Strategies for the development of the software industry in Colombia

by

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by

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Submitted to the Sloan School of Management
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Abstract

Using Michael Porter’s framework for the competitiveness of the nations and Professor Michael Cusumano’s theory on the orientation of the software companies toward services, I analyzed the country of Colombia’s software industry to elaborate a diagnosis of current conditions and to generate some strategies for the Government and for the business sector using diagrams of dynamic systems. Keeping in mind that Colombia has significant human capital, success in this type of industry is likely, not only because the industry is highly dependent on human talent; but also because seeing the reality and determining that the number of qualified people is not very large, the country should create aggressive strategies to increase the number of people qualified for the industry. In the short term, it should emphasize the information technology (IT) services sector taking advantage of its strengths and looking for specific market niches. For the medium term it should look for software products where Colombia has a competitive advantage. Studies the Government is conducting to identify industries favorable to domestic growth could be very valuable to the software industry and could focus on the products those types of industries need. For example, Colombia could begin to analyze if it is well-suited to develop software products for the bio-fuel industry, relatively new industry, Brazil could be a great client and Colombia already has the necessary natural resources for this type of industry.

Thesis Supervisor: Alex Pentland
Title: Professor of Media Arts and Sciences
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1. Introduction

Paradoxically, when I entered to MIT’s Sloan Fellows Program I wanted to know more about my country, Colombia, that when I was living there. Being far away from my country allowed me to see the Colombian situation from a different perspective; I began to value our culture, our authentic and wonderful diversity and also to understand a little bit more the underlying reasons of our domestic situation. And as any good Colombian citizen that is living overseas for a while, I strongly desire to look for alternatives of improvement particularly in those areas in which I can contribute. That is why I decided in my final work to study Colombia more thoroughly than what I have done through my life, and to contribute to the country’s benefit with my experience and with the knowledge acquired during this year in MIT.

Reviewing all the good aspects that Colombia has, I found that one of its best assets is, without a doubt, its human capital; the good will and intellectual capacity of its people and its permanent attitude to do things well. Given my background in computer science and the experience I have acquired working for the Information Systems Department of the Central Bank of Colombia, I decided to study the software industry, which is highly dependent on the human capital, and can be fundamental for the domestic economic growth, just as has happened in some other developing countries.

Colombia lies in the northwestern part of South America, bordered by the Caribbean Sea to the north and the North Pacific Ocean to the west.

Colombia is the fourth-largest country in South America, Colombia measures 1,138,910 square kilometers, including insular possessions and bodies of water, or slightly less than twice the size of Texas. Of this total, land constitutes 1,038,700 square kilometers and water, 100,210 square kilometers. Its continental neighbors are Ecuador and Peru to the south, Brazil and Venezuela to the east, and the Isthmus of Panama to the west.

Colombia is the only South American country bordering the Caribbean Sea and the Pacific Ocean, Colombia has a total of 3,208 kilometers of coastline.
Despite its relatively small size, Colombia is the second most biologically diverse country on Earth, home to about 10 percent of the world's species. This biodiversity results from Colombia's varied ecosystems—from the rich tropical rainforest to the coastal cloud forests to the open savannas.[1]

Colombia is the third most populous country in Latin America, after Brazil and Mexico. The official final number compiled by the 2007 is 46.772 Colombian people.[2]

**ECONOMY**

Colombia's economy has experienced positive growth over the past three years despite a serious armed conflict. The economy continues to improve in part because of focused efforts to reduce public debt levels, an export-oriented growth strategy, an improved security situation in the country, and high commodity prices. Ongoing economic problems facing President URIBE range from reforming the pension system to reducing high unemployment, and to achieving congressional passage of a fiscal transfer's reform. New exploration is needed to offset declining oil production. International and domestic financial analysts note with concern the growing central government deficit, which hovers at 5% of GDP. However, the government's economic policy, democratic security strategy, and the signing of a free trade agreement with the US have engendered a growing sense of confidence in the economy, particularly within the business sector.

[3]"Colombia is a free market economy with major commercial and investment ties to the United States. Transition from a highly regulated economy has been underway for more than 15 years. In 1990, the administration of President Cesar Gaviria (1990-94) initiated economic liberalization or "apertura," and this has continued since then, with tariff reductions, financial deregulation, privatization of state-owned enterprises and adoption of a more liberal foreign exchange rate. These policies eased import restrictions and opened most sectors to foreign investment, although agricultural products remained protected. Unlike many of its neighboring countries, Colombia has not suffered any dramatic economic collapses. The Uribe administration seeks to maintain prudent fiscal policies and

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has pursued tough economic reforms including tax, pension and budget reforms. A U.S. Agency for International Development (USAID) study shows that Colombian tax rates (both personal and corporate) are among the highest in Latin America. The unemployment rate in December 2005 was 10.4%, down from 15.1% in December 2002. The monetary policy has been very successful in Colombia in the last 10 years. The inflation rate in 1990 was 30% and in 2006 dropped to 4.8%.

The sustained growth of the Colombian economy can be attributed to an increase in domestic security, the policies of keeping inflation low and maintaining a stable currency (the Colombian peso), petroleum price increases and an increase in exports to neighboring countries and the United States as a result of trade liberalization. The Andean Trade Preference and Drug Eradication Act (ATPDEA), which has been extended through June 30, 2007, also play a pivotal role in Colombia’s economic growth. Signing a free trade agreement in November 2006 portends further opportunity for growth once it is approved by the legislatures of both countries and implemented.

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
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<th>2006e</th>
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<tbody>
<tr>
<td>Nominal GDP, COPbn 1</td>
<td>256367.</td>
<td>284548.5</td>
<td>315965.3</td>
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<td>Nominal GDP, US$bn 2</td>
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<td>GDP per capita, US$ 2</td>
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<td>Industrial production index, % y-o-y, ave 3</td>
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<td>3.8</td>
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</tr>
<tr>
<td>Unemployment, % of labour force, eop 4</td>
<td>12.1</td>
<td>10.4</td>
<td>9.5</td>
</tr>
</tbody>
</table>

*Sources: 1 Banrep. 2 BMI calculation; 3 IMF; 4 DANE.*
ICT in Colombia

In the Global Information Technology Report 2006-2007 Colombia went down two positions from 61 to 63 whereas the highest ranking Latin American countries were Chile (31), newly included Barbados (40), Jamaica (45), Mexico (49), Brazil (53), and Costa Rica (56). The rankings for the region show an encouraging upward trend, with large countries such as Mexico, Argentina (63) and Peru (78) gaining several positions. The region’s overall improvement can be traced partly to the results of increased emphasis being laid on ICT strategies in recent policy agendas of most countries in the region to reduce the digital divide and increase competitiveness.

The thesis sustains that for the development of the software industry in Colombia several aspects are important: the national government's active and committed role, the sustained development of the human talent, the maximization of the country’s strengths in the services sector, and the search for new markets specially in the Small and Medium Business SME in Colombia, where the potential is enormous.

As theoretical framework, Porter’s diamond of competitiveness with some additional improvements such as the important role of the National Government and of the multinationals will be used. And specifically to analyze the development of the industry, the theory presented by MIT’s professor Michael Cusumano will be applied. For the strategy development, the theory of the dynamic systems will be used to show the importance of the cycles and of the different dynamisms in the software sector, and to find in which direction the efforts should be guided to reinforce some loops.
2. Methodology of Analysis

2.1. Porter's Diamond

A major breakthrough for the cluster concept was Michael Porter's Competitive Advantage of Nations (1990) that conversely to the prevailing accepted development objective of promoting diversified economies, advocated specialization according to historical strength by emphasizing the power of industrial clusters. In his "diamond model" four sets on interrelated forces are associated to industrial competitiveness.
2.1.1. Improvements of the Porter's Diamond

Alongside the discussions on the pros and cons, some main suggestions have been made on future improvement of Porter’s Diamond theory, mainly focusing on three added factors: government role, multinationals and national culture. First, government role has been undermined and should be added as the fifth determinant instead of an external force to emphasize its importance[4, 5]. Second, the significant role of multinationals has been inadequately treated in Porter’s framework and should be the third important external factor [6-9]. Due to this, a nation’s competitive strength may be derived from home factors (home diamond or single diamond), international factors (double diamond) and a combination of both home and international factors (multiple diamond). Third, national culture is also a neglected element in the framework despite the facts that religion, language, class stratification and social norms have a significant impact on businesses. Therefore, a double diamond, and multiple-linked diamond have been suggested to emphasize the importance of these missing factors.[5-7, 10-12]

The current study, conducting a systematic analysis based on the Porter’s single diamond framework and the government, multinational and national culture gives a particular focus on government policy and firm strategies in relation to these factors. The purpose in doing so is to find out if the factors are important, how important they are, and why they are important in shaping the rise of the software industry under the impact of government and firms.

2.2. Cluster Definition

Clusters are a geographically proximate group of interconnected companies and associated institutions in a particular field linked by commonalities and complementarities. Clusters encompass an array of linked industries and other entities important to

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competition... including governmental and other institutions –such as universities, standard setting agencies, think tanks, vocational training providers and trade associations[10, 13]

As the above definition says clusters are “geographically proximate” groups of business, public entities and support organizations with their relationships can be extended to include firms and organizations abroad. Because of the internet the global supply chains are increasingly being more integrated, this integration has led to additional investments and activities that ultimately strengthened the exporting cluster.

Export clusters

“Successful export clusters are integrated in the global economy. A closer integration and establishing communication links with ‘customers’ and representatives of foreign markets allow clusters to identify emerging trends and respond successfully to customer needs. It can also be a mechanism to attract FDI and/or identifying competitive supplier”[13]

External linkages are particularly relevant in developing countries:

“Full-scale clusters are rarely found in developing countries and external linkages become more important to the competitiveness of developing country firms than internal ones”[14]

One area where there seems to be increasing international inter-firm cooperation is where one or more large foreign buyers establish linkages with local firms to increase the quality or the availability of the products. This cooperation can create a joint project to the upgrade of capabilities and, ultimately, competitiveness of the cluster. [15]

Examples in Colombia

“In Caldas, Colombia, Espresso has established relationships with local cooperatives to produce “specialty coffee”. The initiative includes joint activities in areas such as
specialized technical education, tasting, quality control, infrastructure upgrading, logistics, and traceability. This has contributed to the Colombian sector being able to compete successfully in the “specialty and gourmet” coffee segment, where increased and consistent quality strongly influence the market price of the product”.[15]

“In the fall of 2002, Carlos Alberto Garay, executive director of the Asociacion Colombiana de Industrias Plasticas (Acoplasticos), reflected with pride on the transformation of the institution over the past two decades. Originally created in 1961 as a lobbying group for the nation’s major plastics manufacturing companies, Acoplasticos had shifted its focus in the early 1980’s toward improving the productivity of the Colombian plastics and rubber cluster, encompassing not only plastics and rubber producers but also certain petrochemical, man-made fiber, paint, and ink industries.”[16]
2.3. Business Software

Before examining the information technology industry in Colombia in more detail, it is important to understand the structure of this industry. The information technology industry has three main components: 1) the computer hardware segment that includes computing and communications products and devices; 2) the computer software segment that comprises computer programs, user interfaces and applications; and 3) the information technology enabled services segment that enhance other business functionalities with the use of computer hardware and software. The software segment may be further categorized into two types: a) generic off the-shelf software products that may target a vertical business segment or multiple segments or b) customized software or application developed to suit the need of a particular user in the context of a specific technology or business need. In some cases, large software packages such as ERP or CRM products designed to serve multiple vertical segments on multiple technological platforms require a lot of tailoring and customization before operating under a set of specific business needs.

Software development can be broadly categorized into custom developed software and packages or generic software products. Software companies providing customized software concentrate on particular vertical market segments or domain areas, like retail, banking, and manufacturing. Software products may be targeted to a vertical segment or may cut across segments, but rarely to a specific user. Information technology consultants, such as Anderson Consulting, provide “solutions”, which may involve some combination of custom developed software and commercial off-the-shelf software and hardware products. Software development involves a number of stages: Conceptualization, requirement analysis, high-level design, low level design, coding, testing and support. These stages roughly correspond to stages described in the waterfall model of software development. The value added is typically greater in earlier stages of development – namely requirement analysis and high level design.
Products Companies Become Services (or Hybrid) Companies

The professor Michael Cusumano of MIT explains in his book The Business of Software how the software companies are changing their business models to turn in an hybrid company: services and product-oriented. “Products Companies Become Services (or Hybrid) Companies Companies selling standardized software packages can also lose lots of money or see their profits and sales decline dramatically. Sometimes this occurs when their products become commodities and competitors emerge that drive down prices. This situation leaves firms that offer high-end custom or semi-custom solutions in a better position than the products companies that cannot differentiate themselves. The other problem, as noted earlier, occurs when the market becomes saturated or the economy turns bad: Customers stop buying new products or postpone purchasing decisions. Some companies, like i2 and Siebel, seem to get caught in the middle of a transition. Their financial reports suggest that both companies geared up for high-volume product sales during the late 1990s, with lots of people hired in R&D, sales, and marketing. Then they encountered low-priced competition and the economic slump. New sales to new customers required steep cuts in prices or creating complex deals of multiple products that proved expensive and difficult to install. When times are bad for new product sales, software companies are left with services-oriented revenues or maintenance. If times are sufficiently bad, or if their markets are sufficiently saturated with products, then the products companies may become services companies. We can see this trend as well in the next Figure, which presents graphs on the left-hand side detailing revenues coming from services and maintenance (that is, all sources except for new software license fees) at the eight companies cited earlier, usually from their first public data in the United States filed with the Securities and Exchange Commission. Between 1993 and 2002, Business Objects went from 18 percent services and maintenance to 46 percent; i2 went from 34 to 71 percent during this same period. Siebel went from 5 to 57 percent during 1995-2002. Between 1992 and 2002, PeopleSoft went from 30 to 73 percent and Oracle from 40 to 64 percent. Even firms that had a strong services orientation before the 1990s saw a shift to
services: IBM went from 58 to 74 percent (excluding hardware revenues) and Compuware from 62 to 76 percent. SAP, during 1997-2001, saw its services and maintenance revenues go from 50 to 69 percent. The bottom graphs in Figure 3 show what this shift in revenues from products to services looks like in percentage terms. The two trend lines are, by definition, mirror images of the other; the data excludes revenues that are not software products or services and maintenance. What we see, though, is the same crisscross pattern we saw in Figure 1, as services revenues eventually exceed product revenues (Siebel, i2, PeopleSoft, Oracle, SAP). Business Objects seems headed in the same direction. IBM and Compuware have already crossed this threshold sometime in the past before 1992. Enterprise software companies generally understand the need to tailor products to individual customers, and they usually learn how to charge adequately for their services or go out of business. As a result, they are more oriented toward services and hybrid solutions than products, even in their early days. We can see this at PeopleSoft, founded in 1987. This company introduced a low-priced human-resource management product that ran on personal computers rather than bigger machines. Over time, PeopleSoft has moved to a broader product line, added more industry-specific features to a growing product set, and, not surprisingly, placed even more emphasis on services. SAP may appear to be an exception to the rule that products companies are better poised for rapid growth compared to services-oriented companies. It sells high-end enterprise planning applications that require extensive consulting, training, and maintenance contracts. It has generated a lot of new business from services, which have grown faster than product license fees. SAP revenues rose 2.5 times between 1997 and 2002 (about $2.7 billion to $6.9 billion). However, average headcount at the company also rose exactly 2.5 times, from 11,558 to 28,604.14 So SAP is not an exception: Europe's largest software company has grown rapidly by rapidly hiring – a trend that cannot continue forever. Compuware and PeopleSoft, as well as IT consulting firms, are largely in the same position: If they grow, it is mainly by growing headcount. I will also say, though, that a hybrid solutions company has a greater chance of ramping up product sales (perhaps with a new release) and growing more quickly than a pure services company. In short, for most enterprise software companies, the two sides of the business – products and services – are impossible to separate completely. Most corporate customers demand services (including maintenance

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contracts with a regular schedule of upgrades) along with the new software products. In addition, it does not seem easy to evolve from services to products (as the majority of revenues), at least not without making major acquisitions and changes in the mental model of the business and in personnel. Software companies usually evolve the other way around, like Business Objects, i2, PeopleSoft, Siebel, and Oracle, from selling mostly products to selling increasing amounts of services and maintenance. Even Microsoft – the premier mass-market packaged software company – discovered the value of services when it wanted to increase sales of Windows NT and what it used to call its “BackOffice” products. It decided to create a solutions group in-house to help large customers and third-party firms install the enterprise version of Windows as well as new servers, e-mail, and corporate collaboration products. For many software products companies, services such as customization, installation, and integration support are necessary to drive new product sales. Service revenues and costs are not yet high enough for Microsoft to separate these from other revenues. But with increasing sales of enterprise systems and revenues from MSN, and the purchase of Great Plains Software in 2001, service revenues have been rising. For example, Microsoft reported that Enterprise Service revenues rose 34 percent in fiscal 2001, compared to the previous year”'[17].

![Graph showing the percentage of total revenues from products and services over time.](image)

Source: Michael A. Cusumano, *The Business of Software*
Computer services cover a wide scope of operations, including custom software development and systems integration, implementation and maintenance, consulting and training, as well as on-line support, outsourcing and hosting. Many of the companies which operate in this industry have a vertical market approach and offer particular knowledge and expertise in specific industry sectors. Areas of business include:

- consulting
- professional services
- systems integration
- systems houses and VARs
- BPO, outsourcing and processing services
- technical maintenance/desktop services
- on-line support services
- training
- recruitment and contractors.

**What is Business Process Outsourcing (BPO)?**

Business Process Outsourcing (BPO) is the act of transferring some of an organization's repeated non-core and core business processes to an outside provider to achieve cost reductions while improving service quality. Because the processes are repeated and a long-term contract is used, outsourcing goes far beyond the use of consultants.

The main difference between Business Process Outsourcing and more traditional IT outsourcing is that Business Process Outsourcing (BPO) offers companies a way of achieving transformational outcomes much more quickly. In a typical Business Process Outsourcing (BPO) contract, a service provider takes over a specific corporate function. Effective Business Process Outsourcing (BPO) encompasses much more than just changing who is responsible for performing the process. In Business Process Outsourcing (BPO), the
outside provider not only takes on the responsibility to manage the function or business process, but also re-engineers the way the process has been traditionally done.
3. Porter’s Diamond analysis

3.1. Government

Governments intervene of behalf of a special industry for a number of compelling reasons. First, some vertical sectors can be powerful engines of national growth, because the growth is determined by factors that are exogenous to that nation’s economy. Second, governments intervene because of market failures. Market failures manifest differently in developing and developed nations. In developing nations it is the absence of markets that governments try to spur. In more advanced nations it is the imperfections in existing markets that governments attempt to remedy; imperfections such as externalities, incomplete information, monopolies, and risk.

3.1.1. Implemented Policies and Programs

The National Policy for Innovation and Technological Development

[18] The National Policy for Innovation and Technological Development was established in 1994 as part of the National System of Science and Technology, referred to as the Colombian National Subsystem for Innovation (CNSI). The aim of the system is to promote innovation and transfer of technology to enterprises, centers of technological development, regional centers of productivity, business incubators, universities, consulting firms and finance institutions, in order to increase the competitiveness of productive sectors. The CNSI has increased the number of technological offers in Colombia in recent years, thus marking the beginning of a cultural exchange among entrepreneurs. This move has underlined the importance of technology in the future.

Program on Export Competitiveness Agreements
The Ministry of Trade, Industry and Tourism launched a programme on Export Competitiveness Agreements and Regional Export Competitiveness and Cluster Agreements. These agreements aim at identifying the specific problems of a productive chain and fostering solution to its problems through actions which involve the private and public sectors academy and the civil society. So far 41 Agreements have been signed, out of which 29 correspond to goods and 12 to services; 31 are national and 10 regional. [18]

The main issues treated in the Agreements are: training, innovation and technological development, finance, foreign trade, environment and cleaner production. The Agreements cover 86.2 per cent of the non-traditional exports of Colombia. The Regional Export Competitiveness and Cluster Agreements on industrial sectors comprise: the leather and leather products cluster of Nariño; the electronic cluster of Zona Cafetera; the textiles and apparel cluster of Zona Cafetera; the cluster in horticulture and fruits; and the cluster in women’s clothing. The support institutions belonging to the National Innovation System supporting these agreements include: the Ministry of Trade, Industry and Tourism; CAF (Corporación Andina de Fomento); FONADE (Fondo de Financiamiento de Proyectos de Desarrollo; FINAGRO; BANCOLDEX (Banco de Comercio Exterior de Colombia); FOMYPIME; PROEXPORT; IFI (Instituto de Fomento Industrial); SENA (Servicio Nacional de Aprendizaje); COLCIENCIAS; PRODES; FINDETER; and the Ministry of Agriculture and Rural Development. [18]

National Policy for Productivity and Competitiveness (1998-2007)

As part of the National Policy for Productivity and Competitiveness (1998-2007), the “Colombia Compite” network was created mainly to coordinate the efforts of resources between the private and public sector as well as academia in order to address cross-cutting themes, which require an approach covering several institutions. The Colombia Compite network is headed by the Government and coordinated by the Ministry of Trade, Industry and Tourism.
ICT Policy

Government software bills are aimed at strengthening the sector through incentives for private investment. Among the benefits and incentives for investment is the Tax Reform Law (Law 788 of 2002). This law establishes tax exemptions for those companies that register new medical products and software that are of high value for national scientific investigation.

There is no a concrete government policy that supports the software sector. There are some government insolated policies but there is no a global strategy to promote and improve the development of the information technology and communications.

At the present time the conditions become favorable since the Ministry of Communications has some available resources originated from the cellular phone companies due to their high penetration in Colombia. The Minister of Communications is very committed to the development of the Communications and Information Technology sector and is advancing a study to generate the development policy of this sector.[20]

3.2. Factor Conditions:

3.2.1. Human Capital

Human capital has far-reaching effects on the economy and life in society, as shown by many empirical studies.

The definition of human capital and the indicators constructed to quantify it must therefore take account of all the elements included in the concept as accurately as possible.

Within acquired human capital, a distinction is made between formal education, informal education and experience. Formal education comprises legally regulated academic
education, training within enterprises, and courses for the unemployed. Informal education is imparted fundamentally within the family circle, but it can also be acquired through self education by way of different means of transmission of information, such as books, the mass media or computers. Experience, for its part, consists of all the situations lived by an individual, which enable him to react to circumstances on the basis of the knowledge thus acquired. All these elements condition the labour raining and system of values of the individual, thus determining his productivity.

The availability of high-quality, trainable manpower and strong entrepreneurial and managerial talent is the only necessary condition for the development of an IT industry. If countries cannot wait for a high-quality technical-education system, it may still be possible to mount focused training and certification programs in targeted niche areas. This would, of course, require the foundation of a good university education system that is producing easily trainable manpower.

**Human Capital Indicator in Latin America**

<table>
<thead>
<tr>
<th></th>
<th>Argentina</th>
<th>Brazil</th>
<th>Chile</th>
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<th>Peru</th>
<th>Venezuela</th>
<th>India</th>
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<td>46</td>
<td>61</td>
<td>46</td>
<td>38</td>
</tr>
<tr>
<td>Investment in employee</td>
<td>34</td>
<td>27</td>
<td>34</td>
<td>40</td>
<td>61</td>
<td>40</td>
<td>61</td>
<td>46</td>
<td>34</td>
<td>61</td>
</tr>
<tr>
<td>Development of IT skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality of IT training</td>
<td>49</td>
<td>40</td>
<td>29</td>
<td>26</td>
<td>60</td>
<td>55</td>
<td>55</td>
<td>52</td>
<td>9</td>
<td>63</td>
</tr>
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<td>Education programs</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult literacy (2003)</td>
<td>97</td>
<td>67</td>
<td>85</td>
<td>85</td>
<td>96</td>
<td>96</td>
<td>66</td>
<td>92</td>
<td>93</td>
<td>96</td>
</tr>
<tr>
<td>Percentages 15 and over</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal computer</td>
<td>122,881</td>
<td>690,196</td>
<td>108,607</td>
<td>NA</td>
<td>106,209</td>
<td>398,815</td>
<td>NA</td>
<td>92,655</td>
<td>161,014</td>
<td></td>
</tr>
</tbody>
</table>

** Source: World Bank Development Indicators 2002

Strategies for the development of the software industry in Colombia 22
Education System in Colombia

Governance in the Higher Education System

The Meaning of Governance

Governance refers to the proper exercise of power or authority. When this concept is applied to higher education institutions, it implies the group of formal and informal devices used to make and carry out suitable decisions. The exercise of power could be both external and internal. External exercise of power refers to the relationship between the institution and its supervisory agencies; on the other hand, the internal exercise of power relates to the lines of authority governing the external powers. There are many instances in which this exercise of power overlaps, particularly in the development and execution of policies. As in any other country, governance in Colombia’s higher education system could be affected by numerous external factors, some of which will be discussed below.

External Factors Affecting Governance in Colombia’s Higher Education

Among the most significant external factors affecting governance in Colombia’s higher education system are: 1) changes in the labor market; 2) changes in demand and in the profile of potential students; 3) fiscal crisis; and 4) violence.

1. Changes in the Labor Market

The demands of the labor market in the last decades have considerably influenced the way higher education is envisioned and developed, mainly due to two factors. The first one is the speed of technological change and the subsequent demand for technology; and the second one refers to the changes in the economic system which leads to new approaches and types of work. Therefore, the higher education should be flexible and comprehensive, enriching and adapting to the new scientific knowledge and technical developments; thus providing the new professionals, technicians, and current labor force, opportunities to acquire and apply new technologies, and to participate in a continuing training and education to adapt to the changes and innovations.
Viewed from this perspective, higher education should be responsive and integrated to the regional economy and to the Department and Municipality development plans. This implies the creation and/or strengthening of regional universities, thus allowing students to identify with their regions and to develop a sense of belonging and community, which at the same time will propend for a solid and balanced regional development.

2. Changes in Demand and in the Profile of Potential Students
In terms of higher education, it is the State’s main responsibility to provide for adequate access and coverage and to meet the current and future students’ needs and expectations. However, coverage provided by the State is very limited: only 14.3% of those in the age group 18-24 attend a university. Concerning expectations about education, to have access to good quality education and social mobility are the main aspirations youths have. To fulfill theses two expectations there has to be policies in place to provide financial aid to students and to offer them access to good quality higher institutions.

3. Fiscal Crisis
The national policies as well as the higher education institutions in Colombia have been greatly affected by the country’s fiscal crisis. Expansion of coverage of higher education has been the main objective of the Government, without regard to specific policies for relevance, equity and quality. Due to lower demand for university enrollment the institutions find a reduction in their funds which urge them to find creative ways of increasing them. Consequently, the competition to win potential students has increased, and the potential risk of lowering the academic standard requirements for the admission of new students is present. Also, in their recruitment effort, many universities are offering loans similar to those provided by the banking system and by the Colombian Institute for Educational Credit and for Technical Studies Abroad, ICETEX (Spanish acronym), reducing their resources for academic improvement, in detriment of the education quality.

4. Violence
It is of vital importance for higher education institutions to have the ability and the autonomy to self government. Governance in the universities includes exercising autonomy
to define their own rules, norms and regulations; to develop and implement plans and programs leading to the fulfillment of their mission in society with high standards of efficiency, quality and excellence.

However, in Colombia, due to historical reasons, public universities have presented critical problems which reflect their lack of governance. The country’s armed conflict has also contributed to an increment in the low levels of tolerance, and to social disintegration which in no manner help to maintain and improve the learning environment; on the contrary, the learning atmosphere has been frequently disrupted by numerous class interruptions and shut downs due to the prevalent violence. There are other situations against which the public higher education institutions need to be constantly protected such as corruption, lack of commitment and efficiency, second-rate programs, and as stated before, any form of violence. All these situations go in detriment of a high quality education or institutional governance.

The coverage of higher education eligible population remained around 20.0% in 2002, compared with a Latin American average of 25% and Organization for Economic and Cooperation and Development (OECD) country average of 54%.

Although the nation’s public universities educated many citizens throughout the 1980s and the 1990s, the increasing demand for higher education overwhelmed the supply of educational opportunities available in the public sector. Government resources for public education were inadequate and schools could only adequately educate a limited student population.

Recognizing the need for additional higher education suppliers to accommodate increased student demand, private institutions emerged as an alternative to a public university education. As a result, the expansion of the private sector flourished rapidly and the percentage of institutions and student enrollment in private institutions soon outgrew those in the public universities. The explosion of private higher education continued throughout the late 1980s and 1990s, and as a result, Colombia today possesses one of the largest percentages of private higher education in the world. While 41% of students were enrolled in private schools in the 1960s, about 63.9% were enrolled in private higher education.
programs as of 2003 according to the National Accreditation Council (CNA – Consejo Nacional de Acreditación). Of 969,213 recorded students in 2002, 381,063 attended public institutions and 530,707 were enrolled in private programs. Colombia’s 64% rate of private enrollment in 1994 ranks among the highest rates in Latin America and 6th among the higher percentages in the world, such as Korea (80%) and the Philippines (88%).

A 2002 World Bank study also suggested that many of Colombia’s higher education institutions also provided students with irrelevant skill training, complicating their search and ability to secure meaningful employment. While certain private universities experienced increased academic prestige, many private institutions earned a public reputation of being motivated by profit while providing a low-quality, insufficient education out of touch with the true needs of the labor market and a developing country.[19] The quality of teaching in Colombia also raises concerns in the higher education sector. A 1998 study noted that less than 4% of professors in Colombia possess doctoral level degrees. This average education level is below the Latin American average of professors with PhD’s – about 6% - and much lower when compared to the regional leader Brazil (about 30%) or the United Kingdom (about 40%). Only about 20% of professors instruct full-time while others maintain employment in other sectors or institutions. The scarcity of available professors is exacerbated by Colombia’s inability to produce many graduate students or prevent top scholars from attending institutions abroad to complete their graduate studies. In 2000, Colombia exhibited a PhD production rate of only .4 per 1 million residents. This “Brain Drain,” a common occurrence in developing countries, is marked by estimation that the majority of immigrants entering the U.S. have a tertiary level education and that the population of Colombians in the U.S. has increased over recent years. In addition, the National Planning Department estimated that 85,000 citizens with higher education left Colombia between 1998 and 1999. This human capital loss creates inefficiencies within the Colombian economy and hindered science and technology development.[20]

Reality shows that only 38% of the students that enter to the university graduate; and more than 40% do not continue in fourth semester for different reasons such as: 1) failure, caused by the low-level of basic skills that students bring from secondary education, graded as
regular by the ICFES; in this category are found most graduates from public schools; 2) abandonment, caused by the need to work; and 3) dropped out, due to have begun studies without enough vocation, or in other words, mistaken choice of an academic program. [21]

The population in age of entering to higher education, only 22% has the possibility to enroll; this means that 78% is left out of the educational system. These differences, added to the situations of dropped out, abandonment and failure in the superior education, can be surmounted if the IES participate in the organization of the programs by cycles, in such a way that the students can transfer to the higher levels according to their capacities, time and needs. This means that the students without leaving the education system can finish a cycle, work, and if they consider that they have enough abilities and the necessary resources to continue their formal educational process, they can enroll in a higher cycle or otherwise can continue furthering their skills and actualizing in an informal or gradual manner during a lifetime. [22]

The Law 749, offers to the IES and other technical and technological institutions the opportunity to homogenize the common core curricular contents and skills in the fields, among others, of natural sciences, social sciences, mathematics and arts, in such manner that to have approved a content in secondary education will guarantee its transfer to higher education. Even more, if the content was acquired and approved in higher education, it could be transferred among the different programs and institutions, obviously under conditions of quality, avoiding having to repeat them, as it currently happens.

The Law 2216 of August 6 of 2003 defined the education by cycles. The organization of programs for cycles (ciclos propedeuticos) allows the student a spiral ascent toward more qualified levels of education: the first one, professional technician; the second, technological; and the third, professional. When concluding each cycle, the student obtains a title that facilitates his/her insert in the labor market, leaving the road open to return to the educational system at the most convenient moment, and to be graduated as technologist if so desires. Successively, with the recognition of their previous learning, the student will be able to arrive until the postgraduate levels (specialization, master or doctorate).
In practice, the students of 10th and 11th grades could also, in alternate schedule, begin the professional technical cycle, so that when concluding with their secondary education have acquired labor skills that allow them to enter the labor market or to continue in programs organized by cycles (ciclos propedeuticos), or in programs of a single cycle, either technical, technological or professional. This will be the biggest impact that the Law 749 will have in the domestic education system, since at the present time the students graduating from high school have no skills or knowledge that enable them to work, this situation creating a series of social problems.

**IT Human Capital**

In terms of IT human resources distribution, there is a high and well trained availability of medium-level software talents, such as people who understand software technology, professionals with 5 years in the University. In the short term, Colombia lacks versatile talents with both technological and managerial ability. In the last 2 years the Project Management Institute has trained to the most important software companies in Colombia in Project Management [23-25]

There is also a shortage of human resources to provide customer services, commercial planning, programming, etc. at the bottom level. [23-25]
3.2.2. Infrastructure

The most important infrastructure that a software company needs is to have a reasonable bandwidth to be able to communicate with the other companies and to give services for other companies outside the country or inside.

Telecommunications

In 2003, Colombia opened its mobile telecommunications market to Personal Communications Services (PCS) competition. The government issued a PCS license to new competitor Colombia Movil, effectively ending Colombia's mobile telecommunications duopoly and opening the door for competition (Telefonica and Comcel share approximately 80 percent of the mobile market). Colombia Movil received a 10-year concession to develop the market and compete against the current cellular providers. Two municipality-owned telephone companies, ETB (Empresa de Telecomunicaciones de Bogota) and EPM (Empresas Publicas de Medellín), own Colombia Móvil.

The free trade agreement concluded between the U.S. and Colombia provides for an open and competitive telecommunications market in Colombia. Users of Colombian telecom networks are guaranteed reasonable and nondiscriminatory access to the network. This prevents local firms from having preferential or “first right” of access to telecom networks. U.S. phone companies obtained the right to interconnect with Colombian dominant suppliers’ fixed networks at nondiscriminatory and cost-based rates.[26]

The year 2005 proved to be a period of transition for the Colombian telecom market, with intensified competition, continued fixed-to-mobile substitution, and increasing convergence. The signing of the Free Trade Agreement (FTA) between Colombia and the USA in February 2006 had an important impact on Colombia's telecom sector, promoting market liberalization and privatization. In April 2006, after years of thwarted privatization
efforts, the government finally sold a controlling stake in Colombia Telecom to Spain's Telefónica. In early 2006, teledensity in Colombia was 17%, about average for Latin America. Like in other parts of the region, the fixed-line sector is stagnating. But the mobile market is one of the country's most dynamic businesses. Mobile subscribers soared by 110% in 2005, and mobile penetration grew by 24% year-on-year to reach 48%. While broadband penetration is low compared with other Latin American countries, convergence strategies took the country by storm in 2005. Triple play first appeared in Colombia in 2004. By early 2006, another four companies had adopted the triple play strategy, with a further three in the pipeline. WiMax and WiFi have also been welcomed enthusiastically by Colombians.

Colombia's broadband market is still in its infancy, with penetration of less than 1% at YE05, but the market is growing strongly and, although broadband services remain out of the reach of the pockets of most Colombians, there are encouraging signs of movement in the market from both the government and operators. Three nationwide fixed-wireless broadband licenses were awarded in October 2005 - to Telecom, ETB and Orbitel - with regional licenses for WiMAX services being auctioned in H206. In November 2005, the Ministry of Communications awarded two contracts in its bid to boost broadband penetration rates. Unión Temporal Coldecón received a COP57.1bn contract to extend broadband services in the north of the country, while América-Promesa de Sociedad Futura E's COP79.1bn contract was for the south of the country. Each company is responsible for installing, operating, maintaining and providing internet services for 62 months. The contracts form the second phase of the ministry's Compartel universal service initiative.[27, 28]
Source: ORBITEL. FMI, BM, Morgan Stanley, CRT, TMG, ITU
Penetrations of the industry

<table>
<thead>
<tr>
<th></th>
<th>2002 Col</th>
<th>2005 Col</th>
<th>Cambio % Col</th>
<th>2006 June Col</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AL</td>
<td>AL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Lines # of lines/100 hab.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobiles # of lines/100 hab.</td>
<td>10,5</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet # of users/100 hab.</td>
<td>4,6</td>
<td>8,3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandwidth # of users/100 hab.</td>
<td>0,05</td>
<td>0,2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computers #/100 hab.</td>
<td>3,4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: IDC, CRT and Communications Ministry

3.2.3. Legal framework Intellectual Property

Business software piracy:

The piracy rates in Colombia remain high, particularly within small to medium-sized organizations, and inflict damage on the legitimate industry. Sophisticated, high-volume software counterfeit production facilities have been discovered in Bogotá. CD-R burning has become the main form of piracy afflict ing the business software sector. Piracy - both end-user and retail - in cities outside Bogotá is particularly high. Paramilitary groups appear to be involved in distribution of pirated products.

Preliminary 2006 estimated losses due to business software piracy rose slightly to $48.0 million, while the piracy level dropped one point to 56%. Although Colombia has one of the lower software piracy rates in Latin America, piracy continues to cause commercial harm to the business software industry.[29]
Protection of Intellectual Property

[26, 30]“Colombia does not yet provide adequate and effective intellectual property (IP) protection.

As a result, Colombia has been on the “Watch List” under the Special 301 provision of the 1988 Trade Act every year since 1991. An out-of-cycle review in mid-1999 placed Colombia once again in the same “Watch List” category. Colombia has ratified, but not fully implemented, the provisions of the World Trade Organization (WTO) agreement on Trade Related Aspects of Intellectual Property (TRIPS). The weakness of Colombian’s IP protection laws is one of the main factors accounting for weak business R&D funding. Private firms are concerned with a financial return on R&D investment, and will rarely fund the research that results in discoveries that benefit the society at large, without giving the firm an opportunity to realize gains on investment. The enterprises thus have to be assured that they will at least have an exclusive opportunity to commercialize the results of R&D.

Nevertheless, serious improvements in IP protection were achieved in several areas. Colombia, which is a WTO member, has ratified the Uruguay Round implementing legislation. It is a member of the World Intellectual Property Organization (WIPO) and has negotiated to join the Paris Convention for the Protection of Industrial Property, the Patent Cooperation Treaty and the Union for the Protection of New Plant Varieties”.

Patents and Trademarks

“Colombia is a member of the Inter-American Convention for Trademark and Commercial Protection. Colombia requires registration and use of a trademark in Colombia to exercise trademark protection. Trademark registration has 10-year duration and may be renewed for successive 10-year periods. Thus, the Colombian law provides 20-year protection for patents and reversal of burden of proof in cases of alleged patent infringement.

Andean Community Decision 486, which came into force on December 1, 2000, provides improved protection to patents, trademarks, industrial inventions, rules of origin and unlawful competition related to industrial property. This decision, approved after the pharmaceutical industry, which has been particularly affected by inadequate protection of
confidential data, requested that Decision 344 be amended to ensure compliance with WTO requirements.

Decision 486, eliminates previous restrictions on biotechnology inventions, increases protection of industrial designs from eight to ten years, and protects integrated circuits (microchips) designs. However, Decision 486 appears to have shortcomings with respect to protection of data confidentiality and protection for second-use patents. Enforcement of trademark legislation in Colombia is showing some progress, but contraband and counterfeiting are widespread.

The Superintendency of Industry and Commerce acts as the local patent and trademark office in Colombia. This agency suffers greatly from inadequate financing and a backlog of trademark and patent applications exceeding 25,000, although new applications are now generally reviewed within nine months.” [26, 30]

COPYRIGHTS

Colombia’s 1993 Copyright Law increased penalties for copyright piracy. In April 1999 President Pastrana issued a directive to all government and educational institutions to respect copyrights and avoid the use or purchase of pirated printed works, software and audio/video material. Enforcement problems consistently arise not only with inadequate police activity, but also in the judicial system, where there have been complaints about the lack of respect for preservation of evidence and frequent perjury.

New Technologies

Colombia has a modern copyright law which gives protection for computer software for 50 years and defines computer software as copyright table subject matter but does not classify it as a literary work. Semiconductors design layouts are not protected under Colombian law.”[30]
3.3. **Demand conditions for the software industry**

There are no sophisticated demands currently being made of the software industry in Colombia for products. This implies that customers in this industry do not have very high demand of technological sophistication, as most of the software is to facilitate consumers with basic computer software functions [31].

Along with the unsophisticated technological demand, consumer's expectations of standards for services are highly refined. As computer investment, including software, is still a luxurious capital commitment, customers think well ahead to discover if related services can be guaranteed for the durability of their products. For example, before a product is bought, customers tend to compare the applicability of products, prices and related services. A good package of after-sales services certainly attracts customers into buying the relevant products, such as testing, trial services, training, warranty, etc.

We could consider that the software in Colombia has 3 big clients: the Government sector, the finance sector, and the small and medium businesses (SME).

3.3.1. **Government sector**

Colombia has stood out in the electronic government's issue. The official web page has been recognized as one of the best in the world, next to those of Byelorussia and Brazil. The index of electronic participation measures, on one hand, the disposition of the countries to increase the citizen's participation thanks to the electronic government's use, and on the other, the quality, utility and relevance of the information and the services offered by the Government. In the 2005 United Nations Report, in the issue of electronic participation Colombia ranked 10th in the world the same as Chile, and above developed countries such as Germany, Finland, Sweden and France[32]. After 2003, the e-government has stopped its growing and now it needs to reinforce.
3.3.2. Finance sector
This is the most mature sector regarding information technologies. With the entrance of international Banks to the country, the sector has been modernized and is offering e-business services to the public.

3.3.3. Small and Medium Business in Colombia
The Small and Medium Business in Latin America are a huge market that the software has to explore. They do not understand very well that the investment in IT can improve their business and there is a huge opportunity for the software companies to attract this kind of market.

Characteristics of the SME in Colombia

According with the Law 590 of 2000 and the law 905 of 2004 the characteristics of the SME in Colombia are:

<table>
<thead>
<tr>
<th>Type of enterprise</th>
<th>Number of employees</th>
<th>Assets US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Enterprises</td>
<td>51 to 200</td>
<td>662.000 to 1’900.000</td>
</tr>
<tr>
<td>Small Enterprises</td>
<td>11 to 50</td>
<td>501 to 5000</td>
</tr>
</tbody>
</table>

Source: On the basis of Colombia, Law 590, Bogotá, D.C., 10 July 2000.

The micro and SME in Latin America are the 95% of the industry, commerce and services. These companies offer the 70% of employment and up to the 50% of the sales. In Colombia the situation is very similar, the SME offer the 73% of industrial employment and the 53% of the industry, commerce and services.

El 81, 2% of the companies in Colombia are micro, 7, 5% are small business, 1,5% are medium business and the 1,1% are big enterprises. The other 8.7% are assets no reported.
In Colombia there are around 47,750 SME and they are in the 4 economy sectors: Agriculture: 7%, Industry 22%, commerce 34% and 37% with the others.

Exporter SME

ICT in SME in Latin-American
The United Nations developed a survey using the FUNDES infrastructure (i.e. local call centers in the countries) and SME database, during the months of February and March 2004, telephone interviews were carried out with a total of availability of ICTs (PCs, Internet, websites). 454 SMEs – 90 in Chile, 90 in Colombia, 92 in Costa Rica, 90 in Mexico and 92 in Venezuela. The companies included in the database are mainly located in the capital cities of these countries. Therefore, the urban–rural divide could not be analyzed.
through this survey, and the survey results therefore represent only SMEs in urban areas.

[31]

Availability of ICTs (PCs, Internet, websites)

Observing this diagram we can conclude that in general in Latin-American in the big cities the internet is very popular and almost every enterprise is using computers, the e-mail and the internet. But the extranet and intranet are not very popular, they are not selling by their extranets and they are not using the intranet to manage their internal process.

Use of intranet and extranet by enterprise size

Source: E-commerce and developed report Chapter 2
Medium enterprises have developed more intranet that the small ones.

**Types of Internet connection by country**

![Graph showing types of Internet connection by country](image)

Source: E-commerce and developed report Chapter 2

The most common type of Internet connection was fixed connections over 2 Mbps and analogue modem (32 per cent of all SMEs for each type), followed by fixed connections under 2 Mbps (16 per cent) and ISDN (13 per cent). Here, significant differences exist among the countries. Specifically Colombia uses ISDN to connect to internet instead of wireless.

**SME’s use of internet by country**

![Graph showing SME’s use of internet by country](image)

Source: E-commerce and developed report Chapter 2
Colombia uses the internet mainly to look for information and to communicate with people via e-mail. Internet use for communicating with the Government was 77 per cent in Colombia, compared with 16 per cent in Mexico.

According with the e-commerce and developed report Chapter 2: "More than half of the companies had their own website and 22 per cent were considering creating one within the next two years. Those with websites mainly use them for customers to directly send inquiries to the company, for making available product information and for providing after sales support (chart 2.10). Only 12 per cent of the companies offer secure online transactions or online payments via their websites. And only 9 per cent featured back-end integration with their suppliers/customers through their sites. The latter figure was particularly low among manufacturing firms. Again, services companies were the most active users of their website. One fourth of services companies with a website offer digital products through their sites."

Website functionality by sectors

The secure transactions, back-end integration, online payments and digital products are not very developed in the websites in the SME in Latin-American, they use the website to give product information, contact with clients and after-sales support. Again the services sector is the more active using the internet and in this case to publish information in the website but the manufacturing sector is the less active.
The SME in Latin-American are beginning to be active using the online purchases but they have not developed their websites in order to sale by internet.

Costa Rica and Chile are the most active users by internet buying and selling whereas Colombia and Mexico are the least.

Costa Rica and Chile are the most active users by internet buying and selling whereas Colombia and Mexico are the least.
There are some interesting differences among the countries: as far as online purchases are concerned, firms in Costa Rica have mainly used e-marketplaces, whereas most of the firms in the other countries bought directly from through other companies' websites. Similarly, Costa Rican firms made most of their online sales through either e-marketplaces or third-party websites, whereas, for example, firms from Chile and Colombia made all of their online sales through their own websites.

**Perceived importance of ICT’s by country**

Almost all companies (90 per cent) consider the use of ICT and the Internet important to their businesses. Specifically in Colombia the SME are aware of the importance of internet in the firms and they want to implement new information services in order to increase their productivity.
Perceived importance of ICT in the business by country

There are some differences, however, among the countries: while almost 100 per cent of businesses in Chile, Colombia and Costa Rica think that the Internet is important, the figures are somewhat lower in Mexico and Venezuela. Similarly, having a website has a higher priority in Colombia, Costa Rica and Venezuela than in the other countries.

The majority of enterprises (68 per cent) were planning further investments in ICTs during the next two years (high or low); while 30 per cent indicated they did not know yet. However, there are some major differences among the countries: 96 per cent of companies in Colombia answered this question positively compared with only 26 per cent in Chile. This may reflect to some extent the current level of investment and the resulting needs for future investments. Small companies are ready to invest more in ICTs over the next two years. This shows the dynamics and rapid development of e-business adoption.
E-business processes by sectors (only companies with intranet)

Again the services sector companies are more active using the intranet through all the process in the organization but manufacturing companies are the least active.

Those with intranets (and extranets) reported that they used computerized systems for a number of business functions. All firms reported that they used computerized systems for client relationship management, followed by accounting, resource planning and inventory, and document control. These were the most common applications, with more than three quarters of firms responding positively. Least common were the use of computerized systems for training or education (43 per cent) and the use of application service providers (ASPs) (33 per cent).

Barriers to Internet use
According with the report security concerns were by far the greatest barrier to Internet use among all companies (71 per cent), followed by high development and maintenance costs (41 per cent), loss of time due to irrelevant Internet surfing (37 per cent), the non-preparedness of customers to use the Internet (33 per cent), and slow and unstable data transmission (32 per cent).

**Barriers to ICT use by country**

![Barriers to ICT use by country](image)

The weight given to the various barriers differs among the countries. For example, while only 13 per cent of companies in Chile considered costs related to ICTs to be a problem, 66 per cent of Mexican companies considered this important (chart 2.22). Interestingly, a higher percentage of medium-sized companies indicated that costs related to ICTs were the main factor influencing ICT use (55 per cent compared with 43 per cent of small companies), in particular companies in the services sectors. In the manufacturing sector, companies gave most weight to the notion that customers and suppliers were not ready to use the Internet (42 per cent compared with only 28 per cent of firms in the wholesale and retail trade).
Needs in respect of enhancing ICT and internet use by country

The hardware and software concerns, staff training and better connectivity were the greatest barrier to use ICT in Colombia according with this survey. The access to credits was the least important. And in the region Colombia had the high score in SME-specific products and the second in product compatibility.

With this results Colombia has to improve the local software industry and to attract the hardware industry to the country.
3.4. **Context for firm Strategy and Rivalry**

The corporate distribution of the software industry is geographically highly concentrated, but very fragmented as an industry. In terms of geographical location and infrastructure, all the software companies are located in large cities in Colombia, such as Bogota, Medellin, Cali, Barranquilla, Bucaramanga, Pereira and other small cities. The convenient location of these firms allows them to access easily to the necessary resources and bureaucracy for the development of their products. Moreover, some software companies are clustered in particular areas in these cities. The advantage of such a concentration is that consumers can cherry-pick their products swiftly while firms can obtain consumer feedback promptly on why their products are, or are not, bought.

In the last few years, the outsourcing sector in Colombia has experienced a great boom and has become one of the most dynamic sectors of the economy.

Three of the world’s largest IT outsourcing companies: IBM, EDS and Accenture are part of this sector. Colombian companies such as PSL in Medellin, Enigma of ParqueSoft in Cali, and AlfaGL and Compucentro in Bogota, among others, are currently providing services to foreign developers. Additionally, the sector has three important software development clusters: ParqueSoft, InterSoft and SinerTic.[25, 33]

- **ParqueSoft**: the Software Technological Park Foundation, ParqueSoft, is one of Colombia’s largest science and information technology clusters. It comprises 12 Software Technological Parks in the cities of Cali, Popayan, Pasto, Buga, Tulua, Palmira, Buenaventura, Roldanillo, Cartago, Armenia, Manizales, Pereira and Villavicencio.

- **InterSoft**: a Colombian company of the IT sector headquartered in the city of Medellin, with a branch in Bogota. Its purpose is to provide consulting, development, software maintenance and IT outsourcing services. The company is staffed with qualified professionals in different technical disciplines.

- **SinerTic**: A business model that comprises 19 companies. It was born as an integration and association project built upon the specialized product and service platform offered by each of the associated companies. It provides domestic and international markets with

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Strategies for the development of the software industry in Colombia
integrated products and services and leading-edge solutions based on information
technology and telecommunications.[33]

Exports

<table>
<thead>
<tr>
<th>Country</th>
<th>Export Shares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecuador</td>
<td>48.0%</td>
</tr>
<tr>
<td>Venezuela</td>
<td>28.6%</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>24.0%</td>
</tr>
<tr>
<td>USA</td>
<td>16.0%</td>
</tr>
<tr>
<td>Peru</td>
<td>12.0%</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>12.0%</td>
</tr>
<tr>
<td>Chile</td>
<td>8.6%</td>
</tr>
<tr>
<td>Mexico</td>
<td>8.0%</td>
</tr>
<tr>
<td>Guatemala</td>
<td>6.0%</td>
</tr>
<tr>
<td>Honduras</td>
<td>6.0%</td>
</tr>
<tr>
<td>El Salvador</td>
<td>6.0%</td>
</tr>
<tr>
<td>República Dominicana</td>
<td>6.0%</td>
</tr>
<tr>
<td>España</td>
<td>6.0%</td>
</tr>
<tr>
<td>Trinidad y Tobago</td>
<td>4.0%</td>
</tr>
<tr>
<td>Cúmbres</td>
<td>4.0%</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>4.0%</td>
</tr>
<tr>
<td>Haití</td>
<td>4.0%</td>
</tr>
<tr>
<td>Panamá</td>
<td>4.0%</td>
</tr>
<tr>
<td>Uruguay</td>
<td>4.0%</td>
</tr>
<tr>
<td>Francia</td>
<td>4.0%</td>
</tr>
</tbody>
</table>

Source: Fedesoft[33]

There are 800 Colombian software companies and 19 international companies with total
sales of US $ 270 million. The sector has 13,019 direct employees and 17,460 of indirect
employees. The exports are: US $25.8 million and mainly are for Latin American markets.
[33]
The products supply in Colombia is not very high and there are a few strong companies in
Colombia that can offer qualified products to the foreign demand.[24]

Software companies
Among the Colombian companies that stand out in the market as software developers are:

Productora de Software Ltda. (PSL): Provides banking systems and accounting software. It
is a company of software developers and programmers working under the model of
"Software without Frontiers." PSL’s software integrates different areas like finance,
accounting, distribution and human resources. This company is certified as CMMI 5.

Intergrupo: This Company has consolidated its position as one of the leading technology
consultancy agencies in the Colombian market with annual sales of over U.S. $8 million.
Microsoft has recognized Intergrupo as its principal business associate with the highest number of licensed sales in Colombia during the fiscal years 2001-2003.

**B2b Solutions Group** (former Casa Informatica): This Company is focused on developing and complementing e-business software applications. Its primary goal is to leverage existing and new technologies (Web Enabled) through process automation, human resource collaboration, productivity optimization and customer care. In 2003 the company achieved the IBM Top Contributor award as the Primary WebSphere Software vendor in Colombia. Other business fields include business intelligence applications, customer, supplier and employee portals, retail management and manufacturing solutions.

**Heinsonhn Software House**: A Colombian computer company established in 1977 as a pioneer in the development and implementation of application software, as well as offering related services. Today, Heinsohn has a staff of approximately 230 and offers solutions for administration and financial management, the administration of investment portfolios and pension funds, as well as tailor made software.

**Digital Ware**: This Company develops business solutions over the Internet such as administrative, financial, and commercial systems. Its products are launched to perform companies’ internal management and provide outsourcing solutions. Digital ware is an application service provider.

**Latin-American Software Company "LASC"**: Supplier of information technology solutions for financial institutions and service providers. Over more than two decades LASC has evolved with the computer science and banking sectors to offer to its client’s top technology solutions that respond to competitive challenges. Over the years, LASC has carried out projects of great importance for some of the most important banks in Colombia, Venezuela, Ecuador, The Dominican Republic, Panama and El Salvador. LASC offers its clients transactional switches solutions and authorization (S2 Systems); audio response solutions and voice portals (Intervoice Inc); personal and corporate banking, payments solutions and management collection for multiple channels, device networks (Excel);
electronic presentation solutions for invoices, image storage and management (Insci); complete solutions for bank branch automation and automatic test systems (Paragon).

**Energy Computer Graphics Ltd:** An international company located in Bogota that develops telephone software, cable and television systems.

**MECOsoft:** Located in Medellin, this company has expanded throughout South America. It has developed more than 40 software products. The company not only works with clients to develop products, but also works with other software and hardware companies to produce final integrated products.

**Computec:** This Company specializes in administrative information services and risk, commercial communication, databases, credit card administration and outsourcing.

Also in the market are companies such as: Digidata, 2W Ltda, ADA Computadora Ltda, AISOF Ltda, Alcuadrado S.A., Antares Tecnología Ltda., Aprendahaciendo S.A., Atama S.A., Baseware Ltda, Centro de Computación Compucentro Colombia, Centro de Procesamiento Contable Procecon S.A., CNT Sistemas de Información Ltda., Colombia.Net, Asesoftware, and among others.

**CMMI - Capability Maturity Model Integration**
There are 8 companies in Colombia certified with CMMI and only one of those is certified with CMMI 5.[33]

**Software exports**
The software exports also will play a pivotal role in the development of the industry. Firstly, they symbolize the openness, and internationalization of the industry. Exports connect the Colombian software industry with the world with products, services and licensing to the Latin America and may be USA and Europe. This connection creates the links and opportunities for information exchange of technology and techniques. Secondly,
economically, software exports increase the percentage of GNP although currently it is a very small proportion, 0.2. In addition, software exports also generate foreign income for the country, balancing the imbalance of payment. Thirdly, software exports also allow Colombian enterprises to explore the international market demands, and standards in order to provide more suitable international products.

Exports in technology

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filipina</td>
<td>73.6</td>
</tr>
<tr>
<td>Singapu</td>
<td>58.7</td>
</tr>
<tr>
<td>Malasi</td>
<td>58.4</td>
</tr>
<tr>
<td>Taiwá</td>
<td>42.9</td>
</tr>
<tr>
<td>Irland</td>
<td>34.4</td>
</tr>
<tr>
<td>Méxic</td>
<td>21.3</td>
</tr>
<tr>
<td>Brasi</td>
<td>11.9</td>
</tr>
<tr>
<td>Argentin</td>
<td>8.6</td>
</tr>
<tr>
<td>Colombi</td>
<td>6.5</td>
</tr>
<tr>
<td>Venezuel</td>
<td>4.0</td>
</tr>
<tr>
<td>Chil</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Source: Indicadores de Desarrollo Mundial, Banco Mundial. Tomado de: Anuario Mundial de Competitividad [2005]

The sector services

Strategies for the development of the software industry in Colombia
Software services, as a package of software, include consulting, testing, instruction or training, processing, protection and after-sales services. They represent the potential sales of software. For example, in 2005, the services accounted for over 44% of the industrial value. This indicates the importance of improving services for the industry. With the Free Trade Agreement (TLC) entry, the software services will be liberalized, which means more competition, and more diversity of talents and company presence, more inter-corporate cooperation, and more information and technology exchange [25, 33]

### Revenue Information Technology Industry

![Revenue Information Technology Industry](image)

### Investment per cápita in technology

![Investment per cápita in technology](image)

### Proportion of the Investments 2005 (%)

<table>
<thead>
<tr>
<th></th>
<th>L. America</th>
<th>Argentina</th>
<th>Brazil</th>
<th>Chile</th>
<th>Colombia</th>
<th>México</th>
<th>Peru</th>
<th>Venezuela</th>
<th>Rest of LA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td>52.1%</td>
<td>57.7%</td>
<td>45.6%</td>
<td>52.8%</td>
<td>46.8%</td>
<td>53.2%</td>
<td>57.2%</td>
<td>63.1%</td>
<td>75.8%</td>
</tr>
<tr>
<td>Software</td>
<td>14.8%</td>
<td>17.0%</td>
<td>15.3%</td>
<td>13.0%</td>
<td>11.8%</td>
<td>15.8%</td>
<td>12.0%</td>
<td>18.8%</td>
<td>9.9%</td>
</tr>
<tr>
<td>Services</td>
<td>33.1%</td>
<td>25.3%</td>
<td>39.1%</td>
<td>34.2%</td>
<td>41.4%</td>
<td>31.0%</td>
<td>30.7%</td>
<td>18.1%</td>
<td>14.4%</td>
</tr>
</tbody>
</table>

**Total IT**

|                | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

These figures demonstrate the vocation of Colombia as user of professional services somehow, but more than that, as competitive producer since these investments are the reflection of a satisfied and growing demand. It is worth noting that the national added value of these services is superior to 70%. [34]

**Research Activities by Size Classes of Firms**

“Not surprisingly, large enterprises innovate to more than small and medium enterprises (SME) in Colombia, especially with regards to the in-house research. They benefit from better investment capacities and more qualified labor than small Colombian firms: 47,3% of employees have professional qualification in large firms, compared to only 6,2% for small firms and 25,1% for medium-size firms[35]. Unfortunately, international comparison is impossible due to methodological differences in Colombian and OECD studies”.

**Inter-firm Co-operation**

Several studies show that the co-ordination of an innovative endeavor almost always requires a network of independent organizations with different competencies. To a large extent, innovation is the result of inputs from co-operative systems, networks of firms and knowledge-based organizations. However, co-operation agreements are embryonic among Colombian firms, especially smaller ones.

The nature and potential benefits of network co-operation are not always well known in small firms. New business models are more difficult for them to consider due to the lack of highly skilled employees. Furthermore, their managers may be afraid to lose competitive advantages to prospective partners. The recent programs of the Colombian government and business associations (Centros de Desarrollo Tecnologico, Centros Regionales de Productividad, Incubadoras de Empresas de Base Tecnologica) try to promote firms’ awareness of networking, but no statistical evidence can attest to the success of these policies.” [35]
Problems to make enterprises in Colombia

According with the last report of FUNDES [31] the main problems that the SME has to face are:

- Economy situation in Colombia, the variations in the exchange rate, the low investment, unemployment and underdevelopment.
- Finance: The possibilities of finance are very diverse but in the reality the loan term and the interest rate are not very attractive for the companies. Also the requirements of the banks to loan money are very difficult to achieve for the software companies because this kind of companies does not have physical assets to show. The software companies have computers and human capital as mainly assets.
- Bureocracy in finance: When the state gives some finance program to the companies the bureaucracy makes very difficult obtain the money for the companies.
- High costs of acquisitions and implementation of advanced systems and the acquisition of hardware.

3.5. Related and supporting industries

Software and hardware are collectively the main part of the computer industry. The computer industry in Colombia only became a fast-track industry in the early 1990s. Before the Open Door Policy, it served merely as the defense and economic infrastructure of Colombia, and only started linking with consumers in the early 1980s. Nowadays, all the world-class companies are competing in this market, including HP, IBM, Oracle, etc. The focal point of the competition is price and services.

The United States continues to be the main supplier of software to Colombia. Foreign companies have a strong presence in the Colombian market. These companies include Microsoft, which has an approximately 30% market share, followed by IBM of Colombia S.A., with 20%, Oracle, with 12%, Sun Microsystems, with 10%, 72% of the market. The remaining 28% corresponds to companies such as Novell, Cognos, and Business Objectives, among others.
The related and supporting industries are:

**Hardware**: CISCO, HP, IBM, Gateway, Unisys.

**Communication Industry**: Comcel, Telefonica, TIGO, ETB, EPM.

**Operational system**: Microsoft, Sun Microsystems, Unisys.

**Tools for Developing Software**: Microsoft, Oracle, IBM

**Databases**: Oracle, IBM, Microsoft, Unisys.

**Systems ERP, CRM**: SAP, Oracle

**Training**: IBM, Oracle, CISCO, Universities

### 3.6. Foreign Direct Investment (Multinationals and Transnational)

Trade and foreign direct investment (FDI) remain significant sources of innovative ideas and concepts and may take on greater importance as the complexity of innovation at the technological frontier makes it increasingly difficult for individual firms and countries to engage in innovation.

In Colombia, foreign investment grew by an annual average of 55% between 1991 and 1997, compared with 15% in the 1980s. However, FDI fell sharply in 1998, owing to a marked slowdown in privatizations and flagging investor confidence. The total stock of foreign investment in Colombia was close to US$2bn in 2000. Although the US continues to hold the largest share, this country’s participation declined throughout the 1990s in favor of Latin American countries and the EU.

High-technology industries have experienced the greatest increase in international trade during the early 1990s. The telecommunications, manufacturing and finance sectors have increased their share of the FDI stock in recent years, whereas the share of mining has declined. Besides its positive effect on national S&T capacities, investment in knowledge-
based industries proved to be much more persistent than investment in other sectors. Foreign investment in high and medium high-technology industries and services was the only to remain at the same level during the economic recession, whereas it fell down in all others.

The structural composition of FDI reflects the attractive growth of services, especially telecommunications and finance sector, for foreign investors. However, the decreasing share of FDI in knowledge-based manufacturing reflects the low level of Colombian competitive advantages in this area.[36]

[37] Colombia was the South American country with the most growth in Foreign Direct Investment (FDI) in 2005. Colombia took first place in terms of growth in investment inflows, followed by Venezuela, Ecuador and Peru. "In South America, the greatest increases were recorded in Andean countries such as Colombia (227%), Venezuela (95%), Ecuador (65%), Peru (61%), and Uruguay (81%).[36]

FOREIGN RELATIONS

In 1969, Colombia, along with Bolivia, Chile, Ecuador and Peru, formed what is now the Andean Community. (Venezuela joined in 1973 and announced its departure in 2005 and Chile left in 1976 and returned in 2006.) In the 1980s, Colombia broadened its bilateral and multilateral relations, joining the Contadora Group, the Group of Eight (now the Rio Group) and the Non-Aligned Movement, which it chaired from 1994 until September 1998. In addition, it has signed free trade agreements with Chile, Mexico and Venezuela.

Colombia has traditionally played an active role in the United Nations and the Organization of American States and in their subsidiary agencies. Former President Gaviria became Secretary General of the Organization of American States (OAS) in September 1994 and was re-elected in 1999. Colombia has participated in all five Summits of the Americas, most recently in November 2005, and followed up on initiatives developed at the first two summits by hosting two post-summit, ministerial-level meetings on trade and science and technology. In March 2006, Bogota hosted the Sixth Regular Session of the Inter-American Committee against Terrorism.

Strategies for the development of the software industry in Colombia
U.S.-COLOMBIAN RELATIONS

[38]"In 1822, the United States became one of the first countries to recognize the new republic and to establish a resident diplomatic mission. Today, about 25,000 U.S. citizens are registered with the U.S. Embassy as living in Colombia, most of them dual nationals. Currently, there are about 250 American businesses conducting operations in Colombia. During the Pastrana administration, relations with the United States improved significantly. The United States responded to the Colombian Government's request for international support for Plan Colombia by providing substantial assistance designed to increase Colombia's counter-narcotics capabilities and support human rights, humanitarian assistance, alternative development and economic and judicial reforms.

The U.S. has continued close cooperation with Colombia under the Uribe administration. Recognizing that terrorism and the illicit narcotics trade in Colombia are inextricably linked, the U.S. Congress granted new expanded statutory authorities in 2002 making U.S. assistance to Colombia more flexible in order to better support President Uribe's unified campaign against narcotics and terrorism.

The results thus far have been impressive, but much remains to be done. U.S. policy toward Colombia supports the Colombian Government's efforts to strengthen its democratic institutions, promote respect for human rights and the rule of law, intensify counter-narcotics efforts, foster socioeconomic development, address immediate humanitarian needs and end the threats to democracy posed by narcotics trafficking and terrorism. Promoting security, stability and prosperity in Colombia will continue as long-term American interests in the region.

Trade

In 2006, Colombia was the United States' fifth-largest export market in the Western Hemisphere behind Canada, Mexico, Brazil and Venezuela and the largest agricultural export market in the hemisphere after the North American Free Trade Agreement (NAFTA) countries. It was also the 28th largest export market for U.S. products worldwide. U.S. exports to Colombia in 2006 were $6.7 billion, up 19% from the previous year.
Corresponding U.S. imports from Colombia were $9.2 billion, up 4%. Colombia's major exports are petroleum, coffee, coal, nickel and nontraditional exports (e.g., cut flowers, gold, bananas, semiprecious stones, sugar and tropical fruits). The United States is Colombia's largest trading partner, representing about 40% of Colombia's exports and 29% of its imports. The EU, Japan and the Andean countries also are important trading partners. Mining, manufacturing industries and oil continue to attract the greatest U.S. investment, which accounted for 13% of the total $10.2 billion in foreign direct investment in Colombia in 2005. Colombia has improved protection of intellectual property rights through the adoption of three Andean Pact decisions in 1993 and 1994 as well as an internal decree on data protection, but the United States remains concerned over deficiencies in licensing and copyright protection” [3].
4. Diagnosis

To do the diagnosis we will have into account the found facts in the last section.

4.1. Government

The Government has generated policies of taxes incentives that have helped the sector in the last years but have not been sufficient for its development. As stated previously there is not a coherent policy that supports the software sector in a determined way and which considers all the actors in the industry.

As a result of the visit by the then President of Colombia Andrés Pastrana to India in 2001, the need and motivation arose to design and develop an IT training model in Colombia. The National Project of Training and Certification in Information Technologies was initiated under the framework of the Connectivity Agenda. The program looks to expand the use of IT in order to increase competitiveness of the manufacturing sector, modernize the government and public institutions and open up the access to information technology and to the Internet. The institution designated to carry out the project was COLCIENCIAS, Colombian Association for the Advancement of Science. The project's specific objective was to offer to an estimated 5,000 Colombians over a period of 7 years, training to world ranking certification level, in software development and other related services. This project was not successfully implemented. Only 280 Colombians certified their studies. [39]

The Government of President Pastrana (1998-2002) was very committed with the implementation of Information Technology in the industry and in the government in Colombia. The Agenda of Connectivity was in charge of modernizing the IT in the Government sector; and created the plan of Educators to train in IT and in other related initiatives. Also it was very dedicated to the creation of human talent in IT[23-25].
But in the following government the priorities changed and the focus was more in the subject of Democratic Security. Colombia with the Government of president Uribe has worked in the project of Democratic Security; this has been a key of the success to attract the foreign investment. For that reason Colombia in the last years reached the 200% of growth of the foreign investment bringing domestic economic growth. The signature of the TLC (Free Trade Agreement) with the United States would be without a doubt an opportunity of growth for the industry, since it can generate foreign investment.

When the government of President Andrés Pastrana promoted IT, the indexes of use of IT in Colombia were ones of the highest in Latin America; then when the president Uribe change the Government’s priorities the indexes for Colombia lowered as the figures show. This reinforces the fact that the Government's actions and endorsements are fundamental for the economic growth of the sector. Now it is the time for IT for Colombia. The Government is promoting and supporting the sector through the new Ministry of Communications and Information Technologies.

4.2. **Factor Conditions**

4.2.1. **Human Capital**

It is important to recognize the great work made by the Ministry of Education to do of the Colombian educational system, an equitable system but simultaneously of high quality. Some entities were created to review the quality of the superior education and that has brought improvements in the higher education institutions. As a system just implemented still has some weaknesses that must be corrected to assure that the objectives of the Education Ministry are fulfilled. Another great improvement in the educational system is the change to the education by cycles that is somehow solving one of the greatest weaknesses in the system: little human capital is being educated as technicians and technologists failing to take advantage of the immense Colombian population, and that
given their economic condition, plus the country violence, among other things, must leave
the educational system. With the cycles the intent is that those that could not continue with
their education can re-enter the system later on. These measures are the base to allow the
industry to have highly qualified employees as required, as it is the case of software, in
terms of the human capital.

The following section attempts to identify the major weaknesses still present in Colombia’s
higher education system. If these weaknesses are not soon addressed, Colombia will
continue to witness low-quality institutions, unemployment of graduates, and loss of high
quality scholars to other international institutions, and low public and employer confidence
in the quality of education being provided.

In the knowledge-based, global economy, Colombia’s higher education system still
presents aspects of concern related to its quality and accessibility. Despite the
improvements stimulated by the Accreditation System in Colombia, CNA (Spanish
acronym) the quality of education and its relevance has declined. By the same token, the
system still provides unequal opportunities: “The doubling of enrollment in the mid-1990s
occurred primarily in the upper two quintiles, where coverage in 1997 reached 43 percent
and 19 percent, respectively”.

According with a study done by MEN, World Bank, and the National Planning Department
the major weaknesses in Colombia’s higher education system, which will be stated in this
section in five categories are:

1. **Asymmetric Information**

Adequate development and management of information systems has been a concern of the
Colombian National Ministry of Education, MEN (Spanish acronym), therefore it proposed
some reforms such as the Labor Market Observatory; and improvements were carried out to
the National System for Higher Education Information, SNIES (Spanish acronym),
however an inefficient condition of asymmetric information in the education market still
prevails.
An inefficient information system about the education market has a negative impact on the MEN itself, making it more difficult the monitoring and quality control; on the students, not providing reliable information to allow them properly choose the schools according to their needs and expectations; to the labor market, specially in the hiring process due to the lack of suitable information about quality and level of skills expected from the prospects according to the schools attended.

To attain efficiency in the information system the asymmetric conditions must be reduced. Some of the hindering factors to achieve improved information systems are insufficient financial and staff resources; as well as incomplete and inaccurate reporting.
2. Insufficient Incentives

Although education is to be considered one of the priorities in any country allocation of resources, reality shows that it is not always the case, and Colombia is no exception. The World Bank estimated that in Colombia in 2003, spending on higher education equals approximately 4% of GNP or 15% of the total education budget. Most of the financial assistance is allocated to public universities, situation that facilitates the Government the exercise of controls especially in terms of quality assurance. On the other hand, private sector institutions, which enroll a large number of students in the country, receive a very limited amount of funds which goes in detriment of the program quality.

To provide public grants and funds to higher education institutions, for projects considered of national interest, the Government has assigned this responsibility to The Colombian Institute for the Development of Science and Technology, Colciencias (Spanish acronym), a government agency, committed to science and technology development. Despite these efforts, the incentives, financial or non-financial are very precarious for higher education either public or private.

3. Still-Developing Culture of Evaluation

The higher education system accreditation in Colombia has had a positive effect on the institutions following this process in terms of quality improvement; however, many institutions have not yet committed to get the accreditation. And the quality and relevance of education seems to have declined in recent years.

A comprehensive and well structured evaluation and feedback system is fundamental for quality assurance in the educational outcomes. In Colombia, some tools and processes to facilitate institutional self-evaluations are in place. For instance, administrators must conduct self-evaluations and submit the information to CNA and to the MEN for their review. Further information is provided by ECAES scores which shed some light on areas
and programs needing improvement. Even though the information gathered through these compulsory processes is important, the need to continue promoting and developing a culture of self-evaluation as key element for improvement prevails.

4. Lack of Internal and External Evaluation of Higher Education Control Organizations and Ensure Clear and Progressive Governance

According to the restructuring of government institutions in 2003, MEN was organized as both the center of policymaking and of the evaluation mechanisms of the implementation and quality of those policies. Having both responsibilities, the checks and balances within the educational system are reduced, and so are the pressures to evaluate the policies themselves and their implementation. In this same reform, the accreditation activities were concentrated within CNA.

Although the National Planning Department, DNP (Spanish acronym), the National Association of Universities, ASCUN (Spanish acronym), and higher education universities serve as checks and balances, the policies of MEN and its associated higher education organizations seems to face little serious criticism. Furthermore, the division of responsibilities among regulatory bodies is not clear and precise, making it difficult to establish and interagency relationship and collaboration when promoting or drafting new initiatives. For instance, in the area of quality enhancement and assurance there are more than six regulatory bodies involved. Hence, the vast array of knowledge gathered by government and its regulatory agencies about the sector’s strengths and weaknesses, does not conduct to implemented changes and reforms.

5. Lack of Articulation between the Higher Education System and the Rest of Colombian Education System

Despite the efforts made, currently the Colombian education system presents great disparities in the access to education. And this situation is worsening when the central
government budget cuts are made according to performance and results. The few institutions with high rankings in performance, do not necessarily embrace the heterogeneous cultures of the Colombian people, widening the educational gap and the inequality.

Formal education, as regulated by Law 115, is divided into the following levels: (a) preschool, 3 years; (b) basic, 9 years divided into basic-primary (Grades 1–5) and basic-secondary (Grades 6–9); and (c) intermediate (Grades 10–11). Higher education is regulated by Law 30; and scientific and technological activities and research are regulated by the S&T Law 29/99. Higher education is structured into: (a) universities: with undergraduate and graduate programs (the latter including diploma courses, masters degrees, doctorates and post-doctorates); (b) university institutions or schools of technology: with programs of instruction in occupations, professions and disciplines, and diploma courses; and (c) technical-professional institutions which provide operational-instrumental instruction and diploma courses.

The Colombian educational system is currently regulated by several different and separate pieces of legislation creating disarticulation between the different processes and levels. The management of education (finances and administration) is regulated by the Decentralization Law 60; and the pedagogical aspects are regulated by the Education Law 115. Basic-intermediate education is governed by Law 60, whereas higher education is governed by Law 30. According to this new body of legislation, Departments and Municipalities are prevented from intervening regarding education policies, decisions or methodologies, mainly in higher education. Additionally, there is a principle of university autonomy, furthering their distance and isolation from the community at large.

According to the literature reviewed, there are some problems common to the entire education sector, among those are: a) no integrated planning for the sector as a whole, creating a gap between the basic content of the early and later years of education; b) MEN and the Departments have paid more attention to basic and intermediate education than to higher education; and c) in the scheme of Law 30/92, for higher education budgets, regional
universities plan the spending; and central government provides the funds. This division causes constant problems and friction between regional and central administrations.

Added to the facts mentioned above, the situation gets worse when the higher education system is faced with the low academic skills of students enrolling at this level. This situation produces a high number of dropouts and repeaters in higher education, or mediocre graduates. At the same time, the responsibility is shared since it is the higher education system that produces most teachers for basic and intermediate education. Consequently, the education system should be considered as a whole in order to improve the quality of its end results.

To conclude, in the last decades, Colombian’s higher education system has been experiencing changes in government policies and in institutional practices and processes within the framework of adopting innovations conducive to education improvement. As mentioned above, by addressing problems of information collection and exchange; providing financial and non-financial incentives for academic improvement; developing a culture of accountability and evaluation and self-evaluation; fostering inter and intra institutional collaborative work; and articulating the system as a whole, the quality of the education offered by the institutions will highly improve, thus fulfilling societal expectations and achieving the purpose of knowledge production, transferring and appropriation.

**Information Technology Training**

Another great weakness that exists is that the educational cycles, that are, as explained before, a very good idea to enlarge the human capital for the software industry in the low levels of the pyramid (technicians and technologists), have not been promoted completely by the national Government; the public doesn't know of them and therefore has not been able to take advantage of them in their entirety. In addition, the technological educational institutions have not modified their business model to capture that new potential market which is big.
Due to lack of people at this level, technical and technological people, many medium level researchers or project managers also have to deal with programming, which could have been more easily done by junior software workers giving to the products an extra cost.

On the other hand, an evaluation of several enterprises revealed that the software industry has strong technological abilities, but possess limited managerial and entrepreneurial skills. Acquisition of adequate managerial skills has enabled them to deliver spin-offs of their business.[40]

To conclude compared to major software countries such as the USA, Japan, Ireland and India, Colombia lacks versatile talent with both technological and managerial ability. However, the striking difference is that Colombia is also short of human resources to provide customer services, commercial planning, programming, etc at the bottom level. Consequently, this could hinder the effective quality improvement and efficient allocation of labor, time and cost.

In addition, the high demand for human assets that may exists after the implantation of the strategies in the government won’t match the future supply. The number of people working in this industry is less than the shortage of the future supply. [41]

Therefore, enhancement of software education and increasing the supply of human resources has become a crucial issue. Such short supply must have caught the attention of government and firms to strengthen the human resources in Colombia. The major problem is that Colombia heavily relies on universities as a source of supply and pays limited attention to other supply channels, such as training institutions, vocational training,
polytechnic schools, and talent from overseas. Such comparison indicates that non-
university institutions need to be motivated to play a much bigger role.

4.2.2. Infrastructure

The internet penetration in Colombia is very low but the Mobil telephony is very high.

4.2.3. Innovation

With regard to the “culture of innovation” the following weaknesses were identified: (a) the
importance of innovation to increase competitiveness has not been adequately recognized at
the entrepreneurial, policy and academic levels; (b) even on institutional aspects related to
R&D and innovation and the national innovation system, adequate attention has not been
given to budgetary decisions. Besides, Colombia has a low and declining rate of investment
in science and technology, and (c) the need to revise the legal framework. [40]

Other weaknesses identified were:

- Lack of interaction with universities;
- Insufficient coordination between the Centres of Technology Development;
- Confusion between strategies, productive chains, clusters and others;
- Lack of long-term programs;
- Insufficient coordination at the government level; and
- Inadequate indicators. [40]

Carlsson, et al, (2002) argue that participants in an innovative system must have the
“capabilities” to generate, diffuse and utilize technologies that have economic value.”

They identify four key capabilities: (1) selection: the ability to make innovative choices of
markets, products, technologies and organizational structure; to engage in entrepreneurial
activity; to select key personnel and acquire key resources including new competences. (2)
Organizational skills. (3) Functional skills. (4) Learning: to learn from successes and
failures, read market signals and to diffuse technology through the system.
4.3. **Demand**

The finance sector is the major client of the software companies in Colombia today; it is a well developed sector of the domestic economy whose business model is largely based in e-business. This sector of the Colombian economy is highly dependent on IT and is the most advanced in the use of information and communication technologies.

The public sector is the other big client of the software companies. The Connective Agenda Program (Agenda de Conectividad) has worked with the software domestic companies to enlarge the e-Government coverage. Colombia in e-Government is very advanced, but a lot of improvement it is still needed. The integration through information systems of each one of the National Government's entities is lacking. This type of integration would facilitate the presentation of a united front before the citizens; and the information would be completely centralized, so that each institution could access the government's information as a whole, reducing significantly the processes and making both the Government sector as well as the domestic productive sector more efficient. In this area there are quite a few things to do in Colombia and the Colombian software companies will play a very participative role in this process.

The financial sector as well as the Government sector have entered in the world of the information technology and have seen the big advantages of using IT. But another client, even without exploring, is the Colombian small and medium companies (SME); they seem to have not understood yet the importance that IT has for the productivity improvement in their businesses. 95% of the companies in Colombia are small and medium and the use of the information technology by them is still very low. The governance of IT in these companies is empiric and they don't have a well defined methodology for the handling of IT Governance.

In Colombia a great percentage of SMEs are using PCs and Internet but the use of the ICT to look for information via Internet and for e-mail is still limited. 8% of the companies...
have an extranet and 40% has an intranet. In a survey about the use of intranet and extranet, Colombia is almost the last among the countries that answered it (Mexico, Colombia, Chile, Costa Rica, Venezuela).

In terms of type of connection to internet in the SMEs in Colombia, 54% of the companies use ISDN and 38% use modem. Colombia is the country with the highest use of modem in the SMEs according to the survey. On the other hand, the use of wireless connection in Colombia is very low: only 2% of the companies use a wireless system to connect to internet.

Concerning the main purpose of internet use in Colombia, companies are using internet to look for information, for e-mail, and many of them for communicating with the Government and for financial services. No market monitoring or employment information is widely conducted via internet.

In reference to online purchases and sales, 27% of the companies in Colombia are buying via internet; (38%) are buying using a virtual marketplace and (67%) using third-party websites. For sales, only 2% are selling their products via internet and they have their own website or use a third-party website.

**Perception of ICT importance.** Specifically in Colombia the SMEs are aware of the importance of internet and they want to implement new information services in order to increase their productivity. The most important benefits that SMEs in Colombia perceive in the use of ICT are: improvement of their business processes and enhancement of client relationship. They do not see any other benefits in their business structure, supplier relationship or product offer.

**Barriers to internet use.** Some of the major concerns for the SMEs in Colombia about internet use are: safety, development costs, wasted time, communication costs and the lack of client/supplier readiness. In general, SMEs are not aware about the complexity of the internet technology and the slow connections can be a great barrier. This situation happens
because the development of the extranet and intranet in SMEs in Colombia is limited. At the same time, they do not seem to perceive the big barriers that this underdevelopment can bring about.

Among the barriers that SMEs in Colombia see to implement ICT are: high cost, software life cycle (includes development and maintenance), lack of skilled staff, ICT offer doesn’t meet demand, and lack of client/supplier readiness. Barriers considered as the least important are: difficult staff recruitment and staff reluctance. However, the latter would not be a problem since in Colombia people have a positive attitude towards work and are hard workers.

**Needs concerning ICT and internet enhancement.** The most relevant needs related to ICT enhancement as perceived by the SMEs in Colombia are: staff training, better hardware and software, improved connectivity, product compatibility, and SMEs’ specific products. On the other hand, the least important needs are: access to credit and consultancy.

### 4.4. Context for firm Strategy and Rivalry

Even though the software sector in Colombia has been growing in the last years it is still very weak. The software companies are not very strong and neither are they oriented to export their products or services (only the 9% of the total sales are given by the exports). Also, no many of them are certified with the needed standards of quality to produce good services or products. Colombia may be more aware of the implications that the Free Trade Agreement (TLC) can bring to the software industry. The local software industry may be strength to survive with the competition that is coming in and to take advantage of the capabilities that have in the services sector.

According to professor Cusumano’s theory, the software industry is generating more revenues for the services than for the product. Colombia is presenting this tendency and the
value represented by the sector of software services is 46% while the products only generate 16% of revenue. This shows that the companies in Colombia today don't have mature products to put in the market and that on the other hand, they are offering services that give value to the clients.

The Colombian companies are not certified in the standards of quality that this type of industry requires: just 1 is certified as CMM5.

The Colombian culture in general is more competitive than cooperative; it is not easy for the Colombian industry to understand that unity gives strength and that joining efforts knowledge can be shared, and also the difficulties can be overcome more easily. Although the Government has made efforts to increase the cooperation among the industrial sector there is not evidence of the success of these efforts. This factor is very important for the development of the of the software cluster, since the culture of the cluster is to unite efforts and to work all in the same direction.

4.5. Related and supporting industries

The biggest and most important hardware and software companies in the world have businesses in Colombia offering hardware, software, training, consultancy, etc. Although these multinational companies have presence in Colombia they work mainly as a sales force. Some of them establish alliances with Colombian software companies, for instance Microsoft made an alliance with Intergrupo to perform the sale work, training, post-sale service, generation of prototypes, etc.

These multinationals don't develop software neither they produce hardware in Colombia, that is to say they don't have the production chain established in Colombia. They behave as suppliers of the software industry but they are not companies that compete with the local industries. This happens partly because Colombia doesn't have a solid Intellectual Property Law, and also because Colombia doesn't have the necessary international standing in software production as nowadays have India, Ireland, Israel, etc.[23]
4.6. **Foreign Direct Investment (Multinationals and Transnational)**

With the signature of the Free Trade Agreement (*TLC*) Colombia will have its economy liberated thus allowing the foreign-owned investment to increase. In the last years the foreign-owned investment has grown in a significant way bringing economic growth to the country.

The Intellectual Property Law in Colombia is still very weak. A good Intellectual Property Law should be generated to foster trust in the multinationals and transnationals, promoting their investment in the country to produce goods. The ‘piracy’ should also be pursued and drastically sanctioned by the Colombian State, since it deteriorates the trust of the multinationals in the software sector.

The good news is that with the signature of the *TLC* Colombia is committed to improving its Intellectual Property Law, since this issue is seen by USA as an impediment for the treaty signature, therefore Colombia has this issue as a State priority.

4.7. **Culture**

Colombia is a country with a great diversity in fauna, flora, and also in its people. It is a country that has suffered an armed conflict for more than 40 years, and that has had to learn how to enjoy life in a different way and to surpass problems to be able to survive. It is for that reason that we find Colombian talented, creative people and with unimaginable ideas in other countries and contexts, and examples of this same are plentiful in the country. To give a specific example: the invention of the first synthetic vaccine for the Malaria was done by a small research group led by the scientist Patarroyo; unfortunately this study group had to end for lack of economic resources. It is also a cooperative culture in the face
of big tragedies, in Colombia, solidarity campaigns are very frequently a success; and can congregate all the sectors to help the needy when required.

But also the history of violence has left some havoc in the Colombian culture. Colombia is an intolerant country, the difference of ideas, of ways of being and of proceeding is not supported, this has worsened the armed conflict and it has not allowed reaching agreements where the citizenship is the main beneficiary.

Colombia also presents wide regional differences in terms of attitude towards innovation and development. We find that Departments like Antioquia, Valle and Santander are the domestic regions with more venturesome spirit while the other regions are more fearful to take risks and to undertake new enterprises.

Colombia is like two countries in one: Colombia of the high socioeconomic level where the information technology is very good, and the youths have access to educational institutions of high quality; and the Colombia of the lower socioeconomic levels where some are not even able to satisfy their basic needs and where the public educational institutions are of bad quality, making it more difficult the access to the labor world.

Another of the characteristics of the Colombian culture is the culture of the blaming. Team work is difficult to achieve and if something comes out bad there is always someone else to receive the blame. Unfortunately in business the concept of win - win has not been understood properly, hence behaviors of taking advantage of others, and negotiating in the way that there is a winner and a loser is very common. Additionally there is not a culture that helps the managers to learn of their mistakes; the one that errs is marked and it is very difficult to regain the lost leadership. This diagnosis is made based on my life in Colombia and on what I have learned of the international context.
4.8. **SWOT Analysis**

The factors that advantage or disadvantage the software industry in Colombia.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Government</strong></td>
<td>• Liberalized economy.</td>
<td>• Time evolvement is needed for the policies to have effect</td>
</tr>
<tr>
<td></td>
<td>• High fund</td>
<td>• Lack of incentives to attract overseas talent, esp. overseas Colombian talent resulting in no improvement to the brain drain problem.</td>
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<tr>
<td></td>
<td></td>
<td>• Lack of governmental leadership in motivating the software industry and in general the industry of information technologies.</td>
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<tr>
<td></td>
<td></td>
<td>• Lack of regulation of the e-business in Colombia (electronic signature, e-commerce, etc.)</td>
</tr>
<tr>
<td><strong>Factor endowments</strong></td>
<td>• Low cost labor compared with Latin America</td>
<td>• Unbalanced high-medium-low levels of talent distribution</td>
</tr>
<tr>
<td></td>
<td>• High availability of medium-level talent</td>
<td>• Human labor with limited managerial and entrepreneurial skills</td>
</tr>
<tr>
<td></td>
<td>• Firm concentration in large cities</td>
<td>• Wide gap between high demand and low supply for talent</td>
</tr>
<tr>
<td></td>
<td>• High availability of talent to IT Services</td>
<td>• High cost labor to compete with India and China</td>
</tr>
<tr>
<td></td>
<td>• Hard working human capital.</td>
<td>• High costs in telecommunications</td>
</tr>
<tr>
<td></td>
<td>• Strategic location of Colombia; close to USA and the middle between South America and Central America.</td>
<td>• Lower penetration of the broadband internet.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bad sources of financing to the SME (most of the software companies)</td>
</tr>
</tbody>
</table>
| Corporate structure, strategy and rivalry | Dynamic rivalry of 800 firms  
Language advantage and knowledge on the local systems to develop software according with the needs of the users.  
Local networks  
Potential to develop in services.  
Leader in Latin America providing IT services.  
Increase of the IT services companies. | Most firms need financial sourcing  
Low incentive to develop R&D because of: piracy, finance, customer demand for integrated supply: software, services, and integration and the brand preferences of consumers  
Brain drain and employee mobility.  
Low exports 9%  
There are no mature software products to export. |
| Related and supporting industries | Competitive computer industry amongst multinationals | Multinationals are established in Colombia for sales purposes instead of developing products in the country. |
| Demand | High expectations from consumers for services — applicability, prices, and after sale  
Recent policy of stimulation to personal computer market.  
High volume of demand in specific niches such as Miami.  
Huge market (SME) without exploration. | Limited demand in terms of product sophistication  
Low commitment of the government to encourage the ICT in SME. |
| FDI | Pressure from developed countries to improve IP environment  
International organizations accelerate the process for the standardization of software protection  
High Foreign Direct Investment in the last 3 years. | The overall notoriety of IP piracy 54%  
Lack of exchange activities for knowledge and information with foreign countries |
| Culture | Hard working.  
Innovative people to bypass the underdevelopment.  
High diversity in ideas, and thoughts | Blaming  
Win-Lose  
No cooperative, more competitive  
Violence |
<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The Ministry of Communications is highly committed with the ICT sector.</td>
<td>• Possible not successful finalization of the TLC with USA.</td>
</tr>
<tr>
<td>• Available economic resources to develop the sector.</td>
<td>• Possible not successful termination of the war against the violence and the drug traffic, in detriment of the trust in the country as well as the increment of the FDI.</td>
</tr>
<tr>
<td>• In the neighboring country of Venezuela many qualified people are emigrating due to the political situation.</td>
<td>• The violence in Colombia is causing highly qualified people to emigrate.</td>
</tr>
<tr>
<td>• The telecommunications operators in Colombia want to attract the bandwidth market and are in high competition, this will help lowering the prices.</td>
<td>• The services of call centers and of data centers are easily commoditized</td>
</tr>
<tr>
<td>• The countries in the Latin American Pacific coast have a high seismic risk, reason why they look for data and processes centers in countries with lower seismic threats. Colombia has lower seismic threat than many countries in Latin America.</td>
<td>• High costs in the communications in Colombia.</td>
</tr>
<tr>
<td>• The Ministry of Trade is making a study to determine in which industry areas Colombia owes to specialize. The software industry should specialize in this type of industries that will be highly supported by the national government and that will need the total ICT support; there a great software, hardware and communications demand will open up.</td>
<td>• This study will take time and the measures even more</td>
</tr>
<tr>
<td>• Awareness of the importance of the ICT in the Colombian industry is beginning to appear</td>
<td>• Company managers lack adequate management education making the awareness of the ICT importance more difficult to be assimilated completely.</td>
</tr>
<tr>
<td></td>
<td>• Colombia is underdeveloped in this area in comparison with its peer Latin American countries.</td>
</tr>
</tbody>
</table>
5. System Dynamics in the software industry
There are key factors for the success in the software companies; the diagram presented has the system dynamics of the software industry.

5.1. Word of Mouth effect. (Loop R1)

The R1 loop, word of mouth happens when the companies are doing well and the clients are very satisfied with their services; the clients can recommend the company to their suppliers, to their clients and so on. In this way if the word of mouth is favorable the sales increase and the installed base of the company can be greater and greater. But if the word of mouth is not favorable the sale decrease and if the sales decrease and the installed base decreases and the word of mouth is not favorable, and so on.

The favorable word of mouth depends on: a) the quality of the software that the companies are providing; b) the new features that they can include in the software products in order to improve the business value that the clients will obtain with the software; c) the software
delivery time to the clients set by the company; d) the quality of the customer service; e) strong marketing campaigns; f) advertisement; g) the sales process; and h) Customer Service Sensation.

5.2. **Training effect in Human Labor (Loop R2)**

Given that the software industry is very dependable on the human capital, the training of the human capital is very important; this is the base in this industry. According with the reinforcing loop 2 “Training effect”, the attractiveness of the product depends on the talented human capital, and the talented human capital depends on the training that they had received. If people are well trained not just in software development but in the business behind the software, they can produce good software quality. They can also work in R&D in order to produce new features in the software that provide a competitive advantage to their clients.

5.3. **Economies of scale (Loop B3)**

The balancing loop 3 shows the effect of economies of scale. The economies of scale diminish the unit cost, then the price could be cut and the attractiveness of the product will increase; if the product is very attractive the industry demand increases, and the sales are incremented producing more cash flow and more revenue.

In the software industry, economies of scale do not derive from production capacity but rather from the size of the installed user base, as software is made of electrical pulses that can be downloaded by the users, at a relatively small cost to the producer. This means that the size of the installed user base replaces production capacity in classical economic terms.

Thus, just like Microsoft used its economies of scale (i.e. its installed user base) as part of a copy-and-co-opt strategy to dominate the desktop, Google has shifted from a strategy of genuine innovation, which is expensive and risky, to a lower-risk copy-and-co-opt strategy.
in which it uses its economies of scale (i.e. its installed user base) to eliminate competition and dominate the Web.

5.4. R&D (Loop R4)

Invest in product differentiation is by far the best strategy to follow. The development of entirely new products is a core engine of growth for many firms. The greater their revenue of a firm, the larger and more effective the new product development effort can be. New products create new demand, boosting revenue and increasing investment in new product development still more. As firms grow, they can invest more in activities that improve the attractiveness of their products to customers. Most products can be differentiated from those of competitors through enhanced features, functionality, design, quality, reliability and suitability to the current and latent needs of customers.
6. Strategy

According to the SWOT analysis made in the diagnosis section and the dynamic system of the software industries, Colombia can generate short and long term policies.

**Short term policies:**
- Colombia should be focused, in the short term, in the services sector: data centers and call centers that do not require large quantity of human talent; with its current talent the country could cover the demand for the time being, thus it would take advantage of its strengths in the services sector and also attract the growing demand of these services.
- After the study advanced by the Ministry of Foreign Commerce on the industry type that Colombia should be focused on, the software sector should specialize in the type of products that the industries promoted by the Government require for their development. The Government then, should stimulate the software companies to develop the products directed particularly for this type of industries.
- Attract foreign human talent to increase the human capital.
- Establish an aggressive policy of training to increase the levels of human capital especially in the lower levels of the human capital pyramid, as well as in project management and in certifications of the necessary companies for the software (CMM, ISO) export.
- Look for specific market niches where Colombia has links and can take advantage of its current capabilities.
- Strengthen the intellectual property laws.
- Creation of laws that regulate the e-commerce.
- Tax incentives.
- Ensure that the prices of bandwidth decrease to levels that allow companies to use them.
- Establish strong ties between the government, academia and industry in order to find solutions with all the parts involved.

**Long term policies:**
- Improvement of the Colombian Educational System.
Government campaign for a new Colombian culture, more cooperative, less blaming, win-win strategies that favor the union among the companies of the cluster and the competitiveness of the nation.

Increase of Word of Mouth.

English as second language in primary and secondary schools in Colombia.

Increase use of ICT in the EMS.

6.1. Governance of the strategy

To assure the success the Government or the charged organization must systematize critical processes and analytical tools in order to maintain consistency and enhance effectiveness. The methodology must include:

- A detailed manual and workflow diagrams to guide implementation teams through the analytical and change management process.
- A robust project management tool.
- A community website that facilitates interaction between cluster agents and automates critical communication functions (invitation to events, file-sharing, etc.)...

It is also important that the National Government entity that is implementing the Information and Technology policy have the total Presidential support since most of the decisions are related to other Ministries such as Education, Trade and Commerce, Justice, and Foreign Relations, etc. This is critical for the success of the policy to be implemented.

6.2. Word of Mouth effect

Multinational and big software companies have always been strong at leveraging their customer evangelists, and they have translated those relationships online. Apple is among the more brilliant examples and its evangelism programs have been going on for over 20 years. A lot of the most robust user groups are run by the companies themselves and the
software makers also typically have employees participating in external support forums as well. Macromedia, Sun, Microsoft most of the big companies are savvy in that regard.

The Colombian government should be a decisive factor in increasing favorable Word of Mouth, showing to the whole world that is committed with the sector and publicizing the results obtained. At each opportunity the President of the Republic should reiterate that one of its government flags is the impulse of the information and communication technologies in the country; this way the Government becomes a more important entity in the public relations sector, while the dynamics of the sector reach the necessary strength to walk alone.

The Government should also motivate companies to attend international events where the achievements of the local companies could be showcased and to participate in the international educational events of the software sector.

At managerial level it is very important that companies have good Marketing Campaigns, that they participate in the main industry events, and that they start creating business networking. For this it is very important that the software companies have professionals with MBAs and experts in successful business development. One of the weaknesses that the diagnosis of the software industry in Colombia showed is that the majority of software companies are managed by systems engineers rather than by professionals with MBAs, thus causing inefficiencies in their processes and services (sales, marketing, customer service, etc.).
6.3. Training effect in Human Labor

6.3.1. Improvement in the education system in Colombia [43]

Asymmetric Information among the institutions.

The effort made by Colombia’s higher education government institutions in balancing the condition of asymmetric information present in the higher education market should be recognized.

For instance, the new SNIES’s main purpose is to solicit information from institutions and provide it to the public in a complete and understandable manner. The electronic information reporting system, AKADEMIA, will stream-line the process for institutions and will facilitate the information flow between MEN and higher education institutions. These two systems are still being improved and developed, and it is important to have them in full use as soon as possible.

The Labor Market Observatory, as envisioned, will also be an invaluable source of information for policymakers, higher education institutions, students, and future employers. At the same time the information gathered about post-graduation employment will provide valuable feedback to help higher education institutions in the process of relevance and quality control, and curriculum design.

SNIES and the Labor Market Observatory must rely on the information provided by all higher education institutions; therefore, providing it in a complete and timely manner must be strongly enforced and sanctioned by MEN. However, not all the institutions comply with the requirements, and sanctions and penalties are not imposed. It is imperative to design a clear and graduated system of sanctions, penalties and monitoring to warrant reporting in an accurate and timely fashion.
The data for public information would be more useful if it provides some technical analysis such as comparison and ranking among programs and institutions, normalizing ECAES (Spanish acronym for Higher Education Quality Exams) scores, grading performance levels, and explaining the significance of the quality indicators. Most of the information provided to the public relies mainly on input indicators. Even though indicators such as number of students admitted and the student/professor ratio can imply quality of educational experiences, MEN and higher education institutions should more heavily emphasize output and outcome quality measures. These indicators, such as the quality of post-graduate employment experience, acquired academic knowledge as measured by exam results, level of innovation of graduates, or further successful academic publications may more accurately represent the quality of institutions.

Furthermore, strengthening the direct information link between students and higher education institutions is of great importance. Several media could be used for this purpose, and the Government should encourage and support their use. For instance, Institutional web pages could be a good informational resource and mandatory updates should be required. Information could also be published in periodicals, magazines and newspapers. The involvement of the private sector in the creation of a system of information exchange has proven very successful in countries like the United States. Magazines such as U.S. News and World Reports, Peterson’s, and The Princeton Review -private services- are well-respected as sources of reliable information.

**Increase the incentives to improve the quality of the Institutions.**

The practice of providing financial incentives to higher education systems has proven effective in several countries such as in the United States, and even in those that have limited resources such as Chile. The incentives offered could be financial and non-financial, always with the primary purpose of improving quality and relevance, as well as coverage and equity.
A policy for promoting the commitment of institutions toward seeking higher levels of accreditation could be through government institutions offering financial incentives to students who want to enroll in high quality schools. To prevent the widening of socioeconomic educational gaps, and to promote equity and coverage, ICETEX loans and/or government grants and financial aid could be provided to institutions that enroll high-scoring ICFES (Spanish acronym for Colombian Institute to Promote Higher Education) students from underprivileged economic classes.

Furthermore, making the allocation of grants and public funds to higher education institutions contingent on accreditation, either being accredited or in the process, will motivate smaller institutions to academic improvement to fulfill the accreditation requirements. Some efforts in this respect are already being made; The World Bank, in a project that offers financial aid to Colombian students, requires direction of funds towards students with less financial resources with the priority to be given to accredited programs.

To promote relevance and scientific and technological development, financial incentives can be offered to institutions, both public and private, for research projects or studies of national or regional benefit and importance. Additionally, strengthening ties and participation of educational institutions with private sector organizations is a priority; therefore, financial incentives and/or opportunities for collaboration with the private sector could be offered to schools where their students advance innovations, obtain high quality employment, or are outstanding entrepreneurs.

Based on the information gathered by the MEN, various non-financial incentives could be offered to public and private institutions to promote quality. The focus could be on improvements and outcomes which will offer institutions an incentive to better qualify their services. Such incentives could include: creating a positive public image by publicizing and/or rewarding programs or institutions that have achieved outstanding improvements in key areas of knowledge; that have greatly improved in ECAES results that have made research publications, or any other achievement of importance.
Strong culture of evaluation

Higher education accreditation in Colombia includes Graded Registration, Previous Accreditation, High Quality Accreditation, and Accreditation of Graduate Programs which constitute a system of evaluation and self-evaluation. Graded Registration is designed to warrant a basic level of quality and institutions can remain operating at this level if desired.

High Quality Accreditation requires a more thorough and rigorous self-evaluation process, and institutions should be motivated to participate in it. CNA and MEN could use different type of incentives to acquire accreditation such as limiting participation in public bids and projects only to those institutions already with a High Quality Accreditation status or undergoing this process. Even though there is a greater public awareness about accreditation and the competition for enrollment has increased, many schools still do not considered it to be cost-effective; therefore, financial incentives should be significant enough to create commitment towards accreditation.

In the event that higher education institutions cannot be persuaded to complete High Quality Accreditation, mandatory ECAES may provide additional tools for self-evaluation at little or no extra cost. Even though in Brazil improvements in teacher quality and the creation of a culture of accountability could be attributed to the negative publicity associated with poor Provão scores, a system of evaluation and self-evaluation in Brazilian higher education institutions have produced positive results.

CNA, a government agency, is the only accrediting entity in Colombia, and offers accreditation both to programs and institutions. Its task is major, and it is already overwhelmed by accrediting duties and responsibilities. Therefore, to foster a more complete culture of evaluation and accountability, it is reasonable and urgent to create a private sector accrediting body, efficiently and rigorously monitored by the government,
until it begins to gain the public trust. This way CNA, with additional financial and staff resources, could possibly diversify its accrediting process, offering several areas of accreditation for the four official types of educational institutions. It would be worth reviewing the American system of accreditation, which is comprised of several accreditation agencies specialized in particular areas of knowledge.

As stated previously, in Colombia many higher education institutions remain at the legally acceptable minimum without undertaking higher accreditation levels, possibly because they could never fulfill the requirements to obtain High Quality Accreditation. A mid-level or quality improvement accreditation would be a good possibility for this type of institution, and could lead them to allocate funds and staff resources to this important evaluation and self-evaluation process.

Besides developing a culture of evaluation and accountability among Colombian higher education institutions, an effort to strengthen their awareness about their role as providers of a public good should be made. They should recognize that education has a fundamental role in furthering the development of science and technology and of cultural activities.

**Ensure clear and progressive governance**
Articulate the system as a whole instead of many systems that do not speak each other.

The drafting, designing and implementation of higher education policies should be the responsibility of the existing government agencies, which should create a flexible and effective institutional arrangement. This regulatory body should include representative of the following agencies: the Ministry of Education (MEN), the Colombian Institute to Promote Higher Education (ICFES), the Colombian Institute for Educational Credit and for Technical Studies Abroad (ICETEX), the Colombian Institute for the Development of Science and Technology (COLCIENCIAS), the Colombian National Accreditation (CNA), National Commission for Masters and Doctorate (CNDM), Colombia Institute for the Higher Education (CESU), the National Department of Planning (DNP), and a Consultative Committee.
To facilitate inter- and intra-institutional coordination and efficiency, and to prevent inconsistencies and duplication of policies, the functions and lines of authority of each of the participating agencies and institutions should be clearly defined and articulated. The MEN should provide a coherent framework for designing policy to make the collaborative work more efficient. It is also important to have continuous participation and feedback from academic experts and administrators as a way of experiential illustration to the policymakers.

Non-profit organizations could be an excellent resource to ensure transparency, efficiency and integrity of the educational policies and the accreditation process. It will also serve as an independent, private check and balance system. In Colombia the role played by non-profit organizations in higher education is limited so far, but nonetheless worth considering for the allocation of funds and resources for its development.

It is of great importance to ensure the highest transparency in the accreditation process in order to maintain and strengthen its credibility and accountability about the evaluation results. Currently, CNA policies prohibit public release of evaluation results. Allowing the public to be aware of the specific results, statistics and observations of the different institutions participating in the accreditation process will provide transparency and prevent political or any other type of intervention.

Another situation that should be carefully studied by the policymakers and regulating bodies is the reduced financing options offered to the students. This lack of financial aid contributed to a 28 percent decline of new enrollments into private higher education since 1997, resulting in more than 150,000 unfilled seats in private institutions. Yet, given the current student credit conditions, ICETEX fulfills every single one of the 12,000 received eligible applications, which accounts for less than 5 percent of the student population. Similarly, the public system does not take advantage of existing financial instruments to foster efficiency. Seats in public universities cost 29 percent more than in private universities.

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The most critical bottleneck in the higher education system is the post-graduate programs. An aging professoriate has to be replaced by qualified professors and lecturers. Currently, only 2 percent of lecturers have doctoral degrees and less than 14 percent have an advanced degree. Additionally, the country’s competitiveness and innovation possibilities are at stake. Colombian companies cite lack of human capital as the most important obstacle to innovation. Colombia’s National Innovation System suffers substantially from lack of advanced research skills.

6.3.2. Information and Communication Technology Training

The MEN must play a facilitating role in ensuring an adequate supply of the technical labor force and of its quality. Ministry policies must encourage the creation of private engineering colleges and industry IT-training institutions and also, to monitor the IT training institutions, the Government must encourage the creation of an accreditation system run by professional societies.

Additionally, the promotion of a master of computer applications (MCA) degree in many universities is aimed at producing graduates with the combination of technical and management skills required for the expanding IT industry. While the pool of MCA graduates becomes a primary source of recruitment, the programs tend to be stronger in technical rather than management skills.

6.3.3. English as second language

Colombia has to make an effort to educate people in English as a second language since the English language is the most popular language in the business environment in the world. In order to be able to communicate with clients in any part of the world, it is necessary to have
basic fluency in English, both written and conversational. The private and public education in Colombia must place greater emphasis on teaching English (if not bilingual education) to meet this need. In the short-term the Government, through the ICETEX, must design a scholarship program for people who want to learn English abroad.

6.3.4. Selective immigration from Venezuela

Another opportunity that Colombia currently has is to take advantage of the situation in its neighboring country, Venezuela; there are many professionals there who are well educated in business and in software who want to leave their country because of the political situation. Colombia can selectively receive the best people from Venezuela whereas the Colombian education system can meet the demand.[44]

6.3.5. Training aligned with the needs of the industry

The education in the country must be aligned with industry needs; therefore, the Government must be in permanent contact with universities and the private sector to provide and receive feedback, and to work together on providing training in Business Administration and in Software, and meeting the needs that companies have at a particular moment.

6.3.6. Training in quality standards, project management.

The current most important training needs in the software industry are: product development, standards of quality (CMM), technology that promotes the reuse code, and project management. The Government must incentivize the signing of agreements with the universities to ensure they can train people from the Government and from industry in
aspects such as software, quality standards, business, project management, and IT Governance.

The software schools must be strongly encouraged to use international textbooks, invite experts at home and abroad to teach, and give preferential support to Colombian-foreign institutions... Aside from this future-oriented policy guidance, the government also has to provide preferential policy support to existing software talent by encouraging them to work in highly concentrated software bases or clusters, and stipulating that different government organizations should provide ‘convenience’ for their transfer, including for their spouses and children. The Government must be deeply aware of the importance of knowledge from foreign talents, including foreign software engineers and Colombians who live overseas. Its main encouraging policy instrument is to provide them and software technology investors with less procedural difficulties for entering and settling down in Colombia.

It is evident that even though the Colombian Government makes great efforts to enhance the factor conditions, two facts are undeniable. First, although the education of software talent is a good indicator for the potential of Colombian’s software development, its effect will take time to evolve. Second, it is necessary to provide incentives to attract overseas Colombians to work in Colombia. Although the Colombian government can offer generally stimulating rewards to attract overseas Colombians to return and contribute to the country in the form of lump sums, cars, houses, and other promotions, the security conditions of the country still are not very attractive for the overseas Colombians. These people have foreign work and study experience, are familiar with international markets and software standards, understand both the Colombian and foreign culture, and are usually at least bilingual, and so their potential contribution to the country could be substantial.

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6.3.7. Firm-Level Efforts
Human-Resource Development (HRD) is critical in software companies where 95 percent have formal training divisions and learning-needs analysis programs. The minimum training per employee is 40 hours. This covers both technical and behavioral training, and the proportions vary between managerial and technical positions. The government must incentivize this kind of training in the large companies. The companies must recruit from management campuses and not only computer science campuses.

6.4. Economies of scale

6.4.1. Applications as services

The software industry can take advantage of the last technology named “SOA”; if well defined micro services are developed, they can reuse the code already built because many services can be used in different applications. In order to obtain economies of scale and to spend less time in software production, the use of technologies that provide reuse of code is welcome.

The domestic industry in Colombia is extremely fragmented, with many very small enterprises with fewer than 50 employees that lack economies of scale or distinctive competencies. These firms typically focus on developing niche applications tailored to unique needs of the domestic market (e.g. systems integration or specialized financial software developed for Colombia's unique accounting). If the software companies cooperate together in the cluster, they can take advantage of the economies of scale diminishing the unit cost and becoming more competitively priced.

Open source can help the small and medium software enterprises beat entry barriers by decreasing dependence on the more traditional proprietary technologies.
Going online is fundamental for companies in the IT sector. A website proposing well-defined services, clear prices, competitive advantages (e.g. USP, cost reduction and service quality) and a client reference list helps create a trustworthy environment.

### 6.4.2. Teamwork in the cluster

Teamwork in the cluster is very important to generate economies of scale, to create synergies in each one of the sectors of the cluster, and to allow all the related organizations within the cluster to benefit from the collaboration among them. Why reinvent the wheel? If a Colombian company has made something interesting, the whole sector should take advantage of it and build on it, receiving the benefits of economies of scale. Here is where the culture plays a very important role. The Colombian culture should be directed in a positive way to improve the teamwork and to take advantage of the skills that each has individually and as a company. Only in this manner could the software industry in Colombia be presented as a single industry and not as hundreds of good, well-intentioned desires and efforts.

Another important factor is to be able to constitute strategic alliances with big software and hardware companies, and with industries related with software; to take advantage of what they have made.

### 6.4.3. FDI-Alliances

A strategic alliance is an agreement between firms to do business together in ways that go beyond normal company-to-company dealings, but fall short of a merger. (Wheelen and Hungar 2000: 125).

The benefits of strategic alliances are many, and can include:

- Developing new markets (domestic/ international)
- Developing new products (research and development)
- Developing and sharing technology
- Combining complementary technology
- Pooling resources to develop a production/distribution facility
- Acquiring capital
- Executing government contracts
- Accessing new distribution channels, networks or sales and marketing

The Government, for the time being, is the entity that should promote those strategic alliances with the big software and hardware companies, so that they settle down in Colombia in their production cycles, in this way allowing an exchange of knowledge that undoubtedly will be reflected in economic growth and in economies of scale in the Colombian software industry. To encourage establishment of these foreign companies (FDI) in Colombia, the Government should strengthen intellectual property laws as soon as possible.

The companies also have to explore cooperation possibilities with other companies, trade and/or promotion organizations.
Service providers could establish strong linkages with overseas Diaspora networks, universities, private sector leaders and foreign trade authorities. A foreign national within the client company in the US could very well favor outsourcing.
6.5. R&D Effect

The software industry has to be very creative in giving the customers what they need. Innovation in this industry is quite different from innovation in other different industries, because the software industry must innovate in the business model of the other industries, not in the software industry. For this reason, the software people have to know very well the business of the clients, their fears, their problems to be able to produce software that helps them grow and produce increased revenue.

The training for producing new features in the software has to be a) in the business of the client and b) in the best programming practices in software in order to be more efficient and more reliable.

1. The establishment of a National Fund for Productivity and Competitiveness.
2. The Integration of SENA in the National System of Innovation.
4. Consolidation of the National Network of Centers of Technological Development.
5. Support to regional innovation strategies.
6. Fiscal incentives for research and innovation.
7. Systems of standardization, accreditation, certification and metrology (SNACM) and the National System of Industrial Property.
8. National Programs of Innovation and Technological Development.
9. Establish strong bonds between the academic sector and the companies that comprise the cluster to promote research and development.
10. Develop synergies with the academic sector to institute continuous efforts of training and actualization.
11. Define performance indicators to measure the effectiveness of the joined efforts between academic sector and private sector.

Strategies for the development of the software industry in Colombia
6.5.1. Encourage innovation in the companies

Promote formal employee suggestion systems from which some percent of suggestions could actually be implemented. The software-service activity must incorporate incentives to innovate up the value chain toward more complex services, software products, and hardware-software integrated products. In terms of rewards and recognition, a majority of companies may use market data to determine basic pay.

6.5.2. Change of the organizational culture

At this point promotion of R&D also plays a very important role in the culture. The Colombian culture should be redirected in this sense; the Colombians should learn that making a mistake is not always synonymous with mediocrity, but rather sometimes is the consequence of taking risks with which the managerial world should learn how to live. Moreover, the mistakes should be seen as opportunities for growth both personally and professionally. The generation of ideas should be the common denominator in the Colombian industries, with mechanisms created so that people can speak freely and give their ideas without fear of retaliation. Innovation could occur when managers are open to listening to all the ideas that their collaborators have; in this area it is necessary to work a lot in the national environment.

6.6. Infrastructure

IT does not need significant infrastructure like roads, airports, ports, bridges, etc. IT needs good internet bandwidth to be able to compete with off-shoring and outsourcing. In order to compete in the global market, Colombia has to improve the internet connectivity in the country, but given the reality of the infrastructure and the violence in rural areas, a possible solution is to define some zones where software companies can work.
Even though the penetration of the broadband is not very high in Colombia, the key infrastructure for offshore services, such as telecom, could be created selectively through technology parks. Policy support and incentives can also be provided selectively. Most IT destinations may be state-sponsored IT parks that help businesses set up and start production easily. Clearances for businesses can be obtained from these offices.

Given the high penetration of the mobile telephones in the country, Colombia should try to introduce data to the cellular phones using 3GSM or WI FI. The exploration of these technologies and of those that are more convenient for the country could be an area of study for the new Ministry of Communications and Information Technologies.

Although it is certain that the software companies do not require a high degree of penetration of the telecommunications in the country, the demand of the companies need it. To promote e-commerce, B2C, and B2B, it is necessary that the domestic prices of the bandwidth be reduced, so that the price of communications is not a barrier in the increase of the internal demand.

### 6.7. Finance

According to the diagnosis, one of the most difficult aspects of operating in Colombia is the access to credit, because of the interest rate, the term of loans and the associated bureaucracy. The proposal is that: the Government in Colombia a) Gives credits to software companies with a low interest rate and a longer term. b) Cut steps in the process of giving the credits and makes sure companies receive the money at the right moment eliminating bureaucracy. In this way the industry can begin to have good dynamism. Additionally, because the software companies do not have to show assets to get a loan, the Government must provide some credits according with the needs of the sector.

When the dynamics of the software industry comes, the private banks are ready to borrow money because the industry generates trust and they would begin to offer better credits that achieve the demand.

The structuring of a financing plan should consider the following activities.
• Create a promotion scheme in the local environment based on incentives and programs of facilitation to the incursion of entrepreneurs.
• Promote the industry as an export activity.
• Stress the establishment of product quality standards.
• Comply with an appropriate legal regulatory framework that offers safety and strength to the industry.
• Develop financing sources to meet the needs of the industry.
• Warrant a key leading participation on the part of the government for the development of the industry, considering its demanding role.
• Form an arrangement of Institutions and Associations to: stimulate discussion forums, collect key industry information, generate reports, and act as representatives of the industry developers’ interests (FEDESOFT).

6.8. Tax Incentives

This is by far the most important policy to promote growing in the software industry. If the software industry can increase its cash flow because of the reduction in the payments of taxes, they can grow in the way shown in the system dynamics diagram above.

Another advantage is that the financial sector begins seeing the software companies with better eyes and that they begin to borrow money with more trust.

6.9. Development of IT Services

According to the Competitiveness book:

“As a consequence of the globalization, the management of a global value chain with scattered assets all over the world has become a daunting challenge for firms. In the process, the nature of assets and processes has changed.

They are now:
• Traditional assets and processes that are generally owned and located in the home market,
• Off-shored assets and processes that are still owned but located in a foreign market,
- Outsourced assets and processes that are not owned but accessed from a third party in the home or foreign markets.

Off-shored and domestic assets and processes are naturally prime candidates to be relocated according to the competitive advantage of various locations. However, domestic assets are not immune either to be relocated, although the social and political consequences of such a decision are usually higher. One way or the other, a firm’s competitiveness relies on its ability to connect and manage all these assets. From a nation’s point of view, it implies investing in advanced transport, technological and communication infrastructure to help firms link up their assets. Competitiveness also thrives on the ability to be part of a global network of infrastructure.”

“The key determinant to global economic growth is the emergence of new markets. Such markets in Asia, the former Soviet Union, the Gulf countries, Africa and Latin America, don’t just offer prospects for revenues; they also offer unique opportunities for firms to relocate assets and processes.

- During the past two decades, productivity has been thriving on three main strategies:
  - Quality and Reengineering, with the objective of working better.
  - Outsourcing, with the objective of working cheaper.
  - Globalization, with the objective of using the best comparative advantages worldwide.

Globalization has created the possibility for enterprises to increase their productivity while relocating their assets and processes to various parts of the world.

Competitiveness is a matter of balanced policies. Too many governments have not yet mastered the economic imperatives necessary to support and stimulate the competitiveness of their country. The government and economy need to remain in sync in order to contribute durably to the competitiveness of a nation. A growing gap in performance between the government and the economy is a bad omen for the future competitiveness of a country”.

Given the movement that the globalization is generating in industries, the offering of products and services by the software companies play a preponderant role. Professor Michael Cusumano affirms that at this time the software companies are obtaining more
revenues for services rendered than for the licensing of their products. Colombia has not lagged behind in this tendency and the figures demonstrate this.

It should also be kept in mind that the domestic reality, as shown in the general diagnostic chapter, is that there are not quality products to offer in the market; and since the policies that are to be developed take time to obtain results, it is better in the short term that the policies implemented in the software industry emphasize the service industries more than product generation.

The country intends to create a Pole of Development of exportable technological professional services, taking advantage of the comparative benefits and creating around this a national purpose of attraction and commercialization of these services.

The vision of a Pole of Development of Technological Services in the country refers to creating favorable conditions for the establishment of: data processing centers, administrative centers for information handling, safety centers for storage of information and recovery from disasters, centers of administrative processes of third parties, and neuralgic centers of communications. These centers would be developed considering the comparative advantages of location, of political and economic stability, of geographical position, and the meteorological security in the non seismic regions. To all the factors mentioned above (SWOT), should be added both the country’s good telecommunications infrastructure which allows easy internal as well as external connections, and the quantity of skilled labor in areas such as Systems Engineering, Technology Administration and Telecommunications.

Therewith an entire new field of generation of revenues, of new jobs, of centers of dissemination of knowledge, and of technological competitiveness would be created. [35]
6.10. Increase the Demand

Small and Medium Enterprises

In general terms, it is believed that the demand problem mainly consists of a great ignorance on the part of the consumers about what they can demand from the software industry. This is due to the lack of appropriate ways of promoting the products of the cluster. The associate software companies should develop managed marketing campaigns to the SME’s associations.

The Government should encourage the SME to associate to reach certain modernization standards and take advantage of the economies of scale, acquire Colombian software; this way this SME sector could become an important client of the software cluster.

Members of the software cluster should constantly monitor the market to determine their usual or potential clients' unmet needs.

Members of the software cluster should work in training activities for their executives of the potential clients in areas such as IT Governance and strategy of e-businesses, to transform them into regular and loyal clients of their products.

Companies of the cluster should maintain strong ties with the key actors of the managerial environment, SME, big companies or Government. FEDESOFT can be the entity in charge of this.

The Colombian State has significantly advanced working in the information technologies, but is still a great client for the software industry. E-government projects should continue strengthening and thereby the use of information technology will also be motivated in the industry.
Another aspect to consider is the establishment of programs and policies for the modernization of the SME and the entrance to the digital world.

6.11. **Market niches and specialized area**

Certainly for beginning exporters, it could be wise to focus on one area and to specialize so as to be able to supply the client with an outstanding service.

Focus marketing on core sectors and niches, and look to visit specific outsourcing events and seminars rather than big events.

Colombia should look for specific market niches where Colombia can use its capabilities such as: language, same or similar culture, or places where there are large Colombian communities. Such niches could be Miami, where the Colombian population in general as well as the entrepreneurial sector is very large. These companies could be a liaison among the US and Colombia.

The Ministry of Trade is conducting a study to determine in which industry areas Colombia should specialize. The software industry should specialize in the type of software products for those types of industries that will be highly supported by the national government and that will need the total ICT support; there a great software, hardware and communications demand will open up. The government should support the industry as well the software companies that invest and develop this type of software products and in this way the software industry would find the necessary focus.
7. Conclusion:

The role of the government in the software industry is very significant. This has been shown in two aspects aside from favorable policy itself. First, the Colombian government must play a very directive role in promoting the development of this high technological industry. This is clearly shown in the forms of low interest bank loans, government subsidies, incentives, and preferential treatment of exports as discussed in the paper. Second, the government’s significant role is reflected in its emphasis of and initiatives on accelerating the industrial development, such as human capital. However, the government’s role is not a static element in this study. With Colombia’s entry into the WTO (TLC), its role in protecting or involving corporate activities is restricted under WTO standards to allow fair and transparent competition. Therefore, in the near future, the government role in this industry will still be significant, but only from the perspective of encouraging policy development and implementation.

Colombia should consider short and long term strategies. In the short term, Colombia should take advantage of its strengths, which are in providing services such as IT, data centers, BPO and Call Centers. It should also look for market niches that take advantage of its capabilities, such as Miami which could be a bridge between Colombia and the U.S. market both for its proximity and for the quantity of Colombian entrepreneurs living there.

Long term strategies include motivating the use of information technologies in the Small and Medium Businesses in Colombia since it provides a great market potential; this will bring the software sector big benefits as well as enhance domestic development; fixing the education system in Colombia to provide high quality of human capital in all the layers of the pyramid of software industry and to teach English as second language from the basic school, given the software industry is highly dependent on human talent and obtaining successful results in the industry is directly related to improving the educational system.
Regarding human capital, Colombia is a country that seems to have two countries in one. The country has categorized the social strata from 1 to 6, with 6 being the highest socioeconomic level. Those in the upper half of the country represented by strata 4, 5 and 6, have high quality education and are recognized as generating value in companies. The other half of the country, those of strata 1, 2 and 3, have to endure a very low quality of education and in many cases cannot be employed because they do not meet the industries’ minimum standards. It is for this reason that the pyramid of software industry human capital has a high degree of talent in the superior layers and in the inferior layers of technologists and technicians, besides that there are not many their quality is bad. Improvement of the education system is urgently needed to make it accessible to all and generally increase the quality.

Even if reforms in the educational system start today, they take time to become a reality. The Government will play an important role in this task, for example by attracting well trained people not only from within Colombia, but also be seeking individuals from neighboring countries such as Venezuela. It could also aggressively promote training in all levels of the pyramid. Remember that former president Pastrana attempted that unsuccessflly during his tenure. However, we should learn from previous errors and attempt this type of effort again taking advantage of the experience acquired.

Certainly, Colombia has a great future in the software industry and that the Government should support the initiatives of the sector and make Colombia a truly digital country for the domestic economic development implications. Realistically, many countries are several decades ahead of Colombia in the consolidation of the software industry, but if Colombia focuses its effort in some specialized areas where the competition is not high, it could bring many advantages if Colombia is the first-mover in any specific direction.

The Ministry of Trade is making a study to determine in which industry areas Colombia owes to specialize. The software industry should specialize in the type of software products for type of industries that will be highly supported by the national government and that will need the total ICT support; there a great software, hardware and communications demand...
will open up. The government should support the industry as well the software companies that invest and develop in this type of software products and in this way the software industry would find the focus that need.
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