December 2002

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Juan Solano
SUNACIC

Maria Perez
Universidad Simón Bolívar

Teresita Rojas
Universidad Simón Bolívar

Anna Griman
Universidad Simón Bolívar

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Juan Solano
SUNACIC
jsolano@cantv.net

María Pérez
Universidad Simón Bolívar
movalles@usb.ve

Teresita Rojas
Universidad Simón Bolívar
trojas@usb.ve

Anna Grimán
Universidad Simón Bolívar
agriman@usb.ve

Abstract

The role of IT departments in organizations has changed considerably in recent years. This is mainly due to the need to develop competitive advantages to a business to remain a market leadership. Systems, being part of this technology, have become the core of many critical business processes, and this in turn has fostered the growth of systems development companies. However, in order for client organizations and developers alike to compete effectively in a global market, they need to apply a quality approach to these products.

*The purpose of this article is to **describe the experience gained from using the Balanced Scorecard to implement a quality strategy in systems development organizations in Venezuela**. The research model utilized was Action–Research and the evaluation method was "Quantitative Case Studies," obtained by applying the DESMET method. As a result of this experience, a process was implemented to create a Balanced Scorecard geared to the integration of Systemic Quality, as well as a Strategic Map for implementation in systems development organizations*

The processes followed to create the Balanced Scorecard and Strategic Map proposed were evaluated within a Venezuelan organization using systems dynamics. This reduced the space-time variables necessary in a real evaluation and provided us with sufficient knowledge to refine the process.

Keywords: Quality, balanced scorecard, strategic planning, system dynamics, strategic map

Introduction

Organizations have traditionally faced a host of challenges and changes imposed by the environment in which they operate. This fact is even more accentuated now by their need to keep customers loyalty. Quality Assurance is a long-term strategy for improving customer relations. Systems development organizations must also prepare strategies for implementing Quality Assurance plans, which include their processes and products (systems), and in turn enable them to remain both profitable and competitive.

Many quality programs have failed because they were designed as isolated projects, with no real relevance, whereas in reality they affect the entire organization and their success largely depends on the commitment of the participants. One way of attaining a global vision of the change is through an approach that enables the organization to be seen as a dynamic body with inter-related and inter-dependent components, where any change in any component must necessarily affect the others. Management uses strategic planning to anticipate changes and their outcome. The Balanced Scorecard is a systemic model (Kaplan and Norton 1996) that represents the organization through four related perspectives surrounding a common strategy and vision. This article describes a process to create a Balanced Scorecard for integrating quality in systems development organizations. It also proposes

a Strategic Map to help in translating the strategy into action. The Process and the Strategic Map were applied to a Venezuelan organization using system dynamics and simulation tools so their impact on the organization could be measured at a minimum cost.

One of the main contributions of the proposed Process is that it can be developed in organizations that do not have a formal strategic plan.

The following section describes the most important aspects of the theoretical framework of the research. The Action-Research model used is also briefly described, as are the characteristics of the *Quantitative Study Case* recommended by DESMET (Kitchenham 1996) for evaluating the proposal. Subsequently, through a case study, the development of the phases in the Process, the Strategic Map proposed and the results of the evaluation are shown, and finally the conclusions and recommendations of the research are presented.

Background

Quality is the factor that determines any organization's long-term success or failure, along with productivity and costs (Evans and Lindsay 2000). The Systemic Quality approach seeks to balance the opposing forces of software quality – process effectiveness and efficiency – taking the user and the customer into account. The Information Systems Research Laboratory (LISI – the acronym from its name in Spanish) has developed two Systemic Quality application models, one being Process Quality oriented (Pérez et al. 2001) and the other Product Quality oriented (Ortega et al. 2000). However, neither of them gives any indication that these models should be integrated with the rest of the organization, especially with the strategic and tactical plans that help to guarantee productivity and profitability.

This is the reason for an integrated vision is required to determine how each quality model's objectives can be linked to the organization's objectives. This integrated vision by the organization is attainable if the organization is understood as being an open system. Strategic planning occurs in organizations due to the need to be ahead of changes in the environment and attain predefined goals and objectives. In a Quality Assurance approach, attributes like the use of Information Technologies (IT) and a systemic view of the organization, are necessary but not enough to achieve success.

The Balanced Scorecard (BSC) is a systemic model proposed by Kaplan and Norton (1996) ten years ago to help to translate an organization's vision and strategy into specific strategic objectives controlled through a coherent set of actuation indicators. Organizations have employed BSC in organizations in different areas, ranging from government to IT, and in all of them it has proven to be extremely useful. This model enables Quality Assurance to be given a strategic nature. Its structure is determined by the reciprocal relationship between the four main perspectives – the Financial Perspective, the Customer Perspective, the Internal Business Process Perspective and the Learning and Growth Perspective – with the organization's vision and strategy (Kaplan and Norton 1996), as shown in Figure 1.
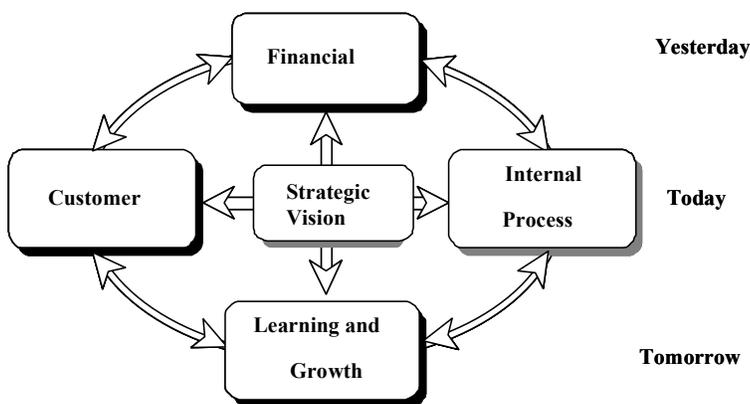

Figure 1. Balanced Scorecard Model
(Source: Kaplan and Norton 1996)

Use of this model has been extended to support strategic management, which is why a process to create the BSC that supports the integration of systemic quality models into the organization has been proposed.

Research Methodology

The basis for the Action–Research model is that Human Activity Systems processes – like organizational processes – can be studied better if changes are included in these processes and the effects produced by these changes observed (Baskerville 1999). The following methodological cycle for this research was established on the basis of this principle, as shown in Table 1. To support the

research methodology proposed, the DESMET Method (Kitchenham 1997) was used. This method was developed in order to select an evaluation method and/or tools that can easily be adapted to this research. Its application consisted in a series of criteria and restrictions for selecting the most suitable evaluation method. As a result of this method, the *Quantitative Study Case* was used. It indicates that the quantitative evaluations are based on the assumption than some quantifiable properties of the processes that are expected to change as a result of using the method to be evaluated can be identified (Kitchenham 1997). This can be expected to integrate the BSC based proposal, since it has a related system of indicators that may bring about the changes as a result of the proposal. The greatest disadvantage is that it must be applied on a real time-scale in order to obtain some significant changes in the BSC model.

Table 1. Methodological Cycle for the Work Undertaken

Research-Action Cycle	Adapted Cycle	Description
DIAGNOSE	1. Documentary Research	Review of bibliographical material.
	2. Analysis of the background of the BSC	Analysis of best practices in the use of the BSC.
	3. Integration Proposal	Proposal for integration of quality models through the BSC.
PLAN ACTION	4. Application of the DESMET Method	Choice of the best evaluation method for the proposal.
	5. Analysis of the context	Specifications and agreements necessary to apply the proposal
TAKE ACTION	6. Evaluation of the Integration Proposal	The method for evaluating the proposal is applied.
EVALUATE	7. Analysis of Results	Study of the results based on the objectives of the eesearch.
	8. Refinement of Integration Proposal	Modification of the proposal based on experience acquired in its application.
SPECIFY LEARNING	9. Conclusions and Recommendations	Conclusions of the research and recommendations for future research.

To offset this disadvantage of the *Quantitative Case Study*, the systems dynamics and simulation tools were used. Through mathematical formulae, they enable the space-time variables to be compressed to reveal the dynamic changes in study models. The dynamics of the models can be experimented with through graphics, tables and animated diagrams. The present state of the organization chosen can be represented, the BSC projected into the future and the effects of changes in key indicators simulated. The advantage with the simulation of a case study is that organizations wishing to participate do not need to have developed a BSC (something not common in Venezuela), nor do they have to make changes or assign considerable resources. Dynamic simulation systems are considered the third generation in IT to support the use of BSC in the organization (Olve et al. 1999). The dynamic simulation tool used was ITHINK®, release 5.

Proposal for integrating Systemic Quality through the Balanced Scorecard

This section describes the development of the integration proposal in a Venezuelan organization. It involves developing the Process to create the BSC and the Strategic Map to create a quality vision. For reasons of confidentiality the company's name has been changed to **VeneSoft, C.A.**. This company has functioned in Venezuela since 1989 and is the branch of a well-known international firm whose head office is in the USA. This company develops systems for customers in several sectors such as: financial, telecommunications, government, manufacturing, etc. It acts as an integrator of different technologies in the entities with which it works. Its employees facilitate the transformation of organizations into intelligent business entities by applying technology to their business processes.

To begin with, all the fundamental premises were reviewed. These are the basic conditions to be fulfilled by an organization (See Table 2) :

Table 2. Review of Fundamental Premises at VeneSoft, C.A.

Premises	Departments		
	Administration	**Development**	**Operations**
Human			
Leader	✓	✓	✓
Creativity	✓	✓	✓
Leadership team	⊠	⊠	⊠
Sense of belonging	✓	✓	✓
Organizational			
Systemic vision	✓	✓	✓
Defined processes	✓	✓	✓
Resources	✓	✓	✓
Cultural			
Commitment to quality	⊠	✓	⊠
Systemic thinking	✓	✓	✓
Shared vision	✓	✓	✓
Recognition	✓	✓	✓
Motivation	✓	✓	✓
Technological			
Technologies Teamwork	✓	✓	✓
Mass media	✓	✓	✓
Accessibility	✓	✓	✓
Management			
Strategic plan	✓	n/a	n/a
Change management	✓	n/a	n/a
✓ Current	⊠ To be developed		n/a not applied

As can be seen, the majority of the premises was covered by all the departments and only the commitment to quality and the leadership team still need to be developed right across the organization. The conclusion was that VeneSoft, C.A. fulfilled the basic conditions for beginning to apply the BSC creation Process. Hence the necessary phases for creating a BSC aimed at integrating systemic quality in software development organizations were proposed, as was a Strategic Map, together with an indication of how it should be distributed throughout the organization. This Process is cyclical and consisted of seven phases (See Figure 2).

The properties to be seen looked at in the case study were also identified in the study and it is hoped that they reflect the effects of applying the proposal. They are focused on the financial aspect. It is from these that the *Shareholder Value* (SHV) indicator was extracted and they are expected to change the function of the strategy to be implemented. In order to establish the value of the SHV, the organization has to provide a series of value drivers. Table 3 summarizes this.

The first simulation model in ITHINK® was prepared using these values in order to represent the current state of the organization. The strategy to be followed for simulating VeneSoft's organizational model to test the integration of the systemic quality, was based on the principles of Value Management. This principle ensures that an organization's worth depends on its capacity to create value. This financial value depends, fundamentally on the strategy implemented (Amat 1999). In short, **if the financial value of the organization currently is determined, and if the growth expected in 5 years is simulated, the shareholder value (SHV), which is also known as the pre-strategy value, can be established. If a growth and productivity strategy based on the integration proposal of the BSC and systemic quality is then introduced, this must affect the SHV. After that, a new model with the changes in value drivers over a similar period to the current one is created in order to estimate changes in SHV.** Table 4 shows a summary of the financial values resulting from the first simulation and the pre-strategy SHV.
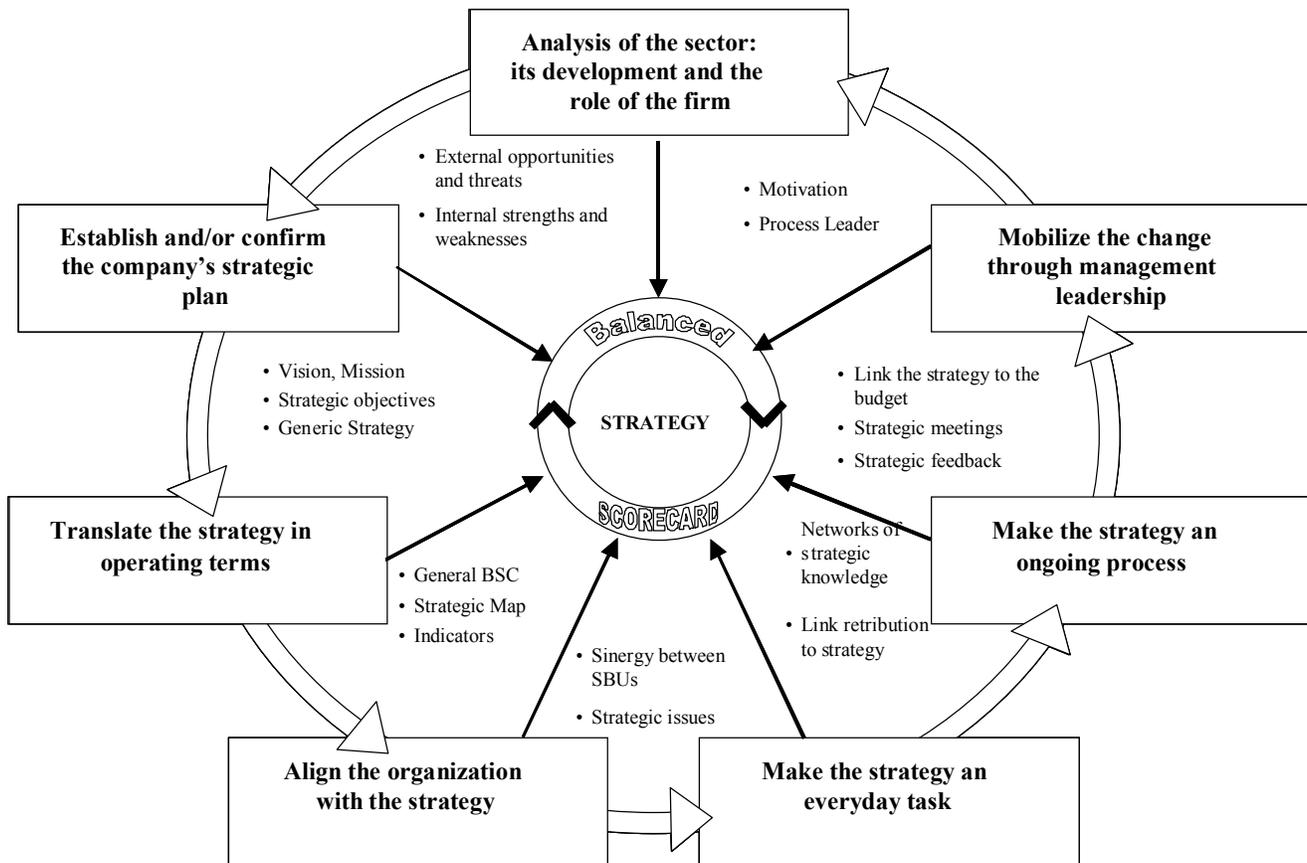
Figure 2. Process for Creating a BSC Aimed at the Integration of Systemic Quality
(Source: Adapted from Kaplan and Norton 1996)

The value of the SHV indicator in the organization's state was **1,661.89 million bolivars**

The process shown in Figure 2 is described in order to show so the change in the SHV pre-strategy indicator.

Analysis of the Sector, its Development and the Role it Plays There

The purpose of this stage is to establish a consensus over the sector's characteristics and requisites, in this case the IT sector, specifically in the systems development market. The external opportunities and threats were analyzed, as were its internal strengths and weaknesses. In the case of VeneSoft, C.A. it was concluded that its commitment to quality should be redefined and a growth and productivity oriented strategy created.

Establish and Confirm the Strategic Plan

This phase seeks to ensure that the commitment to quality is part of the strategic plan. All organizations are created with the goal of offering society a product or service. The mission represents this purpose and must show the fundamental values of the organization, as well as specify the commitment to quality. The vision shows the future aimed at, it is the image of the organization in the future. At VeneSoft it was seen that although quality is explicitly cited, it is nowhere to be found in the vision or mission. **The strategy to be followed will seek to differentiate them from the competition through a proposal to provide an innovative value to customers that must include top quality, fair prices and timeliness. It also aims to achieve operational efficiency and be a cost leader in the sector**.

Table 3. Analysis of the Context – Case Study VeneSoft. C.A.

Organizational	
Characteristic	**Value**
No. of years in the software systems development sector	12
Do they have software Quality Assurance programs?	No
Availability of managing director as project leader	High
Financial	
Value Drivers	Value
Sales (millions)	800
Rate of growth of sales	14%
Operating margin	65%
Accumulated fixed investment (1ˢᵗ year)	410.4 mb
Increase in working capital	9%
Increase in accumulated fixed investment	24.7%
Income tax rate	30%
Capital cost (WACC)	26%
Total investments in securities and shareholdings	195 mb
Market debt	500 mb
Customer	
Value Drivers	**Value**
Customer base	300
Share of selected market	20%
Rate of customer satisfaction (1 - 5)	3
Internal Business Process	
Value Drivers	**Value**
Average price of products and services	0.419205 mb
Learning and growth	
Value Drivers	**Value**
Base of professionals	30
Base of candidates	10
Learning time (months)	2
Global employee satisfaction index (1- 5)	3
Annual contracting rate	24%
Annual staff defection rate	5%

Table 4. Financial Results Forecast for VeneSoft, C.A.

Million of bolivars	2000	2001	2002	2003	2004	2005
Sales	800	984	1,157.60	1420.21	1582.01	1856.02
- Cost	280	344.4	406.16	497.08	553.7	649.6
Op. Margin	520	639.6	752.44	923.13	1028.31	1206.41
Income Tax		191.88	225.73	276.95	308.5	361.92
Margin After Income Tax		447.72	526.71	646.2	719.82	844.49
+Depreciation		59	59	59	59	59
-Increase in fixed investments		410	130.1	159.61	177.8	208.59
- Increase in working capital		40.29	47.4	58.16	64.79	76
Op. Cash Flow		56.42	403.29	482.51	531.32	613.98

Translating the Strategy into Operational Terms

This phase seeks to implement the strategy and manage its evolution through the BSC. First of all the matrix of the BSC was adapted and new indicators, such as SHV and Free Cash Flow, were included in the financial value. The Customer Satisfaction Index was added to the customer perspective. At employee level, the indicators proposed by the Staff Satisfaction Index were summarized. The other strategic objectives were accepted and are expected to support the strategy (See Table 5).

Table 5. Balanced Scorecard Proposed for VeneSoft, C.A.

Perspective	Strategic topics	Strategic objectives	Strategic indicators
Financial	Growth	F1 Increase shareholder value F2 New sources of revenue from outstanding quality products and services F2 Increase customer value through improvements to products and services	- **Shareholder value** - Growth rate of volume compared with growth rate of sector. - Rate of product renewal compared with total customers.
	Productivity	F3 Cost leader in the sector F5 Maximize utilization of existing assets	Comparing expenses with the sector's - **Free cash flow** - Operating margin
Customer	Enchant the Customer	C1 Continually satisfy the customer chosen as the objective.	- Share of selected key markets - **Rate of customer satisfaction**
	Cost leader	C2 Value for money C3 Reliable operations. C4 Quality service	-Comparing value for money with the sector - Percentage of errors with customers
Internal Process	Growth	I1 Create and develop innovative products and services I2 Implement a software product quality model with a systemic approach	- Profitability of new product investment. - Rate of new product acceptance. - **Rate of product quality**
	Increase customer value	I3 Technological improvements to products I4 Apply flexible development methodologies I5 Advisory services	- Timeliness - Product availability
	Operational excellence	I6 Provide a flexible global infrastructure I7 Meet specs on time. I8 Cost leader in the sector I9 Implement a quality system development model process I10 Develop outstanding relationship with suppliers	- Cost reduction - Fixed asset production - Improved yield - Rate of compliance with specs. - **Rate of process quality**
	Good neighborliness	I11 Improve health, safety and environment	- Number of safety incidents - Rate of absenteeism
Learning and Growth	Motivated and well-prepared staff	L1 Climate for action L2 Fundamental skills and competencies L3 Technology	- Rate of **customer** satisfaction

Seen graphically, by linking the objectives and the indicators of the four perspectives a Strategic Map can be created to show the hypotheses through the cause-effect relationships, making it explicit and probable. In order to implement the strategy it is important to communicate the key hypotheses, test them continuously and use the results to adapt the requirements (Kaplan and Norton 2000). Figure 3 shows a proposal for a Strategic Map to integrate the systemic quality approach in systems development organizations, with their objectives and indicators. This can be studied and communicated to the rest of the organization with clarity. In translating the strategy into the logical architecture of a Strategic Map and a BSC, a common, understandable reference is created for all business units and employees. **The quality initiative is fully integrated with the internal processes perspective. This initiative establishes a strong relationship with other events which can enable the financial objectives to be attained.**
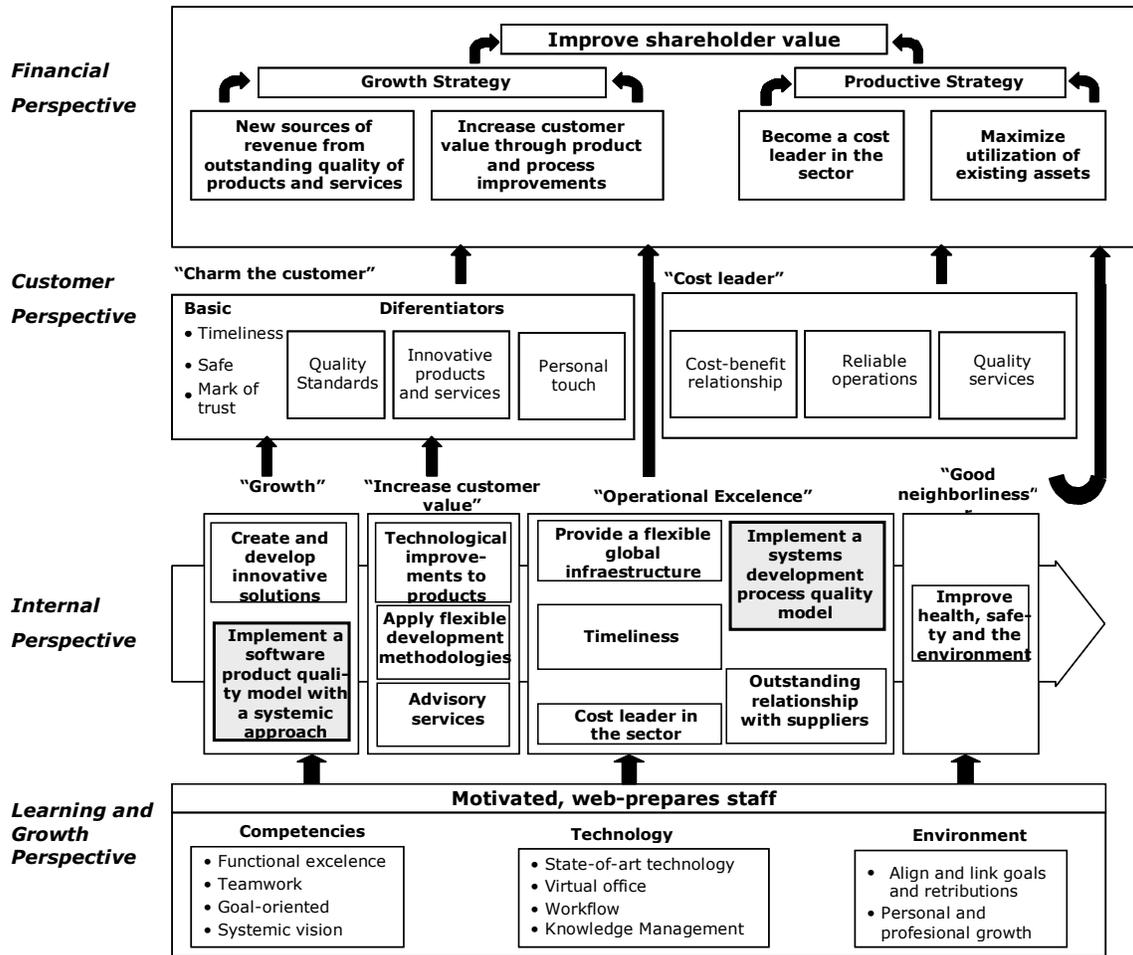
Figure 3. Strategic Map Proposed for Integration of Systemic Quality Approach

The Strategic Map was reviewed on the basis of the following ideas (See Figure 4):

- **Employee Satisfaction** is the base indicator in the Growth and Learning Perspective, which is encouraged by the **Degree of Access to IT**, bearing in mind the fact that this is a systems development firm.
- **Employee Satisfaction** in the internal purposes fosters **Process Quality,** which on the one hand stimulates **Product Quality** and on the other reduces **Operating Costs** (according to Deming's chain reaction). This cost reduction occurs in the medium and long term, since Quality Assurance is initially reflected as a cost increase.
- On the growth side, **Product Quality**, in the Customer Perspective, encourages **Customer Satisfaction** and in turn increase **Market Share**.
- The **Market Share** stimulates economic **Growth** in the Financial Perspective and this, in turn, makes greater **Fixed Investments** possible and stimulates **SHV**.
- **Fixed Investment** enables new **Technologies** to be acquired, which in turn are reflected in greater **Employee Satisfaction,** creating a feedback loop with the Growth and Learning Perspective.
- On the productivity side, lower **Operating Costs** increase **Productivity** in the Financial Perspective, which in turn stimulates **Competitiveness**, and this improves **Market Share**. **Productivity** also increases **SHV**.

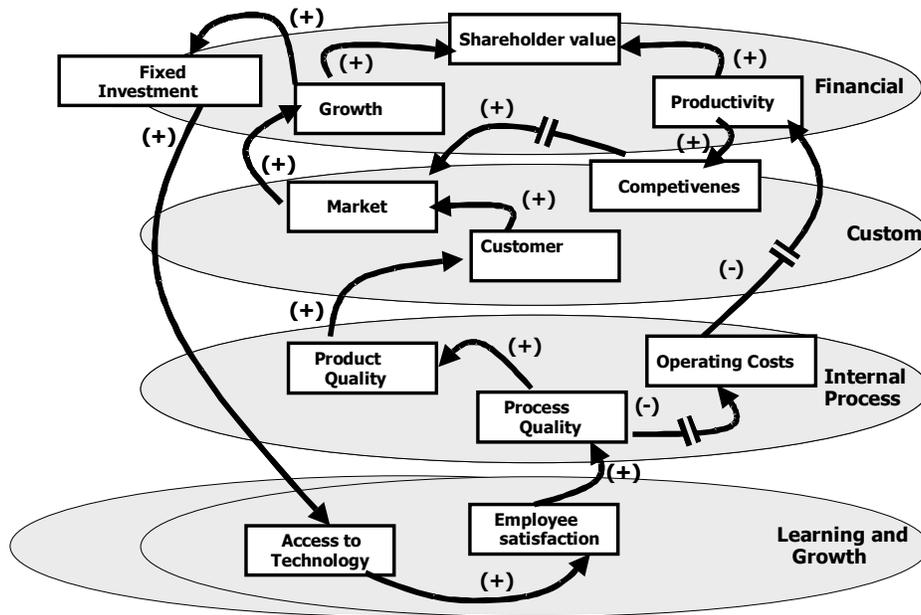This dynamic is reflected in the Strategic Map shown in Figure 4.

Figure 4. Strategic Map Focused on Systems Dynamics for VeneSoft, C.A.

With this new strategy a second simulation model was created in ITHINK®, where the same one was incorporated and the changes observed. An attempt was made to obtain financial results that justify the move towards a quality-based growth and productivity strategy. Table 6 shows the financial results of the second simulation.

Table 6. Financial Results After Simulating the Quality Strategy at VeneSoft, C.A.

Millions of bolivars		2000	2001	2002	2003	2004	2005
	Sales	800	984	1,157.60	1,470.71	1,868.52	2,373.94
	- Cost	280	306.76	360.88	458.50	582.51	740.08
	Op. margin	520	677.23	796.72	1,012.21	1,286.01	1,633.87
	Inco		203.17	239.01	303.66	385.80	490.16
	DISR margin		474.06	557.70	708.55	900.21	1,143.70
	+ Depreciation		59	59.00	59.00	59	59
	- Increase in		42.67	50.19	63.77	81.02	102.93
	- Increase in		410	137.75	175.01	222.35	282.49
	Op. cash flow		80.4	423.84	523.85	650.92	812.36

The SHV indicator value after the quality strategy is **2,186.83 million bolivars**.

The value of the SHV indicator was increased by 31.6% as a result of the new systemic quality based strategy.

Continuing with the Process proposed (See Figure 2), for the following phases we have:

Align the organization with the strategy
In this phase the departments of VeneSoft.C.A. are aligned with the values already established by the strategy. The objectives and goals set must be notified and information shared with suppliers so they too can be aligned with the organization's requirements.

Make the strategy an everyday task

The aim of this task is to disseminate information on the strategy to be implemented, through a summarized table of the strategies or a strategic leaflet. Clear and simple language that everyone in the organization can understand must be used. It must contain the four perspectives of the strategy and the key indicators that show the goals and the results obtained.

Make the strategy an ongoing process

In this phase the way annual proposals by organizations are made is redefined, since the strategies can be linked to the allocation of resources. This is important because it requires constant resources for a period of time that may exceed an annual budget to guarantee tangible results in a quality program.

Mobilize change through leadership

The presence of a leader for the process, preferably the director general or president of the organization, makes it more feasible to undertake all the changes the strategy involves. For VeneSoft, C.A., managing change has always been a very important issue and the need to support a project of this magnitude with the same level of support is widely recognized.

In summary, it can be concluded that the integration processes should be implemented in open organizations, with flexible managers who are up-to-date on relevant issues for guarantee improved management.

Conclusions and Recommendations

The proposal to integrate the quality approach establishes the causal relationships between quality and the other organizational indicators, up to the financial perspective, which enables the feasibility of a quality strategy in management terms to be reached. This research was based on dynamic simulation models for determining the impact of quality in companies. The BSC enables process quality and product quality to be related to the other perspectives of the organization, and its presence in strategic plans generates shareholder value in the medium and long term.

It is recommended to include more than one iteration in the proposal so as to improve the values obtained and, based on simulation models, to create alternative scenarios; apply the proposal in an organization that already has a BSC program, to improve its output; and lastly, establish which is the level at which systemic quality is profitable from a financial standpoint.

Acknowledgements

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