\$6,285,000.00		
Cost of Labor Cost	\$527,940.00		8.40%

The Accountancy department presented the logistic cost (see table 6): 30% of distribution cost and 59% of purchasing cost.

**Table 6. Logistical Cost Analysis in 2008.**

Concept	Amount
Total Sales	\$6,285,000.00
Total Cost of Purchasing	\$2,765,400.00
Total Distribution Cost	\$1,420,410.00
Total Planning SCM	\$527,940.00

In table 7 are shown the profits obtained during 2008.

**Table 7. Analysis of Profits.**

INCOME STATEMENT 2008			
Concept			
Sales		\$6,285,000.00	
Total Cost of Purchasing	\$2,765,400.00		
Total Cost of Distribution	\$1,420,410.00		
Total Cost of Planning SCM	\$527,940.00		
Total Logistical Cost		\$4,713,750.00	75.00%
Profit Before Tax		\$1,571,250.00	25.00%

Both Marketing and Sales departments present the analysis of level service (table 8). Finally, Operations department presented the operations Value (table 9): (a) The Planner applied forecasting techniques and modeling demand in 2009 (table 10), and (b) the Operation manager applied both investigation research techniques and ranking procedures to obtain the values of strains of the elements of performance (table 11).

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**Table 8. Level Services Analysis 2008.**

Months	Services Level Actual
January	82.5
February	80
March	90
April	92.5
May	96
June	75
July	80
August	96
September	65
October	90
Noviembre	81
Diciembre	80
Level Services SCM	11.52%

**Table 9. Result of Value.**

Value 2008	0.72
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**Table 10. Demand Analysis.**

Months	Forecasting Sales	Sales	Diferences	Abs Dif
January	180,000	179,000	-1,000	1000
February	190,000	192,000	2,000	2000
March	200,000	202,000	2,000	2000
April	220,000	215,000	-5,000	5000
May	240,000	241,000	1,000	1000
June	200,000	195,000	-5,000	5000
July	190,000	189,000	-1,000	1000
August	160,000	160,000	0	0
September	180,000	181,000	1,000	1000
October	190,000	190,000	0	0
November	220,000	218,000	-2,000	2000
December	210,000	210,000	0	0
Total	1,230,000	1,224,000	-6,000	16,000
% Error	1.30%			

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**Table 11. Elements of performance Analysis.**

Concept	Speed	Flexibility	Quality	Cost
Lead Time	0.6967			
Mix		0.96		
Changeover		0.99		
Modification		0.98		
Volumen		0.95		
Rerouting/program		0.98		
Material		0.975		
Responsiveness		1		
Indifferent			0.99	
Expected			1	
One-dimensional			0.99	
Exciting			0.99	
Total Cost of Purchasing				0.975
Total Cost of Distribution				0.95
Total Cost Of Planning SCM				0.98
Factors	69.67%	84.54%	97.03%	90.77%
Betas	0.975	0.95	0.99	
Total	0.6792825	0.803175413	0.96059601	
<b>Performance</b>	<b>2.44305392</b>			

The accountant got logistical cost in 2009; and the result between 2008 and 2009 (tables 12-18).

**Table 12. Purchasing Cost Analysis.**

<b>INCOME STATEMENT</b>			
Sales		\$6,285,000.00	
Cost of Goods			
Purchases	\$1,382,700.00		
Other Expenses	\$251,400.00		
Cost of Purchasing		\$1,634,100.00	26.00%

**Table 13. Distribution Cost Analysis.**

<b>Distribution Costs</b>			
Cost of Distribution			
Transportación	\$917,610.00		
Other Expenses	\$188,550.00		
Distribution Costs		\$1,106,160.00	17.60%

**Table 14. Planning Cost Analysis.**

<b>Planning Supply Chain Management after analysis</b>		
Sales after Analysis	\$6,285,000.00	
Cost of Labor Cost	\$276,540.00	4.40%

**Table 15. Logistical Cost Analysis.**

Concept	Actual		Forecasting		Improvement
Total Sales	\$6,285,000.00				
Total Cost of Purchasing	\$2,765,400.00	44.00%	\$1,634,100.00	26%	18%
Total Distribution Cost	\$1,420,410.00	22.60%	\$1,106,160.00	17.60%	5%
Total Planning SCM	\$527,940.00	8.40%	\$276,540.00	4.40%	4%

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a) 2008 and 2009.

**Table 16. Comparison Analysis of Profits, 2008-2009.**

<b>INCOME STATEMENT 2008</b>			
Sales		\$6,285,000.00	
Total Cost of Purchasing	\$2,765,400.00		
Total Cost of Distribution	\$1,420,410.00		
Total Cost of Planning SCM	\$527,940.00		
Total Logistical Cost		\$4,713,750.00	75.00%
Profit Before Tax		\$1,571,250.00	25.00%
<b>INCOME STATEMENT 2009</b>			
Sales		\$6,285,000.00	
Total Cost of Purchasing	\$1,634,100.00		
Total Cost of Distribution	\$1,106,160.00		
Total Cost of Planning SCM	\$276,540.00		
Total Logistical Cost		\$3,016,800.00	48.00%
Profit Before Tax		\$3,268,200.00	52.00%

b) The Marketing and Sales areas got Service Level in 2008, and Comparison between 2008 and 2009.

**Table 17. Level Services Analysis.**

Months	Services Level 2009
January	95
February	96
March	96.5
April	96.5
May	96.5
June	96.5
July	96.5
August	96.5
September	97.5
October	98.5
Noviembre	99
Diciembre	99.5
Level Services SCM	69.67%

c) Finally, The Manager has done comparatives Charts Between 2008 and 2009.

**Table 18. Comparison 2008 and 2009.**

Value 2008	0.72
Value 2009	5.08333333

## CONCLUSION

It could appreciate that the Error reduced 20.09%. It indicates that the company will not pay extra cost in: urgent freights, overtime for labor and administrative people, inventories, and high interest rate because of cash flow.

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In case of Performance, the Flexibility was the worst, it means that there is no capacity to offer more innovative products or replace products when the demand is declining. The company must work very hard to develop new designs and purchase new raw materials, in order to manufacturing new Innovative products with great Functionality.

The purchases aspect is the most significance cost in the finance structure. The Cost is very sensitive because if it lows in 2 or 3 points, profits could improve in more than 5 points; if the raw materials have better characteristics, so the manufacturing process could be easier and more effective than the old process, the deliveries from the suppliers almost arrive on time, and the Volume of the items in specific dates influence in the amount of the discounts.

The Distribution plays a very important role because customers need the merchandising arrives on time, without damage, and complete in quantity. These savings accomplish to invest in buying better trucks, following systems to show the customer services to locate the right position in a specific time, and receive the evidence of receiving products on time; it is important to charge the money from the customers because the Finance department needs to has a very effective cash flow.

The Supply Chain Management department needs to control all the activities into the complete chain because it is essential to reduce the risk in all the activities related ranging from materials movement to packing final products, with the previous argument the Sales department ensures that products always have the right quality and deliver them on time.

One of the most important things in the objectives in the company is the profit, it is protruding to reach 52% in 2009, because if the owners of the company do not receive good money at the end of the year, is possible that they decide to close the company. They need to have a rich company too. It means that the company has an innovative manufacturing process, effective management, and has a Value in services and products, they must be high.

The level service is the thermometer our clients, if they do not feel that the deliveries, prices and secure or the services are not like they need. Their expectative must be measure exactly, because if they do not accomplish or exceed, they could change our company to another competitor. The market suffers changes everyday, and the competitors always fight for get new customers. The company made a big effort to reach 69.67%, it means that the company start to become a company with Value because the services/products have high performance and low cost. Briefly, the value is high and effective.

Value increased from 0.72 to 5.0833, it means that the company becomes much more effective and the process are standard, the Materials has a good quality, the transportation routes are secure, the inverse logistics improve the efficient returns, the planning covers almost any risk, and the purchasing has a very good development suppliers program, enhance the supply, the company has a good profits, an effective Entrepreneur Resources Planning (including Customer Resources Management and Business Intelligent, and personnel are expert in their areas. The previous explanations are the base to accomplish with the expectative of customers and stockholders.

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