ENGINEERING THE NETWORK SOCIETY: A SOCIAL WORLDS/ARENAS ANALYSIS OF ENGINEERING IN GOVERNMENT AND NON GOVERNMENTAL ORGANIZATIONS IN COLOMBIA

by

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To Nathan and Noah

CONTENTS

LIST OF ABBREVIATIONS

AAE - American Association of Engineers

ANDI – Asociación Nacional de Industriales – National Association of Industrialists

APC - Association for Progressive Communications

ASCE - American Society of Civil Engineers

ASME American Society of Mechanical Engineers

ATM - Automated Teller Machine

AT&T - American Telephone and Telegraph

BT - British Telecommunications

CAF – Corporación Andina de Fomento

COINFO - Comision Intersectorial de Políticas y Gestión de Información para la Administración Pública

COCOMACIA - Consejo Comunitario Mayor de la Asociación Campesina Integral del Atrato

CSR - Corporate Social Responsibility

DNP – Departamento Nacional de Planeación - National Planning Department

ECLAC - UN Economic Commissions for Latin America and the Caribbean

ESALs – Entidades Sin Animo de Lucro – Non-profits

FTAs - Free Trade Agreements

GE – General Electric

GELT – Gobierno en Línea Territorial – Online Regional Government

GKP - UNESCO's Global Knowledge Partnership

GM – General Motors

GTZ - German Agency for Technical Cooperation

ICTs – Information and Communication Technologies

ICT4D – Information and Communication Technologies for Development

IDRC - International Development Research Centre

IESO – Iniciativa en Emprendimientos Sociales – Initiative in Social Enterprenneurship

IPRC – Internet Para la Rendición de Cuentas - Internet for Making Local Governments

Accountable

ITU - International Telecommunication Union

MDGs - United Nation’s Millennium Development Goals

MCI - Microwave Communications Inc

NGOs – Non-Governmental Organizations

O2O - organization to organization

OECD - Organization for Economic Co-operation and Development

OSILAC - Information Society Observatory for Latin America and the Caribbean

PCS - Project Counseling Service

POS – Point Of Sale

PUC – Portal Único de Contratación - Web Portal for Online Contracting with the Government

SCI - Sociedad Colombiana de Ingenieros – Colombian Society of Engineers

SAI - Sociedad Antioqueña de Ingenieros – Antioquian Society of Engineers

SPB - Socios Por Bogotá – Partnership for Bogota

STS – Science and Technology Studies

TELECOM – Empresa Colombiana de Telecomunicaciones

TNCs - Transnational Corporations

UNCTAD - United Nations Conference on Trade and Development

UNESCO - United Nations Educational, Scientific and Cultural Organization

USAID - United States Agency for International Development

WPIIS - OECD’s Working Party on Indicators for the Information Society

WSIS - World Summit of the Information Society

WTO - World Trade Organization

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ABSTRACT

Research in engineering studies and politics of design has shown how engineering and corporate capitalism have been co-constructing each other since the end of the 19th century in western societies. However, currently there are no corresponding studies about contemporary changes in engineering brought about by the late phase of capitalism that Manuel Castells has called "informational capitalism." This phase of capitalism has spread very quickly during the last two decades, reaching the poorest countries of the world via the global corporate networks of multinationals and the discourse of informational development. This dissertation contributes to the existing literature in engineering studies by exploring how local engineers in Colombia, a so-called "developing country," are responding to the now internationally hegemonic discourses of informational capitalism and developmentalism. In this context, system and computer engineers have become central actors constructing not only technologies, but also visions of society that help facilitate the construction of market and non-market oriented versions of the information society. In the process, engineering has also adapted to some of the changes being brought by the rise of informational capitalism and developmentalism in Colombia. The most important of these changes is the emergence of a type of engineering oriented to serve social needs that the market and the State leave unattended. This kind of engineering, which I call NG(o)neering, offers innovative ways to apply the knowledge and skills of engineering within society and to understand professionalism in a new light. NG(o)neering also produces socio-technical versions of the information society that balance the dominant tendency to construct informational capitalism, offering paths of professional development for engineers that were not available before. The methodology used in this dissertation has been informed by Anselm Strauss' social worlds/arena theory and Herbert Schiller's Marxist critique of the "information society." The collection of data was based on eight months of ethnographic fieldwork, 43 interviews and archival analysis.

KEYWORDS: informational capitalism, informational developmentalism, engineering, engineering cultures, politics of engineering design

1. INTRODUCTION

"I tend to focus on the development of technologies that have a social impact … my professional life has been oriented to do that. It is being able to identify something that it is going to be important for us in the future, and to build it as an element that it is going to transform society … That is what I am always looking for."

(Hugo Sin, Systems and Computer Engineer from the Connectivity Agenda)

"I think we are making real the possibility that a systems and computer engineer can dedicate professionally to social organizations, and have a social and sustainable impact there."

(Jefferson Ramirez, Systems and Computer Engineer from Somos Mas)

Engineers are not only constructors of technologies. They are also constructors of visions of society. In modern societies they have built technologies that have supported and reinforced visions of nationalism (Hecht, 1998; Amir, 2005), capitalism (Noble, 1977, 1984), segregation (Bowker & Star, 1999), democracy (Norris, 2001) and social justice (See Chapter 6). Their commitment to instantiate visions of society with technologies of various kinds is sometimes clear and explicit. In other instances, however, these efforts are somewhat obscure, deeply enmeshed in particular social locations. In any case, engineers are actors that link visions of society to material realities. They populate the world with artifacts that foster some visions of society in preference to others. Thus, it is important for the social sciences to investigate these visions of engineers that are aimed at having a "social impact," pondering whether these visions are constructing a better society or not.

One of these visions, the so-called "information society," became very popular during the last decades of the 20th century, spreading from rich countries to poor countries all over the world. The construction of this vision of society has been explored within social and managerial theory in the academic world (Castells, 1996; Bell, 1973; Schiller, 1996), within management practices and technological innovations of the corporate world (Drucker, 1993), and within development theories prominent in diplomatic circles and international development agencies of North America and Europe (UNDP, 2001). Less visible however, it has been the role of engineering in sustaining and making the information society a material reality within specific artifacts. During the 1970s and 1980s, David Noble wrote extensively about the relation between engineering and capitalism during the 20th century, noting how both co-evolved together (Noble, 1977, 1984). However, today we are lacking similar analyses that focus on the relation between engineering and the information society informing us about the type of society that it is begin built in concrete practices of engineering, not only in rich countries but also in nations labeled "developing countries" (Escobar, 1995).

This dissertation studies the role of systems and computing engineers in Colombia, a country labeled "developing," in attempts to realize visions of the information society. Engineers are involved here, not only in the artifacts they design, but also in the social elements being constructed or stabilized by their work. From a developing country perspective, the information society in Colombia is a discourse that key decision makers associate with development, neoliberalism and capitalism. Thus, organizations in the private sector as well as government and non-profit groups have launched policies, strategies and programs to boost the production and consumption of information and communication technologies[1] to achieve one or several of these goals. In all of these sectors, there are engineers at work to develop technologies that can sustain distinct visions of information and communication technologies for development. I have focused my research here upon on the versions of the information society endorsed by systems and computer engineers within both the governmental and the non-governmental sectors of society. I chose these two sectors to find alternative conceptions of the information

[1] For my purposes here 'Information and Communication Technologies' –ICT- refers not to a single artifact but to several distinct artifacts –and systems- that manipulate symbols. These include computer hardware and software, voice data, networks, satellites, telecommunications technologies, multimedia and application development tools. Technologies of this kind are used for the input, storage, processing, organization, presentation and distribution of information. In their modern form in contemporary societies they are commonly assumed to be microelectronics-based.

society, ones that are considerably different from those officially endorsed by corporate capitalism. Exploring these versions can show if engineers, who do not work in the private sector, are responding passively to capitalist discourses of the information society extending it in their realms, or, if they are engaging more actively in re-interpreting, adapting, and contesting these discourses. This dissertation also explores these social worlds of engineering to see if they succeed in developing methodologies, technologies and versions of professionalism that are not commonly found in the corporate world.

This research attempted to answer the following question:

"How does the increasing participation of systems and computing engineers in public-oriented ICT organizations in Colombia help stabilize or destabilize capitalist discourses of the information society and, in the process, alter engineering ideologies, practices, technologies and understandings of professionalism?"

This dissertation argues that the work of engineers in government and in non-profits to construct ICTs in Colombia is spreading and normalizing a version of the information society which is capitalist, neoliberal and framed in the discourse of development. The construction of the network government in Colombia (See Chapter 5), for example, shows that the designs of systems and computer engineers for e-government are aligned with neoliberal policies of the Colombian government and foster neoliberalism and global capitalism to the exclusion of other social ends. The work of some non-profits in reshaping capitalist information technologies to include social values (See Chapter 6) also ends up reinforcing corporate capitalism via the discourse of Corporate Social Responsibility. A second argument this dissertation makes is that there are other kinds of engineers, who I will call NG(o)neers, who attempt to destabilize capitalist versions of the information society with discourses and technologies that embody anti-capitalist positions. However, rather than destabilizing capitalism, they have succeeded in partially infiltrating capitalist technologies in ways that incorporate social values that are downplayed by markets and the State. This accomplishment is something especially relevant in a poor country like Colombia full of social disparities and inequalities[2]. In their work, NG(o)neers help balance a capitalist oriented information society with alternative discourses, methodologies, technologies and versions of engineering professionalism.

1.1 Systems and Computer Engineering in Colombia

Systems and computer engineering in Colombia, the focus area of engineering analyzed in this dissertation, has no direct equivalent with engineering specialties in the United States. It combines theories and methods from computer science, software engineering, computer engineering, systems engineering, and network engineering in one single career. Thus, in Colombian universities, undergraduate students of systems and computer engineering are introduced to aspects in all of these areas and they are expected to gain in-depth knowledge in one specific area of their choosing during their senior year.

This profession began in Colombia during the 1960s with the arrival of mainframe computers to a few of the biggest corporations in Colombia, as well as to the government. The first professionals in charge of operating and programming these machines were trained in the United States. They were civil and electrical engineers who specialized in computer science at MIT at the beginning of the 1960s (Rodriguez & Forero, 2006). By the end of the 1960s, several universities in Colombia began acquiring computing equipment and hired some of the professionals trained abroad to develop their own curricula. The first formal program in computer science was established in Los Andes University in 1968 as a postgraduate program for electrical engineers. The next year, Los Andes University began offering an undergraduate program designed after the program of computer science from the University of Pennsylvania that included all the core

[2] Colombia had a population of approximately 43,000,000 inhabitants in 2005 (DANE, 2005). More than half of Colombians live in poverty. 17.8% of the total population is living below US $2 a day (1990-2005), and 64% is living below the national poverty line (1990-2004) (UNDP, 2007). The inequality in the distribution of income is one of the largest in the region. The Gini index for income in Colombia was 0.59 in 2003, being only third in Latin America after Bolivia (0.60), and Haiti (0.59) (UNDP, 2007). The richest 10% in Colombia earned, in 2003, 63.8 times more than the 10% poorest. The same year, the poorest 20% had a share of 2.5% of the national income while the richest 20% had a correspondent share of 62.7% (UNDP, 2007).

engineering courses. Thus, since its inception in Colombia, this career was linked to the Engineering School. This curriculum and orientation was soon adopted by other universities in Colombia, such as the National University. The first system and computer engineers from Colombian universities graduated in 1972 (Rodriguez & Forero, 2006). Since then, these programs have always been characterized as providing employees to corporations and government. Very few systems and computer engineers have dedicated themselves to independent consultancy, or setting up their own businesses, following similar patters already common in other engineer specialties (See Chapter 3). During the 1980s and 1990s, with increasing automation and the advent of the Internet, this profession became highly demanded in Colombian corporations. In the process, systems and computer engineers reaffirmed their location as employees of corporations, a trend started during the 1970s. The Colombian census of 2005 counted 27,000 systems and computer engineers in the country, 27% were women, and 73% were men. These engineers are mostly corporate engineers; 71.3% work for the private sector, 18.2 % for the government, 9% are independent consultants and 1% are owners of an engineering firm (DANE, 2005).

ACIS (Asociación Colombiana de Ingenieros de Sistemas) is the only national professional association that attempts to gather these engineers in Colombia. However, ACIS, founded in 1976, is a weak professional association. Its members represent only 4.5% of the total systems and computer engineers in Colombia, and its activities focus on academic events, publication of bulletins, and continuing education for its members (Rodriguez & Forero, 2006). This association has no power to regulate the entry to the profession either, since it is not in charge of controlling professional licenses for systems and computer engineers. These conditions make it difficult for ACIS to have impact upon the professionalism of this specialty of engineering in Colombia.

The weak professionalism of system and computer engineers manifested in their weak associations, lack of collective control over the profession, and dependence on business has been a characteristic not only of this specialty of engineering but of engineering in general in Colombia during the 20th Century (See Chapter 3). This group of professionals constitutes the center of attention in this dissertation because these engineers are the ones in charge of designing information and communication technologies in Colombia.

1.2 Methodology

For this project, I used a combination of participant observation, semi-structured interviews, and archival research. Research took part in Bogotá, Colombia and Quibdó, Colombia between August 2006 and March 2007. The work was originally planned to be done in Bogotá, the capital city, because that is where the initially identified governmental and non-governmental engineering organizations were located. However, following some of the engineers of one of the NGOs took me to include another field site for participant observations and interviews in the pacific region of Colombia called Chocó.

1.2.1 Fieldsites

The initial field sites chosen for this project were three public-oriented organizations that use ICTs to achieve social goals. During the course of the fieldwork a fourth organization was identified and included in the interviews and archival research. These organizations officially have as their goal the development of information and communication technologies and infrastructures aimed to improve the social conditions of poor people. These organizations are mainly run and led by systems and computer engineers. The first organization is a governmental agency responsible for the design and implementation of e-government in Colombia. The other three are organizations belonging to the third sector (non-profits), which are either run by system and computers engineers or that have engineers somehow engaged in shaping information and communication technologies.

The first organization chosen for this project was the “Agenda de Conectividad” or Connectivity Agenda. This governmental agency, created in 2000, corresponds with a State policy with the same name. As an agency, it coordinates government agencies and ministries, as well as the private sector, to design consistent policies and programs aimed at facilitating the introduction of a neoliberal, and capitalist version of the information society in Colombia. As a national policy, it was designed to be a set of strategies, developed through programs and projects, to extend massively the use of information and communication technologies to increase the productive sector’s competitiveness, to “modernize” public institutions and government, to ensure universal access to information, and to prepare the workforce for the new conditions in global economy (DNP, 2000). As holders of technological expertise, systems and computer engineers have been assigned by the national government to directive positions in this agency since its inception. Since 2003, engineers leading the Connectivity Agenda focused their work in the design and implementation of e-government procedures and technologies for the Colombian government.

The second organization I studied is an NGO called “Somos Más.” Originally, a university project of undergrad students of computing engineering from Los Andes University, the NGO has designed a web portal to network civil society organizations and international cooperation organizations. It also helps other NGOs to design ICTs that help improve the organizations’ work effectiveness in achieving their social goals. Somos Mas is constituted and run by system and computer engineers and it has a well articulated discourse on the role of ICTs that support the third sector (non-profits) in Colombia.

The third organization is a Catholic non-profit called “Corporación Minuto de Dios.” Its main goal is to promote the integral development of poor communities. It collects donations from many sources to finance housing, education, and productive projects for the poor. The strategy it employs is to consolidate alliances with private organizations endorsing Corporate Social Responsibility to design projects that channel resources for the “Minuto de Dios.” Even though this is not an organization run and led by engineers, during the past few years it has worked with corporate engineers in reshaping technologies of informational capitalism to include values of distributive justice. Including this organization in my study allowed me to observe how corporate engineers might be affected by the influence of a non-profit upon their corporate work.

The fourth organization was identified ad-hoc, during the fieldwork of this dissertation. It is a non-governmental organization called COLNODO. Since the early 1990s, COLNODO has been providing services of connectivity to NGOs in Colombia and it has been developing ICT projects for development (ICT4D) sponsored by international NGOs including the Association for Progressive Communications (APC) and Antenna-Holland. COLNODO is primarily composed of systems and computing engineers and it is led by a chemical engineer.

These four organizations provided an array of organizational cultures that challenge engineers working in design and implementation of ICTs in different ways. For example, at the level of interaction with their audiences, engineers in the Agenda engage in direct political interaction with citizens and politicians in public arenas. Thus, they need to defend not only particular projects, but also whole programs and policies of ICT. Their main role is to represent government bureaucracy. In marked contrast, engineers in the non-profits are social entrepreneurs, facing challenges of ensuring their own economic sustainability in a capitalist environment while being faithful to their deeply held principles of social justice.

1.2.2 Research Strategy

The research strategy that I found useful in organizing my work in a meaningful way, especially in the collection of data, was to draw upon the theory/method package of social worlds/arena as applied to science and technology studies (Star, 1999; Clarke, Montini, 1993; Clarke, 2005). Social worlds/arena theory derives from the thought of Anselm Strauss (Strauss, 1991) in the symbolic interactionist tradition of the Chicago School (See Chapter 2). This methodological approach provides a structure that allowed me to organize data collection and analysis at the micro, meso and macro scales of analysis

By focusing on the interactionist analysis of social worlds committed to universes of discourses, social worlds/theory provides a structuration theory. It connects the macro scale of analysis of hegemonic discourses with the micro scale of human symbolic interaction. It does so by focusing on the meso scale of organizations that mediate between macro discourses and micro social action. Thus, at the meso scale, I located governmental and non-governmental social worlds, which include the previously mentioned organizations, to which engineers commit in orienting their work towards achieving social goals. These social worlds mediate between the macro discourses of neoliberalism, global and informational capitalism, and developmentalism as they affect the micro practice of engineering work, social interactions, engineering practices (including design), and development of engineering identities.

This theory has also another benefit, namely that of locating engineers in a larger picture of negotiations with other social worlds. Different from "laboratory" studies of engineering, in which observed interactions are restricted to the social world of the corporation (Bucciarelli, 1994), the work of engineers in governmental and non-profit organizations that I explore here occurs within arenas where engineers meet with other social worlds. These encounters involve negotiations with a variety of audiences about control of resources-means of production. Encounters also include symbolic negotiations over meanings that shape the content of technologies. Thus, it is in these arenas that the agency of social actors is displayed, with some actors better positioned than others to move the arena in a particular direction. In this dissertation, I have focused upon several arenas of design in which engineers participate, places where they negotiate with other agents about resources and features of technological designs.

1.2.3 Method to Collect Data

Guided by the strategy of social worlds/arena theory, the collection of data for this dissertation included two participant observations. One, four months long, was conducted in Somos Mas. It included daily presence in the organization, assistance to design meetings with clients, following the engineers to processes of negotiation with clients, assistance to public presentations of the engineers, and assistance to internal meetings. The second one, also four months long, was done in the Connectivity Agenda. It also included presence in design and coordination meetings with independent contractors, public presentations to general public, specialized presentations to other system and computer engineers in the government, and internal meetings of coordination and negotiation of budget. A third sequence of participant observations, those at Minuto de Dios, was attempted but was in the end limited to formal presentations; it never reached the level of engineering design.

The collection of data also included 43 in-depth semi-structured interviews with 28 of the engineers involved in the observations along with 15 representatives of the social worlds with which engineers interacted during the observations. Out of the 28 engineers, 20 engineers were male and 8 were female. There were 22 systems and computer engineers, 2 electronic engineers, 3 industrial engineers, and 1 chemical engineer. Interviews with 18 engineers were done for the Connectivity Agenda, 6 for Minuto, 17 for Somos Mas, and 2 for COLNODO.

The basic template for interviews included the following questions:

For engineers:

1. Background Questions: What is your name? What is your educational background and previous experience? Age? What kinds of activities do you normally do in your organization? How do you understand the ultimate purpose of this organization?

2. Ideology: Do you think it is important for poor people to be part of the "information society?" Why? How do you understand your role in this project?
3. Strategies: What have been the main strategies your organization has developed to incorporate poor people's needs in ICT for development? How do you evaluate their success?
4. Cultural codes and professional identity: What conditions and situations have you found challenging about working in this particular organization? How have those challenges affected your professional expectations and what it means for you to be an engineer or a technical professional?
5. Designs: When you design ICTs to achieve social goals, how do you address the needs of the different groups to be served? In particular, how do you address the needs of poor people? Do you experience any trade-offs in attempts to satisfy all the groups you serve? How has the inclusion of social values in ICT affected your sense of engineering practice? What contradictions do you experience between what poor people expect from your technological designs and what these designs could realistically do?
6. Interactions: What are the most critical interactions that your organization need to sustain to achieve their organizational goals? What are the nature and the purpose of these interactions?

For representatives of other social worlds interacting with engineers:

1. Background Questions: What is your name? What is your educational background and previous experience? Age? What kind of activities does this organization normally do for your community? How do you understand the ultimate purpose of this organization?
2. Ideology: Do you think it is important for Colombian society to have ICTs? Why? Do you think it is especially important for poor people? Why? How did you learn about this?
3. Designs: What kinds of successes and frustrations have you had with ICTs developed by this organization? Have they been useful to improve your life in any way?

4. Interactions: What is your impression of engineers? How do you describe your interactions with them? Which circumstances motivate you to participate in their projects and which circumstances make your participation less likely?

Finally, the archival research included the archives of the Connectivity Agenda, and Somos Mas (not publicly available material). Data from these archives included memos, meeting minutes, agreements, presentations, reports and contracts. Archival/textual research also included printed, publicly available, material in the online archives of the newspaper "El Tiempo," the most popular newspaper in Colombia, and "El Diario Official," the official diary of the Colombian government where laws and decrees are published. Public available material also included: laws and decrees relevant to e-government and regulation of the third sector, official material about ICT4D and the WSIS published by the United Nations, and research being conducted by other scholars in Colombia about e-government and the third sector. The magazine of the Colombian Association of Systems and Computer Engineers was also included in this analysis.

1.3 Chapters Outline

The first three chapters are conceptual. The first chapter reviews the theory/methodology that guided this research. It describes the ontology, epistemology and methodology supported by social worlds/theory, the ways it has been applied in science studies and some recent re-conceptualizations made to it by Adele Clarke. This chapter also includes a discussion of the analysis of power and some critiques social the worlds/arena theory has faced.

The second chapter reviews the historical relationship between engineering and capitalism in the western world. It draws parallels between the co-construction of engineering professionalism and the rise of corporate capitalism in the United States and Colombia. This chapter introduces the concepts of engineering professionalism, co-construction of engineering and capitalism, and engineering cultures. The main argument here is that contemporary practices of engineering have been shaped by the interactions of corporate capitalism and local cultures.

The third chapter draws on social studies of the information society, understood as an evolution of capitalism expressed in an informational phase. Theories of the information society from Daniel Bell, Manuel Castells and Herbert Schiller are reviewed for this purpose. This chapter also introduces the idea of informational developmentalism using the insights of Arturo Escobar. The main argument in this chapter is that, during the last decades of the 20th century, capitalism in western societies renewed and expanded itself with the use of ICTs and managerial technologies. In this "upgrading" of capitalism, engineers of information and communication technologies such as electric engineers, systems and computer engineers, network engineers, and others have played a major role designing and deploying the technologies.

Having described the conceptual and theoretical context for my research as well as the general location of engineering of ICT in western contemporary societies and in the so-called developing world, I review the specific empirical data collected from the field sites studied in this dissertation in Chapters 4 and 5. The fourth chapter describes the governmental world of information and communication technologies for development (ICT4D) from the perspective of one of its sub-worlds, namely that of e-government, which in the Colombian case is expressed in an ambitious organization called the Connectivity Agenda. The chapter describes its inner workings, the arenas in which it operates, the engineering perspectives that it constructs, and some situations that structure the politics of its technological design activities. The main argument in this chapter is that engineers working in this social world advance informational capitalism and informational developmentalism through their commitments to the social world of government, the bureaucratic field.

The fifth chapter explores the social world of non-governmental world of information and communication technologies for development (ICT4D) from the perspective of three non-profits: Somos Mas, Minuto de Dios and COLNODO. The main argument in this chapter is that the non-governmental social world of ICT4D has responded to the global discourse of informational developmentalism and informational capitalism, connecting to them, but also distancing itself from these influences to some extent by being grounded in local specificities, negotiations, interests and ideologies. This chapter also argues that non-profits have created possibilities for engineering to detach from its main habitat in corporate capitalism. Thus, it explores the implications for engineering professionalism and professional identity for engineers who are committed to the social world of non-profits (NG(o)neers).

The sixth and concluding chapter seeks to answer the initial question posed in this introduction, using the arguments provided by the conceptual and the empirical chapters. The main conclusion is that the contemporary work of systems and computer engineers in governmental and non-governmental organizations is helping stabilize the dominant discourse of informational capitalism and developmentalism. NG(o)neers rather than destabilizing informational capitalism have found ways to balance it, including concerns of social justice in their practices, methodologies, technologies and identities. By doing that, NG(o)neers have opened new spaces for a kind of engineering that is not committed to corporate capitalism, that is changing the technological field (Hess, 2007) of informational capitalism, and that it is recuperating spaces for engineering professionalism.

2. SOCIAL WORLDS AND ARENA ANALYSIS

2.1 Introduction

In this chapter, I present the conceptual framework used in this dissertation that will be used to analyze situated versions of the "information society" being created by systems and computer engineers in Colombia. I will briefly present the conceptual elements of the social worlds/arena analysis and I will highlight the relevance of this methodology for the study of engineering cultures and the situated politics of engineering design.

My main argument in this chapter is that the social worlds/arena analysis proposed by Anselm Strauss, and developed further by his students, provides a sound social theory and a methodology to study how engineers create and sustain universes of discourse through their technological practices. The foundation of social worlds/arena analysis in symbolic interactionism recognizes the importance of micro-social interactions were social meanings are enacted, questioned and recreated. Here we find engineers interacting among themselves and with other actors in practices that are meaningful for them. Some of these practices correspond to the design of technologies.

The main focus of social worlds/arena analysis, however, is on interactions among social worlds, which are collective universes of discourse, introducing a meso-level of analysis. It is in this meso-level where most of the social constrains and opportunities for engineering practice (the micro) are negotiated and socially constructed. It is also in this meso-level that more permanent structures that constrain the agency of individual engineers (the macro) are sustained and socialized. These abstract levels of analysis (macro, meso y micro) can be identified in concrete situations of action. Here, social imaginaries, hegemonic discourses, current negotiations and personal agendas become concrete and configure the situation where engineering practices and the design of engineering technology occur.

This chapter reviews the theory behind the social worlds/arena analysis and its use for the analysis of situated versions of the "information society" being produced by system and computers engineers in Colombia and materialized in technologies and social practices.

2.2 Social Worlds/Arenas Analysis

Social Worlds/Arena analysis was developed by Anselm Strauss and derived from the school of symbolic interactionism. Social worlds/arena inherits from symbolic interactionism its ontology and epistemology. In the following sections, I will lay out briefly the main conceptual elements that constitute the ontology and epistemology of symbolic interactionism and social worlds/arena analysis. I will also explain how this approach sheds light upon engineering cultures and politics of engineering design.

2.2.1 Symbolic Interactionism

Symbolic Interactionism is one of most prestigious traditions in sociology. It has its historical roots in the Chicago School of Sociology and in American pragmatism (G. H. Mead, John Dewey). Herbert Blumer, a student of pragmatist philosopher George Herbert Mead, coined the term "symbolic interactionism" during the 1930s to refer to a "distinctive approach to study the human group life and human conduct." This sociological approach attempted to respond to several challenges in sociology and psychology at the time. One was to recover the study of social interactions in sociology lost to functionalist and behaviorist approaches. Human life and social life had been displaced as the focus of research in sociology to be replaced by abstract concepts like "motives," "goals," "emotions," "values," "social forces," "laws," etc., which were considered drivers of human and social behavior. Interactionists considered inadequate this approach because these "variables" used to explain human life and conduct had no empirical equivalents to be observed in social action. For interactionists the study of social life had to emphasize the action of individuals interacting with themselves and others upon a world of meanings, something that had been lost to functionalism and behaviorism.

Another challenge interactionists took on was to reconcile studies of human conduct and human group life performed separately by sociology and psychology. While sociology relied on social structure and social forces to explain human group life, psychology attempted to explain human conduct by studying individuals in isolation. For interactionists, both approaches eliminated altogether the possibility of explaining how social structures play a part in human subjectivities and how human agency plays a role in responding to established social structures or transforming them. For interactionists it was necessary to create a renewed social psychology that could build an explanatory framework starting from the empirical realities of social interaction.

During the 1960s, Herbert Blumer provided a synthesis of the interactionist approach, based on G. H. Mead ideas. According to Blumer, interactionism relies on three basis premises. The first premise is that human beings act toward things on the basis of the **meanings** that the things have for them. These things could be artifacts, the self, other human beings, institutions, social situations, ideas, etc., which humans encounter in their daily life. The second premise is that the meanings of those things are derived from, or arises out, the **social interaction** that one has with one's fellows. Here social interaction becomes central for the social construction of reality, because it is in social interaction that shared stories, meanings, and common sense are constructed, negotiated, socialized, or contested. The third premise of interactionism is that meanings are not static external forces that exercise an agency of their own on agents' will but rather meanings are handled in, and modified through an **interpretative process** used by the individuals in dealing with the things they encounter (Blumer, 1969). The emphasis on the interpretative process is crucial to recover human agency in social theory, because it is through this process that individuals exercise volition and can be understood as active agents in the construction of the social, and not only as passive subjects of structural social forces.

Interactionists are quick to note that not all of the social interactions are symbolic. What G.H. Mead defines as "the conversation of gestures" is a type of non-symbolic interaction where direct responses to action of another agent occur without interpretation of that action. It is the absence of the interpretation process that distinguishes between symbolic and non-symbolic interactions[3]. Whenever "use of significant symbols" characterizes interaction, people will seek to understand the meaning of each other's actions by means of interpretation. However, according to interactionists, most of the social interactions in human life are symbolic interactions:

> "The term "symbolic interaction" refers, of course, to the peculiar and distinctive character of interaction as it takes place between human beings. The peculiarity consists in the fact that human beings interpret or "define" each other's actions instead of merely reacting to each other's actions. Their "response" is not made directly to the actions of one another but instead is based on the meaning which they attach to such actions. Thus, human interaction is mediated by the use of symbols, by interpretation, or by ascertaining the meaning of one another's actions. This mediation is equivalent to inserting a process of interpretation between stimulus and response in the case of human behavior" (Blumer, 1962: 139)

The interpretative process begins with an agent indicating to her/himself the things toward which s/he is acting. S/he has to point out to her/himself the things that have meaning in a process of symbolic self-interaction. Then meanings are handled, the agent selects, checks, suspends, regroup and transforms the meanings in the light of the situation in which s/he is placed and the direction of his/her actions.

This simple starting point of symbolic interactionism carries with it enormous implications for the study of social life. Its value can be elaborated by explaining the ontological and epistemological assumptions that distinguish interactionism from other social theories.

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[3] One example provided by Blumer is that of two people boxing. A "conversation of gestures" occurs in boxing when reflex responses occur. One boxer automatically raises his arm to parry a blow. However if the boxer reflectively identifies the forthcoming blow as a feint designed by his opponent to trap him, then he is engaged in the "use of significant symbols," and, therefore in symbolic interaction. The following action then will be affected by the interpretation the boxer makes of his opponent move.

2.2.2 Ontological and Epistemological Assumptions

Interactionism understands “human groups” as collectives of human beings who are engaged in action. Action is a defining feature of social groups and “human group life” is an ongoing process of fitting together the activities of its members. Thus, human group life is a continuous process of structuring structure.

For interactionists, a society consists of individuals interacting with each other, and social interaction is an interaction between actors, rather than between factors imputed to actors such as motivations, social status, cultural prescriptions, norms, hidden complexes, etc. Instead of understanding social interaction as a means or a setting for the expression or release of human conduct, interactionists understand social interaction as the formative process of human conduct. It is in social interaction where human conduct is formed. Agents use the interpretative process interacting with each other and take account of others are doing or are about to do. They are forced to direct their own conduct or handle situations in terms of what they take into account. Therefore, human agency has definitive limit, but these limits are not static external forces. They become limits in the situation of interaction and action by their being interpreted as such by human agents.

For example, in social interaction requests, orders, commands, cues and declarations are symbolic gestures that convey to the person who recognized them an idea of the intention and plan of forthcoming action of the individual who presents them. If social interaction is to be effective one agent needs to indicate what the other has to do. That is, s/he needs to produce a symbolic gesture the other person can recognize and act upon it (orders, commands, etc.). This dual process of indicating to others how to act and of interpreting the indication made by others is an ongoing process, in which, and through which, joint activity and human conduct are formed.

Another ontological assumption of interactionism, also relevant to social studies of science and technology (STS), concerns the nature of objects. In interactionism, the "worlds" that exist for human beings and for their groups are composed by "**objects**," and these objects are the product of symbolic interaction, or, in STS terms, of social construction. An object is anything that can be **indicated**, that is it can exist in language as a sign. Artifacts are examples of physical objects. Social categories such as scientist, engineer, priest, and mother are examples social objects. Moral principles, doctrines, ideologies, and ideas are example of abstract objects. In social interaction, human beings populate and create their "world of objects" with these socially constructed objects. The nature of the object consists of the meaning that it has for the person to whom it is an object. Using postmodern terminology, what constitutes an object is the reading that can be made out of it. This meaning sets the way in which an agent sees the object, the way in which s/he is ready to talk about it, and the way h/she is prepared to act toward it. Out of a social process of mutual indications, common objects emerge. These are objects that have the same meaning for a given set of people and are seen in the same way by them all. However, although common objects emerge from social interaction, these objects also retain their interpretative plasticity and flexibility and can be read and acted upon in different ways by other social groups, and in any time their meanings can be open up again for re-signification. This approach of symbolic interactionism to objects has consolidated a solid tradition of theory in STS. Take as an example Star's concept of boundary objects (Star, Griesemer, 1989). [4] Boundary objects defined as "objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star & Griesemer,1989:393) are one clear example of an interactionist ontological understanding of objects. These objects embody a level of common meaning that arises from process of social negotiation necessary for cooperation between human groups, but they also keep multiple meanings for these diverse human groups (or social worlds as we'll define later) that also define their actions toward the object. Thus, boundary objects make possible for social worlds to cooperate without the need to share the same universes of discourse, a

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[4] Susan Leigh Star and Adele Clark are two examples of scholars that inherited the tradition of the Chicago School from Anselm Strauss, and applied it later to STS.

feature of social life made explicit by the social worlds/arena framework. Interactionists call this feature "cooperation without consensus."

In this perspective, to understand the action of people it is necessary to identify their world of objects. People have to deal with this world of objects and toward it they develop their actions. Human group life on the level of symbolic interaction is a process in which people are forming, sustaining, and transforming the objects of their world as they come to give meaning to objects.

One of these special objects for interactionists is "the self." Human beings are able to make indications to others and interpret their indications by virtue of possessing a "self." Because of this self, a human being can be an object of her/his own action. s/he acts toward her/himself, and guides her/himself in her/his action toward others on the basis of the kind of object s/he is to her/himself. This interactionist principle was first argued by G.H. Mead. Mead develops this concept of "the self" as an object we form by placing ourselves in the position of others (role-taking/assuming others' perspective). These others can be a discrete individual, for example when an individual plays "being an engineer." The "other" can be a discrete organized group, for example when an engineer sees herself through the eyes of her mates in a design team. The "other" can also be an abstract community (generalized other), for example when an engineer sees herself as a member of the nation and embodies nationalism or patriotism as part of her work.

The existence of the self makes possible for human agents to have a self-communication and interact with her/himself through a social process of making indication to her/himself. Instead of being a merely organism that responds to the play of factors on or through it, the human being is seen as an organism that has to deal with what it notes. It meets what it notes by engaging in a process of **self-indication** in which it makes an object of what it notes, gives it a meaning, and uses the meaning as the basis for directing its action. Its behavior with regard to what it notes is not a response called forth by the presentation of what it notes, but of the interpretation made through the process of self-indication[5].

Indication and interpretation are core building blocks for interactionism, and they constitute the nature of human action. Human action consists of taking account of various things that individuals note (indication) and forging a line of conduct on the basis of how they interpret them (interpretation). In so doing it, individuals construct their action through an interpretation of what is happening in their area of operation. In collective action, this interpretation takes place by participants making indications to one another, not merely to themselves. Indication and interpretation constitute what Mead calls **perspective**.

Another important element of interactionism it is view of social structures. Human group life in interactionism consists of, and exists in, the fitting of lines of action to each other by the members of the group. Such articulation of lines of action gives rise to, and constitutes, "**joint action**" – a societal organization of conduct of different acts of diverse participants-. Any joint action has to undergo a process of formation which comes into being through the dual process of indication-interpretation. The participants then need to guide their respective acts by forming and using associated meanings. These joint actions and the inter-linkage of joint action in complex networks of action sustain and form organizations, institutions and systems. The diverse array of people occupying different positions in these networks, engage in their actions at those points in the basis of their situated sets of meanings (perspective). A network works because people at different points do something, and what they do is a result of how they define the situation in which they are called to act. This set of meanings has its own setting in a localized process of social interaction. Both, the functioning and the fate of institutions are set by this process of interpretation as it takes place among the diverse set of participants. These joint actions and networks of joint actions are also historic, and some of these, in time, stabilize in "**obdurate realities**" for their participants (structure). This

[5] This interactionist emphasis on interpretation is central to support their thesis (and critique) that humans are not responding organisms, as presented in functionalist and behaviorist theories, but acting organisms.

interactionist definition of structure is not external to human actions, as presented by other social theories, given that it is through human interaction that structure is constructed, interpreted and becomes “structure” for action[6].

2.2.3 Methodological Implications for Engineering Studies

Consistent with their ontological assumptions of the nature of human society, human group life, social interaction, objects, human beings, human action and joint action, interactionists argue that knowledge about the social world needs to be constructed empirically by studying the world of everyday experience, human actions and social interactions. The objects of study then become actions, experiences, interpretations, meanings, and social interaction, and the method of investigation relies heavily in exploration and inspection. Exploration attempts to get a clearer picture of what is going on in an area of social life. Inspection involves casting problems in theoretical form, identifying objects of interest and their associated meanings, establishing relationships among objects, and identifying obdurate interactions and their associated meanings.

The method requires the researcher to study the empirical world of group life and conduct. The importance of perspective (people acting on the basis of their meanings of objects) for interactionists require to see people’s world of objects as they see it. It is necessary to identify the set of meanings associated with every object that is being analyzed. This involves describing the own individual’s accounts of how they see their objects, how they have acted toward the objects in different situations, and how they refer to the objects in their conversations with peers and not-peers.

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[6] Bourdieu for example developed a sound social theory that also shows how social structure (field) is individually incorporated (habit) and enacted in concrete situations of action (Bourdieu, 1998). However, for Bourdieu this is rather and unconscious process given that habits are corporal dispositions that throw individuals to act without passing through an interpretative process. From an interactionist perspective, Bourdieu’s theory neglects to acknowledge human beings as acting organisms rather than as passive objects of habit, and diminishes the role of human agency in transforming, contesting or creating new social structures.

For the study of engineering cultures, from an interactionist perspective, it is necessary to do fieldwork in the social groups where engineering is performed in action. Observe, describe and categorize the world of objects that constitutes the situation of action as brought up by the participants and their indications-interpretations. Observe, describe and categorize the social interactions among participants and the role that objects play in these interactions.

For the study of politics of engineering design, it is also necessary to document the group life of engineering design. This group life is constituted by processes by which people indicate lines of action to each other and interpret the indications of others. It requires identifying the perspectives of people involved in design tasks and the processes of fitting together lines of action (joint-action) –i.e. social acts, coordinated tasks, rituals, traditions, etc –. In the social interaction of individuals in design groups it is also necessary to identify how people create meanings or contest meanings in their interaction. These meanings define situations of co-presence with others, presentation and construct of engineering "selves," and the content of their technological objects.

In engineering settings this implies a need to document the social interactions whose purpose is to structure joint action: establishing goals, planning, organizing labor and responsibilities, negotiating resources, coordinating meetings, persuading others, etc. A researcher must also describe processes of social construction of meanings around objects, negotiations and conflicts among competing meanings.

2.2.4 Social Worlds / Arenas

The Social Worlds framework is a theoretical and methodological extension of symbolic interactionism developed by Anselm Strauss (Strauss, 1991) and Howard Becker (Becker, 1986) in the 1960s and 1970s. When developing their approaches, Becker and Strauss tackled on one of the weaknesses of symbolic interactionism, namely its extreme emphasis in the micro-processes of individual's social interaction and the lack of analysis of macro-processes (structure) and their influence in shaping social action[7].

Clarke and Star provide an initial definition of social worlds taken from Strauss and Becker:

> "social worlds [are] groups with shared commitments to certain activities, sharing resources of many kinds to achieve their goals and building shared ideologies about how to go about their business" (Clarke, Star, 2008: 115)

In a social world framework the units of analysis are the social group and its interactions (encounters) with other social groups, rather than individuals and their social interactions with other individuals or objects. The social world analysis moves symbolic interaction up from the level of the individual actor to the level of the collective actor. Strauss, for example, understands social worlds as "universes of discourse" (Mead, 1972) with which social groups are coterminous (Strauss, 1977, 1991). That is social groups have a dynamic that is concomitant with that of their own meaningful universes of discourse. This approach extends symbolic interactionism beyond the individual towards the social group.

The study of social worlds, organized around universes of discourse (symbols, meanings, interpretative constructs), also includes the analysis of activities, sites, technologies, and organizations typical of particular social worlds:

> "In each social world, at least one primary activity (along with related clusters of activity) is strikingly evident … there are sites where activities occur; hence space and a shaped landscape is relevant. Technology … is always involved. In social worlds

[7] This is actually one of the most common critiques of symbolic interactionism. However, these kind of critiques are more reflective of the work done by practitioners of symbolic interactionism than the theory/methodology itself. As presented by Blumer, symbolic interactionism needs to take into consideration structure (obdurate reality conformed by historically established networks of joint-action) and how structure becomes structure by means of interpretation, where it can be reassessed, confronted and transformed (Blumer, 1969). This same point is brought up by Adele Clark who considers that the structures shaping social action are not abstract-external structures that configure the patterns of social behavior, but rather actions are structured by the situation of actions, which is ultimately built by the practitioners involved in the action. This situation instantiates elements from macro-structures, meso-structures and micro-structures and configures a specific scenario for action to occur (Clarke, 2005)

… once under way, organizations inevitably evolve to further one aspect or another of the world's activities." (Strauss, 1991: 236)

The main thesis of a social world framework is that social worlds are constituted in interaction with other social worlds. It is in these encounters with other social worlds that a "social self" of the social world is constructed and sustained. Here construction and negotiation of meanings, social interaction and indication-interpretation occur at the level of the social group –the meso level. Even if ultimately it is individual actors who engage in social interaction, they do so as representatives of social groups and of universes of discourse. Therefore, this framework focuses on meaning-making amongst social groups –collectivities of various sorts- and on collective action –people "doing things together" and working with shared objects- (Clarke & Star, 2008).

This meso level of analysis is one of the most important contributions of this framework to the social sciences which usually fluctuate between micro-analyses of human behavior and macro-analysis of structure and its influence in directing human conduct. It also provides a point of entry to study the interaction between human agency and structure. The meso-level here is the level of social action, not an aggregated level of individuals. Individuals become social beings through their actions of **commitment** to social worlds and their participation in those world's activities, creating and being constituted by the social world's discourses.

In the same way that G.H. Mead's ideas are central symbolic interactionism, Mead's concept of **commitment** is also crucial to the social worlds framework. According to Becker commitments link individuals to consistent lines of activity in social worlds. Thus, commitment to social worlds is both, predisposition to act and part of identity construction (Becker, 1960). When individuals commit to social worlds, they also commit themselves to sustain and perpetuate the universe of discourses that sustains their social world. They do that by incorporating the discourse as organizer of their world of objects, and sharing a common **perspective** with others provided by such discourse. According to Clarke and Star, "social worlds generate shared perspectives that then form the basis for collective action while individual and collective identities are constituted through commitments to and participation in social worlds and arenas" (Clarke & Star, 2008:115). The meso-concept of commitment is, therefore, central to link the micro level of the individual with the macro level of the institutions.

Social worlds usually segment into sub-social worlds, intersect with other worlds with which they share interests and commitments, and merge. When segmented in sub-social worlds that adopt among them conflicting perspectives on substantive issues of the discourse, the whole is analyzed as an arena (Clarke & Star, 2008). An arena is also a discursive site where different social worlds meet. Because different commitments and perspectives encounter, arenas are usually sites of contestation and controversy. It is also in arenas where social worlds can construct, perform and transform their collective "self." Therefore, one of the most important activities of social worlds in arenas is to establish and maintain **boundaries** between worlds. This work of making and marking boundaries is both discursive and material.

Social worlds/arena framework then assumes multiple collective actors –social worlds- in all kinds of negotiations and conflicts, committed to ongoing participation in arenas (Clarke & Star, 2008). Thus, it is common to find the social world/arenas framework being applied to the study of meaning-making, identity formation, collective negotiation, controversies, face-to-face interactions, and structure/agency in the context of social worlds and arenas.

In STS, Adele Clarke, Susan Leigh Star and Joan Fujimura have been the most prolific representatives of this theoretical tradition. Their work, and the work of their associates, has produced several analytical categories that are now included as part of the toolbox of knowledge and concepts of science and technology studies, among them the concepts of boundary objects (Star & Griesemer, 1989), doability (Fujimura, 1987) (Clarke, 1995), work objects (Casper, 1994), bandwagon (Fujimura, 1988), and implicated actors/actants (Clarke, 2005).

Most recently Adele Clarke has proposed a new extension of grounded theory based on the social worlds framework to move forward grounded theory around "the postmodern turn" and include the specification of structural conditions of action (Clarke, 2005). In Situational Analysis, Clarke emphasizes the analysis of the situation of action, rather than the action itself, which is the focus of analysis in the social worlds and interactionist frameworks. She ascribes agency to the situation of action, which can be understood as ecology of micro, meso and macro, human and non-human, material and discursive entities. For Clarke, this analysis of the situation of action is a necessary step in symbolic interactionism and social world analysis to clarify its postmodern tendencies and align their theory/methods packages with those insights provided by postmodern studies in recent years[8].

2.2.5 Guide for a Social Worlds/Arena Methodology for Engineering Studies

Traditionally, the method associated with a social worlds/arena framework has been grounded theory (Glaser & Strauss, 1968). Grounded theory is a qualitative methodology developed by Anselm Strauss and Barney Glaser. This methodology is based on the qualitative analysis of ethnographic material (observations and interviews). It follows an abductive approach in which the analyst goes back and forth between the empirical data and the conceptual means of expressing them. Thus, theory grows out of grounded categorizations of data and a perspective that organizes and selects the relevant empirical materials.

This dissertation used grounded theory to analyze and code the data from archival analysis, observations and interviews. The perspective used to organize, select and code

[8] For Clarke, symbolic interactionism (SI) and social worlds/arena theories have always been ready for the postmodern turn. However, grounded theory has not been able to fully incorporate the postmodern theoretical implications of SI and social worlds/arena theory and it still attached to positivist assumptions. For Clarke, her proposal of Situational Analysis remedies this and defines a theory/methods package based on a post-modern interpretation of interactionism/social worlds-arenas that she intertwines with a Foucaldian discursive analysis and the inclusion of non-human and implicated actants as constitutive of the situation (Clarke, 2005). This situational analysis provides for Clarke a fresh perspective to do grounded theory keeping an eye on the situation of action and another in the action itself.

the "relevant" data was informed by social worlds/arena theory and by the theoretical concepts provided in Chapters 3 and 4. This perspective provides a scheme to see and organize the empirical world of systems and computer engineers in Colombia in terms of universes of discourse such as: informational capitalism, information and communications technologies for development, neoliberalism, and free software. These universes of discourse structure for engineers and other participants their meanings, meaning-making activities, identities, perspectives, social interactions, objects, sub-worlds, and arenas.

Empirically, in the engineering sites chosen, the fieldwork includes recording observed behaviors, and interactions within individuals and between individuals and objects. Then there must be an association with the meanings of those behaviors, objects and interactions that makes evident the processes of indication and interpretation (perspective). These behaviors and interactions can be observed either by doing participant or non-participant observation. The association with meanings requires to inquiry into individual and collective perspectives, therefore attention to language and discourse as well as to in-depth interviews are necessary to connect with these meaning from the perspective of participants (Denzin, 1969). This is the reason why in grounded theory, codes and relation between codes should be constructed from the data as much as possible (even though it is impossible not to introduce pre-conceptions during the coding process). At this point, theory can organize bodies of meaning and connect them to social processes, negotiations and the universe of discourse that constitute a social world. It is even possible to expand the scope of theorizing beyond social worlds to arenas and to what Clarke has called the "situation of action," which instantiates broader social structures usually considered in macro-analyses (Clarke, 2005).

In sum, from a methodological perspective the challenge is to connect the situation of analysis with a theoretical viewpoint to study the social action of engineers. One provided by the social worlds/arena framework and the theoretical concepts presented in chapters 3 and 4. For the purposes of this dissertation, I proposed to do so by defining different scales of observation and analysis, some units of analysis, and social world-arenas organizing concepts.

First, from a macro-level, we can consider that social structure is instantiated in the situation of action by the participant actors. This implies that it is necessary to identify the likely elements of social structure that may be present as the "situation of action." That is, one needs to identify within the empirical data how these elements make it to the "situation" by means of participants' perspectives and which are their consequences in action. In the case of system and computer engineers in Colombia, who attempt to design and deploy information technologies for development, I initially hypothesized that these structural, macro elements are coming from three interconnected sites: informational capitalism, informational developmentalism and neoliberalism. These politico-economic institutions and discourses structure constrains and possibilities for the work of systems and computer engineers in the organizations studied. For example, neoliberal policies in Colombia affect funding patterns for information and communications projects in the government. Indicators developed by international institutions of information and communication technologies for development (ICT4D) are used in Colombia to measure the effectiveness of the work of governmental engineers. This official discourse of ICT4D has also being motivational to create organizations dedicated to design policies of ICT4D, one of these constituted by engineers has been studied in this dissertation. Thus, these discourses can be seen to structure action due to their consequences in affecting funding patterns, creating or transforming organizations, affecting governmental budgets, shaping collective and individual subjectivities (careers), and defining what is "doable" in terms of policies, programs and technologies. The point here is to connect to hegemonic ideologies and institutions that frame the social interactions being studied. The main question to be asked at this level is:

"*How does the increasing participation of systems and computer engineers in public-oriented ICT organizations in Colombia, help stabilize or destabilize capitalist* *discourses of the information society and, in the process, alter engineering ideologies, practices, technologies and understandings of professionalism?*"

Second, in the meso scale of analysis, I used the social world/arenas framework as proposed by Strauss and Becker. Two arenas were center points for the organization and analysis of the data. The first arena was the design of information and communication technologies for development (ICT4D). The **design of ICT4D** was selected as arena because it offered the advantages of connecting directly with engineering work, engineering work objects, and engineering technologies. Understanding design of ICT4D as an arena where social worlds meet to construct objects also connects with the STS interest of studying the co-construction of technology and society. In addition, the scope of social words/arena analysis also touches on identity issues. Therefore, design is also understood as an activity where boundaries of social worlds are sustained or transformed, and where collective and individual identities of participants are in the making. It is in the design arena of ICT4D where the worlds of engineering, informational development, neoliberalism, informational capitalism, and citizens meet to create and recreate the discourses of ICT4D and to materialize it in artifacts, social practices and infrastructures.

The second arena of interest was the **informational development** arena. It is constituted by all those social worlds that are committed to make informational development in Colombia a reality. Therefore it encompasses and subsumes the ICT4D design arena. This arena was selected because the participant social worlds cross different scales. Some of them are local, some of them are national, and some of them are international. They are involved not only in the production of technologies, but also in the transformation of governments, corporations, non-profits, social practices, and life conditions of regular citizens. They continuously produce discursive objects, statistical objects, technological objects, policies, and social categories. It is in the informational development arena in Colombia where the social worlds of ICT4D, development, informational capitalism, corporate social responsibility, free software, human rights, and neoliberalism meet. Because social worlds and arenas intersect, social worlds subdivide, and participants usually belong to multiple social worlds, we will find that some participants commonly travel back and forth these two analytical arenas. In this level social world's discourses also frame doable problems and structure lines of engineering work, define material resources, and construct work objects. The main questions to be addressed at this level are:

"How do different social worlds of engineering understand the "information society," its relationship with social change and their roles in unfolding this project?"

"What are the different responses these social worlds have had to the challenge posed by informational development, informational capitalism, neoliberalism and other social worlds in the ICT4D arena and the need to incorporate social concerns in engineering work?"

"What are the dynamics of the ICT4D design arena and how they affect engineering work, engineering technologies and methodologies?"

Third, at the micro-level, the fundamental questions of symbolic interactionism about identity construction and engagement in meaningful social interactions will be explored. Engineers here are questioned about their perspective of their "selves" as a result of their commitment to their social worlds in informational development. Engineers at the micro-level also engage in meaningful interactions with other participants and world objects to articulate joint actions that sustain structures or transform them (structuring structure). The main question to be addressed at this level is:

"How have engineers' commitments within the social worlds being studied altered their meanings of their work objects, the methodologies they follow, their social interactions with other participants/objects, their careers, and their engineer "selves"?"

2.3 Critiques to Symbolic Interactionism addressed by Social Words/Arena Framework

As I adopt its perspective and methods in my research, it is also important to consider some of the common critiques of interactionism. Symbolic Interactionism has had a long history. Since its beginning during the 1930s and 1940s, it has changed from a micro-sociological, non-statistical, robustly relativistic and anti-positivistic theory, strongly heralded and supported by Blumer, to more meso- and macro-sociological approaches, as developed by Strauss and Clarke. It has also mixed with other sociological traditions such as postmodernism, feminism, and now, more recently, ANT. However, it is still common to find recurrent critiques or "debates" around symbolic interactionism that can be traced back to the 1960s. Gary Fine (1993) summarizes these critiques in three main debates that symbolic interactionism had brought to other major debates in sociology.

The first debate is about the micro and the macro. Symbolic interactionism as presented by Blumer represents the dominant micro-version of sociology. Interactionists however were always aware that connections between levels of analysis needed to be established. However, it was the work of Strauss and his associates, under the paradigm of the "negotiated order," that placed social world analysis and organizational analysis in the interactionist agenda. The effect of Strauss' work was to include the meso level of analysis in sociology. This meso level of analysis provides a bridge between micro and macro level of analysis given that Strauss considered that macro-structures are instantiated in micro-interactions via the commitments participant make to their social worlds. This extension in research led to the understanding that institutions had an important role in constraining meaning, even if these macro structures did not totally determine meaning-making and interaction (Fine, 1993). The meso level (social worlds) came to be understood as the level where social dynamics occur that permit institutions, hegemonic ideologies, economic and political orders to compel commitment or obedience from individual actors. Some other interactionists have gone even further to support the idea of a seamless sociology that recognizes that different levels are intertwined and indivisible (Clarke, 2005).

A second debate is that of agency and structure. Interactionist approaches are empathically humanistic. That is they rely in human agency as a primer mover in structuring social order. This is another point of critique coming from theories that privilege structure or that place agency in non-human actors (ANT). However, the balance between structure and agency has always been a central concern of interactionists. Blumer, for example, used the concept of “obdurate reality” and “sedimented meanings” to refer to repetitive joint actions, shared worlds of objects, and meanings that have become historical or traditional, influencing ongoing interpretive process and social interactions (structure). Strauss also noted that not all meanings and actions were possible between social worlds given that social interactions are set within institutions (obdurate realities), and interactionists recognize that much of the world is not of an individual’s own making. Obdurateness, constrains, negotiations, sedimentation, symbolization and ritualization, all of these interactionist concepts connect the actor with the limits of choice (Fine, 1993). The location that Strauss emphasizes for individuals in social worlds also shows that individual perspective depends on collective meaning creation and negotiations. In addition, considering the non-human has also been a feature of symbolic interactionism as described by Blumer when explaining the social interactions between individuals and physical objects or generalized others. These objects also constitute part of the obdurate reality.

A third debate is that interactionism and social world/arena analyses are politically empty and do not stand on a political position to discriminate between what is good or not. Interactionist strong stance on plurality of meanings and perspectives can be kept at the descriptive level without going to radical anarchism due to constrains imposed by obdurate realities and collective meanings. Analyses of how power is distributed between social worlds and within them have not been part of the mainstream of interactionist research. However, feminist perspectives brought by Star and Clarke have shown that interactionism can explore and make visible structures of power. Bowker and

Star, for example, have explored how power is deployed in the construction of boundary infrastructures trying to freeze meanings and subjectivities in classification and information systems. In the process social structures of domination are sustained (Bowker & Star, 1999). Clarke also includes in her analysis the implicated actors/actants, which are actors/actants that do not participate in meaning-making processes affecting them, either because they are silenced in social interactions or because they are excluded and represented by other participants. Star and Clark's attempts to reveal silences and invisibilities in their interactionist work also constitute political work (Clarke, 2005). Other scholars that have used the social worlds/arena framework in STS have complemented interactionist analysis with other social theories that address more directly issues of power. For example, Steven Epstein, in his analysis of the politics of AIDS research during the 1980s in the USA, complemented his interactionist analysis of the arena of AIDS research and the social worlds of AIDS activists and scientists, with a Bourdieuan analysis of a scientific field where credibility was the organizing principle of the structure of power (Epstein, 1996).

For my purposes, I rely on the prescriptive work of Herbert Schiller to complement the social worlds/arena analysis (See Chapter 4) and to place issues of power at the forefront. Schillers' critical vision of informational capitalism provides conceptual elements to evaluate the social world's perspectives being analyzed, and prescribe if they are convenient or not to achieve their social purposes. When necessary, I will also provide remarks about agency of discourses and, where appropriate, explain structures of power that distribute agency between individual and collective actors in asymmetric arenas.

2.4 Conclusion

In this chapter, I presented the theory and method package that oriented this research: social worlds/arenas framework. This framework is an interactionist theory, developed in the 1960s and 1970s, that focuses on meso level analyses of social life.

Since the 1980s, it has become a widely used methodological approach to science and technology studies. I decided to use this methodology for its clarity in its ontological and epistemological assumptions, which provide a sound basis for social inquiry in my venues of interests in STS, namely engineering cultures and politics of engineering design. In the conclusion of this dissertation, I will explore deeper the theoretical implications for engineering studies and STS of using social worlds/arena analysis.

3. CAPITALISM AND ENGINEERING

3.1 Introduction

Engineering can be understood as a social world or, in other words, as a group of people identified as "engineers" with shared commitments to "engineering" activities and ideologies, sharing resources (knowledge, technologies) of different kinds to achieve their goals (Strauss, 1977). Understanding engineering from this perspective brings up light on how engineering has being defined itself in society in different moments in time and in different places.

From a social world perspective, engineering has been constituted and defined with respect to the other social worlds it has interacted with. This is why; it is so common to find sociologists and historians locating engineering as an object of study in contrast to other social worlds. Thorstein Veblen (Veblen, 1983), for example, in his classic "Engineers and the Price System," situates engineers at the beginning of the 20th century between the pulls of science and the market, two other social worlds. Edward Layton analyzed the historic transition of engineering professionalism from entrepreneurship to employment in the bureaucratic world with respect to the changing social world of industrial corporativism at the turn of the 20th century (Layton, 1986). David Noble (Noble, 1984), in his social history of industry automation, depicted engineers in the middle of a class struggle between the social worlds of workers and managers in a GE factory. Commonly to all of these analyses is that capitalism has been a major force re-structuring the interactions between engineering and other social worlds as well as the social world of engineering itself.

The expansion of industrial capitalism in western societies from the end of the 18th century to the beginnings of the 20th century went along with the rise of engineering as a profession and a discipline. Engineers in the North America during the 19th century, and engineers in South America during the 20th century, obtained relatively quick recognition of its social status because of their crucial role in the processes of industrialization. In the process, engineering as a profession was shaped with an orientation to capital and a market logic, making corporations a natural niche for engineers.

The aim of this chapter is to layout a general understanding of the historical co-construction of engineering and capitalism in two western societies. The literature review will serve to illustrate this relationship in the United States and in Colombia, for purposes of comparison between these two countries and for purposes of locating engineering in Colombia in a bigger social picture.

The influence of capitalism over engineering will be evaluated on the following dimensions:

1. Social Worlds: universes of discourse about engineering that congregate a collective of people sharing similar perspectives and commitments to "engineering" action.
2. Professionalism: monopoly of esoteric knowledge, collective control over the profession, representative and legitimate professional institutions, autonomy and independence from business interests, and social responsibility (Layton, 1986).
3. Technical knowledge: theories, standards, and methods.
4. Technologies: artifacts, systems, and infrastructures.

Conversely, the influence of engineering in capitalism will be observed in the expansion of managerial capitalism and industrialism due to the direct or indirect action of engineers in technical, organizational and political domains.

The narrative begins with a brief history of engineering in the USA during the 19th and 20th centuries emphasizing the links between engineering and capitalism and concludes with the corresponding historical narrative of engineering in Colombia.

3.2 Engineering and Capitalism in United States

The North American engineering profession emerged in the 19th century from the blending of the French and the British engineering traditions. Engineering in France was a well established occupation by 1800 (Reynolds, 1991). Mostly employed by the military, it had already been recognized as an occupation critical for the maintenance of the monarchy. Two corps of engineering, one military, another civil, had already a history of more than 130 years and 80 years respectively, of providing the monarchy fortresses to resist canon fire, bridges over which armies moved, a national network of roads for civilian and military purposes, canals, river and harbor improvements and water supply systems (Reynolds, 1991). Standards of construction, normalization of roads and networks as well as shortage of personal took the French government to institute the first engineering schools during the 18th century [9] with their characteristic emphasis on mathematics and theoretical methods to guide and normalize practice. One of these schools, the Ecole Polytechnique would become instrumental for the construction of the French nation-state, right after the revolution, and would become a model for engineering education in Europe and The United States. In addition to the emphasis on theoretical approaches in engineering, a strong control and regulation of the profession by a central government was, and in many ways still is, a dominant feature of French engineering. This proximity of engineering to the state has always been a feature that has connected French engineering with nationalism and has granted engineers a distinguished social status in French society (Hecht, 1998).

In Britain, however, it was clearly capitalism, rather than the state, the great dynamo of engineering. By the mid 18th century, Britain's commercial and industrial expansion had provided individuals and private associations enough wealth to undertake large and complex technical projects for private commercial purposes. Non-military, self-trained, engineers provided their expertise for these "civil" projects and developed their

[9] Ecole du Corps Royal du Genie – 1749 (training of military engineers), Ecole des Mines – 1778 (training of mining engineers), and the Ecole Polytechnic – 1794 (Daugther of the French Revolution, the Ecole Polytechnique would eventually become the ultimate seat of French elitism, engineering and French nationalism)

careers in this raising private sector. At the end of the 18th century, triggered by an increasing demand for their services, civil engineering had already developed a professional identity, hierarchy[10] and a professional association[11] (Buchanan, 1983). Influences of capitalism in the development of the profession can also be seen in the laissez-faire approach to determination of salaries of engineers and in the on-the-job training for engineering education. During mid 18th century, discussion about salaries was assumed to be a private arrangement between individuals rather than an institutional issue determined by a professional association or engineering union[12] (Buchanan, 1983), situation that would derive in a limited impact of engineering associations on the regulation of the profession on favor of market principles. Also, in contrast to France, engineering education favored an on-the-job training approach rather than a theoretical oriented one provided by academic institutions. This emphasis delayed the acceptance of university accreditations as an entry to the profession until the end of the 19th century. Normally, the few engineers, who obtained university credentials during this period, were obliged to serve an additional apprenticeship in the office of an established engineer and have direct work experience with the reality of the industrial setting before gaining full acceptance into the profession (Buchanan, 1983). The rise of non-military engineers in response to labor opportunities in the private industry, the influence of market principles in determining engineering salaries, and a clear emphasis on practical and empirical approaches to engineering education, show how the social world of engineering in Britain, interacting vis-à-vis with the social worlds of the rising industrial capitalism, grew to become markedly different than its continental counterpart in France.

These two cultures of engineering, the continental tradition with its emphasis on mathematical/theoretical methods and its marked strong by the state, and the British tradition with its emphasis on practical/empirical approaches to problems and its influence by the industrialist market, provided models for what engineering was going to

[10] Consultant, Assistant, Resident, Pupil.
[11] Society of Civil Engineers - 1771
[12] This can be contrasted with the British Medical Association that assumed the functions of a trade union to represent the economic interests for the medical profession during the same period (Buchanan, 1983).

become in The United States and in Colombia during the 19th and the 20th century, respectively.

Before the American Revolution, engineering did not exist as an occupation in North American land[13]. Large-scale organizations or large-scale projects, traditionally associated with the appearance of engineering, were uncommon in colonial America. Colonial governments were small and weak, unable to sustain large armies or to finance large public works. It was amidst the American Revolution that the revolutionary army would demand engineering expertise to conduct sieges, build fortifications, bridges and roads to mobilize troops. In 1775, the American Corps of Engineering was established. However, having no enough engineers home, and also due to France's sympathy with the North American cause, French engineers occupied these positions during the revolutionary war (Reynolds, 1991). The French trained and organized the American Corps of Engineering until 1783, when peace came and the corps was dissolved. However, the influence of French engineering over North American engineering was notably reduced during the post-revolutionary years and during the first half of the 19th century became concentrated in engineering universities. Following the revolution, the project of building a nation demanded an improved transportation network and other related civil works. In contrast to the French experience where the royal government served as patron for the engineering profession, in post-revolutionary United States no central government was able to provide a strong patronage for the profession. Fear of political centralization produced a weak federal government and, in consequence, engineering patronage was assumed by state governments and by private entrepreneurs, a pattern somewhat similar to the British tradition (Reynolds, 1991). Commercial rivalry among states to attract trade, in fact, would also be instrumental in support for large transportation projects financed by mixed enterprise systems that would increase demand for civil engineers (Hunter, 1963).

[13] Statistics collected by John Rae show 62 American engineers born before 1790, and 277 engineers born between 1790-1830 (Rae, 1975).

The construction of the Erie Canal (1816-1825) in New York State was especially significant for the civil engineering profession because it was here that the first formal system of entrance to the profession in the United States was instituted. According to Daniel Calhoun, the magnitude of the project demanded the creation of a system of on-the-job training to supply continuous demand for assistant engineers for short sections of the canal. Engineer prospects would enter the profession doing and learning about surveying, mapping, route selection, mathematics, and personal management working their way up to survey crew chief. The best among them would become assistant engineers. Once the canal was completed, the engineers trained in the "Canal School" carried with them this system of on-the-job training to other projects elsewhere in the country (Calhoun, 1960). By 1837, on-the-job trained engineers from canal and railroad projects were average in the USA. Engineers with academic training only accounted for 25% of all engineers[14] (Calhoun, 1960). Engineers trained in organizational settings, like the Baltimore and Ohio Railroad Company, soon acquired the character and discipline of an "organizational engineer," in a manner resembling the British tradition. The hierarchical organization and the need to conform to organizational objectives shaped their training, occupational status and technical functions, limiting their professional authority to that of the company's. Individualism and professional freedom were curved and engineers became responsive to company interests (Calhoun, 1960). In this way, capitalism in the United States began paving the way for the organizational engineer that was going to be more prevalent at the turn of the 20th century, something more clearly evident in one specialty of engineering closely related to industrialization: mechanical engineering.

Mechanical engineering developed as an engineering specialty during mid 19th century in the USA and followed the same pattern of on-the-job training common with civil engineers. Capital-intensive, mechanized factories provided field training for these professionals. A machine-shop apprenticeship, for instance, constituted the entrance to the profession. Engineering prospects began their career as machine-shop laborers,

[14] By 1837, Academic training for engineers in the USA was available in West Point (since 1802), Norwich University (since 1819), and Rensselaer Polytechnic Institute (since 1824).

became apprentices, later journeyman machinists, and then machinists. Shop owners raised the best of their mechanics to become superintendents or chief engineers and some of the latter would then establish their own shops as owner-engineers (Reynolds, 1991). Mechanical engineering, born as a by-product of industrialism in The United States and located in machine shops, provides a rich analytical point to understand the influence of capitalism on its methods and profession. Bruce Sinclair's analysis of the construction of a North American standard of screw threads during the 1860s, describes how decisive private initiatives were to establish standards for mechanical engineering in the USA, prior to the establishment of the National Bureau of Standards in 1901.

By 1860, industrial development and railroad construction demanded that nuts and bolts of the same diameter be interchangeable. "Locomotives and rolling stock [needed to] be manufactured according to standards, since repairs were frequently required at points distant from a central shop" (Sinclair, 1969). However in The United States at that time there was no single agency capable of establishing and enforcing the implementation of such standards. William Sellers, an on-the-job trained mechanical engineer, came up with a form of thread based on an angle that was easy to produce by any ordinary workman with accuracy. Sellers presented his proposal to the Franklin Institute at Philadelphia in 1864 highlighting the benefits of his design over the English system, also known as the Whitworth standard. According to Sinclair, Seller's design was cheaper to produce. It could use existing tools and machineries and could be produced by any ordinary worker. On the other hand, the English standard required greater accuracy, a high level of craft skill from workers and it was more expensive to produce.

In many ways, the Franklin Institute became the enroller of different actors to move establish Seller's design as the North American Standard. It pursued technical studies that projected the institute nationally, constituted a committee of representatives of Philadelphia's leading machinery firms to consider the subject of screw threads and maintained close contact with scientific and journalistic magazines, academic community, and the US Navy's Bureau of Steam Engineering. The institute persuaded the German government that the North American was superior to the English one with market research showing that by 1887, the Seller's system was the most widely used thread system in North America (Sinclair, 1969). This socio-technical network of nuts, bolts, machinery firms, ordinary workers, cost/benefit rationale, mechanic institutes, technical studies, and nationalism would ultimately establish Seller's as the de-facto standard of screw threads in The United States. The success of this socio-technical system relied heavily on the industrial mindset evidenced in the incorporation of labor costs as one of the basic requirements for engineering design. Seller's design responded to concerns of reducing labor costs and production costs by promoting a design that allowed factories to use unskilled workers and their existing machinery to produce screws. Thus, this system was quickly adopted and defended by industrialists. Sinclair quotes Seller emphasizing this:

> "Skill and ingenuity may indeed accomplish great results, but the problem of the day is not only how to secure more good workmen, but how to enable such workmen as are at our command to do good work, and how to enable the many really skillful mechanics to accomplish more and better work than heretofore; in other words, *the attention of engineers is constantly directed to so perfect machine tools as to utilize unskilled labor*." William Sellers, 1877 (quoted by Sinclair in (Sinclair, 1969), my italics)

In addition to showing the connections between industrialism and the North American style of engineering, Sinclair also shows that a North American tradition of engineering was being formed by distancing itself from its British roots and British traditions of engineering. In interactionist words (Strauss, 1991), the bipolar differentiation, distinguishing French and Britain traditions, provided the initial elements for the formation of North American engineering at the beginning of the 19th century, it gave way by mid 19th century to a more complex arena of engineering styles where North American engineering defined itself as a social world of its own, with a distinctive identity and discourse defined in contrast and in relation to the previous traditions from which it was drawn.

The rise of North American industrialism, a weak federal government, and the early influence of French engineers in military and civil works in the USA strongly shaped the North American engineering style. These factors created a tension between a British tradition that came to dominate a version of private and practical-oriented engineering, common in machine shops during the 19th century, and a French tradition more focused on social service for the state and theoretical methods commonly found in universities. The location and representatives of this clear-cut polarizing tension will blur and hybridize over the years but for analytic purposes it is still possible to map these positions around controversial issues in engineering during the last decades of the 19th century (Reuss, 1985).

By the 1870s however, the predominance of academic training over on-the-job training was becoming evident in The United States. According to Terry Reynolds, this decisive transition in engineering education was also determined by North American industrialism. The intensive production of North American industries at the end of the 19th century demanded a supply of trained engineers that apprenticeship and on-the-job training simply could not provide. Universities and colleges, on the other hand, were able to generate a constant and faster supply of trained engineers to meet industries' demanding pace of technical expertise (Reynolds, 1991). Largely financed by land grants, state colleges and universities open new engineering programs and strengthen the existing ones all over the USA. At the same time, a critical mass of engineers gave rise to professional associations and engineering journals, consolidating the path to engineering professionalism for an aspiring middle class in The United States (Bledstein, 1976).

Industrial capitalism influenced the engineering profession in many other places beyond education. The replacement of small traditional family firms by large corporations at the end of the century (Chandler, 1977) consolidated also the trend initiated by large-scale organizational projects, like the railroad, of building the "organizational engineer." The dominant professional image of the engineering as an independent consultant, in the case of civil engineers, or as an independent machine shop owner, in the case of mechanical engineers, dominant during most of the 19th century, gave way to an increasingly more common image of engineers tied down to large organizational bureaucracies.

3.2.1 Engineering and the Rise of Corporate Capitalism

Historian David F. Noble, in his book "America by Design," traces transitions within engineering professionalism along with the rise of corporate capitalism in the USA between 1880 and 1930, a period often called the "second industrial revolution." By locating engineering as a social world in between scientific technology and corporate capitalism, Noble analyzes the emergence of electric engineering, chemical engineering, and industrial engineering along with their correspondent industries at the turn of the century.

From a Marxist perspective, Noble pays special attention and emphasizes the dialectic relationship between society (social relations), represented in corporate capitalism, and technology (forces of production), represented in scientific technology, two different aspects of the same process of social production. According to Noble, engineering was instrumental for the dominant capitalist social relations to steer scientific technology in The United States in order to perpetuate the capitalist status quo (Noble, 1977). In the Marxist tradition, it was expected that advances in technology and productive forces would be a requisite for the revolution of the working class. However, by the end of the 19th century, it was evident that an expanded industrialism and technological innovations were not leading the way towards socialism but, on the contrary, were consolidating capitalist social relationships in The United States.

It was under these conditions that Thorstein Veblen in 1919 conceived of the surge of a soviet of engineers that would spur a revolution to overturn the vested interests of finance and industry, who were sabotaging national productivity to increase their profit margins (Veblen, 1983). However, Thorstein's revolution, and his soviet of engineers never materialized. In Noble's view, the opposite was the case. Engineers ended up joining the ranks of capitalist industrialism and help in the process spur the survival of capitalism in the USA:

> "Because they embodied the union of business with science, engineers naturally sought, in their technical work, to resolve the tension between the dictates of the capitalist systems and the social potentials implicit in technological development … since they pretty much defined what form technological advances would take, technology tended to evolve in close conformity with capitalist requirements … engineers steadily extended the range of their professional activities to include the deliberate fostering and strengthening of the social relations of corporate capitalism." (Noble, 1977:xxiii)

Noble explains two complimentary ways this development occurred. The first one, elaborated on "America by Design," is the blending of modern engineering with corporate America, government, and technical colleges and universities. Noble narrates this story in two parts. At the end of the 19th century modern science-based electrical and chemical industries monopolized electric and chemical engineering and shaped their growth. A few giant corporations, among them General Electric, Westinghouse, Union Carbide, Du Pont, Allied Chemical and Dye, through consolidation, merging, and patent monopoly came to dominate these industries in The United States before World War I. At the same time formal engineering education had become an obligatory passage point for entrants to the profession. The curricula of these programs were heavily influenced by the needs of these industries. According to Noble, this is evident in the fact technical and scientific knowledge was taught at these schools in close combination with managerial knowledge. It was expected that these "organizational engineers" would join the corporate ladder as technicians first and as managers soon thereafter.

Noble also describes diverse fronts in which organizational, or corporate engineers consolidated their commitment to corporate capitalism. These activities included scientific and industrial standardization, corporate control of invention through the reform of the patent system, growing integration of industrial and university research, transformation of public schools and higher education in accordance with corporate demands for both trained laborers and engineer managers, and the fashioning of a technology of social production in the form of Taylor's scientific management. These fronts, according to Noble, allowed engineers to participate actively in the design of corporate America.

Noble traces the careers of several engineers in the electrical, chemical and mass production industries, Alexander Magnus, Thomas Alva Edison, and Pierre Du Pont among them. He notes how the most renowned engineers were also mobile agents or "travelers" of the different social worlds of business, engineering associations, government and academia. Alternating positions in these worlds and redefining their professional profiles, these engineers carried with them the interest and logic of corporate capital to research centers, government agencies, universities, and factories.

Here a Faustian bargain between corporations and engineering seemed plausible. Modern engineering clearly could become a major scientific and industrial resource for North American capitalism by providing it with production techniques, technologies and expert labor to expand production and markets. It could also increase profit margins under constrains of low labor costs and efficient use of resources. On the other side of the bargain, corporate America would provide the engineering profession with a stable home for the profession, with long term careers that would link engineers, not only to technical activities and positions, but also to managerial positions (Chandler, 1977).

Rooted in the Marxist tradition, Noble concedes a very strong (perhaps too strong) agency to the corporate engineers who orchestrated the design of corporate America in industries, government and universities. However, his historic narrative is still valuable to highlight the fact that modern engineering and capitalism have co-constructed each other.

The second way, in Noble's account, engineers helped spur capitalism stems from their technical activities:

"The capitalist, in order to survive, had to accumulate capital at a rate equal to or greater than that of competitors. And since his capital was derived ultimately from the surplus product of human labor, he was compelled to assume complete command over the production process in order to maximize productivity and efficiently extract this product from those who labored for him. It was for this reason that mechanical devices and scientific methods were introduced into the workshop. It was for this reason that the modern engineer came into being. From the outset, therefore, the engineer was at the service of capital … his design of the machinery, for example, was guided as much by the capitalist need to minimize both the cost and the autonomy of skilled labor as by the desire to harness most efficiently the potentials of matter and energy." (Noble, 1977:xxiv)

Minimizing costs and the reducing the autonomy of skilled labor are for Noble the marks of capitalism in the politics of engineering designs. He elaborates on this point more extensively in his book "Forces of Production" (Noble, 1984). I will come back to this argument later on this chapter.

The Faustian bargain with capitalism had a significant cost for engineering. Locating the corporation as the home of engineering would give engineers responsibilities for the success of the company operations, but without real decision-making authority over the work to be done, now a responsibility of the managers. This produced a major contradiction within engineering professionalism as practitioners struggled to attain professional autonomy and define standards of ethics and social responsibility within a context of professional practice that demanded subservience to corporate authority. At the beginning of the 20th century, this tension brought a noticeable fragmentation of the engineering social world in The United States. A few prominent engineers established as independent consultants or owners of their businesses, and a majority of middle class engineers, were absorbed as salaried employees in large corporations. These different social worlds of engineers frequently clashed in the arena of professionalism. Each of these worlds had different understandings of professionalism, professional identity, control of public works, and the role of state and private interests in engineering. The so-called "revolt of the engineers," at the turn of the 20th century vividly illustrates how engineers lived this transition and how capitalism succeeded in shaping engineering professionalism to fit into corporate America.

3.2.2 Re-visiting the "Revolt of Engineers"

According to Edwin Layton (Layton, 1986), North American engineers adopted professionalism as a social mechanism to regain control over the discipline and their careers that they were losing to bureaucracy. Concerned with losing autonomy and collegial control of the profession to large companies, engineers, at the turn of the 20th century, organized reform movements within their professional associations to professionalize engineering. Although these reform movements decayed rapidly in the pro-business prosperity of the 1920s, they opened a window to analytically understand the diversity of engineering social worlds and the conflicts among them before the profession was assimilated by the social world of corporate America once and for all.

According to Layton, during the 1910s, mechanical and civil engineers seemed to be searching for a redefinition of their place in society and seeking a more active role in solving the social problems of the time. This was manifested in the progressive movement advanced by Frederick Haynes Newell to reform the American Society of Civil Engineers (ASCE) and by Frederick Taylor and Morris L. Cooke in the reform of the American Society of Mechanical Engineers (ASME).

By 1910, civil engineering was a highly fragmented profession. Several local engineering societies existed in different states, and ASCE, the national society, headquartered in New York, was a heavily centralized institution that did not respond to the needs of an increasing young population of engineers. These young engineers were mostly middle class and employed by corporations. They were confronted by an overcrowding of the profession and low engineering salaries. In the national headquarters of ASCE, on the other hand, there were also divisions. A faction of elitist-progressive engineers resented the way business interests dominated the engineering association and advocated total independence from businesses influences upon the organization. This faction opposed the conservative engineers in power in ASCE. The conservatives were elitist engineers as well, consultants and businessmen themselves, and they normally resisted the idea of a unified, activist engineering profession, denying any conflict between the interests of businesses and the interests of engineers.

One of the patrician reformers, Frederick Haynes Newell, national leader of the Conservation Movement, provided an ideology to unite young engineers and progressive patricians against the conservative old guard in control of ASCE, and at the same time to a major political program of national reform. The Conservation Movement was a political, social and scientific movement that sought to protect animal and natural resources for their continued use for humans by applying scientific planning to their management. Conservation was an ideology that was very well suited for use by engineers. It could be presented as a democratic battle of the people against the interests of selfish monopolies, but it was also a campaign for scientific planning by experts. Presented in this way it appealed to young engineers interested in the unity of fragmented factions of engineers, and also appealed to engineering patricians interested in advancing professionalism. Newell was convinced that this approach of applying civil engineering to the conservation of natural resources could be expanded to other social problems like transportation, communication, public utilities, agriculture, housing and education. In his framework of "social engineering," Newell defended the idea that scientific laws governed society as well as the material world, and that by discovering, and applying those laws, engineers could master the design of these human affairs. In his view, the application and use of engineering knowledge in social affairs held the potential for strengthening the engineer's public role, its status and autonomy.

In a long campaign, between 1915 and 1919, Newell orchestrated a reform movement gaining support of the young rank-and-file engineers that were discontented with the current state of the profession. By committing to advance the young engineers' cause, Newell, in his role of president of the American Association of Engineers (AAE), structured a democratic professional association that promoted licensing as its fundamental tool for improving the position of engineers and took steps towards collective bargaining. The successes Newell had, allowed him to transfer to AAE his hopes for the engineering of society urging local chapters to study engineering applied to social problems. However, his discourse of social engineering did not find an echo in the young engineers that were more individually oriented and committed to their own individual material interests. When economic circumstances changed during 1920s and businesses again provided stable conditions for file-and-rank engineers, the voices for reform faded away.

A similar development occurred among mechanical engineers. The advent of large corporations undermined the autonomy mechanical engineers had enjoyed in small-scale machine shops. No longer shop owners, they were reduced to positions of middle-management in large-scale industry. The development of scientific management by Frederick Taylor, during the 1910s, constituted a response that sought to carve out an autonomous role for the mechanical engineering within the corporation. In his theory, Taylor specified that the shop should be managed not by the manager but by the planning department to ensure maximum efficiency. In his scheme, engineers would be in control of the shop while managers would focus upon financial matters. Taylor's ideas quickly gained support by progressive engineers that saw in scientific management an opportunity to reposition the engineer in industry and society as captains of industrial productivity. By the end of the decade, T. Veblen saw in these engineers the grand promise of a soviet that would save industry from the "Vested Interests" of capital (Veblen, 1983). This movement of engineering reform was also supported by figures like H. L. Gantt and Morris L. Cooke within the American Association of Mechanical Engineers (ASME), of which Taylor himself was president. However, among them, Morris Cooke was the most militant. Cooke saw possibilities in scientific management that transcended its relevance to the shop floor. He envisioned the application of scientific management principles to government. He argued that engineers be elected democratically by majority will to positions of social planning. Cooke also conceived of check and balances mechanisms for these politician-engineers relying mainly on peer-review coming from professional associations of engineers, guardians of the public interest. To achieve this purpose, Cooke dedicated himself to purge the engineering societies of business influences that could corrupt the ideals of democratic governance and dedication to the public. Between 1910 and 1930, Cooke constantly criticized the business influence in ASME accusing specific individual of being apologists of practices in utility companies that were against the public interest (Meiksins, 1988). He also criticized the structure of ASME as allowing the utility interest to dominate the association and demanded changes in the Constitution and the Code of Ethics to correct for that failure (Meiksins, 1988). For Cooke, it was clear that an orientation to the public interest and a total independence from business influence were tantamount to engineering professionalism. However, most of the social support for engineering reform in ASME also came from young rank-and-file engineers, and, just as in the case of the AAE, most of the young engineers were not as radical as Cooke about their relationship with their employers. They supported Cooke's reform as a way to gain material improvements, but they did not share his vision of the engineer's social position. For them, the engineer was simply an employee in a corporate or public bureaucracy whose primary problems were wages, conditions and promotions (Meiksins, 1988). Once their employment conditions improved, they quickly withdrew from the reform movement. In that way, the dreams of the patrician reformers of a unified engineering association, a strong code of ethics oriented to the public interest, the participation of engineers in the broader public life and a relative independence from business influences never materialized.

Scientific Management, once considered a fast track to engineering professionalism, was adopted by North American industries, but not in the way Taylor, Gantt and Cooke imagined. By the mid 1920s, scientific management had become orthodoxy in engineering and managerial circles. Time and motion studies, a critical part of scientific planning was incorporated as a normal practice, but the privileged position of engineers in control of planning that Taylor envisioned and considered constitutive of his method was never conceded. This role of planning remained in the hands of managers. Some engineers would make it eventually to those positions, but they would do so not as engineers but as managers, with implications for changes in identity this move would demand. This "appropriation" of Taylor's scientific management by corporate capitalism shows again how engineering techniques and methods were tied to the interests and logic of corporate capital and would not be allowed to exist without them.

By 1920, according to the Wickenden Report[15], 75% of recent graduates from engineering were in subordinate technical, sales, and clerical positions (ASEE, 1930). With gains in better salaries from their participation in the reform movements, and their withdrawal from the progressive ideals for the profession, the majority of organizational engineers consolidated their commitment to the North American corporation and the idea of independence from businesses in The United States became anachronic.

3.2.3 The Influence of Capital on the Design of Technology

The influence of corporate capitalism can also be noted in the shaping of engineering technology. The availability of high amounts of capital, which made possible the creation and maintenance of large-technological systems in energy, transportation, communications, and the design of technologies to substitute machinery for skilled labor to foster mass production, illustrate how in the 20th century capitalism shaped technologies that removed the ceilings limiting the size of commercial enterprises. According to Alfred Chandler, the development of complex and expensive technologies that went along with the institutional control of invention through industrial research labs was a critical factor in the transition from local, small and family-owned businesses to capital-intensive enterprises serving national and international markets (Chandler, 1977).

In his study of the electrification of Chicago, Thomas Hughes, historian of technology, has noted that the growing size of technological systems at the end of the 19th century required high infusions of capital, technological inventions, and an accompanying expansion of managerial hierarchies. As the electrical utility system began growing beyond a small, local scale, engineer-inventors and managers were required to solve the technical and organizational problems proper of this expansion. In the case studied by Hughes, engineer-inventors like Elihu Thomson, Benjamin G. Lamme,

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[15] The so-called Wickened Report (1923-1929) has been one of the major studies conducted on engineering education in the United States. This report recommended American universities to institute undergraduate programs of engineering followed by internships in engineering companies. It also recommended the creation of an organization to set standards for engineering educational programs and to conduct accreditations of engineering programs according to these standards .

William Stanley and Nicolas Tesla provided the industry with critical technologies to overcome "reverse salients[16]" (Hughes, 1983) of this growing technological system. Three-phase alternating current, transformers, high voltage distribution lines, rotary converters, frequency chargers, and the steam turbines made possible the interconnection of small and previously separated and incompatible electrical systems (AC/DC, low freq/high freq). They also proved to be an invaluable resource for Samuel Insull, managerial-entrepreneur and president of the Chicago Edison Company, to create a single, mass producing, monopolistic and technologically efficient, and economically operated company for all Chicago (Hughes, 1979).

The case illustrated by Hughes shows that by the turn of the 20th century, large-technological systems, a major domain of action for engineering, and large-scale utility corporations, a major employer of engineers, were co-constructing each other. This concentration of capital and ownership of large-technological systems reinforced the status of corporations as the major locus of engineering in The United States amplifying the transformations in engineering professionalism reviewed in the last section.

The history of industrial automation in the USA also provides vivid illustrations of the close links between capitalism and engineering technologies. David Noble, for example, dedicates his book "Forces of Production," to explore the co-construction of capitalism and automation technologies in the General Electric factory at Schenectady right after WWII (Noble, 1984). The core of his argument is that the design of machine tools for automation of manufacturing was shaped by the social constrains of the shop-floor, among them, the interest from management to gain control from the shop-floor and to reduce workers' power and influence on production management by deskilling their labor.

Noble identifies two possible design options that engineers at GE considered between 1946 and 1949 to complete programmable machine tool automation. The first

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[16] "reverse salients" are components in a technological system that have fallen behind or are out of phase with the others. These salients become apparent when technological systems expand, and they attract inventors interested in solving these problems to gain fame and fortune creating the opportunity for multiple inventions (Bijker et al., 1987).

one was the "record-playback" (R/P), or "motional" method, whereby a recording was made of the motions of a machine tool or tracer stylus and the recording –motional information stored on magnetic or punched paper tape- was played back to reproduce automatically the identical motions on the machine tool, thereby producing the desired part. In this design, programs could be made and stored easily. A machinist had only to use his/her skills to produce a first part manually, interpreting the blueprint of the part to be produce, or trace a template and the motional information required to produce the part would be recorded. However, this particular design had an intrinsic valence towards reproducing and multiplying the original skills of the worker that recorded the initial templates, which, according to Noble, proved detrimental to its adoption in the Schenectady plant. From the perspective of management, R/P was not adequate to reduce the influence of workers on the control of their work because it relied too heavily upon the skills of the machinists.

The second design, which was adopted, was that of numerical control (N/C) developed by MIT. With N/C the motional information used to control the machine tool was in some ways similar to that of the record-playback, or motional method. The information was also stored on similar media to that of R/P. But the method by which information was stored was markedly different. Here, the motions of the machine required to produce a particular part were described in detailed mathematic models corresponding to the blueprint specifications for the part. These mathematic models were then recorded as numerical information, coded for economy, on the storage medium. Thus, the entire process of producing a part was reduced to formal, abstract descriptions, coded, and then translated by a computer into fully interpolated data to actuate the machine controls. No worker had any part interpreting the blueprint of the part. Instead a programmer was designated to translate from the blueprint to the mathematical and algorithmic terms what heretofore, had been the product of skill and experience of the workers. N/C was less efficient and comparatively more expensive than R/P as documented by Noble. However, it was the alternative chosen by GE due to its promises that in the long-term it would afford management more direct control over the machinery and over production in the fully computer-integrated automatic factory. In words of

Noble, "these technological developments [N/C] were mediated by social power and domination" (Noble, 1984:324).

The rationale behind this design decision is exactly the same rationale that began shaping engineering technologies during the 19th century, exemplified by the North American standard of screw threads promoted by W. Sellers. N/C allowed for the employment of a less skilled, and hence less costly, operator. And now, in a context of unionization, it also helped reduce the control of workers on the shop floor and therefore, their bargaining power. Noble's account leaves agency on the side of management, and places on engineering the role of designer of alternatives to satisfy management's requirements. In so doing it, engineers designed the technologies that have fostered managerial and industrial capitalism in The United States during the 20th century.

3.2.4 The Path to Competitiveness

During the second half of the 20th century, even though the federal government provided critical support for the profession during The Cold War, private corporations remained by and large the biggest employer of engineers. By 1985, for instance, the government only employed directly 15% of all engineers, even though federal dollars supported indirectly 24% more engineers through contract projects carried out by private corporations (Reynolds, 1991).

Keeping up with the growing corporate needs of the 20th century also stimulated changes in the demographics of engineering and opened the profession to women and minorities. Before 1920, engineering was a characteristically male, lower-middle and middle class, and white profession (Rae, 1975). Only 45 women had graduated before 1920 (Reynolds, 1991), at a time when the USA had 134,000 engineers (Commerce, 1975). However, engineering manpower shortages during WWII stimulated the entrance of women to the profession by a factor of five. Later on, during the second half of the century, the decline of white birth rates, the achievements of the civil rights and feminist movements at eliminating institutional barriers that inhibited women and minorities from entering engineering, and constant shortage of engineers pushed the US government to propose a series of policies that focused on recruiting more women and minorities into engineering to keeping up with the demand of technical expertise (Lucena, 2005). Although modest, these policies evidently had an impact on the profession. In 1963, for instance, only 2.1% of all North American engineers were nonwhite and only 0.7% were female. By 1988, 10.2% percent of these engineers were nonwhite (Blacks, Hispanics, and American Indians) (Gordon, 1988) and by 1989, 6.89% were female (Edosomwan, Savage-Moore, 1990).

The government's relatively minor role in shaping engineering was also constant during the 1980s and 1990s, when engineering in The United States was re-conceptualized from the economic perspective of international competitiveness (Lucena, 2005). Whether the issue was the risk of losing competitiveness to Japan during the 1980s, the Asian Tigers and the European Union during the 1990s, or China and India during the 2000s, engineering has always been at the core of policy discussions to maintain the economic leadership of the USA in manufacturing and productivity. According to Lucena:

> "Competitiviness became the language through which America began redefining its national struggle away from a political and military and to an economic idiom, transforming the definition of a nation from a site within which individual interests competed into that of a single economic actor maximizing a collective interest." (Lucena, 2005: 94).

In recent years, this discourse of "economic competitiveness" has framed engineering as a critical resource for the nation. As Lucena has noted, during the 1980s and the 1990s, the government kept a role of being responsible for the well being of the "engineering pipeline," and it concentrate its efforts on the educational system that transmits skills to the workforce, the transfer of knowledge from universities to businesses, and the establishment of international partnerships (Lucena, 2005). The National Science Foundation (NSF), for example, was involved in organizing partnerships between government, industry and academia in both research and education. It created programs to educate and train the North American labor force into a highly skilled labor force and promoted the transmission of university knowledge to business (Lucena, 2005). Keeping a prudent distance from a centralized industrial policy continues to be a trademark of the State in the USA. And, even though, the government continues to support the engineering profession by means of education and training programs, its influence on the profession is still low in comparison to the influence of corporate capitalism or the influence of the State in other countries such as Japan or France.

3.2.5 Conclusion

In sum, the co-construction of engineering and capitalism in The United States has its origins in a major transition from family and financial capitalism of the early 19th century to managerial capitalism at the end of the 19th century. This was accompanied by a major transformation in engineering professionalism from a profession of independent consultants and machine shop owners to new roles as corporate employees. Not only the profession, but also the knowledge, the methods, and the technologies of engineering have been shaped by managerial capitalism. Within this economic and social context, engineering and its products have helped expand managerial and corporate capitalism during the 20th century, positioning the United States as a leader of the second industrial revolution.

The intertwined co-existence of modern engineering in the United States with capitalism has made the North American engineering professions responsive to changes in the structure of capital. Hence, it is reasonable to conclude (as some scholar have suggested) that if there are radical changes underway for capitalism the end of the 20th century and beginnings of the 21st, it should be possible to observe changes in engineering professionalism, knowledge, methods, and technologies.

Before exploring these possible changes in capitalism at the turn of the 21st century and its possible consequences for engineering in subsequent chapters, I will explore the relation between capitalism and engineering in Colombia where my research is situated.

3.3 Engineering and Capitalism in Colombia

In Colombia, the relationship engineering and capitalism had a much different development than in the United States. First of all, industrialism, a big booster of engineering in several modern societies, did not make its entry into Colombian economy until the 20th century. The country had an agriculture-based economy and merchant capitalism that nurtured the origins of its engineering professions. Second, Colombian topography and climate, regionalist self-sufficient economies, a weak State, civil wars, and constant modernization projects also factored in to configure a complex and heterogeneous structure for the social world of engineering. Third, nationalism and regionalism would coexist in tension during the 19th and 20th century, due to the geopolitical fragmentation of the country and switching polities of centralism and federalism, giving rise to moments and places for regionalisms and nationalism that helped shape multiple social worlds for engineering.

It is possible to analyze approach engineering in Colombia as fragmented in different social worlds that, during the 19th century, correlated with specific geographical regions. Common to these social worlds is their immersion in a weak State, political instability and continuous civil wars. Differences among them correspond to different configurations of State-Capital. Two configurations can be observed during this period. The first configuration had a centralist-oriented government, State sponsorship, strong bureaucracy, and a land-based economy. The second configuration had a federalist-oriented government, state-private sector alliances, and a merchant-capitalist based economy. Topography and regional self-sufficiency allowed these social worlds to grow up relatively separate and autonomous in different regions of Colombia during the 19th century.

During the 19th century, French and British-American engineering traditions began to influence the emergence of engineering as a profession. But, given the geopolitical fragmentation of the country, and its different cultural and social values, Colombians did not blend these traditions and develop a single, characteristically national, version of engineering. Instead, they nurtured regional styles of engineering fragmenting the profession from its very beginnings. During the 20th century, national integration, political stability, industrial capitalism and developmentalism would blend these different social worlds of the 19th century engineering.

This section reviews briefly the history of engineering in Colombia, emphasizing crucial moments when capitalism and engineering co-constructed each other. The narrative again is chronological and it is informed by the analytical concepts presented in the introduction of this chapter.

3.3.1 Building the Republic

Colombia's history during the past 500 years has been strongly influenced by elites who control the basic institutions of social and political life. Between the 16th and 18th centuries, a minority of Spaniards dominated Colombian territory and its indigenous population. By 1570 approximately 1,500 male Spanish conquerors and settlers were already supported by labor and food provided by 155,000 Indians paying tribute to their conquerors (Palacios, 2002). This situation of control by an elite minority did not change after independence in the 19th century. The independence movement was also designed and directed by a privileged class of educated "criollos" (creoles), American born descendants of Spaniards, who, inspired by the historical influences of the French and American Revolutions, mobilized the indigenous population to achieve political and economic independence from Spain.

After independence, the creoles achieved the upward mobility that was denied to them during colonial times by European-born Spaniards who previously had monopolized the highest administrative, economic and ecclesiastical positions. When they became the rulers of the new republic, they distributed among themselves the economic and political power of the country in several economic regions that in time would reinforce an already fragmented and regionalized economy[17]. These dominant elites remained in their large landed estates or "haciendas" for generations. The already existing pattern of a small number of large landowners of Spanish descent and a large number of indigenous peasants with tiny plots of land in "Indian towns" did not change at all after independence (Palacios, 2002).

In the process of building the republic, the elites placed great interest in educating their succeeding generations in law and liberal arts[18] to fill political, religious and economic positions that would favor their status, class distinction and political power. Elites also ensured that access to public positions and university education was restricted to their members.[19]

During the first half of the 19th century, scientific and technical knowledge was not usually regarded as valuable asset for Colombian elites at a time when such knowledge was booming in Western Europe and North America. This can be explained by the structure of Colombian economy and society during this period. The wealth of elites by and large depended on their haciendas and the control of labor of slaves and peasants in their lands. Upper class control of land and labor made it possible to hold down wages. Low pay meant that local markets were rather anemic and lacked a broad

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[17] Since pre-Columbian times the country's historically most populated areas have been divided by three mountain chains and the small valleys between them. This historical dispersion of the population in isolated mountain settlements has shaped the spatial fragmentation of Colombia into distinct, more or less self-sufficient regional economies and characteristically different cultures. During Spanish control in the sixteenth century, for instance, there were three chief centers of economic and cultural activity that shaped what was going to be much of the Colombian economy until the 20th century: the eastern highlands (Bogotá-Tunja), the upper Cauca region in the west (Popayán), and the Caribbean coast-lower Magdalena Valley (Cartagena, Mompox).

[18] During the 19th century, the valuable knowledge for the nation had been highly configured by the Botanic Expedition (1783-1810) and the liberal ideas brought by the Independence Movement. Geography, philology, and law became the nucleus of the nationalist knowledge and political and economic development. The study of law and theology was the usual channel to government and clergy positions and it was restricted to creoles who already were of relatively high status.

[19] Class segregation from the colonial period among "whites" (creoles), "libres" (free slaves, mestizos, mulattos), Indians and slaves remained very much intact after independence for being these distinctions mixed with status assumptions and social values. The status of mestizo or mulatto, for instance, implied a lack of public honor. Therefore, there was no access to public positions or university education for these classes that were supposed to be relegated to peasantry and artisan activities. (Palacios, 2002)

base for demand. In this setting, there seemed to be little need for scientific research and applied technical knowledge.

In the United States, lowering labor costs was a crucial factor that motivated development of engineering technologies during the first half of the 19th century. However, in the Colombian case, during this period, low labor costs in agricultural production were controlled by land owners rather than the labor market. This control of wages and the weak local markets it produced eliminated any stimulus that Colombian elites could have had for the creation of labor-saving technologies and methods. In addition, technical activities required a considerable amount of manual labor, and the upper classes in Colombia, markedly aristocratic, considered this as destructive of their status[20] (Safford, 1976).

During the first half of the 19th century, some members of the Creole elite in government[21], the neo-bourbons, believed these dominant patterns among the Colombian elite were obstacles to industrialism that could be gradually overcome. They attempted to introduce the first modernization projects in the country and tried to motivate Colombian elites to become educated in science and in scientifically-based practical knowledge.

Neo-bourbons hoped that through technical education they would provide society with scientific and technological tools for economic progress and instill practical values in the upper classes. They also tried to educate lower classes with the basic technical training needed in an industrial workforce. However, the political needs of consolidating the new republic and the dominant social values brought the majority of the

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[20] Having inherited the military-bureaucratic culture of Spanish society, upper classes in Colombia, especially those from Santa Fé de Bogotá, privileged state power and service to the state over independent economic enterprise. They resembled values closer to those of French aristocracy rather than to those of the British aristocracy. In this logic, liberal professions like law were considered public service to the Crown and enjoyed high social status both in Spain and in the colonies. On the other hand, the illiterate lower classes stuck in a relatively static social structure were restricted to manual labor. This association of manual labor with a subservient class abstracted upper classes from the techniques of production and established social prohibitions against close involvement of this sector of society with processes of production (Safford, 1976).
[21] Francisco Antonio Zea, Lino de Pombo, José Ignacio de Márquez, General Herrán and Mariano Ospina Rodríguez, among them.

elite youth to value the study of law or military over the study of engineering. The extremely poor national treasury and a post-independence debt to London also eliminated any real governmental possibility to finance major public works where technical knowledge could have proven useful. This trend would worsen later in the 19th century as continuous civil wars between centralists and federalists drained the public treasure (Safford, 1976).

Within the private sector, conditions to encourage engineering work and training were not much better. The self-sustaining local economies of the separated regions in Colombia during the 19th century did not help further the integration of a national market or the demand for transportation infrastructure. Just a few products - tobacco, salt, and cacao- not produced locally, traveled among regions of Colombia.

Without nationally integrated markets, commerce was restricted within regions diminishing the incentives to invest in major improvements in overland transportation[22]. In the 1830s, local mule paths configured the precarious transportation network in Colombia connecting highlands to ports of the two main rivers, Magdalena and Cauca, and mobilizing freight between the interior of the country and the Caribbean coast. Most repairs of overland routes were performed by local labor drafts directed by local authorities without technical preparation, and new mule routes were usually opened by private entrepreneurs in return for grants of public lands and the right to collect tolls. But, the absence of profit opportunities from building interregional roads limited these enterprises to a local scale. (Safford et al, 2002).

These conditions discouraged both, state and private investments in public infrastructure. Very few opportunities for training and employment of engineers occurred before 1840. As a point of comparison, by 1840, as noted in the previous section, in the

[22] High costs of overland transportation also limited severely the interregional trade. For instance, during dry periods the cost of mule haulage on the trails was already high -38 to 60 cents per ton/mile between 1848 and 1861, but during the rainy season or when civil wars made mules scarce, these prices could easily double. As a comparison, at this time in the United States transportation costs by canal or railroad were as low as 2-4 cents per ton/mile.

United States private and state funds had already financed canals and railways that had provided both training and demand for engineering.

General Pedro Alcántara Herrán and General Tomás Cipriano de Mosquera, presidents of Colombia between 1841-1845 and 1845-1849 respectively, argued strongly in favor of a concentration of national public works resources so that the government might undertake significant improvements. In 1845, Mosquera's government conceived of a system of national roads and devoted 100% of the road tax, previously distributed among small projects in the regions, to this one project. Mosquera also authorized to contract the services of three foreign civil engineers and a hundred skilled foreign workmen to work on the road system along with the Colombian army sapper battalions. However, the scale of the project was overestimated and drove the government into a fiscal crisis. The next government returned to the previous scheme of decentralized regional revenues and responsibilities for road-building and as a result few large road-building projects were undertaken at the end of the 1860s. Thus, what it could have been a cradle for native engineering training ended up as a frustrated project.

Engineering as an occupation for native Colombians began to spread among the upper class during the 1850s. Two circumstances helped to create this situation: the creation of the first school of engineering in a Bogotá military school and the study abroad by the more affluent youth. The Colegio Militar (1848-1854), modeled after the Ecole Polytechnique, was the first in the country to provide students a clear sense of identity as engineers and offered them governmental employment. At the same time, conservative families began sending their sons to the United States, England, France and Germany for training in engineering at the end of the 1840s, and increasingly afterwards. They wanted their sons to become "industrialists" and to evade the educational system of the time, controlled and influenced by the liberal party. The Colegio and the foreign trained youth clearly contributed to the membership of a nascent corps of engineering, and their social origins also presented engineering as an acceptable profession for the aristocracy.

The period between the 1850s and the 1880s, coincides with a strong growth in Colombian economy caused by booming exports in gold, silver and in tropical-products such as coffee, tobacco, and chinchona bark (Ocampo, 1984). The six most important exports in Colombia to the United States, France, England and Germany went from 6,590 thousands of gold pesos between 1864 and 1870, to 12,770 thousands of gold pesos between 1881 and 1883 (Ocampo, 1984). This current of foreign trade increased both contact with foreign lands and gave the upper class enough money to support overseas education. Between 1865 and 1884, 10 Colombian students participated in the civil engineering program at Rensselaer Polytechnic Institute; 6 of them actually graduated. At least 5 others graduated between 1848 and 1863 in chemical, mining and civil engineering at Yale, and 1 at Georgetown. In 1878, one Colombian graduated from Stevens Institute in mechanical engineering, and 2 from Berkeley in mining engineering and metallurgy. During the 1870s, the first Colombians joined the mining engineering program at Columbia U (Safford, 1976).

The United States remained the preferred destination for overseas studies because of its on-the-job training emphasis, commercial contacts with Colombia, and opportunities to learn industrial techniques. However, few other students chose to go to study in France. Between 1857 and 1874, 2 students went to the Ecole Centrale des Arts, and 1 student attended the Ecole des Ponts et Cahussées. (Safford, 1976). This markedly preference for North American universities shows the interest of upper class parents that their sons would be educated in an industrial culture with a strong practical-training emphasis.

The dynamic exports during of the 1860s and 1870s provided the first tangible opportunities for these engineers trained abroad to engage in road and railroad construction and other sporadic public works. For example, in 1857, Rafael Espinosa Escallón, trained at Yale, worked on the road connecting Vélez to the Magdalena River. However, liberal dominion of the government between 1845 and 1876, constrained the action of most of these engineers who came from conservative families. Now, during the early 1880s, with the return of conservatives to power, Colombia was able to induce foreign companies to undertake major railway construction projects through the figure of concessions[23].

Between 1874 and 1885, a Cuban-American engineer and entrepreneur, Francisco Cisneros, contracted to build five major rail lines: from Medellín to the Magdalena River, from Buenaventura to the Cauca Valley, and from Girardot (a port on the Magdalena River) to Facatativa (close to Bogotá), from Puerto Salgar to Puerto Colombia, and from Puerto Berrío to the center of Antioquia. Collectively these projects constituted by far the largest governmental attempt during this century to build a railroad network. Cisneros always relied on North American and fellow Cubans for the most responsible technical positions, but he also used Colombian engineers for preliminary surveys and as assistant engineers. This pattern it was common among railway entrepreneurs. Generally, foreign and national companies that were granted concessions to build and operate railways imported foreign engineers rather than trust the natives in railroad construction. When Colombian engineers were used, as in the projects of Cisneros, they played their part as surveyors, engineering assistants, exploring routes, or inspecting the finished works for the government. Eventually, some of the engineering assistants would take temporary direction over sections of these projects, as happened in the Girardot-Facatativa railroad between 1887 and 1898 when Carlos Saenz and Manuel Peña, both Colombian engineers, finished 8 km of railroad (Perez-Angel, 2005), but engineering design tasks and project management was commonly out of reach for nationals.

The railroad projects never went smoothly. Changes of contractors, corruption of government officials and foreign contractors during the negotiation of the contracts, and civil wars between 1885 and 1902 drained government resources and stopped the projects several times. The Girardot railway, for example, began in 1880 and it was not

[23] Up to 1870, railway construction had been precarious. Aside from the railway across the Isthmus of Panama, built in the 1850 in a concession granted to a New York company (Otis, 1867) the most important railroad in the country was the 17 miles of railroad connecting Barranquilla with its seaport in the Caribbean, built by a the German company Hoenigsberg Wessels & Cia, and the British Railway and Pier Company (BLAA, 2008).

finished until 1910, keeping Bogotá, the capital city, disconnected from the Magdalena River all this time. The railroad connecting Medellín, the second largest city in Colombia, to the Magdalena River was not finished until 1929. Though problematic, working on the harsh conditions of Colombian mountainous topography and tropical climate, and in a subservient position to British and North American contractors, Colombian engineers gained enormous experience to be applied in other projects and began developing engineering identities fed with nationalist resentment.

3.3.2 Capitalism and the Antioqueño Style of Engineering

During the last decades of the 19th century, two configurations of engineering professionalism began to gravitate around the two most important poles of economic and political power in Colombia: one in Antioquia, the other in Bogotá.

By the 1850s, Antioquia, one of the west regions of Colombia, had grown economically strong based on gold and silver mining and textile production. Gold alone, coming from the region, accounted for more than 70% of the total Colombian exports between 1834 and 1845 (Ocampo, 1984). Direct access to gold, the privileged exchange currency of the time, meant that Antioqueños had also significant advantages over eastern regions, whose wealth was based on land -a less mobile capital-, in expanding their importing activities and establishing links with European suppliers. These active merchants and mining entrepreneurs soon began accumulating considerable amounts of capital and developed a regional bourgeoisie concentrated in Medellín and Rionegro. In more than one occasion the national government had to obtained loans from some of the richest merchant-capitalists. In return, these capitalists were granted special treatment in government contracting or purchasing of public lands, increasing their power beyond the Antioquia region.

Contact with the Europe through gold commerce in the Caribbean and local desires to improve the productivity of the region mines fostered the recruitment of foreign technicians whose skills and knowledge could increase gold production. Beginning in the 1820s, for instance, British engineer Tyrell Moore and German mechanic Enrique Hauseler, introduced Antioqueño mine owners to modern mining methods including the amalgamation process and the use of the steam-powered iron pump. These foreigners would become consultants and business partners to local merchants, some of them eventually settled in the region and helped established the first on-the-job training and shop work for local youth at the School of Arts and Crafts founded in 1869 (Murray, 1997). Antioqueño culture that traditionally valued hard work, rectitude, honesty, austerity, religion and family, identified easily with the industrialist values from British and German immigrants and merchants. This affinity can explain the great interest of Antioqueño capitalists, between the 1840s and 1860s, in sending their sons to study "practical" careers in mining, metallurgy engineering or commerce in the United States and England rather than studying liberal arts or than studying in French universities that had a more theoretical approach to engineering education. Antioqueños, therefore, looked for on-the-job training for their sons in merchant offices in England or university training in North American programs that provided a mix of one or two years of theoretical training with work experience in a machine shop or in railroad or road construction projects.

The political conflict that temporally instituted federalism in Colombia between 1863 and 1886 only exacerbated the separation of the now-Antioquia State from other regions in the country. During this time, Antioquia became the strongest bastions of conservatism under a liberalist regime[24]. The effects of this social, geopolitical and economical regionalism would prove detrimental for the consolidation of a united engineering profession in Colombia.

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[24] The United States of Colombia, 1863-1886, was the outcome of the civil war of 1860-1863 won by the radical liberals. This structure of government was modeled after the United States government and constitution. However, bipartisan differences and continuous civil wars between federalists and centralist caused its demise. The United States of Colombia was composed by 9 states: Cundinamarca, Antioquia, Panamá, Magdalena, Bolívar, Santader, Boyacá, Tolima and Cauca.

Under federalism, radical liberals established in Bogotá the technically oriented National University (Universidad Nacional) in 1868 with its School of Mathematics and Engineering (Facultad de Matemáticas e Ingeniería). The National University, being built on the foundations of the Colegio Militar, inherited the French tradition in engineering education. The immediate Antioqueños response was the creation of the University of Antioquia in 1871 that, having absorbed the School of Arts and Crafts, began providing technical instruction (Murray, 1997). A decade later, the successful School of Mines of Medellín (Escuela de Minas de Medellín), founded in 1887, would absorb the school of engineering at University of Antioquia and consolidate engineering education under one roof.

Since its inception, the orientation of The School of Mines in Medellín was markedly different from that of the School of Mathematics and Engineering at the National University in Bogotá. The School of Mines was founded by the brothers Tulio and Pedro Nel Ospina, who both studied and graduated in mining engineering from the University of California at Berkeley in the late 1870s. The Ospina brothers, who also had large investments in mines throughout Antioquia, always considered the School of Mines and the training of mining engineers a practical investment for the productivity, cultural status and influence of the Antioquia region (Murray, 1997). Therefore, they model engineering training at the School after the North American style of training they were familiar with. This was evident in the introduction of field trips, a feature borrowed from Berkeley, designed to give students a first close view of industrial processes learned about in the classroom (Murray, 1997). Mathematics was only studied in order to be applied to production processes (Arias-DeGreiff, Helena-Sanchez, 2004), and shop-work inherited from the School of Arts and Crafts would continue to be constitutive of technical training in the form of internships (Safford, 1976).

The School of Mines also maintained a symbiotic relationship with commercial ventures in the region. The most notable during the turn of the 20th century was with the Antioquia Railway. Connecting Medellín and Rionegro to the Magdalena River, the Antioquia Railway constituted the main link to connect Antioquia to the rest of the country until the advent of highways and air travel in the 1930s. The construction and administration of the railway was organized by Francisco Javier Cisneros between 1874 and 1890. Unlike British and German entrepreneurs who excluded Colombian labor, Cisneros hired antioqueño engineers from the School of Mines as technicians and supervisors to oversee the construction and operation of the Antioquia Railway. After 1890, when Antioquia took over the administration of the Railway, School graduates supplied the company with virtually all of its superintendents and technical supervisors from 1903 to 1961. The influence of the Railway Company in the School was also evident in the shaping of its curricula. During the 1930s the School had in place courses on railway construction, industrial hygiene, mechanics, locomotors and industrial accounting and administration, all of them taught by current and former railway employees (Murray, 1997).

As a result, Antioquia engineers were able to stand independently of Bogotá, Colombia's political center as an engineering community. By 1887, when Colombia had a good number of engineers[25], two engineering schools in the country and a booming railway construction, a group of engineers in Bogotá created the first professional association in the country, the Colombian Association of Engineers (Sociedad Colombiana de Ingenieros -SCI). However, this "Colombian" association was by no means representative of the heterogeneous social worlds of engineers present at the time. SCI was Bogotá-centered. It began with 50 engineers and science professors in 1887, all of them from Bogotá. By 1898, out of 65 full members subscribed to its journal, only 13 were not from the capital region, and only 1 was from Antioquia (Safford, 1976). According to Stafford, Antioqueño engineers took little interest in Bogotá's engineering society that they perceived was too politicized and subservient to the political elite that favored bogotano engineers. In addition, conscious of their importance to the national economy, engineers and antioqueño bourgeoisie resented the powers, privileges enjoyed by bogotanos. By 1915, the antioqueño engineering community was large and

[25] As of 1870, there were 275 engineers in Colombia. 136 of them in the State of Panama, 82 in the State of Cundinamarca, 24 in the State of Antioquia, 18 in Bolívar, and the rest distributed in all the other regions (Capital Region) (Safford, 1976).

sufficiently strong in its regionalism to found an independent Antioquia Engineering Society (Sociedad Antioqueña de Ingenieros -SAI).

In all of these developments, the support of antioqueño merchant-capitalism and the Antioquia regional government were determinant to constitute a particular professional orientation to engineering that responded to the realities of the region in the Colombian context. Antioqueño engineers were heavily influenced by the British and North American traditions of engineering that shaped their engineering education. These traditions also distinguished its practical and industrial approach from that of the bogotano engineers that were strongly influenced by the French tradition and were nurtured by the central government. This influence of capitalism in Antioqueño engineering would continue during the 20th century when industrial capitalism displaced merchant-capitalism as the main dynamo of Antioquia's economy.

From 1910 to the 1950s, School of Mines' alumni played a key role in the rise of industrialism in Colombia, including the emergence of the textile industry, large public utilities, and other enterprises that turned Medellín into the country's manufacturing center. A significant number of school graduates devoted their energies to modern manufacturing enterprise, at a time when the impact of coffee production had created a domestic market for manufactured goods[26]. These factors not only fostered the birth of food-processor and textile industries in Antioquia, but also, between 1930 and 1945, underlaid Colombia's industrial surge. Large corporations emerged in the industries of textiles, cement, tobacco, and beer, and in most of them engineers from the School contributed to the success of these firms as co-founders, executive managers, or as heads of technical departments. Alumni also founded and became presidents of the National Association of Industrialist (ANDI – Asociación Nacional de Industriales), the most influential industrial association in Colombia. By 1946, School's alumni comprised nearly one third of the country's industrial executives (Mayor-Mora, 1984). According to Colombian sociologist Alberto Mayor, it was the engineers from the Antioquia School of

[26] Loans and capital after 1920s, continuous expansion and integration of transportation, and protectionist policies also encouraged industrial entrepreneurship in Medellín.

Mines that introduced the country to modern ideas of organization and management. Mayor highlights the influence that Alejandro López, professor of the School, had since 1911, when he began adapting and teaching Taylor's principle of scientific management at increasing productivity through a more rational treatment of labor (Mayor-Mora, 1984). According to Mayor, Lopez and School's alumni adapted Taylor's doctrine to the particular characteristics of the antioqueño workforce, turning the industrial workplace to the advantages of the capitalists and factory owners in a way reminiscent of the experience of engineers in the United States (Noble, 1977).

Increasingly between the 1920s and the 1960s, the bulk of antioqueño engineers began joining the rank-and-files of technicians and lower managers in private companies. The rise of technical bureaucracies, such as the Banco de la República, National Federation of Coffee Owners, and the Industrial Development Institute also provided increasing employment opportunities for engineers in the public sector. By the 1940s, upper class engineers were no longer the dominant demographic within the School of Mines' graduates. The increasing arrival of students representing the country's rising middle class had become the face of engineering in Antioquia. This transition, influenced by industrialism, the rise of large corporations, and the middle class, is again similar to that experienced by American engineering. Antioqueño engineering transitioned, between 1920 and 1960, from an upper-class, independent profession that influenced commercial, academic and political affairs to a middle class, bureaucratic technical profession with no major influence over the direction of industry, academia and government (Mayor-Mora, 1984).

3.3.3 The State and the Bogotano Engineering Style

During the 19th century, merchant-capitalism was not a characteristic feature of the eastern regions of Colombia. Bogotá, political and educational center of Colombia since colonial times, relied economically on agriculture and craftsmanship that only provided basic standards of living. Yet, the city always remained the center of political controversy and the chief arena of political careers for the whole country. Owners of "haciendas," big lots of land, constituted an oligarchy that occupied political and ecclesiastical positions in the city grounding their power and influence in land property and control of positions of authority.

Engineers in the east, most of them in Bogotá, were predominantly bureaucratic engineers. They usually came from the capital and surrounding regions of Cundinamarca, Boyacá and Tolima. Its geopolitic location granted these engineers a privileged access to education that antioqueño engineers, and engineers from the other regions, did not have until 1871. Since 1848, the French inspired Colegio Militar, and since 1868, the National University provided education to the bogotano youth that through family, virtue of residence in the capital, and school associations enjoyed political connections not available to engineers elsewhere. Bogotano engineers therefore had inside track for government technical jobs and received appointments surveying, teaching, constructing or inspecting public works. Some of these jobs were in other regions, like Antioquia, where there was availability of local engineers to be in charge of those tasks, fueling animosity in engineers from these regions.

In constrast, private ventures in eastern Colombia were not as dynamic as they were in Antioquia and offered few opportunities for local engineers, aside from occasional surveying and drainage work for local "hacendados." As mentioned before, railway construction did not offer many opportunities for locals either, given that it was a foreign enterprise that relied mostly on foreign experts. Therefore, bogotano engineers grew increasingly dependent on the government for employment, and among Colombian engineers they most markedly resented the use of foreign engineers.

This increasing nationalism among bogotano engineers fed the interests of professionalization. In 1887, demanding to have a greater role in public works, bogotano engineers created the Colombian Association of Engineers (Sociedad Colombiana de Ingenieros -SCI). Conflict with foreign engineers in charge of railway projects, like Cisneros for example, and collective attacks on foreign-directed engineering activities became the motivation for the "revolt" of the bogotano engineers. The SCI journal became a nationalistic medium for bogotano engineers to highlight the achievements of local engineers and to denounce the abuses and technical failures of foreign engineers. Stafford notes that when construction disasters occurred, the engineering society in Bogotá took care to place the blame, whenever possible, on the miscalculation of foreigners, and systematically ignored or diminished the mistakes or technical deficiencies that were caused by native engineers (Safford, 1976).

The proximity of bogotano engineers to national politics and its dependence on government employment certainly conformed to their nationalist ideals for a colombian engineering profession. Even though, they remained mostly an elitist and local group of engineers that, by far, did not represent the interests of engineers in other regions, evoking nationalism served to their interests of uplifting their own social and professional status.

In 1893, the SCI became the official engineering-consulting organism for the State. The SCI kept fostering engineering professionalism by closing the profession through licenses, and by occupying public positions in technical bureaucracies that favored the concepts of the SCI on the creation of the public utilities, national transport infrastructure, and sanitary engineering. It was also a radical advocate of the nationalization of the railway infrastructure and petroleum exploitation during the 20th century. As a consulting organism of the State, the SCI proposed the Colombian government the mapping of the national territory in 1890, a crucial step in the delimitation of national boundaries with the neighbor countries. Creating the "Oficina de Longitudes" in 1902, Colombian government assigned bogotano engineers the responsibility of creating such maps (Obregón, 1992).

The bogotano style of engineering during the 19th century can also be analytically differenced in terms of education. First, the Colegio Militar, and later the School of Mathematics and Engineering of the National University, adopted the French tradition of a strong mathematical foundation for engineering education. Markedly different from the practical-oriented program at the Antioquia's School of Mines, engineers in Bogotá took two years of mathematics, and three years of engineering courses and several of these engineering students graduated both as civil engineers and as mathematics teachers between 1888 and 1898 (Arias-DeGreiff, Helena-Sanchez, 2004). As Diana Obregón has noted, these mathematic-engineers, along with medicine doctors, also constituted the first scientific communities in the country (Obregón, 1992). These professionals, who identified themselves as both engineers and scientists, kept in their engineering institutions an interest in the development of mathematics in a society where the institutionalization of scientific disciplines had always been an incomplete project (Obregón, 1992). This is also supported by Arias that shows that publication of mathematics articles in the SCI journal between 1888 and 1898 was only second to railway articles (Arias-DeGreiff, Helena-Sanchez, 2004).

In sum, the professionalization of engineering in Bogotá between 1880 and 1910 went along different lines than those followed by antioqueño engineers. Under the tutelage of the national government, a nationalist rethoric, and a scientific approach to engineering, bogotanos envisioned a profession that would strengthen and serve the nation. They also envisioned themselves occupying positions in technical bureaucracies and representing science in government and academic circles. Bogotano engineers looked for future job opportunities in the nationalization of foreign developed technological systems and they saw themselves not only as expert technicians but also as scientists.

3.3.4 Industrialism and the Blending of Two Cultures

At the turn of the 20^{th} century, Colombia was beginning to integrate its regions and its regional markets. A rather stable transport structure and booming exports of Coffee stimulated the demand for manufactured goods and, in consequence, industrialism. Between 1910 and 1950, the country would see radical transformations in its population, urban growth, expansion of the middle class, industrialization, transportation, and national integration. These changes would smooth the cultural differences and styles that separated antioqueño and bogotano engineers, blending these styles in a national capitalist-oriented economy that would concede the profession a social status but also a limited impact on social and political life.

Between 1903 and 1948, Colombia achieved a measure of political stability that along with a booming economy, based mainly on coffee exports, eliminated several of the economic and political barriers to technical development evident during the previous century. In a time of unprecedented prosperity, the upper class focused on the planting of coffee and foreign investment increased considerably. Political stability was achieved after the War of the Thousand Days (1899-1903) by partisan agreements and considerable funds flew to the country with the United States' 25-million-dollar indemnity for its intervention in the separation of Panamá from Colombia (1903).

In a relatively stable climate, the pace of railroad construction took off after 1905 with infusion of British capital. Quickly, Bogotá was connected to the Magdalena River, the most important fluvial artery in Colombia, by railway in 1909. Cali, the third largest city in Colombia, was connected to the Pacific Ocean in 1915, one year after the completion of the Panama Canal. Medellín finished its railway connection to the Magdalena River in 1929. However, the desired national integration by railway never became possible in Colombia because of the high costs caused by the irregular and mountainous topography. In the end, it was the highways that eventually connected the fragmented regions. Highway construction began in 1910 and, even though somehow deficient, it was approaching a national integration by the 1950s (Palacios, 2002).

Not only in its transportation infrastructure but also in its industrial and urban development, the booming coffee economy of the first decades of the 20th century offered opportunities for the private and public employment of engineers inconceivable two decades before. Therefore, there was plenty of motivation from engineers to engage actively in politics during this period. Organized in the SCI and echoing bogotano engineers' nationalism, SCI used leadership positions to advocate policies favorable to their interests, among them the nationalization of the railways financed by British capital

(1911-1931) and the nationalization of the exploitation of petroleum (1940-1951). Nationalization meant for engineers eliminating dependency on foreign experts and gaining control over existent railways and petroleum infrastructure. These circumstances were favorable to the creation of more jobs for native engineers and the opportunity for them to "rationalize" these systems from technocratic agencies in the governmental bureaucracy (Safford, 1976).

In 1935, the national government of Alfonso López Pumarejo initiated a series of educational reforms to integrate public university education under a single unified system. This reform led to the incorporation of the School of Mines to the National University as the School of Engineering of the National University at Medellín. The transition caused the loss of autonomy of the previous School of Mines and the loss of its regionalist orientation bringing it to conform to the needs and designs of the newly reorganized National University. Soon this "new" School of Engineering would blend its engineering educational style with national, rather than regional, interests. This was most evident in the creation of the School's program of geological and petroleum engineering that responded to the nationalistic interest of regaining control over petroleum exploitation from foreign companies. The former School of Mines, due to its traditional practical-orientation to education, its traditional expertise on mining engineering and scientific management, became a national asset to respond to the challenge of training engineers for the nationalized petroleum exploitation. When the Colombian Company of Petroleum and Hydrocarbons (ECOPETROL) began operations in 1951, the former School of Mines, now the School of Engineering of the National University, supplied most of its managers and technicians (Murray, 1997).

On the other hand, the bogotano engineers were also leaving behind their privileged and elitist positions. The industrialization of Bogotá and the main cities in Colombia increased demand for engineering labor in industry. Soon, middle class professionals began occupying technical and lower managerial positions in large corporations. Government positions and, therefore, political connections became less important for Colombian engineers. Upper class elites began flowing to the new disciplines of management and economics that offered to them a direct track to the new technocratic positions of power of the 20th century. Since 1920, the two communities of engineers, antioqueños and bogotanos, began several efforts to unite the profession without "regionalisms," and even thought fragmentation and regionalism still persists nowadays it had never been again as markedly distinct as it was during the end of the 19th century. By the 1940s, it was evident, that industrialization, nationalism and the middle class had homogenized the fragmented profession of the previous century around corporate capitalism.

3.3.5 Engineering Encounters Development

The end of WWII would mark a new transition in Colombian engineering. International competition and the spread of scientific and technically-based capitalism convinced the private sector that if Colombian industry were to remain competitive, an engineering workforce specialized in the now dominant industries of the second industrial revolution would be necessary. The National University, however, did not provide the initiative for engineering specialization in chemical, industrial, mechanic and electrical engineering. Instead, the initiative came from the provincial and private universities that opened the doors to these specialties.

During the 1950s, another international development would affect not only engineering but also the way Colombia and Latinoamerica understand themselves in their relation with the United States and the industrialized European countries. According to Arturo Escobar, during the early post-WWII period, the Truman doctrine initiated a new era in the understanding and management of world affairs concerning the less economically accomplished countries in the world:

> "The intent was quite ambitious: to bring about the conditions necessary to replicating the world over the features that characterized the "advanced" societies of the time –high levels of industrialization, technicalization of agriculture, rapid growth of material production and living standards, and the widespread adoption

of modern education and cultural values … capital, science and technology were the main ingredients that would make this massive revolution possible." (Escobar, 1995:4)

This "discourse of development," as Escobar calls it, would become dominant and hegemonic during the 1950s and it would characterize the relationships between the discursively created "First World" countries and "Third World" countries.

Within the framework of "development," Colombian elites also started to see their country as "underdeveloped" and soon enrolled into systematic interventions of the newly developed corpus of knowledge and experts in development[27] (Rostow, 1990). In 1949, Colombia was chosen as the first country to put in practice a plan for development, financed by the World Bank, to improve the conditions of poverty. The mission that came to the country to "diagnose" the status of the economy and its structural causes of "underdevelopment" was led by the economist Lauchlin Currie, and it was assisted by Colombian technicians and World Bank experts. The outcome was the first integrated economic analysis of the country and the first development plan (of many to come) to be co-financed by the World Bank. The Currie Report specifically considered that one of the main obstacles for development in Colombia was the lack of adequate transport infrastructure that would reduce costs of production and distribution of manufactured goods. Therefore, a major part of the Currie Plan was dedicated to improving the national railway and highway systems, the maritime ports and the ports on the Magdalena River (Nicholls-Nicholls, 2004). Another diagnosis of the Currie Report was that Colombia had a "backward" system of public utilities, especially regarding the electrical grid (Sanclemente-Orbegoso, 2005). In this context, not only would the entrance of Colombia

[27] Colombian elites also engaged in creating their own experts. The most example of this is the private "University of Los Andes." Founded by the Colombian elite in 1948 in Bogotá, the University of Los Andes attempted to occupy the same privileged position that the School of Mines occupied during the 19th century, but now under the context provided by developmentalism. Since then, the "Universidad de Los Andes" has been providing the "development" experts that often direct the economic institutions of the country. Alumni from this university usually end up occupying top positions in businesses and government. Directors and heads of technical bureaucracies often occupied faculty positions. For example, among the School of Economics of the University of Los Andes, the National Planning Department (DNP) and the Ministry of Economy a consistent group of economists alternate among them to occupy academic and government positions.

into developmentalism initiate the institutionalization of national planning, but it would also privilege the position of engineers in the apparatus of development as purveyors of science and technology and as the ones responsible for the modernization of the nation's large-technological systems.

During the 1950s and 1960s, central governmental planning oriented by these "development plans" and financed by the World Bank fostered public works at an unprecedented pace. For instance, the national highway network augmented from 12,000 kms to 19,000 kms between 1950 and 1970. Local paved roads also went from 1,000 kms to 5,000 kms (Nicholls-Nicholls, 2004). The average investment in infrastructure during these years was 22% of the total national budget. The National Railway Company integrated 3,380 kms of the railway national network, and by 1967, the electrical system in Colombia was all interconnected and managed by departmental public corporations (Sanclemente-Orbegoso, 2005). The importance of central planning and the growth of the State during these years provided plenty of employment to engineers in government, and government-run public utilities.

However, by the end of the 1970s and during the 1980s the development strategies began showing their flaws: high deficit and increasing levels of debt, increasing disparities between classes and unequal distribution of capital, dependency on international protectionism, poor levels of education and increasing levels of criminality and violence (Palacios, 1994). Instead of considering the failures of the model, it was assumed that the poor results obtained were caused not by the model and the technical experts who built it, but by a deficient implementation of it by the governments in turn and its politicians (Escobar, 1995). Considered inefficient to administer the Colombian economy, the State was asked by economic experts and international institutions to fit into the neo-liberal economic model. It would increasingly rely on market mechanisms (rather than planning), privatize public utilities and companies, and open the economy to international markets and investors. A new political constitution (1991), the end of the international regulation of the coffee market (1989), and the first neo-liberal government

(1990-1994) marked the politico-economic transition of Colombia and engineering to an economic context dominated by the market and corporate capitalism.

During the period of developmentalism, Colombian engineering associations were displaced by economists in their Veblenian ambitions to rationally organize industrial productivity, large infrastructures and public utilities. The dominant institutions of central planning: the National Department of Planning, the Ministry of Economy, and the Ministry of Finance were all run by economists. Engineers, however, kept their privileges as creators of large technological systems and as responsible for improving Colombian infrastructures. Science and technology remained as always, "the main ingredient" for the development revolution.

3.3.6 Summary

The co-construction of engineering and capitalism in Colombia can be observed from the end of the 19th century to the present. However, at least during the 19th century, this co-construction was situated in a specific region, Antioquia. It was in this region that merchant-capitalism clearly shaped a style of engineering fitted to the social and economical realities of the region. Upper class youth, sons of capitalist families, were the only ones with enough economic means to study engineering overseas, and later to return to the region to establish some of the first engineering universities in the country. The amicable relation between mine owners and merchants in Antioquia with foreign engineers also attracted engineering experts to this region to develope a style of engineering oriented to industrial productivity. The shaping of curricula and Taylor's theories in the School of Mines, due to the symbiosis of the School with industrial firms and the Antioquia Railway, also shows the influence of capitalism on antioqueño engineering. At the beginning of the 20th century, the School of Mines provided the work force for Medellín's leadership as Colombia's manufacturing center and introduced industry and corporations to the techniques of scientific management. Several of the School alumni became executive managers, politicians and leaders of industrialization in

Antioquia and in Colombia, and from their positions advanced the ideals of industrial capitalism.

State-sponsored engineering and a technocratic understanding of engineering professionalism could also be found during the 19th in Bogotá, the capital city. Framing the social responsibility of engineering in nationalist rhetoric, bogotano engineers advanced engineering professionalism in Colombian by displacing foreign competitors, and by putting themselves in positions of bureaucratic power to secure the interests of native engineers. Reminiscent of Veblen's vision for engineers in society, bogotano engineer-bureaucrats attempted to create for themselves privilege positions as official consultants to the government in technical matters, pursuing technical efficiency rather than commercial interests, presumably for the common good. Their methodologies and approaches to engineering favored mathematical and theoretical approaches.

However, the surge of industrialism in Colombia during the first decades of the 20th century blended these two engineering styles to favor the spread of industrial capitalism and to the detriment of engineering professionalism. Engineering associations continued to be fragmented and the entrance of the middle class to the profession as employees of corporations consolidated the trend of the profession to be servant to private interests.

During the second half of the 20th century, developmentalism would advance to detriment engineering professionalism by delegating authority to economists. The rational national planning that years before Colombian engineers have dreamt of monopolizing was now in the hands of the economists. By placing industrial capitalism and science and technology at the core of the modernization projects for development, developmentalism also acknowledged the central role engineering has to play within the North American and Western European model of capitalist economics as realized in Latin America, Africa and Asia.

3.4 Conclusion

This brief historical review has discussed several patterns that show how tightly capitalism and modern engineering are linked in both the United States and Colombia. Even though, there are differences in historical trends, locations, and cultures that separate the experiences of North American and Colombian engineers, the co-construction of engineering and managerial capitalism seems to have followed strikingly similar patterns in the long run. The de-professionalization of engineering, the shaping of engineering methodologies and artifacts to foster industrial productivity reducing labor costs, and the massive entrance of middle class engineers as corporate employees to the profession are present in both experiences. In both cases, engineering has provided the organizational and technological means to the expansion of a capitalist economy. On the other hand, capitalism has also provided the engineering professions with career trajectories in large bureaucracies and social status as technical and managerial captains of industry.

The Colombian case also shows striking differences when compared to the United States in the ways it coupled engineering to capitalism within its specific fragmented history and culture. During the 19th century, the outcome was the creation of two regional social worlds of engineering, which reflected the historical, geographic, political and economical patterns specific to Colombia during that period. During the 20th century, engineering in Colombia has focused on solving the technological causes of "underdevelopment" in the country, locating itself again in a different position to that of engineering in a "developed" country such as the United States.

Because capitalism and engineering are situated within the cultural realities of different social worlds, the expressions of capitalism as well as the expressions of engineering are not completely uniform in the two nations described in this chapter. However, for the purposes of this dissertation it is important to acknowledge that in industrial capitalist societies, whether in the North or in the South, in developed or developing countries, engineering and capitalism are co-constitutive of each other. Any change in the constitutive structure of capitalism would affect engineering (professionalism, methods and technologies) and vice versa.

4. INFORMATIONAL CAPITALISM AND DEVELOPMENTALISM

4.1 Introduction

This chapter explores different social theories about the impact of information and communication technologies (ICTs) in capitalism during the final decades of the 20th century. They range from positions that support the existence of radical changes in capitalism introduced by information and communication technologies (ICTs), to positions that consider that ICTs have not altered traditional dynamics of capitalism, to other positions in between. Despite their differences on key issues, these perspectives agree that ICTs and information have a distinct role that characterizes contemporary societies.

I will review briefly some of these social theories, namely those proposed by Daniel Bell, Manuel Castells and Herbert Schiller, including some other relevant insights coming from scholars such as Lawrence Lessig, and Robert W. Mc Chesney. One of the purposes of this chapter is to support the hypothesis that, during the last decades of the 20th century, capitalism in western societies renewed and expanded itself with the use of ICTs and managerial technologies. This phase is characterized by being global, information-intensive, theoretically-intensive, and structured mostly by corporate and managerial capitalism. In this "upgrading" of capitalism, engineers of information and communication technologies such as electric engineers, systems and computer engineers, network engineers, and others have played a major role designing and deploying the technologies, and sometimes the social relations, necessary to sustain this advance.

This chapter also introduces an analysis of a developmental discourse that is powering the expansion of informational capitalism into the so-called "developing" countries, namely that of ICT4D (Information and Communication Technologies for Development). Using Arturo Escobar's discursive analysis of developmentalism, I will elaborate on the re-signification of information and ICTs in developmental discourse and

I will explore how the production of this discourse was, and still is, a necessary step for informational capitalism to go global.

Arguing that capitalism has entered into an informational phase and it is changing, and given the close relationship between engineering and capitalism reviewed in the previous chapter, triggers immediately questions about potential changes in the role of engineering, engineering technologies, practices and professionalism. I will tackle these questions and attempt to answer them in chapters 5 and 6 of this dissertation:

4.2 The Information Society

Since the 1960s in the United States and Europe, it has become part of the social imagination that information and its related technologies are distinguishing features of the modern world. Commentators have long identified the United States, Britain, Germany, Japan, Norway, Sweden and other "developed" nations as "information societies." Accordingly, the United Nations instituted the World Summit of the Information Society at the end of the 1990s to help developing countries transition smoothly from industrial or pre-industrial societies to informational or post-industrial societies.

This widespread buzz, however, is less clear at specifying what the information society is and what its major characteristics and significance are. Frank Webster, a British sociologist has dedicated several years to the study of what scholars, journalists, and industrialists have attempted to conceptualize as the information society. In his analysis, Webster has found six different types of definitions of the information society. Each one highlights certain aspects more than others and, according to Webster, most definitions include one or several of the following types:

- Technological Definitions: information and communication artifacts and infrastructures, developed after WWII/post-war technological inventions and innovations in physics, electronics and computing, are considered to signal the coming of an information society in this type of definitions. Super computers, personal computers, Internet and other computer networks, cell phones, Personal Digital Assistants, cable and satellite television, online information systems, social networking applications, embedded computing capabilities in more traditional technologies (cars, appliances, TV,) etc. are some of the examples of material technologies that are supposed to be omnipresent and characteristic of information societies. The technological definitions emphasize automation, more common during the 1970s and 1980s in western societies, and the merging of information and communication technologies, more visible during the 1990s and 2000s, as main characteristic features. Technological definitions usually advocate rapid adoption of ICTs (Negroponte, 1995) and have motivated international surveys and indicators that measure the “penetration” of ICTs in countries to compare how countries are catching up in narrowing their “digital divides” (Partnership, 2008). Perspectives strong on this orientation tend to be technologically determinist and are inclined to diminish, or completely ignore, the argument that adoption and creation of ICTs can not be separated from the social, political and cultural dimensions of technological innovation, use and appropriation.

- Economic Definitions: Definitions of this kind emphasize the growth in economic worth of informational activities. From this perspective, it is necessary to map the effect of informational activities and ICTs in the gross national product. If information goods, service bureaucracies, information-based productive activities, and information industries account for a greater part of the economic activity than industrial manufacture and agriculture, it follows that a society is turning from an industrial or agricultural society into an information society. Even though different methodologies have been designed to identify important information industries and to measure the impact of information in the economy (Porat, R. & Michael, R., 1977), this quantification relies heavily in interpretation and value judgments as to how to construct categories and what to include or exclude from the information sector.

- Occupational Definitions: Characteristic of sociological approaches, they focus on time and patterns of change of the occupational structure. The assumption is that an information society is in place when most of the occupations are found in information work. The decline of agricultural and blue-collar work and its replacement with white-collar work is a commonly used indicator of this transition. Arguments of this sort are commonly used to show the existence of an information society in OECD countries where more than 60% of the employment is now generated in the service sector (OECD, 2007), more specifically into four industries: trade, restaurants and hotels; transport and communications; finance, insurance, real estate and business services; and community, social and personal services. Scholars sometimes refer to people working in these industries as symbolic analysts (Reich, 1992), knowledge experts (Drucker, 1993), or informational labor (Castells, 1996). These definitions usually rely on statistics rather than on profound qualitative analyses of information workers that cut across with issues of race, class, gender, power and inclusion. One of the most important early exponents of this approach was Daniel Bell who proposed a theory of the post-industrial society.

- Spatial Definitions: Another approach that stresses the ways in which information networks connect locations and alter the organization of time and space. Special interest is put on global-local interactions, permanent and instantaneous communications, and revision of time-space relations. Manuel Castells' theory of the network society relies heavily on such a conception. The suggestion is that the presence of socio-technological networks connecting the local, the national and the international is the marking characteristic of the network/information society.

- Cultural Definitions: Yet another collection of theories center upon the concept of the cyberspace and the explosion of information in social circulation. Media and communication studies have long studied the social effects of a media-saturated society, and some STS scholars have explored the social and psychological dimensions of life in the cyberspace (Turkle, 2005). Also recently, post-modernist research has focused on the effects of an overwhelming availability of signs and their loss of reference in contemporary societies. Within this perspective, concerns about cultural imperialism and private monopoly over information have also been widely discussed by scholars in cultural studies (Poster, 1994). The explosion of symbols and loss of signification in media-laden societies are phenomena of great interest to scholars in several fields of cultural studies.

- Theoretical Knowledge Definitions: These kinds of definitions rely on the qualitative properties of information rather than on the quantitative aspects of it. It is not how much information people have access to but how well informed they are and what the consequences of being informed are in terms of participatory democracy, market, social justice and, in general, society's well being. In these theories an information society is defined as one in which theoretical knowledge occupies a pre-eminence that hitherto lacked. Proponents of these types of definitions advocate the creation of a knowledge society rather than an information society. Moreover, they emphasize the dominion of science-based knowledge and technologies over other types of knowledge that began in the 19th century as characteristic of this transition. It has created, according to these authors, a society of knowledge experts and codified-authorized knowledge that can be learned through the educational process.

The multiple and sometimes confusing meanings attributes to "the information society" reflect the diverse approaches and the different characteristics that commentators, journalists and scholars use when referring to the term. Webster's categories can help us understand what the emphasized dimensions are and which are left obscure. Leaving aside semantic problems about what an information society is, a second theoretical challenge that arises in dealing with information society studies is that of approaching issues of change and continuity in social structures. Scholars such as Daniel

Bell (1973) and Manuel Castells (1996) tend to focus on those aspects or characteristics of the information society that are constituting a different social structure that breaks with the past while some others, such as Herbert Schiller (1996), Langdon Winner (1986), and Anthony Giddens (1990) tend to emphasize the continuation of traditional social structures in ICT-saturated societies. In the rest of this chapter, I will briefly review some of these conflicting theories and try to pinpoint what discussions reveal about changes in capitalism at the end of the 20th century.

4.3 Post-industrialism

The development of the idea of the information society could be found as early as the late 1960s, when Daniel Bell coined the term "post-industrial society." In his book "The Coming of a Post-Industrial Society," published in 1973, Bell claims that the United States is becoming a new type of society characterized by a heightened presence and significance of information (Bell, 1973). Bell also contends that the USA is leading the world towards a new type of social order, the post-industrial society, which is going to be the distinguishing feature of 21st century western societies. Following an evolutionary tradition in sociology, Bell adopts a teleological standpoint tracing a linear progression of societies from pre-industrial-extractive, through industrial-fabrication, to post-industrial-information societies, a sequence that seems, in his view, to be an inevitable outcome of history.

Bell conceives society as of having three distinct and autonomous realms: social structure, polity and culture. "The social structure comprises the economy, technology, and the occupational system. The polity regulates the distribution of power and adjudicates the conflicting demands of individuals and groups. The culture is the realm of expressive symbolism and meanings" (Bell, 1973:12). This distinction is basic for Bell who argues that post-industrial society emerges through changes in social structure rather than in politics or culture. Even though its development affects the other two spheres that need to accommodate or react accordingly, social structure is the sector that influences the transition. Therefore, Bell's book deals primarily with changes in social structure (the economy, technology and the occupational system).

Focused on an occupational definition of the information society, Bell's relies on statistics of major shifts in occupational activities during the different phases of society to characterize changes in social structure. In his vision, the type of work that is most common in any phase becomes a defining feature of a society. In Bell's argument, most of the occupations in an agricultural society are to be found in farming, fishing, and mining. In an industrial society, the majority of occupations will be found in factories, industries and blue-collar jobs, and in a post-industrial society, professionals, technicians and clerical workers would constitute most of the occupational labor. According to Bell, the major sign of the emergence of a post-industrial society is the growth of these service occupations. Bell also cites the fact that the service sector has expanded while industrial and agricultural sectors have declined as symptomatic of a transition to post-industrial societies. In Bell's thesis, a society moves out of industrialism when it has sufficient wealth to lay out on immaterial services, which in turn generate service occupations that account for a majority of the employment and that do not produce goods, but rather consume goods created elsewhere.

The excess of wealth produced by industry by reducing labor while increasing productivity through automation and computerization provides a continuous demand for services including hotels, education, health, entertainment, psychology, etc. This growing service sector provides enough labor opportunities to relocate that labor displaced from agriculture and industry. Moreover, since service occupations rely on individual knowledge and skills rather than on unskilled labor they are less likely to be automated, making employment in this sector more secure.

Bell also states that "the post-industrial society is an information society" (Bell, 1973: 467). In a service society the material for work is not land, or machinery, but rather, information. Labor and capital, the central variables of the industrial society, are replaced by information and knowledge: "knowledge, not labor, is the source of value"

(Bell, 1980:506). Whether it is in education, advertisement, financing, tourism, and so on, the service sector relies basically in the production, distribution and consumption of information. Service work is information work.

> "My basic premise has been that knowledge and information are becoming the strategic resource and transforming agent of the post-industrial society … just as the combination of energy, resources and machine technology were the transforming agencies of industrial society." (Bell, 1980:531,545)

Therefore, in this information/service society, the central figure is the professional equipped, by education and training, to create value out of information and knowledge. Among these professionals, the most important are the ones that create "theoretical knowledge," namely "scientists and engineers, who form the key group in the post-industrial society" (Bell, 1973:17), because this knowledge is the source of productive value, the source of growth in society. For Bell, the ascendance of professionals in society also expands the ethos of planning pervading society with forecasts, strategies and plans that would eventually substitute for the invisible hand of the market.

Bell believes that science and engineering have been the critical variable in the economic growth and change since the Cold War years. Science-based industry, engineering and science-based governmental decision-making have been, in his view, the basic cause of the recent economic transformations. According to Bell, during industrial society, a goods producing society, the dominant social ethos (in Max Weber's sense) was "economizing" for economic growth (produce more with less). More recently, with the expansion of science and engineering a new ethos appears that will become dominant, that of "sociologizing." Bell considers that the "ethos" of scientists is professionalism and not profit maximization, therefore private interest will not pervade their "theoretical knowledge," and their location in key positions of social structural power will cause these professionals to spread a new "sociologizing" ethos in which profit maximization of the market declines in favor of maximal welfare for the public at large.

With regards to politics, one of the supposedly independent realms, Bell claims that with the increasing general levels of education throughout the population and professionalization, there will be more participation in political decision-making. However, Bell does not explore analytically these implications for politics, as he does so with the social structure. Bell's argument is reduced to the impossibility of a technocracy by producers of "theoretical knowledge," because these professionals would not constitute a single political class as they would be dispersed, staffing many different organizations with competing interests.

Finally, in the culture realm, according to Bell, within the social structure of knowledge workers and a service economy there is a fundamental conflict, a widening disjunction, between the necessarily communalistic ethos of the new sociopolitical order, and the antinomian thrust of a culture dominated by a full blown individualism and its narcissistic expression. Given that most of the occupations in the service society center on interpersonal interactions, the professionals would identify with their clients as individuals promoting a communal society. This communalistic ethos will also be spurred by social and environmental concerns that will conflict with the individualism and hedonism of the previous consumerist society.

This rather utopian picture of the evolutionary post-industrial society with full employment, communal and caring, and broadly educated professionals is not without empirical and theoretical problems. As some critics have shown, Bell's is a rather difficult thesis to sustain in front of empirical evidence. For example, occupation in industry can not be accounted as a defining feature of an industrial society. Of the so-called industrialized nations only England employed most of its labor in industry, and it did so only for a brief period of time during the 1800s (Webster, 2002). Another weak point in Bell's theory is that an excess of wealth produced by industrialism has not been a pre-requisite for the growth of the service sector in poor countries where rampant poverty, agriculture and weak industries co-exist with increasing service sectors. In addition, the overly optimistic prospects for employment in service societies tumble in front of rising unemployment rates in supposedly post-industrial societies like the United States (Kumar, 2005).

The stress on scientists as independent from "economizing" principles also reflects common Mertonian (Merton, 1973) or Bourdieuan (Bourdieu, 1975) assumptions of science as being a separated and self-contained sphere with an inner logic independent of institutional arrangements, political and cultural influences. This separation overlooks the continuation of rationalizing and economizing principles in the production of scientific and engineering knowledge. In fact, some STS researches have shown that "economizing" resources and tools in the laboratory has long been a major factor in shaping what kind of scientific research is done or not (Clarke, 1995). Other scholars continuously stress the close links between universities, research centers, corporations and government in defining the structure of scientific research (Kleinman, 1995). In addition, as I showed in the previous chapter, engineering has been strongly controlled by private corporations since the end of the 19th century and has not been independent from capitalist concerns with profit maximization.

Though empirically and theoretically problematic, Bell's treatise still highlights genuine phenomena in western societies at the end of the 20th century: the growth of the service sector, increasing information work, increasing automation and computerization of productive activities in industry and agriculture, and increasing importance ascribed to theoretical experts (professionals, technicians, scientists, etc.). All of these are recent phenomena that could support Bell's argument about a change in modern societies. However, as Krishan Kumar has noted, Bell's post-industrial society relies too heavily in an on-going and permanent rationalization of industrial production (more for less) that has constituted the core ethos of industrial capitalism since the 19th century, making Bell's theory more of a theory of expansion and strengthening of industrial capitalism than one of radical departure in production and social structure (Kumar, 1978). The changes studied by Bell, far from showing a serious rupture with the past and a the rise of a new social order, seem to present a more minor and less radical transition from a mass production capitalism to a more advanced stage of capitalism characterized by a greater degree of planning and the use of "theoretical knowledge."

As controversial as it was during the 1970s, and still remains, Bell's theory has provided metaphors, concepts and a language to discuss what was happening and is happening in industrialized western societies at the end of the 20^{th} century. It still remains a rich starting point for sociological research that seeks to understand what has changed and what remains constant in contemporary societies.

4.4 Informational Capitalism and the Network Society

Manuel Castell's magnum opus, "the information age: economy, society and culture" is a trilogy of the sociology of contemporary societies at the end of the 20^{th} century that has also influenced considerably the social imaginaries of the information society. Based on extensive research and statistical analyses, Castell's work explores the influence of information and information and communication technologies (ICTs) on the economy, globalization, transformation of work and organizational structure of corporations, culture, social movements, identity construction, gender, and the nation-state. Castells theoretical lineage is that of post-Marxism, evident in the conviction that radical political change is not likely to come from the working class, but rather from identity politics emanating from social movements, which can not be explained in terms of class conflicts. Castell's core argument is that the "information age" announces a new society which has been brought into being by the development of socio-technical networks, enabled by ICTs, and which gives priority to information flows. This new society is also characterized by an expanded form of global capitalism called by Castells "informational capitalism." In order to explore the qualitative changes that characterize this transition it is necessary to clarify some of the concepts Castells uses.

The starting point for Castells is what he terms the "information revolution." His basic disposition shares the technological enthusiasm of some other scholars, like

Nicholas Negroponte for example, about the transformation of the material culture with the "accelerating and unprecedented" use and ubiquity of ICTs. Castells specifically refers to the phenomenon of convergence of technologies in microelectronics, computing, telecommunications and optoelectronics, and biology (genetic engineering) in what he calls the "technologies of information processing and communication" (Castells, 1996).

The information revolution, for Castells, is the result of technological breakthroughs that have happened since the 1970s, in advanced materials, energy sources, manufacturing techniques and in transportation technology (Castells, 1996). These breakthroughs have produced technologies with effects equivalent to those machines and steam power had in constituting the fabric in which industrial activities were woven during the Industrial Revolution.

> "Information technology is to this revolution what new sources of energy were to the successive Industrial revolutions, from the steam engine to electricity, to fossil fuels, and even to nuclear power, since the generation and distribution of energy was the key element underlying the industrial society." (Castells, 1996:31)

These technologies are revolutionary because they are "pervasive," that is they penetrate all domains of human activity and induce patterns of discontinuity in the material basis of economy, society and culture. Therefore, what Castells attempts to prove in his theory is that this sudden, unexpected surge of technological applications has transformed processes of production and distribution, the location of wealth and power, social structures, and cultures in those societies that have been able to master these new technological systems.

In addition to being pervasive, information technologies have an affinity to create and support network structures of organizations and individuals. This topological configuration is easily implemented and supported by computer and telecommunication networks and constitutes for Castells a major transformation of social structures.

Another concept important in Castells' theory is that of informational capitalism. For Castells the term used by Bell of "information society" is of poor analytic value when describing distinctions in the present era given that all societies in history have used information. Instead, he proposes the concept of "informational capitalism." Each of these words needs to be explained separately. First, "informational" refers to what Castells have called "informationalism," which identifies "the action of knowledge upon knowledge itself as the main source of productivity" (Castells, 1996:17). Castells parallels this informationalism with Bell's post-industrialism using the familiar Marxist concept of "mode of development." As a mode of development, informationalism refers to productivity levels characterized by technical relationships of production. In other words, informationalism is a technological arrangement through which labor works on matter, energy and/or information to generate a product and determinate the level and quantity of surplus. In this sense, informationalism, just as other modes of development such as the agrarian mode of development and industrialism, is defined by technological elements that are fundamental in fostering productivity in the production processes. In the case of informationalism the source of productivity lies in the technology of knowledge generation, information processing and symbol communication, that is in the action of knowledge upon knowledge itself (Castells, 1996).

Now, "capitalism," the second term, lets Castells observe that familiar forms of economic relationship (profit-seeking, private ownership, market principles, etc) still prevail now. For Castells, informationalism as a mode of development was historically co-constructed with the restructuring of the capitalist mode of production[28] at the end of the 20th century. In his analysis of historical changes, again from a Marxist perspective, what truly matters for Castells is to understand the actual interaction between modes of production (capitalism) and modes of development (informationalism) enacted by social actors within the current conditions of technological and economic development.

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[28] From a Marxist perspective, Castells understands a mode of production as a "set of rules for the appropriation, distribution and uses of surplus in a productive system. The modes of production define social relationships of production determining the existence of social classes that become social classes through their historical practice" (Castells, 1996:16). Capitalism is one of such modes of production and Statism is another.

According to Castells, the Keynesian model of capitalist growth that brought unprecedented economic prosperity after WWII hit a crisis during the 1970s manifested in rampant inflation and the inability of the public sector to expand markets in order to absorb a growing productive capacity of goods and services. The reaction from governments and firms to the crisis brought the establishment of neo-liberal policies in the form of deregulation, decentralization, privatization, globalization, and the dismantling of the social contract between capital and labor that underlaid the stability of the previous growth model. These series of reforms aimed at deepening the capitalist logic of "economizing" and profit-seeking in capital-labor relationships, globalizing production and consumption, and marshaling the state's support for competitiveness of national economies. In these series of reforms in firms and in governments, technological innovations and organizational change, focusing on flexibility and adaptability, were critical in ensuring the speed and efficiency of restructuring. Just-in-time production and management, global integration of financial markets, off-shoring of productive activities, and global control of productive activities in transnational corporations would not have been possible without informationalism[29].

Thus, "informationalism influenced the expansion and rejuvenation of capitalism, as industrialism was linked to its constitution as a mode of production." (Castells, 1996:19). As such, informationalism has altered capitalism but it has not replaced it as the dominant mode of production in contemporary societies. In this point, Castells clearly distances himself from Bell. Castells acknowledges that "economizing" is still the dominant ethos in informationalism and he also recognizes that the shift from industrialism to informationalism is not the historical equivalent of the transition from agricultural to industrial economies, and cannot be equated to the emergence of the service economy. His argument is that what we have now is an informational agriculture, informational manufacture and informational service activities that produce and distribute

[29] Informationism, a technological arrangement, incluyes not only information and communication technologies, but also organizacional and managerial technologies that have been hand-in-hand with the use of ICTs. Among them: international division of labor, flexible production, multifunctional labor, total-quality control, interfirm networking, horizontal corporation and global business networks, and flextime work.

on the basis of information and knowledge embodied in the work process by the increasing power of ICTs. In other words, informationalism has subsumed industrialism rather than replace it, and it did in a moment when industrial capitalism needed to go informational and global or collapse.

Castells also observes that "informational capitalism" is an unforgiving, even rapacious, form of capitalism because it combines enormous flexibility with global reach thanks to networks arrangements (Castells, 1997:338). These network arrangements are for Castells even more important than informational capitalism itself in defining the emergence of a "network society." This concept of a network society is a critical one in Castells' theory.

Castells argues that the undergoing transformation towards an "information age" is better characterized by the spread of networks linking people, machines, institutions and countries. In fact, this network structuring of society and technology has been a determinant feature of global capitalism. These networks are socio-technical arrangements. It is not only computer and telecommunication networks, but also the structuring of firms into network enterprises and business networks[30] in order to achieve flexible production and real time capitalist activity around the world. Even social movements (Castells, 1997) and governments (Castells, 1998), according to Castells, have adopted this structural form as a defining feature to organize their activities at local and global levels:

> "Networks constitute the new social morphology of our societies, and the diffusion of the network logic substantially modifies the operations and outcomes in processes of production, experience, power, and culture … this networking logic introduces a social determination of a higher level than that of the specific interests

[30] Castells illustrates this with examples from family based networks in China and Northern Italy, entrepreneurial networks in Silicon Valley, communal networks of the Japanese keiretsu type, cross-border firm networks, and organizational networks of decentralized corporate units from former vertically integrated corporations that re-adapted their organizational structures to compete in global markets (Castells, 1996).

expressed through the networks: the power of flows take precedence over the flows of power." (Castells, 1998: 469)

The dominance of this social structure also undermines the structure of power. Castells supports this point acknowledging the increasing weakness of the nation-state in the network society. For Castells, modern nation-states are unable to respond to the challenges posed by global networks and contemporary politics of identity. Global financial flows that can destabilize the financial in matters of seconds, foreign debt, and systematic interdependence of exchange rates of national currencies have made governments lose control over fundamental elements of their national economic policies and have created an increasing dependence of governments on global capital markets. On the other hand, identity politics have fragmented civil society in a plurality of identities that demands and challenges the State simultaneously. Being unable to respond to this multiplicity of claims the State has fallen in a state of illegitimacy in the view of these identity-centered groups. In addition, nationalism as a source of definition of citizen identity is given way to other forms of identity (ethnic, territorial, religious, sexual orientation, etc) that are not circumscribed to the nation-state, such as the Zapatistas in Mexico or the Christian Coalition in the United States (Castells, 1997). This crisis of the nation-state in the information age does not mean, however, its demise. Castells insists that the importance of the State remains. States still have "some regulatory capacity and relative control over its subjects." In the new power structure, Castells see the State being one of the sources of power, one of the nodes in a broader network of power. From this perspective, Castells joins advocates of "governance[31]" as the form of government in neo-liberal States[32]. These networks of governance are local, national e international and

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[31] "Governance" is defined by the UN Commission on Global Governance as "the sum of the many ways individuals and institutions, public and private, manage their common affairs … a continuing process through which conflicting or diverse interests may be accommodated and co-operative action may be taken … it includes formal institutions and regimes empowered to enforce compliance, as well as informal arrangements that people and institutions either have agreed to or perceive to be in their interests." (Governance, 1995).

[32] Neoliberal programs are designed not only to shrink the State and make it "more efficient," but also to shift the balance of power in society from governments and the public sector to private individuals and groups. Within neoliberal development circles this kind of institutional reform came eventually to be identified with "good governance." It was argued that the general thrust of free-market macroeconomic policy, decentralization and privatization would open new avenues for self-reliance, entrepreneurship and

they reposition governments not as central sources of power, but as another node in networks, in which power is distributed among corporations, non-governmental organizations, social movements, etc. I will elaborate more on governance later in this dissertation because it constitutes a fundamental re-structuring of political life that has been powered by neoliberalism, developmentalism and ICTs, both in rich and poor countries.

Castells also notes that in "informational capitalism" we now have capitalism without a capitalist class. Network-oriented and adept "informational labor" is responsible for running capitalism nowadays. On this point, Castells seems to join Bell in positioning informational labor -Bell's knowledge workers- in a central and privileged role based on individual meritocracy rather than on class markers:

> "Knowledge and information are the essential material of the new production process, and education is the key quality of labor, the new producers of informational capitalism are those knowledge generators and information processors whose contribution is most valuable to the economy." (Castells, 1997:345)

Castells' informational labor is constituted by accountants, teachers, systems analysts, financers, account investors, advertisers, architects, lawyers, scientists, engineers, designers and other university-educated "experts." Central to informational labor is automation of generic labor, creation of networks, and design of products, information technologies and organizational structures, making scientists, engineers, managers and investors central figures of informationalism. This group has become the key force in society, responsible for just about everything from designing technology to managing corporate change. However, their agency is constrained by the more powerful agency of the network of flows. These faceless capitalists, not integrated by class markers, run, but do not control, informational capitalism. In consequence, previous forms of stratification based on class and capital are now being replaced by new types of inequality based on individual skills and education. Manual workers -"the working

participation. In the process, civil society would be strengthened and equipped to reform unaccountable and unresponsive governments (de Alcantara, 1998).

class"- find themselves increasingly redundant and ill at ease in informational capitalism. Challenged by information labor which, as the innovative and wealth-producing force, imposes changes on them, unskilled and uneducated labor is pushed to the margins of informational capitalism. According to Castells, at best they find low-paid, low-level, insecure employment and at worst they turn into criminals.

Joining the working class in the peripheries of informationalism, Castells also places the "Fourth World," constituted by those who have no part to play in informationalism because they lack resources of capital, academic credentials and skills that make them appeal to global capitalism. Maids, janitors, security guards, waiters, etc. constitute the ranks of this fourth world and constitute an underclass that dedicates to serve information laborers. This generic labor sinks into the underclass for remaining anachronic with the structure of the network society and informational capitalism. Exclusion and inclusion is, in consequence, mediated by the terms of the informational-capitalist-network society. Those left out of the network become underclass in this form of stratified society.

Finally, in cultural terms and echoing concerns of other media scholars (McChesney, 1999), Castells also fears that the information age is entertainment-led and most of its popular content is edited by a few centers of media monopoly. Even though, Internet has a technological valence towards interactivity and individualization that may enable people to constitute online communities, a considerable amount of the content that is mostly accessed by internet navigators is still coming from mass media conglomerates (McChesney, 1999) that edit information content from an entertainment and market-oriented perspective. In consequence, Castells thinks that this entertainment-led information will result in people being interacted on by centralized forces rather than being truly interacting, "the price to pay for inclusion in the system is to adapt to its logic, to its language, to its point of entry, to its encoding and decoding" (Castells, 1996:374). However, Castells also notes that other spaces for interactivity do exist and they have been used to strength social movements of resistance and project-identities. He refers to cases when Zapatistas in Mexico, or globalization-resistance movements have used the internet to organize collective action, diversify resources, and maintain global visibility (Castells, 1997).

Castell's network society-informational capitalist theory is overall a major account of social, cultural, political and economic changes and continuities in contemporary societies, and without doubt a point of reference for any social studies of the so-called information society. In comparison to Bell's theory of the post-industrial society, Castells' theory of the network society is more nuanced and robust. His Marxist/post-Marxist framework allows him to explore not only social structure, as in Bell's case, but also the systemic interactions and relationships within and among culture and politics. Marxist influence for instance can be observed in the emphasis Castells places on structural features -economy, labor and technology- in his first volume of the series (Castells, 1996), to explore later the sociology and culture of the network society in his second book (Castells, 1997), and concluding with his analysis of politics in the global order of the information age, more detailed in his third volume (Castells, 1998).

More critically, we can use Webster's classification of theories of the information society to locate Castells' network society theory. As a sociologist, Castells develops a sophisticated occupational, economic, spatial and cultural definition of the information society. However, his core occupational group, informational laborers, is less well defined than Bell's core occupational category: critical knowledge workers –scientists and engineers- losing analytic power. Under the same definition Castells places designers, engineers, scientists, managers, stock brokers, journalists, clerical workers and so on. Castells goes from defining informational labor as those possessing enough technical knowledge sufficient to use ICTs with ease (i.e. clerical workers), through those that possess, create and use scientific knowledge to create more valuable knowledge or technologies (scientists, economists, engineers, etc.), to those with qualities that facilitate organizational or institutional matter (managers, investors, etc.), making the category of informational labor analytically weak.

In socio-economic terms, Castells seems to dismiss the influence of a propertied class in informational-global-capitalism, and according to some critics ignores the prevalence of socio-economic structural inequalities that still shape the pool of the most valuable informational laborers that have graduated, for instance, from prestigious universities such as Harvard, Oxford and Cambridge. From a Bourdieuan perspective, we could conclude that Castells ignores how wealth and the elitist educational system interact to produce an academic field that systematically excludes those without the required cultural capital, normally associated to those with more capital, from the pool of elite-informational laborers (Bourdieu, 1988). John Scott, for example, argues that even though capitalists, while still able to pass on their properties to their heirs, cannot guarantee transmission of management positions (Castells' faceless capitalists). However, the propertied class has also formed a pool from which top corporate managers are recruited. This elite pool, specially advantaged in the educational system, possesses high-level informational skills that allow them to stand at the top of the stratification system, distancing themselves from those in the subordinate service class in the ranks of corporations (Scott, 1997). Therefore, and contrary to Castells focus on meritocracy and structural agency of the network of flows, it seems that there is still a capitalist class steering informational capitalism.

Lastly, it is necessary to note the sophistication in Castells theory, which by grace of his analytic separation of mode of development and mode of production allows him to balance changes and continuities in contemporary society. While accounting for qualitative changes in labor, technological frameworks, organizational structures, social stratification, politics and culture spurred by the mode of development, Castells is also able to provide a narrative of continuity and extension of the capitalist mode of production due to the continuing importance of private property, market principles and accumulation/distribution of capital. His theory of co-construction of informational capitalism, ICTs and a network society also combines elements that connect this perspective to canonical socio-technical theories of co-construction of society and technology in STS. All of these elements make Castells' theory a robust ground to support one of the main arguments of this dissertation, namely that qualitative changes of capitalism have occurred at the end of the 20th century, although preserving the “spirit” of capitalism and its rationale as a mode of development in an ICT-powered version of it. This argument is also supported by Marxian analyst Herbert Schiller, who in addition provides a theoretical framework to evaluate how ICTs have been co-constructed with versions of informational capitalism.

4.5 The World-Market Based Information Order

Herbert Schiller, Marxist American media critic and sociologist, argues in a way similar to Castells that the United States at the end of the 20th century entered an era in which production and dissemination of information became major and indispensable activities for the socio-economic system. This feature is characteristic of advanced capitalist societies that rely on the promotion of information and the use of ICTs. Schiller’s work also argues that current theories of the information society tend to overlook the poor, the disadvantaged and nations not located in Europe or North America.

In several books and newspaper articles, such as “Information and the Crisis Economy” (Schiller, 1986), “Culture, Inc.” (Schiller, 1989) and “Information Inequality” (Schiller, 1996), Schiller analyzes the structure of media in America, focusing on patterns of ownership, sources of advertising revenue, and audiences’ spending capacities. In his view, these elements profoundly constrain the content of information available nowadays, whether we are talking about TV news and documentaries, videogames, or Internet online content. Schiller’s method is to locate a particular phenomenon (i.e. web page, TV station, etc) within the context of an entire socio-economic capitalist system explaining how capitalist principles have guided the content of information and how this phenomenon has reinforced the broader capitalist system.

Schiller’s starting point is that in the current era of capitalism, information and communication have a critical role in maintaining the stability and health of the economic system. Thus, contrary to post-industrialist notions that capitalism has been transcended, Schiller highlights that “long prevailing imperatives of a market economy remain as determining as ever in the transformation occurring in the technological and informational spheres” (Schiller, 1981: p.xii). Consequently, Schiller interrogates information technologies through filters of power, control and interests. He wants to know where benefits from ICTs go, and where control is located:

> “An entirely new electronic environment-industrial and individual, factory and household is being created at an astonishing speed. Who will own it? Who will direct it? Who will utilize it? Who will benefit from it?” (Schiller, 1993:64)

Schiller is especially concerned with the privatization-commercialization of information and the consolidation-conglomeration of ownership of the information industry (television, telecommunications, computers, consumer electronics, and publishing and information services). According to Schiller, even though there is increasing information available everywhere, access to this information is mediated by market principles:

> “The commercialization of information, its private acquisition and sale, has become a major industry. While more material than ever before is available … ‘ability to pay’ is becoming the governing principle of access to information” (Schiller, 1987:6)

Schiller saw this happening in the privatization of Internet during the 1990s and the buzz and expectation of government, retailers, and media giants over a juicy market of 90 million households and more than $3,5 million dollars in revenue produced by the integration of the information industry in the United States. Early in the 1990s, Schiller foresaw conditions that we are currently living with now, an electronically organized total environment that encompasses individual, household, business and work practices in their totality. Its major components being the Internet -at the time, Gore’s “information highway”- and all the electronic gadgets that feed into it.

The centrality of market principles in the information society described by Schiller is a prime engine towards the commodification of knowledge. For Schiller, information has become another commodity in the United States, something increasingly sold and bought. Underlying this dynamics of information, Schiller identifies a corporate capitalism that is highly concentrated, oligopolistic, and global. Capitalism of this kind imprints a distinguishable private orientation to the development of information and ICTs, rather than orienting technologies and information for public ends. Schiller sees this happening in three specific locations: the private-controlled access to information, the private shaping of the available content of information, and the decreasing availability of public-oriented information. Schiller illustrated this with the media-saturated-electronic environment invading the home with market messages in the form of 24x7x365 cable channels of shopping programs and sport channels turning athletes into market objects (Schiller, 1993). Schiller also saw in the privatization of the Internet a threat to the continued availability of the network at reasonable cost to educational users (Schiller, 1993), and he feared an increasing reduction of the availability of access to and accountability over public information because of continuous restrictions imposed by the United States government upon the Freedom of Information Act as well as the outsourcing of public-data management to private contractors (Schiller, 1985).

Along with his discussion of market principles and private control over information, Schiller also takes into account structural social inequalities as a capitalist imprint of the information society. Schiller considers class inequalities to be a major factor in the distribution of, access to and capacity to generate information. Class stratification is for Schiller a major factor in shaping who gets what information and what kind of information they may get. Schiller considers that those without capital will be the losers in the information age. Another structural inequality he notes is that between rich and poor countries which stems from the domination of the world's media system by Western capitalism. This informational and cultural imperialism is due to the fact that the world's information environment overwhelmingly emanates from the Western nations, especially the United States (McChesney, 1999). From a Marxist perspective, Schiller argues that cultural imperialism of this kind provides dominant players in the global economy an instrument for ideological domination.

In short, market principles and class inequalities are, in Schiller's view, the defining elements that have characterized corporate capitalism and he considers them to be defining elements of the "information society." On this point, Schiller distances himself from theorists that consider the information society as a rupture with previous types of society, mainly because he considers that there has been no rupture, no "information revolution" overturning corporate capitalism and its logic. For Schiller, corporate capitalism and its features of market principles and class inequalities, dominant since the late 19th century (Chandler, 1977), are still behind the creation and expansion of information and ICTs.

Schiller was alert to the fact that corporate capitalism grew during the 20th century in scope and size. He was particularly interested in transnational corporations such as IBM, Dell, Apple, AT&T and other giants of information and communication technologies. Schiller saw in these companies the influence of ICTs in expanding capitalism but he also saw ICTs as enablers of the existence of these transnational companies. These global corporations required sophisticated computer communications infrastructure for their daily activities, especially the coordination of productive activities all over the world from centers in London, New York City, and Tokio. Schiller acknowledges the critical use of ICTs not only within particular corporations but also within firms for the operation of a world market and international financial networks.

The expansion of advertisement is another of the impacts of ICTs on capitalism. Global marketing of Levi´s jeans, Coca Cola drinks, GM cars, or Microsoft products would be unthinkable without the support of the mass media system. Schiller argues that this commercialized system portrays the capitalist American way of life evident in the type of houses depicted, the clothing, lifestyles, leisure, consumerism, and infatuation with celebrities. The admiration it provokes among audiences around the globe increases the demand for American products and services required to materialize the American way of life in Asia, Africa, or Latin America. The expected result is expanded markets for corporate capitalist America.

Herbert Schiller's view is that the contemporary information environment expresses the interests and priorities of corporate capitalism as it has developed over time and it is an essential component in sustaining the international capitalist economy. On this, he joins the ranks of other media scholars like Robert MacChesney (1999), STS critics of the "information revolution" like Langdon Winner (1986), and sociologists like Manuel Castells (1996). Central to his common critical commentaries about the "information society" is his Marxist framework that revolves around the analysis of key concerns of capitalism, namely: market principles, commodification of information, class inequities, corporate capitalism and consumer capitalism. I will describe each of these analytical elements to help focus on the kind of questions that should be asked when studying visions or versions of the information society being constructed.

4.5.1 Market Principles

Schiller claims that market principles, especially the search for profit maximization, underlie the information realm as they underlie the capitalist society. As a rule, information is produced and made available only where it has the prospect of being sold at a profit, and it is produced more abundantly and with greatest quality where the best opportunities for gain are evident. It follows that market influence is decisive when it comes to determining what sort of information is produced, for whom, and on what conditions. The corporations that dominate the information industry operate on the basis of market principles ("economizing"), and to this end they tailor their production to those areas that hold out the prospects of greatest reward. Clearly, from this perspective, there is nothing neutral about information and communication technologies or information production when market principles orient their development and content.

When analyzing the effect of market principles on ICTs and information, Schiller guides his research by asking: What were the priorities of corporate suppliers during R&D of these technologies? Who are the consumers of this information and how do they gain access to it? What kind of information is this and how does it promote public or private interests? Who owns and controls information and technologies after they have been produced?

The adoption of market practices by information and ICT producers is not a matter of choice. Indeed there are massive pressures disposing them towards certain policies. One overwhelming imperative is that the provision and servicing of information networks is an intensely competitive market which impels players to act in particular ways, most notably pushing the biggest players to consolidate operations, restructure, create alliances and merging within themselves to take control of a competitive world market dominated by just four or five giants of the industry. Thus, companies like AT&T, BT, and MCI are also pressured into a race over which they have little control.

The primacy of market principles in the information realm has been also consequential in the decreasing support for key public information institutions that for long have been dependant on public funds. Schiller worries about decreasing budgets and privatization of museums, libraries, governmental information services, and educational channels. Reaganomics and Thatcherism, in the United States and in Britain respectively, have been instrumental in furthering such measures. According to Schiller, reduction of government, privatization and deregulation are landmarks of market principles shaping information policies. Schiller accounts for the negative consequences of these policies in restrictions on library opening hours, shortages of funds to buy books in libraries, charges for access to exhibitions formerly free to the public, and above-inflation increases in prices for governmental information (Schiller, 1987). In his view, what we witness between the federal government and defenders of free access to information, such as the American Library Association is “a silent struggle being waged between those who wish to appropriate the country’s information resources for private gain and those who favor the fullest availability. The latter have been in steady retreat.” (Schiller, 1985:708)

With public funds reduced, universities, art institutions, and libraries are driven towards private funding to remain viable. In consequence, major effects of the commercialization of formerly public information can be seen on what information is created and on what terms it is made available. At the least it leads to increasing prices for access and to the favoring of exhibitions and programming appealing to a wide public able to pay for them. Access to museums become then only available to those who can pay for it and museums are pushed to continuously design attractive "products" to attract visitors. This is clearly a characteristic feature of market principles in the public information realm; changes in the organization and funding of cultural institutions in favor of the market do have important consequences for the information that is "made public" and how it is made available.

4.5.2 Commodification of Information

According to Schiller, information has become another object to be produced and consumed. Because it is developed and made available in a market society, so must it be treated like most other commodities within a capitalist order. As such, it is considered something vendible, subject to price mechanisms, something to be bought and sold. To become a commodity, rules about turning information into a private property with an assigned value need to be created. Legal and technological mechanisms have been in place, and some more others are still being developed, to ensure that authors of intellectual works are identified and they profit from their works and the use of them by third parties. Authors like Lawrence Lessig, have shown how this extension of private property to intellectual creations was initially designed in the American Constitution to protect and incentive intellectual producers and to enrich the production in the information realm (Lessig, 2000). However, Lessig also notes that American Constitution also established boundaries to the author's intellectual property rights such as the "first sale" and "fair use" principles, also designed to ensure a maximum public use of information that would benefit the education, culture and political dynamism of citizens.

This balance between author's rights and public interest was altered during the 20th century by the increasing value that information and intellectual works showed to have in an increasing national and global market, and by the patronage of intellectual producers by corporate capitalism (Lessig, 2000). Lessig has shown how corporate interests have promoted and lobbied for changes in the law of intellectual property, for example increasing the years an intellectual creation is out of the public domain and transferring intellectual rights from individuals to corporations. This has been also accompanied by a reduction in "fair uses" by digital technologies that control access and copies of intellectual works and by the criminalization of the circumvention of these "trusted" technologies (Lessig, 2000). The consequences are telling, for the use and circulation of information is highly controlled by the ability to pay for it. Moreover, as a commodity, information has acquired a distinct form from other commodities in the sense that it can not be "owned" but "licensed" for specific uses, users and period of time. Even public libraries now need to pay for licenses to have and maintain access to databases and information that previously had no cost for them. This condition restricts enormously the free circulation and flow of information in society with a considerable impact for the education, culture and cultural participation of those who cannot afford to pay for this information.

ICTs, copyright and patenting, from this perspective, have been used to maximize profits and return of investment of publishers, corporations and other sponsors of intellectual production. This commodification and commercialization of information what Schiller deplores. In his view, information should be a public good not something exclusively bought and sold in the market.

4.5.3 Class Inequalities

As a commodity, information and ICTs are made available only to those best able to pay for them. The fact that the market is the mechanism to allocate offer and demand of information means that it is responsive to a society differentiated by income and wealth. In other words, class inequalities also structure the information society. The most common way of showing this has been suggesting evidences of "digital divides" within and between countries (Norris, 2001). However, this approach is mainly technological and does not address other qualitative dimensions of the information society.

The presumption in technological approaches to the digital divide is that these divides are regrettable because they exclude the poor and disadvantaged from full participation in the information society. According to these approaches, governments should enounce an IT policy oriented to deploying computers and networks for public access in libraries, schools and community centers in order to reduce the digital gap. The premise is that without such policies new technology tends to block people from accessing the opportunities being offered in the digital environment. Another approach is to let the market and non-profit organizations fill in the void by selling low-cost computers and connectivity, or maintaining a few community access points for the poorest. For Schiller, all of these approaches confuse cause and effect, and they have no practical consequences for the poor. They rather distract attention from more substantive, structural issues of class divisions.

Sociologist Vincent Mosco, endorses this position. While studying how power is used to shape the production, use and distribution of information as a commodity, Mosco suggests that we are living in a "Pay-per" society (Mosco, 1988). There is pay-per view in cable TV, pay-per call in telephony, pay-per bits of proprietary information, and even payment of salaries per keystrokes. For Mosco, information and communication technologies have made possible to monitor and measure, at a fine level of detail, more of our electronic communication and information activities. Models of "economizing" run by businesses have profited out of this, allowing companies to charge by multiple categories of service based on numbers of bits transmitted, speed of transmission being used, type of data being accessed, and so on. In consequence, the informational environment has become not a uniform experience for everyone but rather a plethora of possibilities that can be paid for. The ones who pay the most will have a different experience of the informational than those who can not afford to pay for the same services or level of service. The higher one is in the class system, the richer and more versatile will be the informational environment: faster speed, more reliability, wider coverage, more amounts of data to be transmitted, proprietary types of content/services to be accessed, etc. As one descends the social scale, so does the quality of the informational environment one will get. Thus, it follows that reducing the digital divide is not going to affect social divides created by capitalism, which ultimately creates new information and communication technologies to sustain and increase existing social divides.

The centrality of this ability-to-pay marker, and the linkage it has with class inequality, leads Schiller to conceptualize the "information-rich" and the "information-poor," both within and between nations (Schiller, 1983):

> "Access to information becomes a factor of wealth and income. The general public and the State itself are progressively excluded … The division inside the society between information 'haves' and information 'have nots' deepens just as it does between nations, making the less-developed ones –which in the information age means the overwhelming majority- still more dependent on the few information generators, processors and transmitters." (Schiller, 1983:88)

According to Schiller, this dependence on centers of information and technological systems located in richer countries, limits poorer countries to the left-overs of the "First World," for example with Hollywood reruns, and makes them dependent on what the affluent nations are willing to make available, for example news produced by the Associated Press or Reuters. Poor countries may be further disadvantaged by the rich's monopoly of leading-edge information technologies such as satellites which may monitor poorer nations from far above in the skies to track coca plantations in Colombia and Bolivia, for example.

Schiller's arguments are also supported by Pippa Norris who shows that even in rich countries with high penetration of ICT, and therefore a low "digital divide," the traditional economic and social gaps have not been altered. Info-rich and info-poor continue to be the traditional rich and poor (Norris, 2001). Some other STS scholars have also noted that not only social divides are not narrowing but conditions for the poorer may be worsening. Eubanks for example has argued that benefits and burdens of ICTs are not distributed symmetrically in society. Most of the burdens of ICT are placed asymmetrically on poor people (Eubanks, 2004). Low-income people are more likely to be subjected to technologically-mediated surveillance on the job, with key-stroke counters and phone monitoring (Sewell &Wilkinson, 1992; Sewell, 1998), and they are most likely to lose jobs and workshop control to technological change and worker deskilling (Noble, 1984; Gans, 1995).

In short, what Schiller suggests is that within and between nations, the information society arises within a class society. Thus it reproduces existing inequalities and may indeed exacerbate them.

4.5.4 Corporate Capitalism

A fourth concept and starting point of analysis for Schiller is the relationship between corporate capitalism and the information environment. Corporate capitalism, in the making since late 19th century (Chandler, 1977), has had several consequences for the informational environment stemming from its central position and enormous wealth in modern economy. One is that information and related technologies are developed and put in place with the corporate market uppermost in mind. State of the art ICTs are usually found among corporations, which have the ability to pay for them and have also identifiable needs for sophisticated information facilities. The consequences of this, as David Noble has shown, are that corporate capital's overriding interest in profitability has shaped information technology innovation (Noble, 1984) and its institutional structures (Noble, 1977).

It is now evident that ICTs have bolstered the powers of corporate capitalism by enabling companies to expand operations and markets. Off-shoring, for example, is nowadays a common managerial practice of transnational corporations (TNCs). It has become common to distinguish between a "front end" and a "back end" of operations. The latter is associated with the company's operations that can be made invisible to consumers and that, by virtue of ICTs and organizational structures, can be performed in oversea countries. Decentralized and distributed activities supported by ICTs have also slimmed down corporate headquarters, allowing subsidiary elements of the business to operate as independent profit centers (i.e. franchises, autonomous branches) while simultaneously bolstering centralization, made possible by a range of electronic and information technologies used to register and monitor instantly all financial and operational activities (Schiller & Schiller, 1986).

The dominance of corporate capitalism can be seen in the ways it structures the content of the "Pay-per" society as well as the increasing importance of intellectual property for corporation and governments. From a "Third World" point of view, this can be seen in negotiations over free trade agreements (FTAs) with the United States. For example, in Colombia and Peru, during the past few years there have been innumerable rounds of negotiations between locals and official representatives of the United States drafting bilateral FTAs. In all of them, a contentious issue has been that of intellectual property rights. The culture of piracy, common in Latin American countries, has allowed locals, for several years, to share American-produced content or technologies, such as productivity software. However, FTAs demand that Latin American countries curtail these practices, police them, and punish them by law, because these "illegal" practices reduce profits for American TNCs interested in expanding markets in these countries. This "disciplining" of Latin American legal systems and consumers is a necessary condition for the expansion of American markets that will asymmetrically benefit American TNCs rather than local firms.

Finally, nowhere it is corporate capitalism shaping the information society more clearly than in the ICT-information sector itself. Robert McChesney shows in his book "Rich Media, Poor Democracy" how the international oligopoly of a few giants of the media industry -Time Warner, Disney and Rupert Murdoch's News Corporation-, structured through concentration and consolidation of media companies, came to be as a fundamental part of the structuring of global capitalism. According to McChesney, one of the biggest impacts of this oligopoly of the international media has been that journalism has been coerced to fit into a marketable and profitable mold to be sold. The mold demands a ceaseless flow of fast-news in non-controversial, superficial, sensationalistic, and entertaining formats. In the process, journalistic principles such as holding people in power accountable, encouraging rigorous fact checking, and keeping a balanced diversity of opinion are affected, degrading not only the content of information people receive, but first and foremost the role of journalism in a healthy democracy (McChesney, 1952-, 1999).

4.5.5 Consumerism

The fifth and last concept, critical to Schiller's analysis is that of consumerism. Consumerism refers to an individualistic (as opposed to a collective) way of life, one in which people 'buy a life' by paying personally for what they get. It entails a lifestyle that is home-centered to the detriment of civic relationships. Thus, individual needs are not satisfied in the public sphere, in contact with equals, but rather in the buying of goods and services to be consumed privately.

In Schiller's view, informational developments have continued to promote consumerism and social passivity. They have provided the means by which people are persuaded that consumerism is a desirable and inevitable way of life. Countless ads now inundate educational channels, cell-phones permanently send to their customers un-solicited text messages urging them to consume services. Spam from private vendors floods email servers and inboxes. Through this sustained information bombardment all spheres of human existence are subject to the intrusion of commercial values.

Robert Putnam argues a position similar to Schiller's. According to Putnam, more television watching is one of the reasons to blame for the decline of civic participation and social involvement in the United States in the decades after WWII. TV has encouraged lethargy and passivity and it has stolen time for civic engagement (Putnam, 2000). The couch-and-potato lifestyle has only getting worse with technological innovations such as digital and interactive TV in which consumers can now buy any advertised product directly from their TV, reducing trips to shops where they might have face-to-face encounters with their neighbors. The same can be said about online shopping that combined with home delivery had offered corporations another lucrative sales channel. For consumers, it is just another reason to consume from home.

Consumerism also shapes the content of the information being provided. Athletes are fully dressed in branded clothing; movies are filled up with sponsored elements that make; and schools and kids' channels are increasing targets of marketing (McChesney, 1952-, 1999). This hyper-commercialization has also become personalized by virtue of ICTs. Cookies and other technologies that track individual consumer behavior provide sellers with information to target advertisement at the individual level. Each transaction is monitored refining individual customer's profiles in order to customize advertising and cognate material to lock the audience even further within consumerist habits. Moreover, the information collected in this organized, private surveillance becomes itself a commodity that can be sold to anyone interested in marketing products or services to specific markets.

4.5.6 If Schiller Had Worked in Wikipedia: Revisiting Schiller's Critique

Since Schiller wrote his critique about the information society during the 1980s and 1990s, several tendencies opposing informational capitalism have become salient. After Schiller's death in January 2000, clear counter-tendencies to corporate-capitalist oriented information and ICTs that were not salient during Schiller's life have spread all over the world concentrated in a specific technology: Internet. I especially have in mind Internet applications that constitute what has been called the "Web 2.0." On this, I refer to the exponential growth of user-generated content and technologies that has supported the existence of on-line/off-line communities, such as blogs, chatrooms, independent media on-line, community-generated content in communitarian networks, social software, etc. There has been also the emergence of social movements aimed at media reform and the recovery of information as a public good promoted by scholars and technicians. These reform movements are more salient now than they were during the 1980s and 1990s. Free Software and Creative Commons are but two examples of these movements. In effect, these technologies and reform movements have addressed during the past few years several of Schiller's concerns and they need to be considered in any evaluation of the influence of corporate capitalism. They show us that not only corporate capitalism acts as a shaper but also as a reference point for other actors to resist and create alternatives to mainstream corporate-shaped information and ICTs.

A very insightful description of these alternatives to informational capitalism is provided by Yochai Benkler, a law scholar (Benkler, 2006). Benkler sustains that the turn of the century witnessed a memorable turn of events for the place of media and information in contemporary capitalist societies. Benkler suggests that the market-oriented information economy criticized by Schiller is not the only information economy now in place in contemporary societies using the Internet. For Benkler, a "new stage in the information economy" is displacing the industrial information economy that characterized information production during the 20th century He calls this stage "the networked information economy."

The networked information economy, in words of Benkler, is characterized by "decentralized individual action -specifically, new and important cooperative and coordinate action carried out through radically distributed, non market mechanisms that do not depend on proprietary strategies-" (Benkler, 2006:3). By this, Benkler refers to widely distributed and collaborative efforts to produce information commons such as Wikipedia or Free Software. The low barriers of entry to the production of content on the Internet, due to increasingly low costs of the means of production in this environment in developed and developing countries, have allowed information producers, who do not represent market interests, to participate in the formerly tightly controlled economy of information production. These individuals by their engaging with Internet tools and applications are populating the information environment with information goods which are not to be sold or buy but which are mainly destined to be publicly shared.

According to Benkler, the networked information economy unfolds an information dynamic which is more economically effective that the dynamics of the industrial machine of information production. By developing an economy of production and consumption of information good at its marginal cost (zero), the networked information economy provides a more dynamic economic of information which is not restricted by barriers imposed to inputs that need to be paid before they are processed as final products (Intellectual Property Rights) . This dynamism results in increasing production of information goods available for future production that benefits the society at-large by providing a rich and diverse informational environment not subjected to market and editorial constrains of corporations and governments.

This type of economy relies in a common feature of all economies which is commonly ignored and devalued: free labor (Terranova, 2004). In the networked economy user-producers dedicate long hours sharing their thoughts and writings on the Internet with friends and strangers without expecting a monetary return. Users dedicate time to post news about issues ignored by the mass media or the State (think of the work of bloggers during Katrina). People enrich the information goods with personal pictures or videos that can be used by others without paying royalties (Flickr, YouTube). Scholars and other intellectual producers now offer their insights openly to the public without the barriers of the copyright (Creative Commons, Free Courseware). Other people dedicate time to work in collective productive activities such as reviewing books, producing software components (free software) or improving existing software applications, proof-reading translations of books or scanning of books in the public domain to make them accessible on-line, or creating text-books to be freely available for poor families (Free High School Science Texts –FHSST- in South Africa). This “social factory” (Terranova, 2004: 75) is the source of value in the networked economy making information goods available on the Internet at its marginal cost. The free laborers are also not limited to the highly-skilled producers of information goods in the market-oriented information economy. Free laborers are also young people without university education, stay-at-home mothers or fathers, the unemployed, and many other users that by using Internet applications enrich the information goods with their knowledge and perspectives and provide Internet with its value for other market-oriented purposes:

> "Users keep a site alive through their labor, the cumulative hours of accessing the site (thus generating advertising), writing messages, participating in conversations and sometimes making the jump to collaborators." (Terranova, 2004: 91)

The social relevance and economic novelty of this networked informational economy is that it offers a path of production of information public goods not contemplated by Schiller, who only saw information increasingly being produced in a market-oriented information economy as a commodity. The solely existence of this parallel and complementary economy renews the hopes that a more varied information environment can be allowed to exist along side market-oriented information economies if neoliberal ICT policies do not kill this economy by privileging the market over the "social factory," returning to the pessimistic state originally contemplated and criticized by Schiller. This is actually the most important concern of scholars like Lessig and Benkler, who have also turned into activists by openly criticizing neoliberal policies in the United States which privilege the interest of few corporations attempting to shape commercially (and ineffectively) the economy of information on the Internet:

> "The political and judicial pressures to form an institutional ecology that is decidedly tilted in favor of proprietary business models are running head-on into the emerging social practices [the networked information economy] … It is hard to predict at this point whether a successful sustained effort on the part of the industrial information economy producers will succeed in flipping even more of the institutional toggles in favor of proprietary production." (Benkler, 2006: 470)

The networked information economy presented by Benkler responds also to several of Schiller's concerns with the market information economy. First, the network information economy shows that favoring a closed market-based information economy actually reduces the possibilities for innovation by raising the entry barriers for innovators without the capacity to pay for expensive licenses, patents and royalties. The network information economy by eliminating these barriers benefits the production and distribution of information commons and creates a more dynamic environment for cultural and technological innovation (Benkler, 2006). Second, in this type of economy information is not considered a commodity but rather a public good, a constitutive part of the social commons. Information is not to be sold and buy but to be shared, improved, worked on it, reproduced and redistributed. Thus, the ability-to-pay, observed by Schiller, is not a deterministic factor that discriminates between qualitatively different informational environments. Those who can afford to pay for access to the on-line version of the Encyclopedia Britannica have access to a similar level of information quality to those who do not pay a fee to access to a common-based peer production such as Wikipedia, with levels of quality that match those of the Encyclopedia Britannica (Benkler, 2006). Third, enhanced autonomy derived from participation into commons-based peer production turns couch-and-potato consumers of mass media into active, critical produces of their own informational environments. This exciting possibility of a renewal of the public sphere, mostly dominated by the corporate media, also shifts the passive role of consumers of market-produced media into deliberative citizens enriching the democratic exchange of ideas and perspectives in liberal democracies (Benkler, 2006). Fourth, and last, corporate control or government control does not orient the content and the directions of the type of productive activities being developed in this information economy. In fact, the richness of the networked information economy relies in the diversity of information goods, some of which are in openly confrontation with state ideologies and market-favored orientations to the lowest-common denominator (Benkler, 2006).

In conclusion, the salience of the networked information economy during the past few years has tempered the overly pessimistic prospects for the information society raised by Schiller during the 1980s and 1990s. However, the increasing role of the non-market information economy can still be hurt and reversed by neoliberal policies and the state protectionism of the industrial informational economy, just as Schiller feared. The future outcome is still unclear but it will surely be the result of struggles and confrontations over the shaping of the information environment between social and reform movements, cultural producers, information industries, capitalists, and politicians.

4.5.7 Towards a Prescriptive Analysis of the Information Society

Schiller's five interdependent concepts, framed by his Marxist approach, provide a healthy reality check to mainstream technological optimism and romanticism surrounding the "information revolutions." Schiller's aim, different than Castells' and Bell's, is not that of elaborating a social theory of change, or a sociology for a new type of society. It is rather to elaborate a refined critique centered on the influence of capitalism in shaping the direction of innovation in information technologies as well as the uses of ICTs in market economies. Where Bell foresees a radical rupture of post-industrial societies with the past towards a utopian future and Castells theorizes a plethora of changes and continuities in the network society with mixed benefits and burdens, Schiller sees only the worsening of social and human conditions in an expanded capitalism, especially for those living in the underclass.

Schiller criticized what he understood as troubles neglected by American politicians in the 1980s and 1990s and was also vocal in support of needed policy changes. In his articles in popular newspapers and magazines, Schiller very often suggested policies to counteract the narrowing of publicly-available information and the oligopoly of the media industry:

> "A national debate about the character, objectives and direction of the information society is long overdue. The political task ahead is to develop strategies for expanding the public information supply without resorting to the ability-to-pay mechanism. Social accountability must be restored to broadcasting, which means reversing the deregulatory fever that has encouraged concentration of ownership in the media … The American Library Association continues to defend the principle of free access to information. A few Congressional committees have begun to explore

information issues. The extent to which these few groups and voices can be multiplied and transformed into unified, politically effective expression will determine whether the information society fulfills or thwarts human needs" (Schiller, 1985:710)

Schiller's ideas for policy changes now resonate with contemporary arguments by Robert McChesney, Lawrence Lessig and Yochai Benkler, showing that his critique is still relevant twenty years later. For this reason, I consider Schiller's approach to be a relevant framework to evaluate some of the impacts of today's information and communication technologies.

For purposes of a prescriptive analysis, as intended in this dissertation, I have adapted Schiller's dimensions of analysis and critique in a set of heuristics that can be used to pose questions about ICT design and use in a market economy. I have also incorporated in these heuristics the imaginative possibilities brought up by the non-market oriented information economy described by Benkler to complement Schiller's insights:

1. Market Principles: Are the goals of "economizing" and search for profit maximization the defining criteria for technological innovation of ICTs and shaping of information content? Is profit-maximization the organizer of distribution of information technologies and content in society? What were the priorities of corporate suppliers during R&D of ICTs? Who are the consumers of information and how do they access it? What kinds of information are available and how do they promote public or private interests? Who owns and controls information and technologies after they have been produced? Are there any spaces for Bell's "sociologizing" to become a criterion to direct the production of information and ICTs?
2. Commodification of Information: How do price mechanisms affect the production and consumption of information and ICTs? What kind of commercial object is information? How do legal systems and governmental policies support the commodification of information? How do particular laws and policies distribute benefits and burdens of turning information into a commodity in a stratified

society? How pervasive is the "ability-to-pay" mechanism to allocate access to information in society? What are the havens of public information and how ubiquitous are they?

3. Class Inequalities: What are the social dynamics that segregate the "information-rich" from the "information-poor" in this society? How do existing inequalities of social class translate into the informational realm? What kinds of information do poor and marginalized people get and how do they access it? Who gets to decide what information should be made available to the poorest and how? What are the expectations and assumptions behind the discourse of "digital divide"? How does "ability-to-pay" create different informational environments for the rich and the poor? How do rich and poor people experience informational environments? Are ICTs being used to systematically exclude the underclass from social, civil or political benefits? Are ICTs being used to monitor and control asymmetrically what marginalized people do? Are ICTs and information helping reduce existing social inequalities or helping exacerbate them?
4. Corporate Capitalism: How do contemporary-corporate capitalism and ICTs have co-constructed each other? How do ICTs enable organizational structures that sustain global expansion of corporations and markets? How do corporations demand for ICTs and private-R&D have shaped technological innovation of ICTs? How does the current structure of the media and information industries influence the shape and content of information and ICTs? How do corporate interests orient the shape of information technologies? What are the negative consequences for workers, citizens and consumers of corporate interests setting the direction of technological change? How have corporations profited out of this? Are there alternative information and ICTs not being shaped by corporate capitalism?
5. Consumerism: How has consumer capitalism encapsulated information and ICTs? In what ways has consumerism transformed the content of available information? What are the impacts on civic and political participation? What is the way of life being portrayed by information in contemporary ICTs? How does it promote

consumerism and how does it affect other aspects of social life? What kind of information and ICTs do exist to counteract consumerism as a way of life?

These conceptual elements should be approached as heuristics, rather than as a list of exact questions to be answered fully. They offer a perspective from where to interrogate versions of the information society and specific ICT designs being used in stratified societies. These heuristics are valuable for the aims of this dissertation. My hope is not only to describe the construction of some elements of the information society by engineers in Colombia, but also to evaluate whether this construction is good for Colombian society or not. Thus, I will use these heuristics to evaluate the kind of information society that is being advanced by engineers in their technologies and infrastructures. However, an additional dimension of analysis needs to be included. None of the thinkers I have discussed in this chapter seem to have elaborated a theorizing of the information society as a neo-colonialist discourse of developing countries attempting to reshape social reality for developing countries. Arguments about cultural imperialism, global division of labor, and dependency on information production from centers in rich countries hit a cord, but they still do not fully capture the problematic of neo-colonialism at the beginning of the 21st century. In Escobar's words "the accumulation and expanded reproduction of capital also require the accumulation of discourse and cultures, that is, their increased normalization" (Escobar, 1995). This prompts us to question which contemporary discourses coming from "developed countries" are attempting to normalize contemporary societies labeled as "developing countries" to allow for the expansion and adoption of the information society.

Castells mentions that developing countries are being reorganized in the geopolitics of an international division of labor, moving from an earlier role as sources of raw materials and natural resources to sources of cheap labor for developed countries. He also touches on discursive dimensions of the network society when explaining the transition from class politics to identity politics in his analyses of social movements in Latin America, feminism and environmentalism. However, Castells does not go into detailing the social dynamics by which developing countries reinterpret themselves as playing a different role in a new global economy. Bell paid almost no attention to "underdeveloped" countries forecasting that they would become industrialized, modernized and westernized while developed countries would transition to post-industrial societies. That is, rather than being enrolled in a global information society, they would be one step behind from post-industrialism. Schiller, on the other hand, was concerned with "Third World" countries as being relegated as passive recipients of the informational and technological "left-overs" from rich countries by corporate arrangements. Neither did Schiller occupy himself in explaining the discursive mechanisms by which the information society would be realized in developing countries. I argue here that the expansion of informational capitalism within developing countries happened not only through the works and dynamics of transnational corporations and governments, as Schiller and Castells suggested, but, extending Escobar's insights, also under the discursive umbrella of informational developmentalism.

States, corporations and civil society of the so-called developing countries, during the 1980s and 1990s, increasingly began to include the idea of a post-industrial order based on information and communication technologies within the developmental discourse. The traditional techniques of developmentalism, planning and management, began including explicit goals of transitioning to service economies and developing national infrastructures to expand the prevalence of ICTs. Soon a coherent discourse and arrangement of international and national institutions was in place to support what can be called "informational developmentalism," namely a colonization of social reality that produces discourses, social imaginaries, institutions, professional knowledge, technologies, and subjectivities to re-organize "developed" and "developing" countries in the global information society.

The discourse and institutions of informational developmentalism have been fundamental in promoting, selling and buying into the idea of the information society for developing countries. Thus, the information society from a "Third World" perspective is not only encapsulated by corporate and managerial capitalism, as Schiller suggested, but also by a complimentary informational developmentalism.

4.6 Encountering Informational Development

In his book "Encountering Development," Arturo Escobar argues, from a Foucaldian perspective, that development should be understood as a historically specific representation of social reality which permits particular modes of thinking and doing, while disqualifying others. Escobar maintains that the professionalization of development knowledge and the institutionalization of development practices were the main mechanisms that made such representation possible and hegemonic after WWII (Escobar, 1995). These mechanisms organized the way the world came to understand concepts such as "poverty," "progress," "hunger," "First World," "Third World," etc. They also shaped subjectivities by which people came to recognize themselves as "developed" or "underdeveloped," and, they reorganized the way in which rich and poor countries restructured their interactions to channel and receive international help and financing. For example, during the post-WWII era, forms of knowledge and disciplines in nutrition, health and rural development were created by a handful of experts in North America and the U.K. and resulted in the implementation of massive programs in Third World countries during the 1970s and 1980s. According to Escobar, and following Foucault, this discourse of development gained a life of its own. Being grounded in social imaginaries, institutions, professions and development knowledge, developmentalism raised as a hegemonic regime of representation for rich and poor countries (Escobar, 1995).

Gradually, developmental discourse constructed or re-constructed symbolically different social categories to "normalize" human and non-human actors and make them fit into the order of developmentalism; first peasants, then women and later, the environment. This has allowed development knowledge, programs and institutions to define discursive frameworks where social categories can be normalized, analyzed, theorized and become objects of and targets for different versions of developmentalism, such as rural development, gender-oriented development, and sustainable development (Escobar, 1995). Following Escobar's line of thought, we can say that information is another attempted object and target of development that has been adopted and re-signified in developmental terms. At the turn of the millennium, this became evident in the creation of the Global Knowledge Partnership (GKP) and in the declaration of the UN's eight Millennium Development Goals (MDGs)[33].

Since 1996, the United Nations, the World Bank and the government of Canada began organizing committees to work on developing visions of "a world of equal opportunities where all people [are] able to have access to and use knowledge and information to improve their lives" (GKP, 2001). Public, private and non-profit organizations were the main actors enrolled to participate in these committees. One of these early initiatives was UNESCO's Global Knowledge Partnership (GKP). GKP's aim was to "promote broad access to – and effective use of – knowledge and information as tools of equitable sustainable development … share information, experiences and resources to realize the potential of information and communication technologies to improve lives, reduce poverty and empower people" (GKP, 2001:5). GKP began weaving information and ICTs into the already established discourse of sustainable development by emphasizing the role of information on setting up the conditions to provide "knowledge for development." This knowledge for development is a repository of recommendations on policies, programs, and procedures to design and implement programs for sustainable development[34]. The use of ICTs to create, sustain and distribute this knowledge for development around the globe opened the doors to ICTs to be incorporated in the grammar of developmentalism.

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[33] Before this, however, international agencies such as the Canadian International Development Research Center (IDRC) had already developed a discourse about the role that ICTs played in development, and had funded projects in this direction.

[34] Since its beginnings this compilation of "knowledge for development" relied on the use of information and communication technologies. On of the first initiatives of GKD was an email distribution list called "The GKD List." In 2001, the Center for Innovative Technologies at the Education Development Center, a GKP member that administers the GKD List discussion, undertook a synthesis of GKD member recommendations in March 2001. Over three years, more than 3,000 discussants from around the globe had articulated recommendations on how governments and international agencies can help expand access to ICTs and promote their effective use in support of sustainable development. These recommendations were organized in four categories: policies and regulatory steps, infrastructure and access, building human capacity, and content-locally relevant applications-wealth creation (GKD, 2001).

Information, in GKP's incipient discourse, for instance, was another "resource" that needed to be present to satisfy the conditions for development. The general assumption was that the changes brought by new ICTs in shaping information economies demanded a developmental approach that could understand the role of information, knowledge and ICTs in economic and social development. It also assumed that the poor now needed to be "empowered" with information for development, that policy and regulatory mechanisms needed to be in place within developing countries to pave the way for the information economy (GKP, 2001).

It is relevant to note here that the gradual incorporation of information to developmentalism comes at a time when the privatization of Internet was at its peak (Abbate, 2000). At the end of the 1990s, corporations had already set up electronic commerce platforms on the Internet and they were creating massively Internet business fueled by speculations about the information economy, right before the dot-com bubble burst. Capitalism had already entered its global and informational phase, as Castells suggests, and social imaginaries were also filled with stories about digital beings, post-industrialism, third waves and new riches. All of these elements factored in to transform development discourse.

On the other hand, by the end of the 1970s and during the 1980s, developmentalism was in crisis. High deficit and increasing levels of debt, increasing disparities between classes and unequal distribution of capital, dependency on international protectionism, poor levels of education and increasing levels of criminality and violence were prevalent in Latin American, African and Asia under developmental paradigms (Palacios, 1994). However, instead of considering the failures of the model, the World Bank and the rest of the development institutions assumed that the poor results obtained were caused not by the model itself and the technical experts who built it, but by a deficient implementation of it by governments and politicians (Escobar, 1995). This attitude would eventually open the doors to neoliberal policies for development, which, inspired by Reaganomics, began to be exported to "developing countries" in the 1980s as "structural adjustments" (Cavanagh, 2002).

In Colombia, for example, because the State was considered inefficient to administer the national economy, economic experts and international institutions demanded that it give way to market forces, which neoliberalism considers more efficient than central planning in allocating resources and alleviating poverty. Since late 1980s, the Colombian economic model began to rely increasingly on market mechanisms (rather than planning) to structure its economy. Accordingly, the government privatized public utilities and companies, and opened the economy to international markets and investors (Melo, 2004). The hope was that a more dynamic economy controlled by market forces would lift all the boats. More capital and productivity would generate more jobs for the poorest. Free competition would also ensure lower prices, product innovation, and the expansion of saturated markets to include those at the "bottom-of-the pyramid," improving the distribution of goods and services to the poor (Prahalad, Hammond, 2002).

In this neoliberal model the role of the State was reduced to ensure that market forces could operate without interference. Widespread neoliberal policies, supported by development agencies such as the World Bank, the IMF, and the UN, became de-facto assumptions for development plans and structural adjustments of national economies (Cavanagh, 2002). This spread of neoliberalism during the 1980s and the 1990s in developing countries went along with the expansion of global informational capitalism. In fact, it provided policy mechanisms to make national economies fit into this global expansion of capitalism. For example, one of the first recommendations of the World Bank for a developing country to create the necessary conditions for informational capitalism is to privatize telecommunication companies (Kurbalija, Gelbstein, 2005).

National telecommunication monopolies, very common in developing countries during the 1980s, were considered an inefficient mechanism to provide low-cost connectivity for voice and data that could allow the customer base to grow and cover the poorest people. The World Bank also considers that the absence of competition is negative for the market to generate incentives to innovate and adopt state-of-the-art ICT infrastructure and artifacts. In other words, in this discourse, national monopolies of telecommunications in poor countries correlate with high-end markets for telecommunication services, poor national coverage and backward infrastructure of networks. Therefore, these public monopolies are considered to be one of the main causes of the digital divide. In consequence, attacking the digital divide, in informational developmentalism, required starting with the privatization of national telecommunications and the opening of the telecommunications market to foreign investors, which usually end-up being the international telecommunication tycoons that have enough capital to keep growing in developing economies[35]. In this way, the global expansion of corporate capitalism seems to have gone hand-in-hand with the adoption of neoliberalism in developing countries and the structuring of an informational development discourse.

A few years after GKP began speaking the terms of informational developmentalism, the World Bank continued elaborating a more sophisticated discourse about the role of information and communication technologies for development. In 1998, the World Bank issued its annual report stating again the importance of ICTs for development:

> "There is a growing recognition that telecommunications are no longer luxuries for developing countries, but rather strategic factors of development and poverty reduction that need to be integrated in development strategies more prominently and systematically." (World Bank, 1998:9)

A common assumption in these reports is that of the coming of the post-industrial society, as elaborated by Bell. This information economy grounds any developmental initiative and it is not questioned. The post-industrial society is coming, period. Developing countries can take advantage of the ICTs to leapfrog stages of infrastructural development and begin developing informational economies or be left behind in this new phase of global capitalism. Consequently, multilateral organizations such as the World Bank, UNCTAD and UNPD have included in development agendas the acquisition of

[35] Internationally the liberation of telecommunications has been heralded by the World Trade Organization (WTO) and the International Telecommunications Union (ITU).

information and communication technologies, the upgrading of telecommunications infrastructures, and the creation of adequate environments for the information economy (liberalization, expansion of markets, and corresponding legal frameworks) (World Bank, 1998).

At the turn of the century, the widespread use of informational development discourse was made evident in the definition of the United Nation's Millennium Development Goals (MDGs). The MDGs, a set of global development goals to be achieved by 2015, were structured around eight goals[36] and eighteen targets that could be quantitatively measured. These goals attempted to define a common road and commitment for the 189 nations that adopted them and the 147 nations that signed the Millennium Declaration, during the UN Millennium Summit in September 2000. One of these targets of development was specifically about ICTs: "in cooperation with the private sector, make available [to developing countries] benefits of new technologies, especially information and communications" Goal 8: Target 18 (UNSecretary-General, 2001). Since then, the United Nations has become an international leader in constructing the discourse of information and communication technologies for development, and in enrolling governments, non-profits, private sector and other multilateral and international organizations to sustain this discourse.

During the first years of the new millennium, non-profits, governments and multilateral institutions would continue strengthening the credo of ICTs as a necessary condition to achieve the MDGs. A plethora of institutions and organisms working separately began to integrate around an increasingly uniform informational development discourse. Among them: The World Bank Information for Development Program, GKP, The public-private partnership: "Digital Opportunity Initiative", the Internet Corporation for Assigned Names and Numbers (ICANN), and the International Telecommunications Union (ITU). The confluence of institutions and the convergence of discourses

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[36] The eight goals are: 1. Eradicate extreme poverty and hunger; 2. Achieve universal primary education; 3. Promote gender equality and empower women; 4. Reduce child mortality; 5. Improve maternal health; 6. Combat HIV/AIDS, malaria and other diseases; 7. Ensure environmental sustainability; 8. Develop a global partnership for development (UNSecretary-General, 2001).

consolidated between 2002 and 2005 around the UN's World Summit of the Information Society (WSIS). At WSIS countless of committees negotiated and agreed on the configuration of what information societies should look like and what the place of developing countries in it should be. As Escobar mentions in his analysis, this congruence of institutions, social groups and discourse is necessary to constitute an apparatus that creates, legitimates and structures the symbolic elements that construct the social reality of development. It is this apparatus that creates not only the "talk," but also the places and the moments to "talk about it" and "do something about it."

4.6.1 Speaking Informational Developmentalism: ICT4D

By 2001, informational developmentalism or, as it began to be called in developmental language, Information and Communication Technologies for Development (ICT4D), had some distinct features. It was motivated by neoliberal policies and the global expansion of corporate capitalism, as mentioned previously. But, it also had development concerns at its core. In consequence, information and ICTs entered developmentalism in two related ways: first, from an economic perspective, as a factor of productivity change in established industries and in the creation of new economic sectors (manufacture of ICTs and ICT services). Second, ICTs also enter developmentalism from a social perspective, as a necessary tool to help achieve social goals of literacy and education (e-ducation), health (telemedicine), and democracy (e-government, online civic participation). Everett summarizes this multiplicity of messages around ICTs and development that bombarded Latin American countries at the end of the 1990s:

> "Businesses argue that the Internet is crucial to achieving competitiveness in global markets, governments tout the new technology as the road to modernization and national development and activists argue that the Internet allows social movements to transcend borders and resist global, political and economical forces" (Everett, 1998:385)

At the same time constructions of worrisome "digital divides" began enriching development vocabulary (Norris, 2001; Aspray, 2004). The assumption behind developmental approaches to the digital divide is that asymmetric access to information and ICTs between poor and rich countries will increase existing economic gaps because these technologies constitute the infrastructure for economic growth in informational capitalism. Thus, attempting to reduce the digital divide became one of the main concerns of ICT4D and the "digital divide" became part of this grammar. Digital divides within and between countries also became a quantifiable way of showing the existence of new social categories, such as "info-rich" or "info-poor," or the "haves" and "have-nots" of the informational society (Schiller, 1996) that were crossing traditional social categories of race, gender, age, and class. Reports of the digital divide in the United States, for instance, located Afro-Americans, Hispanics, low-income people, people without formal education, single mothers, seniors (+55), and people with visual or other impairments, as the "info-poor" or the "have-nots" of the informational society in the U.S.A. (USDeptCom, 1998).

In a similar way, concepts such as "computer literacy" made their way into educational programs directed to adults and poor communities, and created more social markers distinguishing between those "computer literates" who can use proficiently ICTs to generate value in the private sector and those who are not, and therefore would be excluded from ICT-based employment.

The enrichment of the informational development grammar centered on problems and targets in "the information society[37]" was also followed by a language of solutions, and programs[38]. For example, addressing the digital divide meant to ensure "universal

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[37] In informational development grammar, there is no distinction between an "information society" and an "informational society" as suggested by Castells. This shows the lack of substantive sociological analysis on the content of the terms develop in informational developmentalism, and makes it a broad and analytically weak concept. However, it is commonly used and abused in development circles and official reports. In this dissertation when I refer to the "information society," I refer to the developmental understanding (or misunderstanding) of it rather than to sociological interpretations of the term.
[38] The language of solutions normally use (and abuse) the prefix e- (meaning "electronic"). Given that informational development plans include projects that intersect development goals with ICTs, it is expected to find projects of e-health (most commonly telemedicine), e-ducation (courses and educational programs

access" to information and ICTs, and this became one common principle of action for governments, NGOs and private sector. Because poverty concentrates in rural areas, the model that fell into everyone's lap was the concept of rural "telecottage" or "telecenter[39]" that had been rolled out in the European and North American periphery during the 1980s and early 1990s, promoted by the Canada's International Development Research Center (IDRC). The model consisted in setting up a room or building with one or more Internet-connected PCs, to be accessed by communities, and students (López-Colomer, 2002). This model could be installed fairly quickly; provide tangible evidence of achievement; deliver information, communication, and services to poor communities; and provide sales for the ICT companies that were partners in most ICT4D fora. Thus, during the 1990s millions of dollars were invested in setting up telecenters all over the world[40], from the USA (Aspray, 2004), to Colombia, Mali and India (Heeks, 2008).

Another dimension of the ICT4D discourse attempts to re-signify governments and their location in an information society. According to informational development, governments facilitate the structuring of information societies not only by designing legal frameworks and opening their economies to foreign investment, but also by becoming themselves one of the biggest consumers of ICTs (Gairola, et-al, 2004). Within this model, it is assumed that digitalization of government processes will allow them to "modernize," and still be able to deliver their public functions despite neoliberal changes that are reducing governments' size and their budgets. The goal here is for governments

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on the Internet), e-commerce (use of Internet as sales channel or integrating productive processes in industries), e-government, and so on as constitutive of such plans. This e-phase of development goals and programs clearly attempts to mark a transition from previous forms of developmentalism where ICTs had not been incorporated as a centrally symbolic element.

[39] These projects are also known as electronic kiosks, community access points. They differ from cybercafés in that they are totally or partially subsidized by governments, NGOs, private sector foundations or other parties. So members of the community where the telecenter is located do not have to pay for its use or pay a tariff lower than the regular market's price in a cybercafé, for example.

[40] This approach was the main archetype of ICT4D projects during the 1990s and beginning of the 2000s. However, it is now evident that the "telecenters" approach has several flaws. Namely, the failure of many ICT4D projects to deliver and survive, the limited reach of individual telecenters projects, the lack of evaluation and the increasing competition faced by lower prices in connectivity, more accessible ICT gadgets for low-income people and affordable cyber-cafes (Heeks, 2008).

to become “electronic governments.” Underneath, there is the hope that governments can emulate corporations in their transition to informational structures and technologies (Castells, 1996). When governments invest big money in ICT infrastructure and in “e-government[41]” projects, they also help expand electronic commerce with private suppliers and create local markets for private entrepreneurs that can supply the technologies the government demands. Having government services online also urges citizens to become expert users of ICTs and to have a cheaper and faster access to government services, strengthening the culture of using ICTs among them (Gairola, et-al, 2004). As a consequence, projects of digitalization of services, interconnectivity between government agencies, and re-engineering of governmental processes became central priorities in development plans for developing countries.

Overall, the discursive construction of problems and targets was a necessary step to structure informational developmentalism. An enriched vocabulary to indicate problems or barriers to become “information societies” -national monopoly of telecommunications, computer illiteracy, digital divide, etc.-, and a definition of targets for policies and programs –liberalization of telecom sectors, info-rich, info-poor, haves, have-nots, computer illiterates, etc.-, allowed the concentration of initiatives, programs and institutions to build the “information society.” By the turn of the century a whole body of knowledge about ICT4D had been accumulated and concentrated in core institutions at international and national levels. MIT and Harvard, for instance, created in 2003 the journal “Information Technologies and International Development,” just for this purpose. Several institutions such as UNDP, UNCTAD and the World Bank, NGOs such as IDRC and APC, and, even government agencies, such as the Ministry of Commerce in Canada had become “experts” in ICT4D knowledge. They still travel to developing

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[41] E-government refers to the computerization of services and applications used by the government in carrying out its daily activities. According to Gairola, et al: “Broadly defined, e-government is the use of ICTs to promote more efficient and effective government, and to facilitate more accessible government services. e-Government might involve delivering services via the Internet, telephone, community centres (self-service or facilitated by others), wireless devices or other communications systems.” (Gairola, et-al, 2004:5-6)

countries to advise governments in organizing plans that seek to develop their own information societies. In the process, these institutions emulate the work of the "development missions," during the 1960s and 1970s, which carried with them the task of propagating developmentalism in countries that gradually became "underdeveloped" (Escobar, 1995).

4.6.2 Informational Development Goes Global and Multi-Stakeholder

In her analysis of ICT policies in Latin America, Margaret Everett notes another important element in the institutionalization of informational development. That is the increasing importance of civil society and non-governmental organizations (NGOs) in informational developmentalism. This phenomenon is also consequence of the weakened nation-states at the end of the millennium. The decline of welfare states and the rise of neoliberal governments in western capitalist societies brings a noticeable retrenchment of the state from social spaces unattended by the market. This space was eventually occupied by innumerable non-governmental organizations (NGOs) that were created in the 1990s and, more recently and in an absolutely ironic way, by private firms under the rubric of "Corporate Social Responsibility" (CSR).

Several of these NGOs, like the Association for the Progress of the Communications (APC) for example, concentrated their efforts mainly in ICT4D and obtained funding for ICT4D programs in developing countries. In the process these NGOs gained expertise in ICT4D and developed their own knowledge about informational development. In fact, by the time governments began speaking the language of informational developmentalism NGOs had already appropriated the discourse and were regular participants in GPK and other ICT4D institutions.

When the United Nations decided to convoke the first phase of the World Summit on the Information Society in 2003, the regular format of convoking representatives of governments to discuss common principles and agendas to build a global information society had no sense. The expertise on information and communication technologies for development was already distributed among technicians working in private and public sector and in NGOs with experience in designing and implementing ICT4D projects. Thus, governments had to share the floor with NGOs and private sector to learn from them about ICT4D. This structure of diplomatic participation that engages actors coming from government, market and civil society to define guidelines, principles, rules, and procedures to steer, in this case, the construction of the information society, is now being refer to as "governance," in diplomatic circles (Kurbalija, Gelbstein, 2005).

In this context, what is called "governance" is a manifestation of the debilitation of governments trying to organize competing networks of power in neoliberal states (Launay, 2005). Networks of corporate capital, civil society and decentralized local governments are assembled in common networks around specific social issues in need of of regulation and control (Castells, 1997). States with no practical power to build the information society by themselves are called to "partner" with civil society organizations and private sector to create the necessary policies and programs.

From this perspective, the World Summit of the Information Society (WSIS) constituted one of the first experiments in international diplomacy in bringing together networks of power heralded by civil society, private sector organizations and governments to negotiate in a multi-stakeholder structure of "international governance." The political relevance of this experiment has been analyzed by other authors elsewhere (Klein, 2004), but, for the purposes of this dissertation, it suffices to say that it is a clear manifestation of how power has being restructured in global informational capitalism:

> "Building an inclusive development-oriented Information Society will require unremitting multi-stakeholder effort. We thus commit ourselves to remain fully engaged—nationally, regionally and internationally—to ensure sustainable implementation and follow-up of the outcomes and commitments reached during the WSIS process and its Geneva and Tunis phases of the Summit. Taking into account the multifaceted nature of building the Information Society, effective cooperation among governments, private sector, civil society and the United Nations and other international

organizations, according to their different roles and responsibilities and leveraging on their expertise, is essential." (WSIS, 2005a)

The final documents of the WSIS: "Declaration of Principles: Building the Information Society" (WSIS, 2003), "The Tunis Commitment" (WSIS, 2005b), and, "The Tunis Agenda for the Information Society" (WSIS, 2005b) are evidence of the incorporation of information and ICTs within developmental discourse and they also bind a global commitment to make ICT4D a reality in policies, programs, and projects:

> "We reaffirm our resolution in the quest to ensure that everyone can benefit from the opportunities that ICTs can offer, by recalling that governments, as well as private sector, civil society and the United Nations and other international organizations, should work together to: improve access to information and communication infrastructure and technologies as well as to information and knowledge; build capacity; increase confidence and security in the use of ICTs; create an enabling environment at all levels; develop and widen ICT applications; foster and respect cultural diversity; recognize the role of the media; address the ethical dimensions of the Information Society; and encourage international and regional cooperation. We confirm that these are the key principles for building an inclusive Information Society, the elaboration of which is found in the Geneva Declaration of Principles" (WSIS, 2005b).

Having agreed on the construction of information societies globally, representatives of governments also agreed on developing a system to monitor and evaluate their progress towards the consolidation of an information society. The adoption of this system, and the model behind it, provides one of the most clear and contemporary examples of how informational developmentalism is permeating the social reality of "developed" and "developing" countries around the world. In the next and final section of this chapter, I will illustrate this example in the case of Latin America and Colombia.

4.6.3 Measuring the Information Society in Latin America

After the first phase of the World Summit of the Information Society (WSIS) in Geneva-2003, one of the outcomes in the Action Plan was an international commitment to create standard indicators, methodologies and questionnaires to harmonize ICT statistics in developed and developing countries. Such standardization is needed to compare progress towards informational development goals among countries. In 2004 the Partnership on Measuring ICT for development was launched in Sao Paulo, Brazil to stating its aim as follows:

> "[the partnership] provides an open framework for coordinating ongoing and future activities, and for developing a coherent and structured approach to advancing the development of ICT indicators globally, and in particular in developing countries. It includes the ITU, the OECD, UNCTAD, UNESCO Institute for Statistics (UIS), four UN Regional Commissions (ECA, ECLAC, ESCAP, and ESCWA), the UN ICT Task Force and the World Bank as partners. Some National Statistical Offices (NSOs) from advanced countries are also members and contribute to the partnership activities by providing expertise and advice to NSOs from developing countries as well as in the transfer of knowledge in areas such as methodologies and survey programs" (Partnership, 2005a).

The regional UN Economic Commissions for Latin America and the Caribbean, ECLAC, became the coordinator for this effort in Latin America. Beginning in 2004, UN-ECLAC set up OSILAC (Information Society Observatory for Latin America and the Caribbean) to harmonize and standardize the procedures for local collection of data and the construction of common indicators among countries. OSILAC gathered the national bureaus of statistics from all Latin American countries in several conferences and produced several reports aimed at generating agreements on content and procedures to standardize the production of ICT data. It was acknowledged that international harmonization with the existing indicators and statistics of OECD countries needed to be ensured by implementing a common basic set of "minimum" indicators that could allow comparison between developed and developing countries, and also comparison between developing countries to quantify the "digital divide."

> "Reliable statistical data and indicators regarding **readiness**, **use** and **impact** of Information and Communication Technologies (ICT) help policy makers to formulate policies and strategies for ICT-driven economic growth, social and political development and the prevention of a new form of socio-economic exclusion, termed the "digital divide". In order to obtain a comprehensive picture of information society development, ICT indicators will need to be mainstreamed into existing surveys of National Statistic Offices (NSOs)." (Schulz, Olaya, 2005), my highlighting.

As a starting point, in 2004, Latin American representatives of the national bureaus of statistics gathered all the existing official information of surveys and data regarding the state of ICT in their respective countries. In Colombia, for example, Hernando Chacon, statistician from the Colombian Bureau of Statistics (DANE, for its initials in Spanish), was designated as one of the Colombian representatives to OSILAC, given his experience in a previous survey that collected national data on the state of ICTs in Colombia (DANE, 2003). This survey however had not been framed in developmental language and it did not incorporate the now widely accepted concepts of "digital divide" and "computer literacy." The survey had been basically oriented to capture only the quantity and types of information and communication technologies used in the nation. When Chacon presented the Colombian survey and offered it as starting point to construct the indicators, its orientation did not convince the representatives from other countries that were now heralding the discourse of informational development (interview with Chacon). Eventually, Chacon, as well as all the other representatives of Latin American national bureaus of statistics, ended up adopting a commonly agreed set of concepts approved by OSILAC to collect ICT data in national surveys in order to build compatible indicators (OSILAC, 2006).

> "In all of this about the information society, one of the objectives is to reduce the digital divide because there are some studies that show that countries that use more intensively ICTs are more competitive … one aspect of that is access ... another aspect is digital literacy" (interview with Hernando Chacon)

In 2005, when the Partnership presented the final report on measuring ICTs during the second phase of the WSIS, participant governments agreed that indicators of **access** and **use** of ICT needed to be included in their regular national censuses and household surveys (Partnership, 2005b).

Immersed in the discourse of informational development and developmentalism, the global enterprise to quantify and measure the "progress" of nations towards becoming information societies took on a strong colonialist flavor. The demand to use the state of information and communication technologies in OECD countries as basic template to begin building indicators to measure the information society in developing countries, was not only an operational technicality required for purposes of data comparison, but also revealed that the so-called "information society" to be constructed in developing countries could only be the OECD's model of it.

Thus, expanding the project of informational capitalism to include developing countries required all key players to enframe it in the discourse of informational development. Echoing earlier models of development theory (Rostow, 1990), the construction of indicators to measure the information society was based on a presumed movement toward an ideal type of information society modeled upon the structure of contemporary societies in the North. To determine what constituted the "basic set" of minimum elements to indicate how developing countries were turning into information societies, the OECD developed a linear model of progress and stages of development for information societies.

> "Depending on the respective phase of development of an information society, indicators to measure this progress can be assigned to three groups, namely Readiness, intensity of Use and Impact indicators. The underlying model of these three groups of indicators was developed within the work carried out by the OECD's Working Party on Indicators for the Information Society (WPIIS). This model, the so-called WPIIS Model for Ecommerce Indicators, states that market maturity determines research interest and needs, since, as the development progresses, indicators and related policy issues in focus change over time" (Schulz and Olaya, 2005).

4.6.3.1 The WPIIS Model

The WPIIS model (see Fig. 1) includes a first stage of “E-READINESS” developed by economist Jeffrey Sachs and the Center for International Development at Harvard University (ITG, 2000). This “e-readiness” refers to the degree to which a community or society is prepared to participate in the networked world. The model assumes that most developing countries are still on this preliminary stage and need to construct indicators to measure their progress to the next stage. The data on “E-readiness” indicators is categorized in four sub-stages of development in the following areas: telecommunications infrastructure, network access, ICT workforce, local generation of content, ICTs at the workplace, ICTs at home, ICTs at school, e-commerce, e-government, telecommunication regulations, and ICT trade policy (ITG, 2000). The higher the stage, the more “e-ready” a developing country is for the “networked world.” For example, the four stages of “telecommunications regulation” that describe the state of “e-readiness” of a developing country are:

> Sub-stage 1: “There are no plans for the liberalization of the community's telecommunications sector. There are no regulatory provisions which promote universal access to telecommunications services. All services are provided by a single operator, whether private or state-owned. Voice and data service offerings are limited.” (ITG, 2000):19
>
> Sub-stage 2: “Plans for the liberalization of telecommunications services are in place or are being formulated. Provisions for universal access to services have been established, though they are ineffective.” (ITG, 2000):19
>
> Sub-stage 3: “Plans for the liberalization of the telecommunications sector are in place and are being implemented. Progress is being made in achieving universal access, but there are many hurdles in implementation. Services such as data, paging and mobile telephony are available from competing private providers. Alternative carriers compete for private network services, leased lines and other telecommunications services for businesses. Incumbent provider networks are being opened to competition through interconnection and/or unbundling obligations.” (ITG, 2000):19

Sub-stage 4: "The telecommunications sector has been liberalized, with a regulatory regime in place to promote open competition. Regulation is effective in promoting universal access. An independent regulatory body sets and enforces telecommunications regulations. Citizens and businesses have a number of options for their telecommunications and data services. Incumbent networks have been opened to competitors, and new competing carriers are taking advantage of these arrangements to offer services. There is vibrant competition among mobile wireless providers. Spectrum has been allocated consistently with international standards, and licensing arrangements encourage new market entrants. The provision of value-added services such as broadband Internet is recognized as a source of competitive advantage." (ITG, 2000):19

The most advance stages of "e-readiness" in this case are, of course, those that mirror the state of the telecommunications sector in OECD countries. If developing countries want to get to those levels of informational development they need to implement neoliberal policies and open their markets to the globalization of the telecommunication sector.

The second stage of informational development in the WPIIS model is the "USE" stage. In this stage there is a widespread use of ICTs in a society and its economy. The third stage of the WPIIS model corresponds to the "IMPACT" stage, in which visible impacts of ICTs can be observed within society and economy as a whole. That is, a country has been transformed to become an "information society" once it has reached the stage of "IMPACT." Obviously, most of OECD countries now stand on the second and third stages of informational development.

According to the final research report by OSILAC published in 2005, Latin America lagged behind OECD countries even in the first stage of "E-READINESS." For that reason, OSILAC did not recommend using indicators different from those necessary to measure advances in the first and second stages of informational development until further advances were evident to suggest that an impact on society and economy could begin to be noticed and measured (Schulz, Olaya, 2005):

"The most important task at the moment is to start measuring information society matters on a basic level and from there to evolve towards more sophisticated instruments using the experience then acquired. As the development of the information society progresses, the relevant indicators will shift away from readiness towards impact indicators. The classification of indicators according to these stages of development will reflect this change over time" (Schulz, Olaya, 2005).

Thus, the WPIIS model of progress towards an "information society," which is foundational of current global indicators collecting ICT data all around the world, is already being used to categorize the current status of whole sections of the world in the context of informational development. These indicators have objectified informational development and they are now being used to transform the subjectivities of whole nations. I have focused on Latin America to illustrate this objectification of informational development, but the same set of categories and judgments have been applied in Asia, Africa, and Europe. The WPIIS model provided a conceptual framework, a language, and even an "objective" measure to indicate who the "established leaders," "rapid adopters," or "late entrants" are. It also provides the means to qualify if developing country is an information society or not (IBM, Economist, 2008).

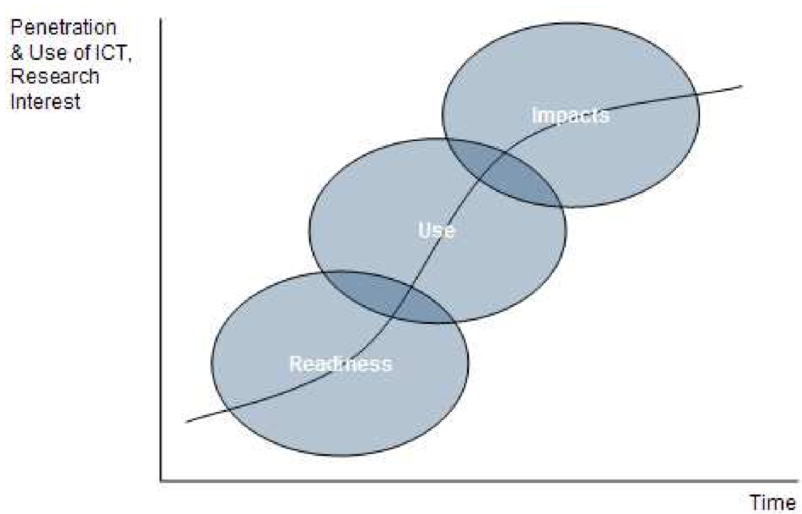

Figure 1. Groups of ICT Indicators depending on the stage of development of an information society (WPIIS MODEL FOR E-COMMERCE INDICATORS)

Source: Statistics Canada and OECD's Working Party on Indicators for the Information Society (WPIIS).

A major outcome of this global process of harmonizing collection of ICT data and ICT indicators was the agreement of governments to principles that spell out what constitutes an "information society." Since 2004, 181 governments have provided the data to feed the central databases of the Partnership. This data has been used to produce two composite indices -the ICT Opportunity Index (ICT-OI) and the Digital Opportunity Index (DOI)[42]- that are supposed to monitor and evaluate the construction of "a fair an equal information society" (WSIS, 2005b). The analysis of these indices is now annually published in the "World Information Society Report" that benchmarks "the continuing growth of the Information Society around the world" (ITU, UNCTAD, 2007).

Every year, the report ranks developing and developed countries in a scale from the less-informationally developed to the most-informationally developed. The report serves as a guide for national expectations and aspirations about how to move up the scale of informational development. This ranking, however, is by no means the only one currently being produced. Other similar rankings are also found in annual or bi-annual reports of other development agencies that have built more specialized indexes: the UN's Global E-government Readiness Report (The E–Government Readiness Index and the E–Participation Index ranking 127 economies), the World Economic Forum's Global Information Technology Report (The Networked Readiness Index ranking 122 economies), and, the UNCTAD Digital Divide Report (The ICT Diffusion Index ranking 180 economies). In this way, development agencies have joined a collection of private institutions that were collecting data, creating indexes and reporting on the state of informational economies since the mid-1990s[43].

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[42] http://www.itu.int/ITU-D/ict/doi/index.html

[43] One of the most popular rankings worldwide generated in the private sector, is the annual E-readiness report, produced by IBM and the Economist. This private sector-oriented ranking has a different conceptual approach to the design of the e-readiness index to the "informational development" approach presented here. Its e-readiness model is more concerned with the "readiness" of countries to perform proficiently in global informational capitalism than with the "readiness" to use ICTs to achieve development goals, such as the MDGs. This "private-sector" index ranks 70 countries, and in 2008 its top five economies ranked were: United States, Hong Kong, Sweden, Australia and Denmark. The bottom five were: Kazakhstan, Algeria, Indonesia, Azerbaijan and Iran (IBM, Economist, 2008). This ranking contrasts enormously with "development" rankings. As a point of comparison, The United States that ranks first in the Economist's ranking, ranked 20th in the Partnership's World Information Society Report of 2007.

The objectivity of these statistics and rankings is taken for granted by governments in developing countries up to the point that these governments use such rankings to see and to value themselves. That is, data of this kind affects the subjective perception of how countries understand their place in informational development. In earlier frameworks of developmentalism, countries learned to understand themselves as "underdeveloped" or "developed" (Escobar, 1995). Now, within the categories of informational development they also learn to judge whether or not they are "information societies." For example, in Colombia, it has become a common practice to use international "e-readiness" rankings and reports to evaluate the impact of national ICT policies. Every time one of these "e-readiness" reports is released, journalists and bureaucrats use them to evaluate the effect of ICT policies in reducing the digital gap, achieving development goals (Pardo, 2005), improving the state of the national informational economy (Piñeros, 2007), and advancing e-government (AdC, 2006). If ICT policies and programs have been successful, they should show it in improving the ranking of Colombia in one, or several, of these international rankings.

In short, measuring the information society has become consequence and cause of the discursive construction of informational development. Once categories were constructed, they were objectified and measured to make them seem realistic pictures of social change. They were legitimized by new and existing institutions and "governance" procedures that organized multiple stake-holders in the international arena of developmentalism to agree upon principles and procedures for policy making. Mobilized in informational development discourse, a conceptual framework of "stages of informational development" was constructed by OECD countries to conceptually support the construction of indicators. To collect the data necessary, a whole international, regional and national regime of production of ICT4D indicators and statistics was put in place. These data and indicators are now being used as a way to evaluate the success or failure of ICT policies. They are also used to set development goals and structure development plans. Finally, they serve as tools of self-reflection to create subjective visions of the place of a country in a global informational capitalism, reinforcing the concrete "reality" and common-sense of informational developmentalism for "developed" and "developing" countries.

4.7 Conclusion

In this chapter, I have discussed several social theories of the "Information Society." My argument is that there are insufficient theoretical grounds to support the view that there has been a radical rupture with the past that allows us to say that we now live in a qualitatively different type of society shaped by an "information revolution." On the contrary, capitalism, which has been an organizing principle of society since the 16th century, constitutes the most resilient source of continuity with previous patterns of social structuring.

A second argument made in this chapter is that if modern societies have not radically changed into "information societies" they are increasingly becoming "informational capitalist" societies. That is, capitalism as a dominant organizing principle that has shaped form, content, and intended-use of information and communication technologies in modern societies, has also been shaped by socio-technical arrangements made possible by these technologies. I have referred to this "new" shape or phase of capitalism as "global informational capitalism," using Castells' term. Reflecting on Herbert Schiller's critique, I have also explored some of the constitutive elements of informational capitalism that could be used to evaluate whether or not this new phase of capitalism is creating conditions for a better society. Some promises for a better society have arisen during the past few years from the construction and expansion of a non-market oriented network society that is producing and enriching the informational environment of capitalist economies with information public goods.

Finally, I have argued that global informational capitalism has accelerated its expansion into developing countries through its entrance into earlier forms of development discourse. I have called the incorporation of information and informational capitalism into the discourse of development, informational development. The proximity of informational capitalism and informational developmental has helped persuade developing countries to invest heavily in attempts to create the conditions for informational capitalism as a way to achieving an elusive goal: "development."

These three arguments are central for this dissertation because they establish the context for my study of the specific ways in which information and communication technologies are designed and deployed in Colombia. Since the 1990s, "developing" countries, including Colombia, have found themselves investing resources and creating policies to become players of informational capitalism. They have also found themselves symbolically redefined in a global conception of informational development that also influences the direction of national policies and national attitudes towards ICTs. Both, informational capitalism and informational developmentalism frame and orient ICT engineering in Colombia today.

The next chapter will explore how Colombian engineers, producers of ICT, have responded to these dominant and increasingly hegemonic discourses. First, I will analyze the response of bureaucrat engineers working in the governmental agency created to implement ICT4D programs in Colombia. Later, I will compare this response to the one coming from NG(o)neers (NGOs' engineers) immersed in the discourse of informational development.

5. ENGINEERING THE NETWORK GOVERNMENT

5.1 Introduction

The arena of information and communication technologies for development in Colombia is not a consensual site. While some discourses, such as the digital divide and computer literacy, have tended to dominate the arena, it is still populated by different interpretations of how ICT should be used to address developmental goals in Colombia. Around these interpretations, or perspectives, gather social worlds that construct distinctive discourses about ICT4D and that materialize these discourses within artifacts that are populating the world of objects and material infrastructures of social life in Colombia.

My research examines two of the most prominent social worlds in this arena: the social world of governmental ICT4D and the social world on non-governmental ICT4D. In this chapter, I will describe the governmental ICT4D worlds from the perspective of one of its sub-worlds, namely that of e-government, which in the Colombian case is expressed in an engineering organization called the Connectivity Agenda. For this purpose I will describe the inners workings of engineers in this organization, the arenas in which they participate, and some situations that structure the politics of their technological designs.

5.2 The social world of governmental ICT4

In the framework of informational capitalism and developmentalism presented in the previous chapter, the location of a national economy in the global capitalism is defined in terms of how "competitive" or "e-ready" it is to generate offer and attract demand for their markets. In this framework, the competitiveness of a developing nation does not rely on its comparative advantage as a raw materials provider to rich-industrialized countries, as it used to be under the geopolitical order of industrialism, but on its capacity to innovate, generate value upon knowledge and offer conditions to attract foreign investment.

In this scenario, Colombia entered in the 1990s to participate in the global structuring of informational capitalism. A new political constitution in 1991, the end of the international regulation of the coffee market in 1989, and the first neo-liberal government from 1990 to 1994, marked the politico-economic transition of Colombia to its move into the global project of informational capitalism (Melo, 2004). Gradually, during the 1990s, the Colombian government included in its national development plans a neoliberal vision of development.

> "The recent events in the old socialist world, and the increasing consensus on a new orientation for the State in the economy, have influenced not only ideas of politicians, but also doctrines about growth and economic development … old ideas that value excessive spend in public infrastructure, an activist role of the State, public expenditure as re-activator of the economy, and subsidies or protectionism of industries have been conceptually discarded due to their inefficacy and uselessness. On the contrary, the central role of markets, information, human capital, and externalities are the topics that nowadays dominate in the ideas of development." (DNP - Presidencia, 1991:12), my translation.

The Colombian government also understood that if foreign companies, from developed countries, were going to be drawn to Colombia, they would demand similar technological infrastructures to those they had in their original countries (robust transportation networks, reliable public utilities, and information and communication infrastructures). These infrastructures would allow foreign companies to operate at their accustomed levels of efficiency and to maintain coordinated activities with central nodes of management and administration overseas. The national government aiming also at creating a competitive private sector for the global economy, considered crucial the use of ICT to provide technological environments for national industries to integrate horizontally and vertically in "clusters of productivity" in a few areas considered "competitive" by the government and the private sector (Porter, 1998). Competition with foreign companies in the global economy also required national companies to set competitive prices, in consequence low-production costs needed to be ensured by automation and intensive use of information technologies (DNP-Presidencia, 1995).

Along these lines, since the mid-1990s the Colombian government has implemented national programs to expand its computational and telecommunications infrastructure. These efforts have been accompanied by the privatization of the telecommunications sector that up to the mid-1990s had been controlled by only one public company: TELECOM. This move eventually opened the doors for Colombian, Mexican, Spanish and American private companies to acquire the national telecommunication infrastructure and expand the communication networks in Colombia (Law 142 from 1994).

By 1999, informational development had already being incorporated in the public discourse of Colombian government. Andres Pastrana, president from 1998 to 2002, proposed in his national development plan "to support the upgrading of the Colombian information infrastructure … to contribute to economic and social development" (DNP-Presidencia, 1999). During his mandate, several programs were created to tackle the "digital divide." The first program was called "Computadores para Educar," modeled after the program "Computer for Schools" of the Canadian government, which recycles donated computers and refurbishes them to equip schools, especially to those located in rural areas (DNP, 1999). The second program was called "COMPARTEL," and its aim was to ensure universal access to telephony and internet connectivity by deploying small telecenters in scarcely populated villages and rural areas in Colombia. However, it is in Colombia's first national ICT policy where one can notice how thoroughly the language of informational development had impregnated and shaped the policy-making process.

5.2.1 The Connectivity Agenda

In 2000, Pastrana's Ministry of Communications, Claudia de Francisco, presented the first comprehensive ICT policy in the country: "The Connectivity Agenda." This state policy was proposed by the government to facilitate transitioning the country towards the "information society" (DNP, 2000). It was structured to be a vision and a set of strategies, programs and projects, to extend massively the use of information and communication technologies in Colombia (DNP, 2000). The policy also attempted to improve the competitiveness of the ICT sector and the other sectors of the economy by using ICTs. The policy aimed to "modernize" public institutions and government by implementing e-government projects. In terms of community, the policy goal was to ensure universal access to ICTs in order to reduce the "digital divide," and to change the education system to prepare the workforce for the information economy:

> "Information and Communication Technologies (ICTs) are tools that enable the development of a new economy (e-conomy), the construction of a more modern and efficient State, the universal access to information, and the acquisition and effective use of knowledge; all of these, fundamental elements for the development of the modern society." (DNP, 2000:3) my translation.

It was at this point that National Plans of Development in Colombia began speaking informational developmentalism. Reducing the "digital divide," ensuring "universal access" to ICTs, introducing computers and "computer literacy" programs in schools and communities, and constructing "e-government" became work objects for politicians, technicians, policy makers and development experts. These work objects sustain informational development and provide a discursive framework to smooth the Colombian economy transition to global informational capitalism. At a moment when a shrinking State needed to invest its public finances in technological infrastructures (transportation, energy and telecommunications) and social programs (education) with positive externalities for a neoliberal economy and, at the same time, provide social guarantees for the poorest and marginal who are left unattended by the market, the discourse of ICT4D offered a conceptual framework, an integrated vision, and a language to connect both social and economic goals: development and capitalism.

The Colombian Connectivity Agenda was modeled upon the Canadian models of "Connecting Canadians Agenda" and "Computers for Schools." It was the result of a partnership established between Pastrana's government and Industry Canada that provided guidance in the design of Colombian ICT policy[44]. Missions of members of the Canadian government traveled to Colombia to share their experience and members of the Colombian government traveled to Canada to learn about the governmental programs related to ICT:

> "In November 2000, President Andres Pastrana officially inaugurated Colombia's national CFS [Computers For Schools] Centre, whose goal is to refurbish and distribute 20,000 computers to the most needy of Colombia's 60,000 schools. During the inauguration, President Pastrana thanked the Government of Canada for supporting and promoting the Colombian CFS program. Based on the Canadian example, Colombia's goal is to become one of the most "connected" countries in Latin America" (Canada, 2001).

These missions resemble the work of developmental missions that have come from North America to Colombia since the 1960s, exporting models of development now in the context of informational capitalism and developmentalism:

> "It is a top priority of the Government of Canada to help developing countries overcome the digital divide … It has always been Canada's policy to help the poor. However, the imperative is now even more crucial as the forces of globalization, technological development, and the scale of human activity, reinforce our fundamental interdependence with the rest of the world." (Canada, 2003: 231)

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[44] In addition to bilateral Memorandums of Understanding between Canada and Latin American countries like Colombia and Mexico to export models of informational development, Canada has also been actively involved in the international-informational development arena as Chair of the G8 Digital Opportunity Task Force, and as participant in the United Nations Information and Communication Technologies Task Force. More recently, Canada has led a process within the OAS to create the "Agenda for Connectivity in the Americas" and the Action Plan of Quito to help countries "understand the concept and the necessary steps to implement connectivity" (Canada, 2003:237). Institutionally, Canada provided the initial funding for ICA (Institute for Connectivity in the Americas). ICA was announced at the 2001 Summit of the Americas as Canada's contribution to spreading its connectivity model. It is the forum for hemispheric innovation in "the application of ICTs to strengthen democracy, create prosperity, and realize human potential" (Canada, 2003:237). Sponsored by the Department of Foreign Affairs and International Trade, the Canadian International Development Agency and Industry Canada, ICA is currently located at International Development Research Centre offices in Ottawa and Montevideo.

The Colombian group in charge of designing the Connectivity Agenda was mainly composed of electronic engineers and systems and computer engineers. Because Colombia lacked local informational development experts required to craft the policy, Pastrana's government resorted to engineering expertise in ICT. In 2000, for instance, a small group of electronic engineers was initially in charge of consolidating all of the ICT national programs under the policy of "Connectivity Agenda" (Interview with Nicolas Silva), the director of "Computer for Schools" was a systems and computer engineer, and the director of COMPARTEL was a civil engineer. Martha Cecilia Rodriguez, a systems and computer engineer from Los Andes University, also became the first director of a new agency, also called the "Connectivity Agenda," in charge of coordinating government agencies to implement the national ICT policy.

Pastrana's government's excitement about informational development was so high that the Connectivity Agenda, initially intended to be coordinated by the Ministry of Communications, was deemed a top presidential priority and it was relocated in the president's office[45] (Casa de Nariño, as it is called in Colombia). Pastrana and De Francisco considered that the Connectivity Agenda needed to be at the uppermost level of government to have the necessary authority to coordinate the several governmental agencies, regional and local governments involved in the implementation of the ICT policy and its programs as soon as possible.

Between 2000 and 2002, the Agenda was above all a technocratic agency. The first director of the agency was Martha Cecilia Rodriguez, a systems and computer engineer from Los Andes University. Her team also consisted mainly of a group of engineers and lawyers that focused on promoting the development of WebPages in all of the national public agencies, and then linked these pages to a national web portal. The technocratic bias of the engineers from Agenda and their distance from the informational

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[45] In January 2001, it was delegated the coordination of the Connectivity Agenda in the Presidency with the establishment of the Presidential Program for the Development of the Information and Communication Technologies as the agency in charge of "guiding, designing, and proposing policies, plans, and programs to guarantee access and implementation of new ICTs, in order to facilitate their use as support of economic growth and competitiveness … [and to] facilitate and optimize the management of governmental agencies and their public contracts" (Decreto 0127, Enero de 2001)

development language can be evidenced in their design of a national survey to determine the technical conditions of the ICT infrastructure in households, firms, and government (DANE, 2003). In this national survey, the engineers focused on obtaining data about the type of information and communication technologies being used in the country (operative systems, processors, servers, etc.) rather than attempting to obtain data about the categories of informational development. For example in the report of the survey, indicators about access, commonly used to measure the "digital divide," did not explore public or communitarian forms of access to ICTs, which at the time were more plausible than individual access to ICTs.

> "When speaking about Internet access, it was initially thought that it was from households, work and firms that people would get access to Internet, and that was the approach of the survey. Later, once COMPARTEL grew, more cyber cafes were available, and wireless technologies caught on, other agencies such as CRT [Commission for the Regulation of Telecommunications] began creating surveys to measure communitarian access to ICTs. However, at that time, our interest focused more in private access because the objects were more focalized in only one site [one that can be captured by household and firm surveys]." (Interview with Nicolas Silva, ex-employee of CA)

Other governmental agencies that had already begun speaking and working on informational development before the Agenda was created (COMPARTEL and Computers for Schools) became subdivisions of this technology-oriented agency after 2000. The fracture in language, intentions and practices between the Agenda, COMPARTEL and Computers for Schools, in time, fragmented the imagined uniform social world of government ICT4D in Colombia, in an arena of multiple versions, approaches, and, ultimately, organizations of different and sometimes competing social worlds. The programs COMPARTEL and Computer for Schools eventually grew independent and achieved more popularity than their parent-umbrella agency making opaque the works of the Connectivity Agenda in other areas. Computers, telephony and internet connectivity in rural areas and schools brought popularity to these programs and consolidated a position in the social imaginaries of journalists and poor communities.

In 2003, a new government took office in Colombia. With the reorganization of its bureaucracy, the Connectivity Agenda experienced a radical transformation. Alvaro Uribe, the new president did not make ICT a central policy of his government as had the previous president. By the time Uribe, representative of the right-wing, took office, Colombia had a strong guerilla uprising. The country had experienced an enormous failure in the peace negotiations with the FARC[46], and had an economic crisis comparable to that of the Great Depression during the 1930s[47]. In strong alliance with the private sector, Uribe engaged in determined efforts to "recover national security" and territory lost to FARC, using support from Washington and the United States-sponsored "Plan Colombia." Thus, the emphasis of Uribe's government was clearly military and ICT4D policies and programs diminished as a presidential priority.

In consequence, the Connectivity Agenda was moved from the Presidency to the Ministry of Communications as just one of the number of programs handled by the Ministry. In the process, the Agenda lost all the previous political power and privileges that it enjoyed under the previous Presidency. The confusion of change of functions, responsibilities, and a new director with his own version of the Agenda, caused the agency to shift direction from being a national coordinator of the ICT policy to being an executor of hundreds of small programs that were contracted without clarity about goals and how to coordinate efforts among several governmental agencies[48]. As a result, other agencies began taking on their own hands the development of national ICT projects for development. One of them was the vice-president's office, which began coordinating the implementation of an information system to make public contracts and their related processes visible on the Web for public scrutiny. Another initiative came from the Ministry of Commerce that contracted with MIT's Digital Nations project to promote

[46] Fuerzas Armadas Revolucionarias de Colombia (FARC) is the oldest guerilla in Colombia and in the world. Since 1964, the self proclaimed marxist-leninists guerilla has been in permanent war with the Colombian State.
[47] The Gross Nacional Product experienced negative growth between January 1999 to January 2000, between 0 and -5%, and it experienced low rates of growth during 2001 and 2002, 1,4% and 1,7% respectively (Kalmanovitz, 2004).
[48] Between 2002 and 2003, the Connectivity Agenda spent more than 15 million dollars in small projects, and grew in bureaucracy without major impact. This was cause of intense criticism coming from within the government and the press. Several of these programs, such as the educational program "Inteligente," were just a big drainage of public funds with no results.

local developments of content in Colombia's municipalities and to create a center for the generation of knowledge in ICT4D (Corporación Colombia Digital).

5.2.2 Constructing the Boundaries of e-Government

Between 2003 and 2005, amidst all these external pressures, relocations, shrinking budgets in 2002 and 2003[49], and competing agencies in the government, the Connectivity Agenda had to re-define its identity in the arena of ICT4D. In June 2003, Hernan Moreno-Escobar, systems and computer engineering of the University of Los Andes and Ph.D. in Economy from Université Paris-IX, became director of the Agenda. Under Moreno, the Agenda remained a technical-oriented agency constituted by a dozen of computing and electric engineers and three lawyers. Having lost the functions of coordination of the national ICT Policy and having become executor of programs, Moreno decided to focus the work of Agenda engineers on designing and implementing a national e-government strategy.

Another event that defined the current status of e-government in Colombia was Moreno's decision of bringing Hugo Sin to work for the Agenda. Hugo Sin, another systems and computer engineer from Los Andes University, had already a respectable and well recognized career in the private sector and the academia. The media in Colombia had even labeled him "The Father of Internet in Colombia" because Hugo Sin pioneered the first connections to Internet in Colombia[50]. By the end of 2003, Sin and Moreno had already designed what was going to constitute the backbone of e-government in Colombia:

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[49] During Pastrana, the Connectivity Agenda budget was $9 million dollars for 2001, and $4 million dollars for 2002. During Uribe's government, the CA's budget was $6,6 million dollars in 2003, it was $7,5 million dollars for 2004, $12,1 million dollars for 2005, $7,2 millions for 2006, $12,2 millions for 2007, and $23,5 million dollars for 2008. Overall, the Colombian government has invested annually between 1,6% and 3,5% of its General Budget in the Connectivity Agenda and its programs (My own analysis extracted from the DNP's General Budgets for National Investments between 2000-2008).

[50] While working at University of Los Andes in 1991 Hugo Sin connected the first Colombian nodes to Internet and hosted the domain .co that provided the first "Colombian" URLs in the Internet

> "We wanted to focus the efforts of the Agenda in something specific, because the original field of work assigned to the Agenda was too broad. So, it was easy to disperse efforts and resources. What we wanted to do with the director at that time [Hernan Escobar] was to organize our way of doing things, our way of thinking, and our way of conceptualizing through an architecture for online government … and try to find a small number of big projects, rather than work on many small projects without achieving real impact as we found things were when we got to the Agenda." (Interview with Hugo Sin)

This informational architecture consisted of three main dimensions of e-government. The first dimension was the normative and political aspects of e-government, delegated to the lawyers of the Agenda and the Minister of Communications. The second dimension was technological, and it was constituted by an appropriation of international best practices, technologies and standards. The last dimension was concrete in-house applications of e-government for the Colombian government.

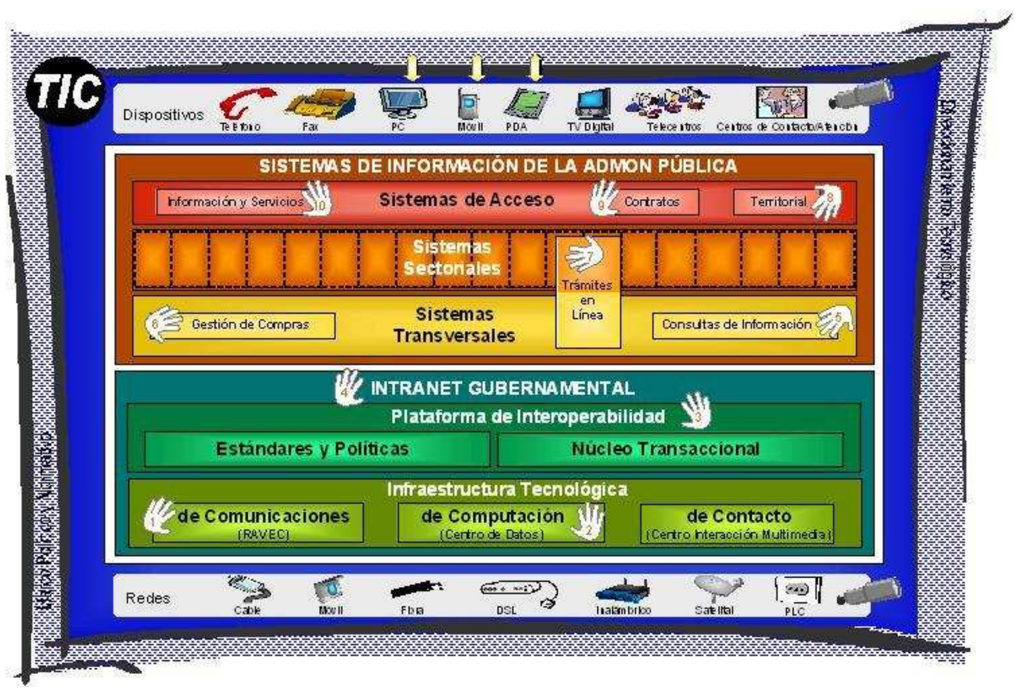

Figure 2. Online Government Architecture by Connectivity Agenda, 2006

Figure 2 is an illustration commonly used by engineers of the Agenda in public presentations that describe these dimensions of Online Government. The illustration shows the layered character of organization of the projects, and emphasizes the activities performed by the engineers of the Agenda over political, legal or external activities performed by lawyers or other representatives of the CA. This is evident in the illustration where the component that constitutes the center of attention corresponds to in-house developments while the other two dimensions: normative and political aspects, and exogenous technological influences, are left in the background and in the periphery.

The work object "online government," once defined as the product to be delivered by the Connectivity Agenda's activities, organized Agenda's goals, work activities, projects, and teamwork. This came as a critical turning point necessary in 2003, when the Connectivity Agenda was subjected to internal and external critiques for not delivering any concrete results and being dispersed in dozens of small projects, some of which were collapsing. Other agencies in the government were taking over some of the responsibilities of the Connectivity Agenda and they were actually doing better at making ICT4D a concrete reality in Colombia. Thus, finding one dimension of ICT4, not being handled by any other agency and appropriated for engineering work, had become a matter of survival for the Agenda. The decision of Moreno of focusing on e-government, and Hugo Sin's design for online government offered this specific and concrete field of engineering work in informational development that it was not being attended by any other agency and that could be developed by Agenda engineers to show concrete results.

Thus, since 2003, the Connectivity Agenda began to present itself as the leader of e-government in Colombia. The boundary work necessary to present this new role of Agenda became that of distinguishing the agency from what other ICT4D governmental agencies were doing. By focusing on mainly technical tasks and engineering work of e-government, the Agenda then separated itself from the now established programs of COMPARTEL, and Computers for Schools. Eventually the words "Connectivity Agenda" became associated solely with "e-government in Colombia."

Focusing on technologies and national infrastructures of e-government, the Agenda responded to what now has become an imperative for governmental agencies in Colombia, namely designing and using ICTs to "modernize the Colombian State."[51] By becoming an expert in e-government and concentrating knowledge, resources and coordinating tasks among all governmental agencies, the Agenda positioned itself as an obligatory passage point in issues of e-government. Thus, e-government as a work object also allowed the Agenda to recover the leadership and the authority lost when Uribe's government changed the Agenda from a presidential initiative to a ministerial program.

One strategy was fundamental to consolidating this position of power: Moreno's move to hire Hugo Sin. This move sent a message to all ICTs engineers in public agencies and to the public in general. Sin was a visionary and a sound engineer who was able to bring Internet to Colombia, before it was considered a critical component of the new economy, and was therefore the right guy to manage the complex task of consolidating e-government in Colombia. His technical expertise and credibility helped establish legitimacy for the work of Agenda in e-government. Another key step was the creation of COINFO that allowed the Agenda to have direct access to top-level national decision-making in ICT policy without having to pass through the filtering of the Minister. Because the Agenda was now a program of the Ministry of Communication, leadership in e-government would be one of the Minister's responsibilities. However, this change would have created a bottle neck for a rapid advance of projects and would have diminished the protagonist role of the Agenda.

In December 2003, Francisco Santos, vice-president, created COINFO (Comision Intersectorial de Políticas y Gestión de Información para la Administración Pública), a commission that includes the Vice-presidency, the Connectivity Agenda, the Ministry of Finance, the Ministry of Communications, and the National Bureau of Statistics (DANE). COINFO was created to fill in the empty space left by the Connectivity Agenda when it became a program of the Ministry of Communications and lost its leadership as the

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[51] As stated in the ICT policy of 2000 (DNP, 2000)

national coordinator of the ICT policy. Membership in this entity ensured for the Agenda to be situated again at the top level of decision-making on information and communications technologies for the Colombian government.

E-government as the main discourse of the Agenda also provided a source of meaning, perspective and commitment for engineers. Setting e-government as the central goal of the Agenda consolidated the technical character of the organization. While the political and normative aspects were addressed by the director of the Agenda and her/his lawyers, most of the activities of the agenda were technical activities handled by the engineering staff. Constructing the engineering infrastructure for e-government constituted a challenge for engineering work and for engineer careers, and motivated and committed engineers to a vision that gave them a feeling of working towards something "big," worthy, and important for Colombia. In words of one of the engineers:

> "When I came here [to Agenda], I thought it was a great work environment, because it means developing solutions that benefit all the population, the whole country. So, it is super, super enriching. Let's say that I could bring everything that I have learned about social work, helping people, and create technology solutions from previous experiences to this work. So, here I feel happy in an environment where I develop not only technical solutions, but contribute to broader goals." (Interview with Johanna Pimiento)

This vision to which Agenda engineers committed, it was also recognized by engineers from outside the Agenda, who interacted with Agenda's engineers. They saw it as a vision to construct a different country through their designs:

> "Hugo [Sin], as I see him, is a visionary … there is something that Hugo always says, which maybe could be laughable to all of us but that I think … deeply it is real. Hugo says that him, with the [Governmental Network] Intranet, is building a country … in reality, this is what all of us should have in our mind, at the moment of presenting or defending the project." (Interview with Luisa Montoya)

Building e-government was then a daunting technical challenge and project of social change that motivated engineers working at the Agenda to pursue a technological vision of what government should be. Since 2003, when the initial architecture for e-government was designed, The Connectivity Agenda changed director twice. Gustavo Gomez, electronic engineer from La Javeriana University, replaced Moreno in June 2005, and Maria Isabel Mejía, systems and computer engineer from University of Los Andes, replaced Gomez in November 2006. Hugo Sin, at this writing, however, has remained as technical director of the Agenda since August 2003, keeping a stable and uniform discourse about e-government during this period.

5.3 The Strategy of Online Government

The strategy of online government in place in 2006, at the moment of the fieldwork for this dissertation, consisted of a series of sequential phases through which all of the Colombian state agencies needed to pass in the effort to create e-government in Colombia. It was established by presidential decree in 2000 by President Pastrana (Pastrana, 2000), and presented government agencies with a timeline to transform the paperwork, "*tramites*," a citizen needs to do to with the government, from face-to-face interactions with public employees to on-line interaction with official web portals, "*tramites en linea*." This paperwork is the main regulated process by which citizens get access to their rights and comply with their obligations with the State.

There were four main phases established by the government to realize this goal. The first phase of "online information" commanded governmental agencies to create their own websites and to establish a presence on the Internet. The second phase corresponded to an "online-interaction" phase, in which a two-way interaction should be operative on the agencies' websites (communication, provision of info, denounces), mainly by email or chat. The third phase, an online-transactional phase, required agencies to have functional electronic transactions allowing citizens to get online access to goods and services provided by the government (paying taxes, applying for public jobs, biding to get a public contract, applying for welfare benefits, etc.). This phase required access to online methods of payment and verification of identity (digital signatures), support of data bases, and private and secure connections. The fourth phase was the "transformational phase," in which complex paperwork requiring coordination among several entities was offered through national web portals with one single entry point for the citizens. Internally, the system should determine which information was needed from and requested by the agencies, and it would satisfy offers and demands of information among agencies to process any request from citizens without letting them know about the internal structure of the process. At this point, the inner workings among governmental agencies to process a request should become a black box for the citizens. They should not know who is doing what, with what data, where that data is kept or how it is validated. In other words, at the most developed stage, e-government should become an invisible infrastructure (Star, 1999).

The presidential decree commanded agencies to comply with an ambitious timeline for each of these phases: phase 1 to be accomplished by 12/31/2000, phases 2 and 3 by 12/31/2001, and phase 4 by the end of Pastrana's government 12/31/2002 (Pastrana, 2000). However, by December 2002, when Pastrana was leaving office, not even phase 1 was completed, and, by 2006, only very few agencies had reached phase 3. One study by a Colombian researcher (Rodriguez, 2006) in 2006 showed that 100% of the agencies had some kind of online presence complying with all the requirements in 76% of the cases (Phase 1), 95% of the agencies had some type of interaction with the citizen with 53% of them working effectively (Phase 2). Only 30% of agencies had complete independent services for citizens (Phase 3), and just 37% of complex services for citizens involving several governmental entities were available online (Phase 4)[52].

Pastrana's decree also assigned the coordination of the online government strategy to the Connectivity Agenda. Since 2000, the Agenda has been responsible for

[52] In consequence, in 2008 a new decree with updated deadlines for e-government was issued commanding national agencies to implement fully all of the phases of e-government by December 2010, and regional and municipal agencies by December 2012 (Decreto 1151 de 2008), that is 10 years later than initially anticipated by Pastrana's presidential decree.

providing the technological means for the national, regional and municipal agencies to construct e-government. By 2003 engineers from Agenda had already in place a set of programs and projects that has remained stable ever since. To help agencies achieve their e-government goals, the Connectivity Agenda offers artifacts[53] and knowledge[54] to implement aspects of the informational phase, the interaction phase, and part of the transactional phase (See footnote). Agenda also develops the common infrastructure and applications that integrate all the autonomous and independent information systems of the agencies under a unified electronic system. This common infrastructure is necessary for

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[53] Artifacts include: 1) Computers and connectivity, through the program COMPARTEL of the Ministry of Communications. 2) Servers that provide hosting services for websites and applications in the Agenda's Data Center in Bogota. 3) Back-ups, standard security and privacy policies, and on-demand computing are services that are also offered by the data center. 4) The Governmental Intranet, a high speed, secure and "intelligent" network, only for governmental agencies, with standard protocols and languages to allow for voluntary and automatic data interchange among agencies. 5) Applications for all governmental agencies. This is software developed by the Agenda or by other control agencies in the government that demand use by all of the governmental agencies (i.e. "Sistema de Informacion Financiera – SIIF," system to manage and monitor agencies' budget preparation and execution, or "Portal Unico de Contratacion - PUC," system to inform publicly about public contracts).

[54] Two main types of knowledge: knowledge to use existing technologies provided by the Agenda (for general public employees), and technical knowledge to create e-government technologies (for bureaucrat engineers). The processes, by means of which knowledge to use artifacts is taught include: 1) A permanent national program called "Gobierno Territorial en Linea – GELT," or regional online government. GELT's staff is in charge of visiting all of the cities, regions, and municipalities in Colombia to train public employees and to provide them with the technological tools to implement the phases of e-government. It also includes workshops to create websites in the unified national portal, and to learn how to work with management content applications to keep websites up to date. Public employees also learn how to use the applications of e-government already available (PUC) and how to fill it in with their content. This is considered a program of "appropriation of technology." Appropriation, in this context, means the effective use of the technologies of e-government. This meaning does not presuppose a creative attempt of users to re-signify, use technologies for their own purposes or re-designed it, as understood in STS literature (Eglash, Croissant, Di-Chiro, Fouché, 2004). On the contrary, for the Agenda, "appropriation" means that the intended use of the designers of the technology is effectively performed by the consumers of it. Creative use of the technology risks breaking with the structure of a unified e-government. 2) A broader program of "appropriation of technology," which includes online courses, certifications, motivational presentations, and workshops for public employees. It also includes activities to impact on the broader public by using mass media: an online blog of e-government in the most visited portal of news in Colombia, presence in newspapers and technical magazines (Computer World, ACIS), presence in public events of the Ministry of Communications (Consejo Comunal de Telecomunicaciones 2007 -broadcasted in national TV-, Navegante de la Conectividad 2008), and presence in popular events of IT (Colombian Campus Party 2008). Technical knowledge to create e-government artifacts is restricted to a narrower public. It happens in closed meetings with engineers and technicians of other governmental agencies that have the budget to create their own e-government applications. These meetings are regular and attempt to diffuse common standards and procedures established by Agenda engineers to other engineers in charge of related activities. Protocols, language standards, interoperability, detailed technical activities, and architectures are diffused through these meetings. Only electrical, electronic, systems and computer engineers attend these meetings. These engineers range from CIOs from governmental agencies to rank-and-file engineers directly in charge of technical implementation.

independent agencies to develop fully their individual transactional phase, and move towards the transformational phase, where complex processes involving multiple agencies can be implemented. Coordinating between several agencies demands Agenda to be present in inter-sectorial committees where decisions at the national level are made (COINFO[55], GRAT[56], PRAP[57], CINCO[58], etc.).

5.4 Engineers of the Agenda in Action

Between November 2006 and March 2007, when the fieldwork for this dissertation was conducted, the Agenda had a total of ten engineers, five males, five females. Among them, five engineers, four males and one female, were directly responsible for the operation and expansion of five of the main technical components of Online Government, namely the Interoperability Platform, Territorial Online Government, Portal of Contracting for the Colombian State (PUC), Data Center, and Network of High Speed for the Colombian State (RAVEC). Hugo Sin, technical director, oversaw the operation of these different components of e-government and he himself was in charge of R&D. Maria Isabel Mejía, another systems and computer engineer, was the director of the Agenda.

As regards gender, all of the four male engineers were directly involved with design tasks and assumed full responsibility over design decisions of their components. They usually kept strong and close contact with private contractors in charge of the implementation of the components technically specified internally in the Agenda. From the group of five female engineers, only one was directly involved in activities of design of components at the same level as their male peers and with the same responsibilities.

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[55] Comisión Intersectorial de Políticas y Gestión de Información para la Administración Pública (http://www.dnp.gov.co/PortalWeb/Gobierno/COINFO/tabid/157/Default.aspx)
[56] Grupo de Racionalización de Trámites del Departamento Administrativo de la Función Pública (http://www.dafp.gov.co/)
[57] Programa de Renovación de la Administración Pública (http://www.dnp.gov.co/PortalWeb/Gobierno/ReformadelEstado/tabid/98/Default.aspx)
[58] Comisión Intersectorial de Contratación Pública (http://www.contratos.gov.co/puc/infoCINCO.html)

Another female engineer was involved in technical maintenance of a software application, and the other three were in charge of managerial tasks and programs of appropriation of technology rather than being directly involved in engineering design activities. Thus, even though there was a balance in terms of gender of the engineers, paying attention to their activities showed that male engineers in the Agenda wer more heavily engaged in technical and engineering activities than their female counterparts, which concentrated in management and promoting the use of technology. The rest of the employees of the Agenda were lawyers, managers, management assistants, and secretaries.

Several activities were noticed during the fieldwork that characterize what engineers do in the Connectivity Agenda. Engineers mainly engaged in: (1) interactions with other social worlds and boundary work, which include public presentations of who they are, and what they do, their projects, and their conceptualization of e-government. (2) negotiations about resources, which include planning, preparation of budgets and presentations and defense of budgets. (3) coordination of work activities, which includes meetings, planning, and internal and external communication. (4) design, supervision, maintenance and, sometimes, implementation of technical components. These activities are not necessarily expressed in exact divisions of labor because one engineer of the Agenda normally would do more than one of these activities.

These observed activities provide a picture of engineering in action in the social world of e-government that I should be explored further. For the purposes of this dissertation I will inquiry into Agenda's understandings of informational development and its relation to what engineers of the Agenda do to foster social change. These meanings will be explored in engineer's presentations of the Agenda to the public. I will also describe one of the ongoing projects of e-government: "Portal Unico de Contratacion." This project informs how Agenda incorporates its social goal of improving democracy by providing better information tools for citizens to participate in the social control of government. PUC also illustrates how persuasion and coercion are some of the strategies used by the Agenda for the diffusion of its technologies in governmental agencies. Later, I will explore the arena of design of a specific technology to be provided by the Agenda: on-demand computing. This service was still in the initial phases of design, so it provided an empirical window to observe and analyze the dynamic of engineering design. On-demand computing also shows in action some of the activities engineers engaged with: negotiation of resources, coordination of work activities, and interaction with other social worlds.

5.4.1 The Agenda in Public: Communicating Socio-Technical Change

The attempt to influence how the Agenda is seen and understood by others in public presentations is one of the most important activities of the engineers involved. Common audiences for these presentations are citizens, academics, engineers, and bureaucrats. There are basically three types of presentations: organizational, technical, and mixed presentations combining both elements. Organizational presentations attempt to sell the idea of e-government to the public and directors of bureaucratic agencies that need to be involved as clients of e-governments projects. Organizational presentations also operate as boundary work to distinguish the Conectivity Agenda-Program from the Connectivity Agenda-Policy, and they also draw limits of what the agenda does by presenting e-government as the Agenda's work object. In words of the engineers, these presentations are supposed to "sensibilizar" (give awareness) of e-government in Colombia and the role of the Agenda in this project. Presentations of this kind also operate as boundary work, in the sense that they attempt to clarify the focus of Agenda exclusively on e-government, and they attempt to provide a perspective of Agenda's engineers as *credible*, *focused* and *knowledgeable* experts of e-government:

> "[In public presentation] what I emphasize the most is that we have a clear focus. I highlight that we are focused and that we have a concrete plan of action, with concrete goals and activities. Because one critique we face [from bureaucrats and journalists] is that we do not know what we do, and we are doing nothing. So, I really focus in letting people know that we know that we are doing, and how we

are going to do it, and that there is a conceptual framework behind that." (Interview with Maria Isabel Mejía, Director CA)

The content of these organizational presentations begins with a definition of online government as a strategy - to use ICTs to "construct a more *efficient, transparent, and participative* State that offers better services to its citizens and firms, to support a more *competitive productive sector*, a more *modern public administration* and *a better informed community, with better tools to participate*" (Mejia, 2006). In these presentations there is also a contextualization of e-government in informational development and ICT Policy in Colombia. This includes a description of the target of the Millenium Development Goals that states that governments and private sector should work toward using ICTs to achieve development goals. It also presents the principles of the information society agreed in the WSIS, and how the current Agenda de Connectivity-Policy incorporates these concerns. This connection with informational development locates e-government in a broader national and international context of meaning of ICT4D. However, it is used more for rhetorical purposes because this discourse does not permeate the engineer's relevant set of meanings, and it is even excluded from the presentations when time is needed:

> "I talk about that [ICT4D] just formally. It is a formality. Moreover, I often skip it in my presentations. Those are inventions from international organizations. It does not mean much to me, but you know … one needs to give meaning to what one does. Those are things that countries sign when they meet at the WSIS, for instance, and all of those countries [including Colombia] have committed to do some things, but that is a formalism. For me it is just that a formalism and I could not care less about that." (Interview with Maria Isabel Mejía, Director Agenda)

Such presentations also provide several elements of the e-government discourse as constructed by the Agenda, among them, a vision of ICTs constituting the technical infrastructure for a modern, transparent and efficient government. From this perspective, the current social interactions between government and citizen are interpreted as burdensome, ineffective, and distorted. The discourse adopts a corporate language and it portrays the government as provider of services with citizens as its clients, consumers of these services. It presents a story of how negative interactions between government and citizens have been until now and how they will improve with e-government.

In this story, whenever a citizen needs a service that is provided by the government (i.e. passports, national IDs, paying taxes, licenses, permissions, subsidies, etc.), s/he currently needs to pass through bureaucratic hell. S/he is confronted with red tape and long lines, and, in the best of the cases, needs to travel to different agencies in different geographical places to do the paperwork required to get the service. In the worst of the cases, s/he would be mislead or given misinformation that would send her/him to the wrong agency or to present a wrong document required to process his/her application. Later, if the application for the service is successful, it follows an internal processing of the application that could last months. If citizen is lucky and the application is not misplaced during the processing, s/he would finally get the expected outcome.

This burdensome process narrated by Agenda engineers connects with daily and familiar experiences of people with the government and its red tape, what in Colombia is called "*tramitologia*." In the story, the citizens are portrayed as the delivery boys and girls of the State, "*mensajero del Estado*," traveling from agency to agency, back and forth, carrying the documents agencies require and demand from each other. Thus, instead of the citizen being the client of the state, the citizen is portrayed as the unwilling, unpaid employee of the state. Figure 3 is one graphic used by the director of the Agenda to illustrate the "before e-government" situation.

The solution as presented by the Agenda (Pimiento, Gonzalez, Quiroga, 2006) is to move from this state of things towards another type of interaction between government and citizens, namely that offered by e-government. The vision of e-government is presented as a transition that orients government to citizens' needs rather than the other way around. E-government offers a restructure of government's inner operations and organizational structures, changing them from organizational structures based on fragmented agencies to a network structure working collaboratively to provide services to citizens. The vision is of a government that citizens regard as "unified," as a whole, rather than a complicated and seamless web of agencies contradicting each other.

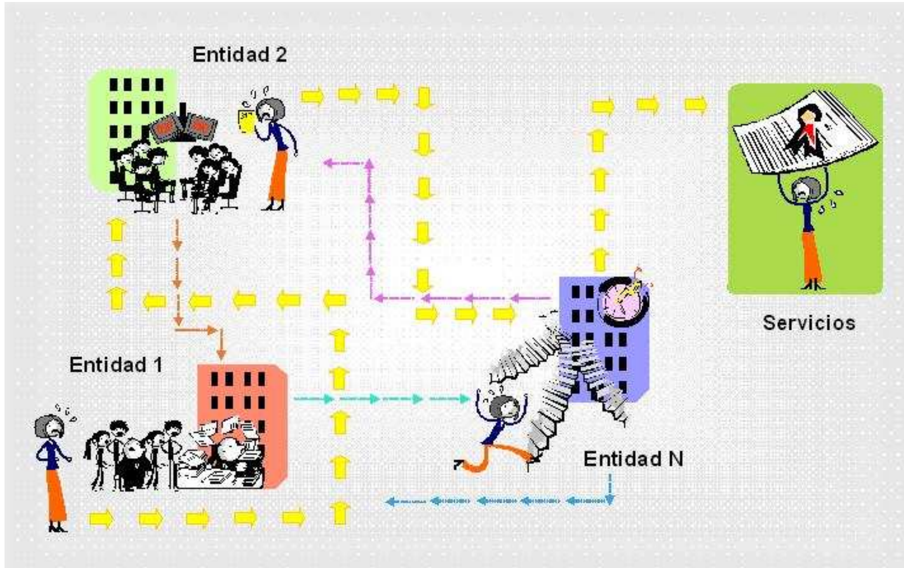

Figure 3. Before e-Government (Mejia, 2006).

The "unified" vision of the State as a compact entity would translate into a better experience of social interaction of citizens with the State. Instead of navigating through red tape, traveling between agencies, and losing time and patience with long lines and ineffectiveness, the citizen goes to a unique portal of the Colombian State where s/he can find all of the possible information and transactions that s/he could possibly demand from the State or that the State demands from the citizen. After proper identification is been verified, the citizen should be able to satisfy their demand for services without worrying how it is done or by which specific agencies. In STS words, e-government aims to be a black box for governmental services. In the process, citizens are faced with an image of an efficient government that saves them money, time, and headaches. Citizens in this discourse are represented as the beneficiaries of e-government, re-signified from being "*citizens in-line*" to become "*citizens on-line*," from victims of red tape to avid internet consumers of e-government services. Interactions of citizens with the government are also re-signified from obnoxious, long, and ineffective interactions with a chaotic bureaucracy to clear, smooth, fast, cheap and effective interactions with the black box of "*unified government*." Finally, the government and its bureaucrats are represented as "servants" of citizens connecting also with a widespread discourse of the modernization of the state that wants to build a government oriented to citizen's needs and to change the perception of the government bureaucrat from “funcionario público” (Some one who performs a function, a duty, in government) to “servidor público” (a representative of the government who serves citizens). The following is the imagery used to illustrate this “after e-government” state of things:

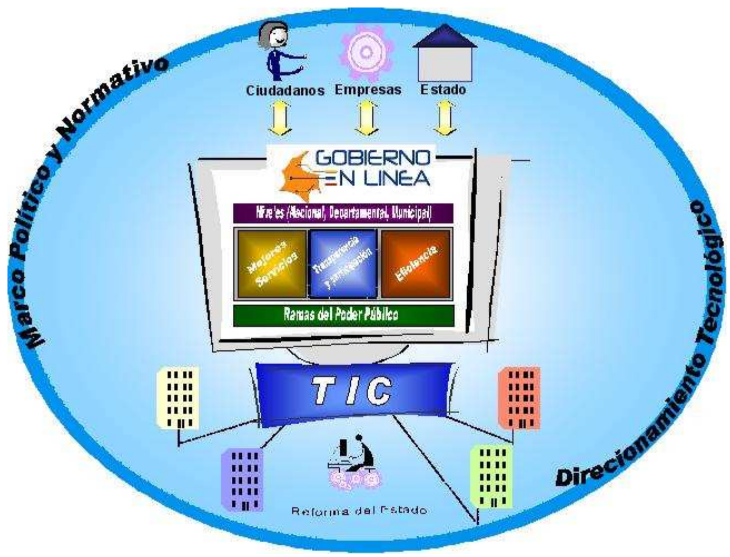

Figure 4. After e-Government (Mejia, 2006)

After presenting this vision to citizens, organizational presentations go on to describe the portfolio of projects of e-government currently in-process in the Connectivity Agenda without describing detailed technical aspects of them or technical architectures. During my fieldwork I observed the same elements of discourse and imagery being presented several times to lay audiences, academics, government employees, and directives of government agencies. It was usually presented by the director of the Agenda, Maria Isabel Mejia, although, sometimes Hugo Sin was the speaker.

Sin would not normally use metaphors to present online government to other engineers, but when required to present to lay public he would resort to using the metaphor of the iceberg. This metaphor also serves to address external critiques about the Connectivity Agenda doing nothing. According to Sin, online government can also be seen divided in two parts: the "*front-office*" and the "*back-office*." Front-office is that part of online government visible to the public in their interactions with e-government, mainly web portals, such as the Web Portal for Online Contracting with the Government (PUC) or the Web Portal of the Information System to Identify Beneficiaries of Social Programs (SISBEN). The front-office is the tip of the iceberg, the part of the iceberg that is visible. It also corresponds to the application layer in the TCP/IP metaphor. However, most of the iceberg is not visible, the part that corresponds to the back-office.

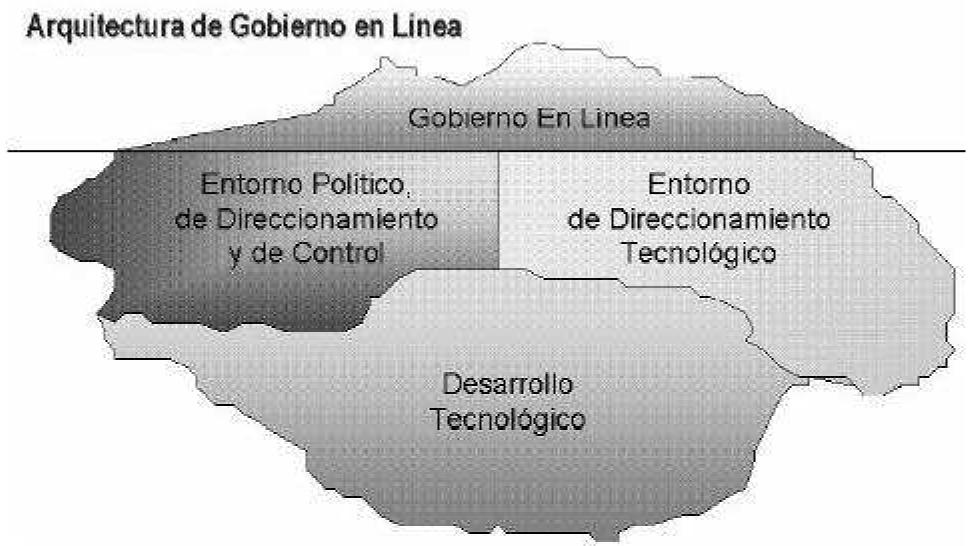

Figure 5. Iceberg as a metaphor for e-gov by Hugo Sin

(Moreno-Escobar, Sin-Triana, Silveira-Netto, 2007)

The back-office refers to the technological infrastructure that is needed for e-government to work and it consumes more of the work and resources without producing too many visible outcomes for outsiders. In the Agenda, this back-office refers to the projects in charge of deploying physical connectivity, the structuring of a secure, high speed network for governmental agencies (Governmental Intranet), a Data Center, a standard language to share information among government entities (GEL_XML), and an "intelligent" router to connect producers of data with consumers of data in the government (Transactional Router). These components are the backbone of e-government and as technological infrastructures; when working fine, they should be invisible. They also correspond to the transport, internet, and link layers in a TCP/IP metaphor. Work on these activities consumes most of the resources in the Connectivity Agenda. Because it is difficult to show the invisible to contradictors of the Agenda, normally not engineers, the use of the iceberg metaphor attempts to provide a rational explanation about why resources and taxpayers' money need to be invested in invisible infrastructures. As Sin observes:

> "I have presented the architecture of e-government as an iceberg, where the tip of the iceberg is what everybody sees. All of the services of e-government are located right there, and that is what the citizen sees, what the businessman sees, what the different governmental agencies see, and in essence that is what they need to see. But, for that to exist underneath there must be a big support … the biggest part of the iceberg, which is the architecture of online government, which is not visible, is constituted by the political and normative work that needs to go along and the technological projects such as RAVEC, Data Center, Transactional Router, GEL_XML, and all of the other components that we are developing. If it is true that these components are not visible, without them e-government would not exist." (Interview with Hugo Sin)

The iceberg metaphor is also especially interesting because it includes organizational and technical elements as intertwined components, co-constructing each other. Laws and policies are necessary to provide entry points for the use of technology in government and some of the changes in processes required by e-government and implemented in ICTs require new laws and policies to change the structure and workings of governmental processes. For Agenda engineers changes in technology need to go along with changes in society if e-government is going to work.

Technical presentations, a second type of presentations of the Agenda, occurred in more enclosed spaces. Whether in engineering conferences or in meetings with technical directors of informatics divisions from governmental agencies, lay citizens were normally absent. These presentations were often done by Sin, depending on the importance of the event for the Agenda, or by any other engineer in charge of one of the technical components of online government. Some of these presentations were general and covered the whole architecture of e-government, while some others were specific to particular components and processes. In these presentations, a noticeable absence was the discourse of ICT4D or discourse of achieving social goals by using ICTs in government. There was never a mentioning of Millennium Development Goals, WSIS, or e-government from the perspective of the citizen. These presentations also went into very specific technical features of the e-government project, its architecture and its components. When presented e-government in these instances the official imagery of technical components inspired by the TCP/IP model was commonly used. The language in these public presentations was basically the language of electronic, systems and computer engineering. The imagery was filled with schemas and tables describing the general architecture and the specific architecture for each component of e-government. For example, Figure 6 is an illustration used to explain the architecture of production in the data center.

Technical presentations served the purpose of diffusing standard technical procedures that needed to be implemented by governmental agencies to connect to the infrastructures being developed by Agenda, to receive feedback and to consider exceptions helpful in adjusting the original designs if necessary. These presentations also provided the opportunity to display technical expertise in e-government and its components, a way to establish authority and credibility among engineers from other governmental agencies.

One of the technical presentations attended, for instance, was led by the director of Operations and the director of the Web Portal for Governmental Contracting (PUC). More than 20 technical representatives from governmental agencies attended. The goal of the meeting was to provide step-by-step instructions to use existing individual portals of contracting that these agencies had put in place to feed with their data a central data base managed by Agenda using a technology called web services. These web services connected agencies' data bases with the Agenda's Data Center and fed the PUC with their local data about contracts every time a contract was locally initiated or updated.

Thus, this presentation constituted a space for diffusion of information about procedures for technicians from other agencies.

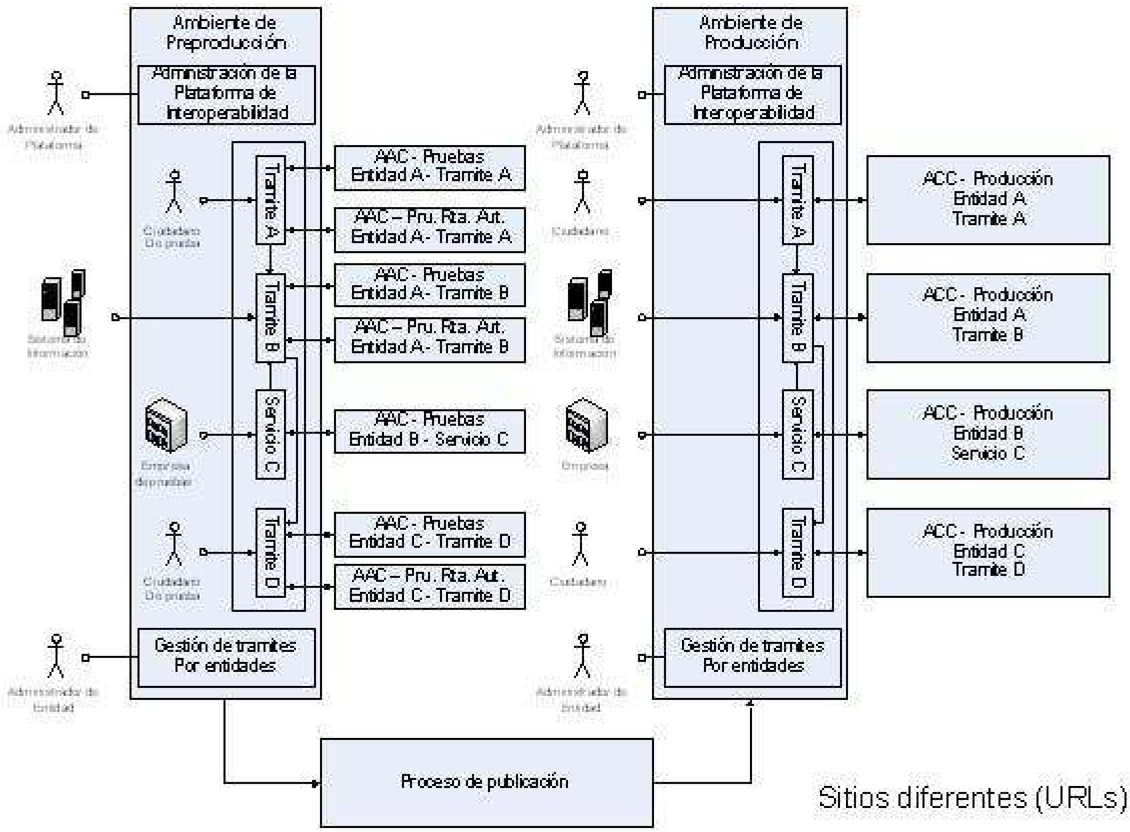

Figure 6. Pre-production and Post-production in the Platform of Interoperability (PDI)

(Pimiento, Gonzalez, Quiroga, 2006)

Engineers from governmental agencies who where introduced to the Agenda through these presentations would usually carry with them a perspective of sound expertise and robust knowledge and designs:

> "They are very strong technically. Hugo, Juan Pablo … they are very methodological … so it is something different in terms of implementing a

> technical solution in the State. They have developed a very good monitoring system, and they are very well documented. Most of the engineers are not that strict with documentation, but they are …" (interview with an electric engineer, client of Agenda)

Another type of presentation was what can be called "mixed," where both organizational and technical presentations were included, usually presented by both the general director of the Agenda and the technical director respectively. These presentations were performed in situ, in front of potential new clients that could be enrolled in the Agenda's projects. They combined several elements explained earlier in my descriptions of the organizational and technical presentations.

5.4.2 Incorporating Social Concerns into e-Government: The Case of PUC

The core objective of the Agenda is to "construct a more *efficient, transparent, and participative* State that offers better services to its citizens and firms, to support a more *competitive productive sector*, a more *modern public administration* and *a better informed community, with better tools to participate*" (Mejia, 2006). Therefore changing the inner workings of the State to improve democracy, by providing citizens with better tools (ICTs) for participation, is intended as a clear way of incorporating social concerns into e-government. The way Agenda engineers have conceptualized achieving this goal is by focusing upon transparency in governmental contracting. Having all the information about procedures and ongoing processes of contracting on the public allows citizens to exercise social control on local, regional and national governments and to reduce corruption. Providing electronic means to facilitate consolidated information about the national demand for government services and products also spurs the inclusion of more businesses as suppliers of good and services for local, regional and national governments. It also generates better conditions for the government to negotiate and gain access to better quality and prices in product and services, once restricted to a few providers (Santos, 2007). Having this information publicly available on the Internet also makes corruption less likely, because all of the information about the different phases of governmental contracts is made visible and can be consulted and contested any time by any citizen.

Under these assumptions, in October 2003, the vice-presidential program of anti-corruption and COINFO launched the PUC a project to be implemented by the Connectivity Agenda. Its objective was to implement a nation-wide unified informational system to make public all the information about contracts of private agents with the State. PUC is only the initial, informative phase, of a broader project called SECOP (Sistema Electrónico para la Contratación Pública), which also includes a transactional phase where citizens or firms can contract with the State completely online. This system will be also integrated with other information systems in charge of monitoring public finances. The rationale behind the system was presented by the vice-president of the Republic as follows:

> "Many employers and businessmen could not know dates of public biddings, all because there was limited access to that information … to counteract this problem it was created a unique web portal for e-procurement … Now the opportunity of being selected will be for all the enterprises: big, medium and small companies. It could influence the creation of new enterprises; it implies better prices for the national purchases, economic competitiveness and growth .. this is democratization of a fundamental element for Colombian economy." (Speech of Francisco Santos in the OECD's Measuring the Progress of Societies 2nd World Forum 2007, Istanbul)

The initial design and implementation of PUC was done by the Connectivity Agenda. The Agenda constructed a Web Portal (www.contratos.gov.co), that captures information from governmental agencies about calls for tender, ongoing biddings, and current state of contracts with suppliers of goods and services for the State. The website captures the data and sends it to an Oracle Data Base, physically located in the Data Center of the Connectivity Agenda. Once published, all of the tenders, bids and contracts can be accessed from the same web portal using data base queries that consult the data base and return with the results to be displayed on the portal.

According to a national law (Ley 80 de 1993) all governmental agencies are obligated to publish information about their contracts with the private sector. They could do so in the official diary, national newspapers or their own websites. In the initial phases of operation, the PUC was offered to public agencies as a convenience, provided by the State, to comply with this law. PUC was especially offered to those governmental agencies without resources to publish contracts information online, or without financial resources to publish constantly this information in local newspapers. Thus, if by law governmental agencies needed to publish information about their contracts, they could do so by different channels and PUC was just another option to be used in a voluntary basis. Between 2003 and 2005, about 100 governmental agencies used PUC regularly to publish their contracting information (Interview with Johanna Pimiento). Thus, considering that in Colombia there are over 2,000 governmental agencies at different levels, the PUC in 2005 was far from its goal of operating as a single entry point where all the information for contracting with the government was concentrated.

In consequence, the Agenda engineers decided that if PUC was going to be used massively by the governmental agencies the strategy of voluntary use of the information system needed to be substituted by something more coercive. To make all of the governmental entities publish on the PUC, Johanna Pimiento worked with a lawyer from the Agenda in creating a decree that obligated all governmental agencies to publish their contracting information on the PUC (Decreto 2434 de 2006). The decree was endorsed by the Minister of Communication and approved in 2006. When word of the decree was out, agencies began registering in the PUC and publishing massively on it. In 2004, when using the PUC was voluntary, the system registered 679 entries of contracts. Between 2005 and 2006, when the decree was drafted and published making participation obligatory, the number of contracts online jumped to 7,849 in 2005 and to 10,976 contracts registered in 2006 (PUC, 2008). PUC, as one of the first information systems designed for the infrastructure initially proposed for e-government, and because of its mandatory use, quickly gained visibility among governmental agencies. Today, over 2,322 entities are registered in the PUC and they have published over 140,000 records about contracting information since 2004.

In 2006, the PUC was maintained by a team of engineers from Agenda and independent engineer contractors. The three engineers from Agenda in charge of the project, Johanna Pimiento (technical director), Marcela Gonzalez (assistant) and Ivan Morales (contact with clients), had been in charge of the PUC since 2005. The independent contractor in charge of operating and maintaining the infrastructure of PUC in the data center was Telefónica-Telecom a private company. Telefónica-Telecom dedicated one engineer full time to be Oracle data base manager for this project. This group of engineers, two females, and two males, worked as a single unit. They were constantly monitoring the functionality of the PUC, detecting and correcting bugs, and producing statistics of use for the direction of the Agenda. They also had weekly meetings at the Agenda to monitor the state of the PUC and coordinate tasks for the next phase of the SECOP to be designed and implemented in 2008 (Interview with Marcela Gonzalez).

In these coordination meetings, the group of the Agenda shifted between two positions with respect to the independent contractor, sometimes as workmates, collaborating in identifying bugs and correcting flaws in the code supporting PUC or in the data base manager, and some other times as controllers of the terms of the contract, demanding procedures and bugs to be fixed. This usually defined the environment of the meetings from informative or collaborative to confrontational.

For the engineers in charge of making PUC a material reality, this technological system responds to different goals than those originally proposed by the vice-president. Instead of focusing on suppliers and Colombian businesses as the prime beneficiaries and clients of the PUC, from the engineer's perspective governmental agencies now constitute the clients and beneficiaries of the PUC. Agencies are, in the end, the ones that produce the content of the application. Without this content the information system would loose its value. Therefore, time and resources from the Agenda go to promote the use of PUC among these agencies. Suppliers of goods and services for the State remain as implicated actors in this project. They are represented as part of the process but they are not directly involved in the construction of the technology or in making it work. At the informative level of the PUC, they are seen as merely passive users and recipients of this system. Hardly, they are ever mentioned in meetings of the project.

A truly participative economy of procurement that includes small and medium businesses and that extends the pool of suppliers of goods and services for the State is absent from the PUC engineers' daily practices. Instead, what they see themselves constructing in this system is what they call "transparency" and "efficiency" for the state agencies. That is, they adopt the perspective promoted by the State, rather form a view from another social world's perspective:

> "Before, contracting processes were done privately, on the desk of the public employee. Now he is obligated to publish and to show how he developed the whole process. That is already a high level of transparency, which is visible to anyone. It has no restriction of access. The information about the process since its inception to its end can be accessed by anyone … so we are building transparency [with the PUC] … During the next phase, which is transactional, not only the information about contracting processes is going to be online, but the whole process itself will be there. This will provide an information system that is going to cut times, save money, and facilitate formerly burdensome processes with electronic mechanisms like online reverse auctions." (Interview with Johanna Pimiento)

Agenda engineers recognize that in the long term the goal of PUC is to facilitate the entrance of new providers and suppliers of good and services wanting to contract with the State. Thus, the system should allow the bulk of contracts with the State to be distributed among many more suppliers than it was the case before PUC existed. Small and medium enterprises that before were excluded from the pool of suppliers of the State due to lack of information, corruption and burdensome paperwork should find themselves increasingly included as new suppliers via this system. However, Agenda engineers see this outcome more as a collateral consequence than a goal of their design. In fact, at this point there is no simple way to determine if the pool of suppliers has changed from before to after the introduction of the PUC, or if this pool has been diversified including new firms, and small and medium companies that were formally excluded (Interview with Johanna Pimiento). Moreover, the system only receives information from governmental agencies and the social practices that engineers promote to sustain the PUC, and later the SECOP, only involve these agencies. This includes teaching agencies how to use the portal to publish the contracting information, and in the future, it will involve teaching these same agencies how to manage the whole contracting process online. Inclusion of small and medium potential providers for the State in the design and in trainings about how to contract with the state via this technological system is still lacking.

A third perspective about the PUC comes from Maria Isabel Mejia, director of the Agenda, in her public presentations. Because PUC is one of the few operational applications of the Agenda, the director commonly includes PUC in her presentations of e-government in Colombia as an example of what Agenda engineers do and to show progress in e-government. In her view, the PUC is a tool to "improve transparency in government and to create new channels for citizen's participation and citizen's social control of the government" (Mejia, 2006). In fact, citizens have never been included in any phase of the design of the PUC and have remained as implicated actors, represented in this case by the director of the Agenda as ultimate beneficiaries.

Following engineers involved in the actual design and implementation of the technology in this case shows that even though the vice-presidency of the Republic has a perspective of its own about PUC (transparency and a democratic participation of previously excluded suppliers of goods and services), even though the director of the Agenda has another vision (transparency and social control of citizens on the government), the social world of e-government constructed by engineers of the Agenda developed its own version of meanings about PUC (transparency and efficiency). The perspective of the engineers-designers intersects with the other perspectives sufficiently enough to make the object respond to the other visions too. However, what it is materialized in the technology ends up being closer to the perspectives and meanings of those directly involved in the design of the technology. PUC evidences the inclusion of the engineers' values of transparency and efficiency, but it does not incorporate other values intended by other actors such as democratic inclusion of small and medium suppliers, or social control of citizens in governmental contracting, which are deemed to be rather collateral outcomes.

Another point worth nothing is the use of coercion as a means of diffusing the technologies of e-government. Under the umbrella of the State, or as part of the "bureaucratic field" (Bourdieu, 1998), Agenda engineers have access to coercive measures as a resource. In the case of the PUC, voluntary participation to provide content for the PUC's database did not work to make this system what it was supposed to be: the only centralized portal for governmental contracting. Thus, Agenda engineers resorted to the use of the law to make governmental agencies provide content for the PUC. The use of decrees and laws is actually a normal practice of the Agenda. Engineers work with lawyers to craft decrees, laws and paragraphs for the national development plans to make sure their technologies keep being developed, and that these technologies are actually used. These decrees and laws are backed up by the National Department of Planning, which also is a member of COINFO.[59] In instances of policy making, like COINFO in which Agenda participates, Agenda engineers have access to governmental power to help diffuse their technologies in the bureaucratic field.

5.4.3 Design as an arena: On-Demand Computing

In 2006, one of the ongoing projects of e-government in an initial phase of design was that of creating and implementing a service of on-demand computing in the Agenda's Data Center. A look at the design of this component of e-government provides an opportunity to explore the inner workings of engineering within this social world.

[59] The top level multi-sector entity for decision-making in ICT policy issues in Colombia.

On-demand computing, now also referred to as SAAS (Software As A Service) or cloud computing, is the encapsulation of computing as a utility, just like electricity, gas or telephony. In this scheme, a few big, normally private, companies (IBM, Oracle, Microsoft, Google) present themselves as utility companies that provide computing power, servers, applications and storage space for their clients. Businesses, governments and citizens can contract with these utility companies to consume units of computing power, storage, and applications through Internet connections. In other words, it works as an outsourcing of computing activities (or leasing, if clients rent the equipment and place them in their own facilities). In maintaining their computing divisions, businesses normally have to invest in hardware, software, and staff. Businesses also have to cover costs of depreciation, unused installed capacity, maintenance of hardware and software. Now, under the model of on-demand computing, businesses are offered the option of paying for only the computing services they consume from utilities without being worried about operating and maintaining the infrastructure necessary to provide the service. In this model, consumers use the Internet to access web-based applications[60] and other services utility companies provide and they are charged only for what they consume. Hence, utility companies are the ones that worry about investing in state-of-the-art technologies and actualize hardware and software when new versions are available. They also assume tasks of maintenance, and support to clients.

On-demand computing is an old concept (time sharing, for example) that has been revived in the IT world recently due to technical advances in grid computing, web-development, and industry certifications in security (Lamb, 2008). IBM and Hewlett Packard, among other firms, are now figuring out how to implement business models for on-demand computing and how to solve technical obstacles for integration of platforms to make the model viable at a large scale (Preston, 2008). It is also a controversial technology usually contested by engineers and staff from IT departments that fear losing their jobs to this new modality of outsourcing. On-demand computing has been also a

[60] Google internet applications, such as email managers, word processors, spreadsheets and calendars, are available on line and they are examples of this business model currently available for free to the general public. However, companies like Microsoft and Oracle are now offering on-demand computing for specialized applications for companies. These commercial services are charged.

hard to sell idea to companies that are still stuck with millions of dollars invested in their existing infrastructure and are not willing to simply get rid of their own computing equipments and start afresh under another model (Lamb, 2008). However, for small companies, without built-in computing infrastructure or budget for IT infrastructure and staff, on-demand computing is perceived as an attractive option and they may constitute the initial market of computing utilities (Rivlin, 2007).

In Colombia, on-demand computing began to be heard of in business circles in 2004, presented as a solution for the computational needs of small and medium enterprises (SMEs) in Colombia. Oracle, for example, offered Colombian SMEs to be charged U$335 per user of its applications annually. SMEs would access these applications by Internet from Colombia, while the servers of the application would be physically located in Austin, TX (Jaramillo-Marin, 2004). The argument was that businesses would not need to invest capital in servers and technical staff, but would still have access to constantly updated technology, support and high levels of security and administration.

In 2004, engineers from the Connectivity Agenda decided to include on-demand computing as the business model offered by the Agenda's Data Center to the governmental agencies. With this decision, they took on the task of creating this managerial and technical model from scratch and became pioneers of this model in Colombia.

> "We did market research with the biggest providers: ETB, Telmex, Dibeo, etc. All of them offer hosting services, but that is pretty much it. They do not administrate applications, monitor them or update them, and the client still need to operate the applications. So, I would say that now in Colombia we are the only ones offering on-demand computing." (Interview with Jose David Rodriguez, director of the data center, electronic engineer)

The rationale behind the incorporation of on-demand computing as part of the data center was that the international IT technological field was moving towards this model and it offered opportunities for government agencies to stop buying machines and IT infrastructures. Instead, they could buy only the information services that they needed from the Agenda's data center working as a centralized computing utility (Interview with Jose Rodriguez). In addition, adopting on-demand computing was regarded by Agenda engineers as a matter of "*technological justice*," a necessary step to speed up the construction of e-government.

5.4.3.1 Technological Justice

For Agenda engineers, the Colombian public agencies are very dissimilar in their ICT infrastructures. Some of these agencies like ECOPETROL, the national oil company, the Ministry of Education and the Ministry of Finance, have a strong financial capacity to maintain their own computing centers with up-to-date technologies. In contrast, some other national agencies with small budgets and most of the regional governmental agencies do not have the financial capacity to buy and maintain expensive hardware and software. The ICBF (Colombian Institute for Family Welfare), the Ministry of Culture, the National Post Service, and municipal city halls in small cities and rural areas are some of the examples of these agencies without the financial capacity to dedicate big budgets to IT.

> "We want to attract to our data center, all of those agencies of the State that want to acquire technology, or want to have their own data or computing centers, but do not have the resources, technological capacity and the staff to do so … concentrating all of these agencies in one single point reduces operational costs and salaries for the whole State." (Interview with Jose David Rodriguez, director of the data center, electronic engineer)

It is interesting here to note how engineers from Agenda have mapped the discourse of informational development among Colombian public agencies. From, the engineers' perspective, the technological world of governmental ICT is a fragmented and asymmetrical world of "haves" and "have nots" within the information society. While some governmental agencies with big budgets are "info-rich" and have autonomous participation on e-government (they have created their own transactional services online, keep an online presence, have implemented Electronic Data Interchange –EDI- with their providers, and have incorporated ICTs in their productive activities even before e-government became a national program), most of them are still "info-poor" and normally have outdated equipment, no technical expertise, and not pragmatic means to go beyond the construction of a web page.

> "All of the State agencies should have the right to access all of the technological services … it is an issue of equality. I do not think it is fair that one agency can have all the resources, and all the technological features like teleconference, wireless networking, etc., and when you go to a small agency, where the intellectual level of the public workers is the same as in any other agency, you see they lack aggregated-value services just because they are small. Then, I'd say that a public worker from the small agency has the same rights to use services provided by state-of-the-art technology as a public employee in a big agency enjoys. What happens is that the big agency has the resources and it uses them on IT investment, but the small agency needs to wait until, eventually, it gets a transfer of resources from the central government to invest in technology. So, it is basically an issue of equality … all of us [public workers] should have the right to use the same [technological] services and that is our goal." (Interview with Jose David Rodriguez, director of the data center, electronic engineer)

The "right" to enjoy the same technological environments and the construction of "*technological justice,*" understood here as equal, fair, and impartial share of the benefits of ICTs in the government, constitutes a powerful element of discourse that positions these engineers in a role of promoting social change, and gives them a perspective of how a "better" government can be constructed. In their vision, on-demand computing offers the same technological environment and the same technological experience to both powerful and powerless agencies, creating an egalitarian technological field for their users. Those agencies with greater needs and with more demand for computational power, storage capacity and use of applications will pay more than those with a lesser need or demand, but every agency can pay to get access to the same levels of technological services. In other words, in the discourse of Agenda engineers, on-demand computing embodies technological justice by allowing "info-rich" and "info-poor" agencies to enjoy the same informational environment.

Another motivation for on-demand computing, less ideological, is that "info-poor" agencies constitute a practical barrier to speed up the construction of a national e-government because most of them, if not all, need to be enrolled to construct the promised experience of a "*unified government*." The Agenda engineers have oriented on-demand computing precisely as one of the solutions to eliminate a governmental "digital divide" that prevents the construction of the network government. By offering a data center that implements on-demand computing and marketing this service to all of the agencies of the state, especially to small agencies with poor or no computational resources of their own, the Agenda engineers are gradually creating a centralized and standardized platform to bring all agencies under the same umbrella of e-government. As we noticed previously, these engineers have access to coercive measures as a resource to diffuse technology. So, they could easily work out a decree obligating info-poor agencies to connect to the government networks and build their own electronic services of e-government services. But, in a context where info-poor agencies have no practical means to implement sophisticated computational services, these decrees are would not be a useful tool and the Agenda would risk appearing itself out of touch with reality of info-poor agencies. Thus, the availability of on-demand computing in the data center of the Agenda can now be used to force small agencies to use it in order to comply with the national goals of e-government.

5.4.3.2 On-Demand Computing as an Economics Object

The design of technological components in the Agenda is limited by the financial resources at its disposition. Every project needs to be included in the Agenda's budget and it needs to be approved by the vice-minister of communications and the CEO of the

Financial Fund for Development Programs (FONADE)[61]. These two actors make sure that financial resources being assigned are aligned with the goals of the Ministry and the Development Plan of the current government. During the annual preparation of its budget, Mejia and Sin defend their proposed plan of activities and projects for the following year and negotiate specific amounts of money for each activity/program. Because its core activities are technical and demand a great deal of money, Mejia and Sin need to convince their audience that their designs will produce the promised results, and that some kind of return on investment will materialize.

On-demand computing was a hard to sell in this scenario. No one else in the Colombian market had developed or acquired the technology to offer this service. In 2006 it was still a technology in the making within international firms, and that did not help much either. For these reasons, the vice-minister (engineer, economist and MBA) and the CEO of FONADE (engineer and economist), during a first defense of this project by Sin, concluded that on-demand computing was too risky to invest public money in its development and asked Mejia and Sin to return with more arguments. During a second defense of on-demand computing, Sin and Mejia were interrogated about the demand for this service and about the reasons why the government had to implement this model instead of keeping things as they were: each agency in charge of its own computational infrastructure. Sin's reply was managerial and business oriented, rather than technical. He backed up his arguments with the existence of a demand for on-demand computing in the government supported with a market research that had identified 15 agencies interested in becoming clients of this service. He also tackled on reducing the risks of government wasting public money on this project by referring to the close work engineers of the Agenda had had with Telefonica in developing a sound techno-financial model to make on-demand computing an economically viable option not only for agencies government, but also for Telefonica[62]. These arguments were sufficient for the vice-minister and the CEO of FONADE to approve the budget for this project.

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[61] "Fondo Financiero de Proyectos de Desarrollo" – FONADE, for its initials in Spanish, is part of the National Planning Agency, or "Departamento Nacional de Planeacion" – DNP.

[62] Fundamental to keep this relationship with Telefonica was an agreement that financial risks attached to this innovative model would to be assumed by the Agenda. The Agenda, for instance, guaranteed

In this scenario of negotiation of resources, on-demand computing works as a boundary object. The meanings associated to this object are framed by the social worlds of management and economics rather than engineering. The object on-demand computing is seen as an alternative for investment in technology. Therefore, questions about risks associated with the investment, demand for the product, and return on government's investment follow. In these meetings on-demand computing becomes an economic object and Agenda engineers are compelled to speak about the object in those terms to the vice-minister and the CEO of FONADE. Since Agenda engineers have no major background in economics, it is rather a stressful and unconformable situation they need to pass through. In fact, it took Sin and Mejia four of these meetings elaborating on their arguments to get the funds for this project approved in this committee. For Sin what it mattered the most in this scenario of negotiation was to present a reasonable scheme of reduction of risks and be completely confident that the innovative model was going to work in practice:

> "It is necessary to manage risks in these topics of technological innovation [on-demand computing], and in front of uncertainties and doubts that delay decision making, it is important to know how to transmit confidence to those decision makers. The confidence that comes from showing to them that one is committed to make the model work and that one is technically prepared to make it a reality. It is impossible to relieve all fears, and sometimes it is not easy to convince, retrospectively, to comptrollers that what we decided it to do it was what we needed to do, but one is absolutely sure that it was what we needed to do. At least, one is convinced about what needs to be done, and acts accordingly, letting everybody know why one is convinced." (interview with Hugo Sin)

From a social worlds/arena perspective this process of negotiation took the social world of Agenda engineers to reconstitute their techno-financial object into a purely economics object as it was seen by the agents responsible of approving budget for on-

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Telefonica a minimum income for 20% of the installed capacity of equipments in the model of on-demand computing. The Agenda also guaranteed a future captive demand for this service, given that coercive measures as a resource (law, decrees) would be used to bring in governmental agencies to use on-demand computing, just as it was done with the PUC.

demand computing. All of the technical elements constitutive of this object did not matter in this arena of negotiation of financial matters.

5.4.3.3 Constructing On-Demand Computing: Construction of Work Objects

The construction of on-demand computing involved engineers from Agenda and Telefonica. Telefonica had been the independent contractor of the Agenda since 2005. It had been in charge of operating the entire technological infrastructure for the data center, governmental intranet, interoperability platform and contact center. Once Agenda decided to implement on-demand computing in the data center, a project team was established between Agenda and Telefonica to work on the technical and financial details of the model. Jose Rodriguez from Agenda and Felipe Poveda from Telefonica were responsible for this project.

Among the features that Rodriguez and Poveda needed to be design for on-demand computing to work, there was a technological system that recorded consumption of computational resources by different consumers in quantitative "units of computing power," and a business model that related these units being measured to prices per unit. For over a year, Rodriguez and Poveda worked on defining what a "unit of computing power" meant, how to measure it with hardware and software tools, and how to set a price to be charged for the consumption of these units. These units of computer power had to include multiple variables of software and hardware being used: amount of memory being used, use of processor, use of storage, traffic on the network, and licenses of proprietary software being used.

> "trying to conceptualize [on-demand computing] is not easy … it is easy to imagine it, but it is not easy to ground it in numbers. For example, you can say 'the memory is 100 units,' and then you begin charging per unit every resource. But, with issues such as licensing … How do you split it in units when the same license is being used by several applications? Then, that was when we began creating the model … for licensing we decided that all the applications had the same right, whether if they use

> it or not, they needed to pay for the right to use. While, for use of the memory, processor, and traffic generated on the network … that is something we can measure with an operations manager." (Interview with Felipe Poveda, Telefonica)

The operation manager is a proprietary application produced by Microsoft called MOM (Microsoft Operations Manager) that generates reports on the performance of servers, traffic on the network, and applications being used. MOM can generate reports of individual clients on their uses of computational resources. Thus, this technology satisfied the requirement of recording individual consumption of computational resources to make on-demand computing work. The second element to make the model work, the definition of "units of computing power" and its commodification, took more time to be developed by Poveda and Rodriguez. During several months in 2006 and 2007, Poveda developed a system of variables that could be measured in the data center and that reflected use of computational resources. Rodriguez reviewed the proposal of variables sent by Poveda, revised it with him. Together they determined the units to be measured (Interview with Jose Rodriguez). The next step was to generate monthly reports of consumption of the defined computational units. MOM would produce individual reports on use of computational resources. These reports would be fed into an information system that would take these individual measures, it would identify the computational units being consumed, and it would create a bill using a table of prices per unit. The result was the bill consumers would get, which corresponds to the price of computational services used in the data center every month.

As Telefonica took part in the design of a new model for pricing of computational resources, the company gained a lot. It developed experience in on-demand computing that the company plans to translate to other business units and other clients in the future (Interview with Felipe Poveda). The experimental model of the Agenda is now being used as a pilot, tested in "secure conditions[63]," until an optimized model it is ready to be offered for other consumers in the private sector. From this perspective, the engineers from Telefonica consider that their work with Agenda, developing the new model of on-

[63] These secure conditions refer again to the agreement between Agenda and Telefonica to guarantee a minimum income for the company and to ensure a stable demand for the model (See previous footnote).

demand computing, is also helping them develop business models that can be exported to other sectors and countries in Latin America. In the view of Poveda, projects like this in the government can work as spaces for R&D for private corporations (Interview with Felipe Poveda).

The “memory units,” “processor units,” “storage units,” and “traffic units,” were among the work objects that needed to be created conceptually and measured by hardware and software. In addition, the concept of “computation as service” rather than “computation as machinery,” needed to be constructed. Government agencies usually think of ICT capacity as machines and software that need to be bought. They assign budgets to buy computers, servers, storage units, software licenses, and so on. Attempting to change this perspective of agencies to promote on-demand computing, engineers needed to sell also the idea of “computation as service,” more compatible with the product they were offering.

> “We are not investing in “fierros” (machinery), private operators [Telefonica] do that, we are offering a service” (Maria Isabel Mejia, director of the Agenda)

Engineers of the Agenda have incorporated this paradigm so deeply that it has become a work object, a means through which they organize their own interactions with their independent contractors. In the relationship Agenda-Telefonica, for instance, there is an ambiguous contract stipulating that Telefonica needs to ensure standards of quality in the operation of the infrastructure: reliability of servers, capacity of the intranet channels, back-ups, links that do not break during interchange of data, and so on. Telefonica understands this contract as a matter of dedicating equipment and staff to offer specific services at well defined levels of operation. However, when engineers of Agenda identify an improvement in the infrastructure owned and maintained by Telefonica, and Telefonica is not willing to dedicate more equipment to cover for the necessary improvements then a conflict of interpretations emerge. Agenda engineers focus upon services, while engineers from Telefonica focus upon machinery. For example, engineers of the Agenda detected that a possible improvement in the operation of the governmental intranet was to dedicate a single server to DNS in the data center. When Agenda engineers suggested to Telefonica engineers, bounded by their internal budget, that they needed to negotiate internally to get extra-resources to buy a server that was not contemplated initially to improve the service, Telefonica engineers initially reacted negativelly. For engineers of the Agenda, this is a matter of being oriented to provide a high quality service. For Telefonica engineers this means "getting a new machine not including in the initial budget." These conflicts of interpretation between a paradigm of service and a paradigm of machines were fairly common:

> "Hugo insists that we need to see the RAVEC (high speed network for the governmental intranet) as a solution, not as a set of interconnected links [machinery], and that we need to typify the traffic of Internet on the network to ensure a minimum availability of the channel, something that was not specified in the original contract" (Interview with Luisa Montoya, Telefonica)

Emphasizing service over machinery generated a space of ambiguity in the contractual relationship to which independent contractors eventually adapted.

> "Then, I come here to my company [Telefonica], which it is utimately the one that assigns me a budget, and say "look, my client says that this is not a set of links, but an integral solution of connectivity for the whole state." But my company is not going to understand that, because it was not put it like that in the beginning of the project … In this case, we are aware that we can interpret this in these two ways. If we wanted to interpret this in just one way, we would go to the lawyers because in the end this is costing us more money. But, if we go to the reality of things, we also want the same thing for the network … and we also want to keep the client." (Interview with Luisa Montoya, Telefonica)

Thus, the idea of computing as service, represented by on-demand computing, became an enduring work object in the discourse of Agenda engineers. Computing as service permeated the rest of the components of e-government, and the interactions between Agenda engineers and independent contractors. In fact, today, the orientation of e-government to provision of computing services rather than machines is the central idea behind the integration of disparate information systems of the State under the project of the Interoperability Platform, which is supported by the approach of "Service-Oriented Architecture - SOA.[64]"

5.4.4 Technological Neutrality: A Conflict Object

One controversial issue that the social world of e-government in Colombia has faced in the arena of ICT4D is that of using proprietary software for its technological infrastructure. The loudest critique in this arena has come from the social world of non-govermental ICT4D.

Manuel Davila, the most salient representative of the FLOSS (Free/Libre Open Source Software) movement in Colombia has criticized the use of proprietary software, like Windows or Oracle, as the basis for structuring e-government in Colombia:

> "The top-level directives of the Ministry of Communications, when asked to use free software, hide behind the term "technological neutrality," which is the shield to kill the debate. Who can contradict someone who says the position of government with respect to its technologies is neutral? … nobody." (Manuel Davila in his online blog in El Tiempo 03/12/07)

To understand this conflict it is necessary to present the different interpretations of the situation. On one hand, the Agenda engineers find themselves in an internal

[64] SOA is a design framework that unifies different technological platforms. It identifies each independent platform as a business unit that provides specific services. SOA structures large applications by connecting these services in a logical model that delivers meta-services. The main technology used is that of "Web Services." SOA structures a logic chain of web services that connect offer/demands of services from/to other business units in a menu of meta-services integrating different platforms. Part of the daunting task of the Agenda's data center is to integrate in one single platform all of the diverse applications coming from governmental agencies. Some of these applications used proprietary operative systems/applications (Microsoft, Lotus, Oracle, etc) and some others use non-proprietary operative systems/applications (Linux, Apache Servers, etc.). The integration approach of "Open Architecture" endorsed by Agenda attempts to tackle on this complexity, and bring together all of the existing applications of the state, making it possible for them to communicate with each other on a Web environment. Provision of services is what matters here, not machines.

conflict with respect to free software. Most of them endorse free software as a good alternative for the State because of its high technical standards and the reduction in costs of licensing that comes with it. However, they are also situated in a neoliberal government,[65] and it is expected from the government to be one of the biggest clients of private software companies. Therefore, Agenda engineers as representatives of the government can not publicly endorse free software because in doing so they would send a clear message to the market that rules of free competition in the market have been broken by the government, which has sided for a specific product and killed competition. The internal conflicts are evident in Agenda's engineers:

> "It is evident that we are attached to very expensive platforms, like Windows and Oracle. One could expect that something like e-government, which has a huge impact and national scope, which is very flexible and open and which is also constrained by a limited budget, should be working on a different platform. Maybe this thinking I have is linked to my previous experiences in academy and working at the university, because in the end this [goverment] is becoming just another business, and every business has its business decisions … however, internally, we think otherwise." (Interview with Marcela Gonzales, Agenda)

Hence, there is a clash of discourses, one technical coming from engineers favoring the use of free software in government, the other, a neoliberal discourse coming from the "establishment." The engineers of the Agenda present themselves to outsiders as unbiased supporters of all technologies. They do not endorse any specific technology over the others leaving those technological decisions to decision makers in the individual agencies. Agenda engineers refer to this position as "technological neutrality:"

> "that is our policy in the data center, we offer the services that agencies need, but we are not married to any specific technology." (interview with Jose Rodriguez, Agenda)

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[65] For purposes of comparison in South America, Venezuela and Brazil, that have had critical responses to neoliberalism have embraced the used of free software in government by law, expressed in their national ICT policies.

To avoid confrontation with the social world of private ICT and the central neoliberal government, engineers avoid the subject by presenting "technological neutrality" as one of the principles of e-government. This element of their discourse, serves several purposes. First, it evades controversy while complying with neoliberal principles and removes engineers from any "political scenario." Second, it pragmatically addresses the current reality of the State in which agencies independently endorse either proprietary or non-proprietary software,[66] according to their own preferences. Thus, this position does not disturb the free market of software in Colombia or the autonomous decisions of agencies to favor some technologies over others. In other words, it is a politically correct element of discourse.

Advocates of free software, however, faced with the official discourse presented in public scenarios by Agenda engineers, criticize this apparently neutral position. From their perspective, there is no reason why the State should not be more favorable about free software and endorse it officially. Representatives of Agenda and the Ministry of Communications have addressed this critique as follows:

> "Today, governmental agencies are free to contract with any software provider that can satisfy their needs and requirements … directing the State towards using only free software, will leave out of the picture the proprietary software and anyone else … ignoring commitments [of technological neutrality] Colombia has made in the World Trade Organization and the Andean Community of Nations" (MinComunicaciones, 2007).

Advocates of free software in e-government respond saying that endorsing technological neutrality dilutes the possibility of a democratic debate about the kind of technologies used by the State and financed by taxpayers:

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[66] Within the government, there are cases of clear support of free software but that happens at the level of operative agencies, not at the level of executive agencies. One clear example is the "Superintendencia de Servicios Públicos" that in 2003 implement a technological infrastructure based on free software, and in December 2006 launched a free software application for document and processes management, called ORFEO, under a GPL license. However, these are isolated cases and there is no formal policy to support free software in the Colombian State.

> "There can not be neutrality when some products, proprietary, have at their disposition the commercial strength given by publicity, while the free software does not have it, because its support comes from the community. This gap can be closed by the State becoming one of the voices of free software … then, instead of talking about "technological neutrality," let's talk about being neutral in processes of inclusion and decision." (Davila, 2007)

This ongoing debate, shows that an object conflict[67] (Hess, 2007) continues to swirl around the kind of software (technology) being used in e-government. The arena of controversy draws upon three analytically different positions associated with different universes of discourse. One position favors the use of free software in the government. It is represented by systems and computer engineers committed to the social world of free software, including Manuel Davila. Another position is represented by official representatives of the government, such as the Minister of Communication or the Director of the Agenda, committed to the principle of technological neutrality recommended by the World Trade Organization. A third position, less polarized, not public, and more ambiguous, corresponds to the internal position of Agenda engineers. They are compelled to back up the government's official position, even though internally most of them are supporters of free software, they use it, and they have incorporate it as part of the technologies of e-government, along with proprietary software.

5.5 Engineering Identities

Agenda engineers work under the umbrella of the State. This condition affects their practices (public presentations), they way the do engineering work (negotiations of budgets, political lobby), their interactions with others (technological neutrality), their preferred technologies (on-demand computing), and their resources at hand (coercive

[67] According to Hess, an object conflict is a "definitional struggle, simultaneously political, economic and semiotic. The conflicts involve which objects should be released onto markets and, within categories of objects, which designs should be given priority over others." (Hess, 2007):80.

tools) as we have seen in this chapter. On the other hand, Agenda engineers are also influencing what the State is going to be like. They create and promote social categories (the unified State, info-rich and info-poor agencies), propagate socio-technical ideologies (computing as service, technological neutrality), and materialize these symbolic meanings within concrete social practices and technologies (standard procedures for paperwork, governmental intranet, PUC, on-demand computing, laws, decrees, etc.).

As they work within this situation, engineers also create a persona of themselves. They create an image of what an engineer of e-government in Colombia is or should be. They adopt, individually and collectively, meanings that make sense of their technological and social practices in the Agenda. This image is also perceived by others and shapes many interactions.

In the Colombian bureaucratic field, there is a dominant stereotype about engineers. Because salaries are not too competitive with those in the private sector, many observers assumed that the best engineers are usually captured by the private sector. As noted in Chapter 3, engineering in Colombia is also associated with corporate capitalism. When governmental agencies need engineering expertise, they normally turn to private, independent contractors. Engineers in government, in this stereotype, are not expected to be innovators, because risk capital, necessary for innovation, always goes to private entrepreneurs. Moreover, the fear of being prosecuted for having spent public resources in risky "experiments" also prevents engineers in government from being innovative. This prompts engineers in the State to be passive adapters of private-developed technologies, consumers of engineering technologies developed elsewhere that have been shown to be reliable and to produce a good return on investment.

The work done by Hugo Sin and his engineers in the Agenda since 2003 has confronted several of these assumptions and stereotypes of engineering in the public sector. Thus, Agenda engineers are seen as better technically than the average engineer in the public sector and matching technical levels in the private sector:

"Agenda engineers have clear goals, and they have well established bases, they are very strong technically … if you go to another public agency and you meet their engineers, you will find everything. There will be people who are more or less knowledgeable, and some others that do not have any idea what they are doing, who would not care if you deliver tomorrow or in 15 days, or in one month. Agenda engineers are very commited and focused. They have clear where they want to go, not like in other governmental agencies, where they generate projects because they have the budget not because they know where they are heading to." (Interview with Luisa Montoya, Telefonica)

Agenda engineers also seen as innovative, willing to take risks. Entrepreneurs with a vision they have and they use to convince others in all of the instances they participate. Independent contractors, employees from other governmental agencies, journalists, and even contradictors of the work of Agenda recognize that Agenda engineers have the technical skills for the task at hand.

"Johanna and Marcela are excellent technically … I have also seen in my work with them that they have excellent managerial skills with high technical standards, and that is something difficult to get. Her level is very good." (Interview with Oscar Rodriguez)

Thus, this technical program of the State mostly run by engineers is also producing a thorough revision of the stereotypes about engineers who work for the government. Much of this improved reputation can again be attributed to Hugo Sin, who over the years has consolidated a team of engineers who uphold high standards of technical skills and who are committed to a strong vision of e-government. The director of the Agenda, on her part, has secured generous compensation packages for Agenda's engineers comparable to those of the private sector to retain these engineers.

The strong focus upon research and development in the Agenda, also breaks with the stereotype that innovation occurs only in the private sector. Models like on-demand computing, being implemented jointly by Agenda and Telefonica, show that Agenda can be a laboratory for R&D of ICT with benefits that can spill over into the private sector.

The environment of creation, innovation, and technical challenge along with competitive salaries is a powerful magnet to attract engineers and gain their commitment to e-government.

> "Here, the work is totally team work. The idea is to collaboratively construct solutions to our problems, not to impose a solution unilaterally … but this is atypical in the State, where there is always the imposition of someone saying how things should be, and judgments are not confronted. But this is the raison d'être of Agenda. The Agenda is an element more visionary, more about innovation, and innovation that does not come from one person, but from a group of people." (Interview with Juan P Quiroga)

Individually, engineers see themselves also as constructors of this vision, connecting their technological interests to a socially meaningful enterprise:

> "I think I always have had the tendency to develop technologies with social impact, and that has been my life and my professional career. It is to identify something that it is going to be important in the future; to build that element that it is going to change society. I am always looking for that. Then, I think the social has always been my call … I have a vision of the future, and that is what I like to do, being able to identify something that in the middle or long term is going to transform society and it is going to important in that sense." (Interview with Hugo Sin)

Hence, there has been a change in perspective from designers and developers of technology to creators of solutions that are transforming the way Colombian government works. This vision provides a meaningful space for the professional identity of Agenda engineers:

> "When I got here, I liked the work environment because is to create solutions to benefit the whole population, the whole country … many engineers expect to become CIOs, or to administrate servers and machines in a corporation, from a technical perspective. But here you can flip that over and say "I have the technology, I know how to construct it, but technology is not the center of what I do. The center is everything else I can support with technology." That is what I have learned in the Agenda." (Interview with Johanna Pimiento)

Agenda engineers still see themselves as bureaucrats. They have adapted to the bureaucratic field, learned its rules and ways, and adopted its procedures. They also know how to use the resources they have at their disposition within this field. Working on laws and decrees along with lawyers has become routine for them. They have learned that they represent official positions, even though sometimes they disagree with them. They have also learned how to make a space for themselves in bureaucracy by becoming the spokesperson for e-government. They know that their job is political, that it needs to adapt to many different other worlds, and that government power is distributed in so many agencies that the best they can do is to create alliances, persuade vice-ministers, ministers, and congress people that their work is worth supporting.

> "The first months working here in the government, I knew there were going to be many obstacles: paperwork, red tape, etc. all of those things that I never liked I was going to find them here. But you get used to that after a while, and now I don't even think of it, and focus myself on the really important things … now if in this moment I have gained some respectability in the government, it is because I have won it with my work. I have won the trust of the people that have worked with me. The quality of my work has gained me the trust and credibility that I actually have in government circles. I interact with the vice-president, the Minister of Communications … I never thought I was going to do that! … I saw those people from far away. Nowadays, I sit down and talk to the Ministers. That does not mean that I have those doors open, but if one day I need to talk to any of them I will not worry, I'll go ahead, and I have won that right with my work. If I need to talk to any director, vendor, or vice-minister to get things done and move things forward faster, I will do it without any doubt … I have developed this ability of getting things done in the government." (Interview with Hugo Sin)

> "I had never worked in the public sector before coming here. I always worked in the private sector. Thus, understanding the private sector took me a while. Understand its workings, its operation. Understand how the other agencies worked, the other public employees … that was tough, because in the private sector the dynamic is different … I am glad I got to the Agenda, with a great work team that I had not seen in years. Before, while working in the private sector I interacted with public employees in several projects, and when I got to those agencies I ran into

incompetent people that were going nowhere. You could equally tell them black or white, and they would not distinguish. You could sell them anything, for them everything was the same. When I got here to the Agenda, I met this team with all the skills, all the capacity, all the analysis … I learned, and now I think that it was because of them that I assimilated better the challenge of working in the government." (Interview with Robinson Malagon)

5.6 Intersections

5.6.1 Intersections in the Government: Connecting the Macro to the Micro

Building the major infrastructure for the network government would be impossible without Agenda engineers mobilizing different social worlds other than their own. Coordination with other agencies in the government is a must for this technical enterprise to move forward. The general director and the technical director of the Agenda are the main representatives of Agenda in several instances of the government where decisions about ICT policy and ICT procedures for agencies are made. It is in these instances that engineers generate commitments to infocapitalism and infodevelopmentalism.

As explained in Chapter 3, infodevelopmentalism and infocapitalism are expressed in a National Development Plan. This Plan, presented for the president to the congress for approval every year, defines annual goals, strategies, programs, projects and investments for every agency in the government. The agency in charge of coordinating the construction of the plan among governmental agencies and ensuring its logical consistency is the National Department of Planning (DNP for its initials in Spanish). Whatever makes it to the Development Plan needs to be approved by DNP.

After infocapitalism and infodevelopmentalism made their way into the official discourse of development in Colombia, the DNP created several inter-sector committees to regulate the ICT environment for the whole government and align it with processes of modernization in governmental agencies. Here I will describe the work of two of these committees.

One is COINFO, an obligatory passage point for all of the projects of investment in ICT in the government. As mentioned earlier, COINFO, is constituted by the Vice-presidency, DNP, Ministry of Finances, Ministry of Communications, National Bureau of Statistics, and the Connectivity Agenda. It is the top-level decision-making committee for ICT issues in all governmental agencies. In this committee the Agenda, as a technical agency of the government is assigned to implement some projects. This was the case with the PUC. The PUC was initially an initiative of the vice-presidential program of anti-corruption. When COINFO was created, the committee delegated on the Agenda the implementation of the PUC. It was also in COINFO that Agenda engineers convinced the other members that participation of governmental agencies in the PUC had to be made obligatory by decree as a formal governmental policy of ICT. Thus, this committee articulates into ICT policies macro issues of informational development, such as modernizing government with ICTs, making it efficient and less corrupt to attract more foreign investment, and fit the government into neoliberal precepts agreed in the WTO. In fact, PUC was financed by the UNPD (United Nations Program for Development) because it responded to requirements of ICT4D.

In COINFO, Agenda seeks to implement the material aspects of a discourse of ICT4D that has been assimilated by the Colombian State. The macro (ICT4D) finds its way to the micro (technologies, social practices) via the meso (COINFO-DNP-Agenda-eGovernment).

Another inter-sector committee in which Agenda engineers participate is the PRAP committee. PRAP is a DNP program that responds to neoliberal aspects of informational development and capitalism. It attempts to modernize the Colombian State "rationalizing its functions, re-dimensioning the size of its administrative structures and strengthening its capacity to comply with its core goals" (DNP, 2008). In other words, it seeks to re-engineer the government from a business perspective:

> "A central participant in the construction of e-Government is PRAP. Because, it is modernization. It is understanding the need of governmental agencies not from the perspective of informatics, but from the perspective of the agency as a business … the word "business" needs to be applied to the State, it needs to be determined what its mission is, and if what it is doing it is doing it fine or not. It needs to be determined how to improve current processes, how to monitor them and control them. All of this in order to serve the citizen better … then, the central focus of ICT in the government is not the technologies per se, it is the citizen … that is the central axis for governability." (Interview with Marcela Ramirez, DNP)

Technologies are understood here as constitutive of a major re-engineering of the State to transform it into an efficient corporation. It is here in the PRAP where the integration of information systems of all the governmental agencies is promoted by the DNP at the national level. For DNP this integration of its information systems of the State is necessary to construct a modern State, as stated in the National Development Plan. The Connectivity Agenda, member of PRAP, is left in charge of implementing the technical aspects of this integration. Therefore, in these intersections with DNP, Agenda finds itself implementing this vision of modernization of the State through the use of ICTs. In return, it draws power and legitimacy from the bureaucratic field from through participation in DNP's PRAP and COINFO. This ensures its place in the governmental social world of ICT4D in Colombia.

5.6.2 Intersections with the Non-Govermental Social World of ICT4D or "how a frankentechnology is born"

As we haven seen, the official version of informational development adopted in Colombia is another means of spurring informational capitalism. However, there are other versions of infodevelopment which are not heavily committed to pushing infocapitalism (See next chapter). When the social world of governmental ICT4D interact and intersect with these versions it brings something new to the mainstream corporative, neoliberal discourses that dominate e-Government in Colombia. Not all the attempts to create these intersections are successful, as we have seen in the case of making free software an official ideology of the government. But, some of these versions get to permeate the symbolic and material reality of e-Government. The most clear example of this can be found in the incorporation of the software "Internet to Make Government Accountable to Citizens" – IPRC (for its initials in Spanish – Internet Para la Rendición de Cuentas), an integral part of e-government in all of the 1,100 cities, and towns in Colombia.

IPRC is a political and technological development of a Colombian NGO called COLNODO. COLNODO is a technically oriented NGO that designs software and provides ICT services to other NGOs in Colombia. It ideologically identifies itself with the international discourse of ICT4D endorsed by NGOs, through its affiliation with the Association for Progressive Communications (APC). In October 2002, the newspaper NEXUS invited COLNODO to present a proposal of how to use Internet to facilitate accountability processes. COLNODO, being technically oriented, contacted another NGO, "Transparencia por Colombia[68]" with more experience in grassroots-political processes, democracy and citizen's social control to work with on a pilot project that incorporated Internet to these ongoing processes.

One of the mayors that worked with Transparencia, the mayor of Paipa, Rodolfo de Jesus Diaz, volunteered to participate in this pilot. De Jesus, had a local group called the "Convite Paipano por la Integridad" (The Paipa's Invitation to Integrity) that had already implemented a local version of Transparencia's model. Thus, the "Convite" was a producer of information about local accountability that could be posted on the Internet as another channel, parallel and complimentary to public audiences, to document these

[68] Transparencia had already been working with several local governments on issues of government accountability, and they developed a proposal for a social system of government accountability that included the participation of citizens in dialogical spaces where the mayor would present "the State of the municipality." The proposal included a list of themes that needed to be presented and discussed between mayors and citizens in public audiences, among them: advances in the achievement of goals proposed by the mayor's plan of government when s/he was elected, a detailed description of how taxpayers money was being spend by the local government, rationale and procedures begin followed in hiring staff in the city hall, execution of programs by sector (health, education, infrastructure, participation, etc), contracting processes, relations with the local council, etc (Transparencia, 2003). Participation in this program was voluntary, and Transparencia was contacted by several mayors that were interested in implementing this system of accountability in their towns.

processes. COLNODO designed a web application,[69] using free software, to publish all this information on the web page of the municipality and presented the experience as "Transparency in Paipa" to USAID. As a result, USAID financed the extension of this experience to four other municipalities in Pasto[70], Popayan[71], Buga[72] and Rionegro[73]. These processes were always characterized by a bottom-up approach, working closely with mayors and citizens, who volunteered and committed to run the public audiences and to provide the content for the websites. The consolidation of this experience and learning from these socio-technological processes constituted the first version of IPRC.

In many ways, what COLNODO and Transparencia constructed was an alternative version of e-government built from the grassroots. The IPRC engaged representatives of local governments and citizens in a socio-technical experiment of using Internet to improve the existing social dynamics of accountability. In the process local democracy was strengthened and the community found a meaningful use of a technological tool to support this democracy.

The methodology used by COLNODO engineers in developing IPRC was also strikingly peculiar. Instead of engineers representing "the citizen," "the government," and "their needs," turning them into invisible-implicated actors, government, citizens and their needs actually became present as participants of the design. COLNODO engineers worked with citizens and public employees of City Hall to structure the contents of the information about accountability to be published. In the end accountability rested on a social agreement about specific subjects to talk about between citizens and mayors. This agreement was the basis of a structure for the contents of accountability to be published on the website:

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[69] The technology consisted in adapting a Content Management System developed by APC, under a GPL license, to the format agreed between mayors and citizens in their joint work with "Transparencia por Colombia." This technology is free, available online, and can be used and adapted by anyone with the necessary technical skills without paying for licenses or royalties. (http://sourceforge.net/projects/apc-aa/)
[70] www.alcaldiadepasto.gov.co
[71] www.popayan.gov.co
[72] www.transparencia.buga.gov.co
[73] www.rionegro.gov.co

"The tool was constructed collaboratively, it was not a technical process exclusively done by COLNODO … collectively we constructed a tool to facilitate those processes [accountability]. At the beginning, the municipalities complained, because they thought that using Internet just for processes of accountability was too boring, and they wanted to also use it as the web portal for their municipalities … they began to include more elements and new ideas for their websites. Thus, there was something else happening spontaneously. We just began working on a tool for public accountability, and then the municipalities adopted it but they also changed it into something bigger, they also wanted to use Internet to show more about their municipalities …" (Interview with Julian Casasbuenas, COLNODO)

In 2003, "Transparencia por Colombia" donated the first version of IPRC to the program of anti-corruption of the vice-presidency. The Vice-president's office asked the Connectivity Agenda to evaluate IPRC to be considered for implementation as part of the e-Government strategy. Agenda engineers contacted COLNODO engineers and Transparencia and worked together on a second version of IPRC to be implemented nation wide. This second version, defined a unified pattern of graphic and technological design to make uniform all of the web pages of the 1,100 municipalities in Colombia. The web template included IPRC, as designed by COLNODO, integration with PUC, the official tool for contracting processes with the government, and integration with the main web portal of the Colombian state (http://www.gobiernoenlinea.gov.co). Once a standard for municipalities was designed, the engineers of the Agenda decided to implement it in all of the municipalities in Colombia through its program GELT (Territorial Online Government). By 2006, this design was already in place in 619 municipalities (AdC, 2007). COLNODO, with its experience in grassroots work, remained central to this project as an independent contractor of Agenda. It handled technical assistance for the management of the application with Telefonica and trained people who were going to be in the field in charge of teaching public employees how to use GELT in the municipalities (COLNODO, 2003).

The absorption of IPRC into Agenda's project GELT allowed a technology created by a non-profit to go mainstream in the broader strategy of e-Government in Colombia. However, the original techno-political methodology used by COLNODO engineers to develop the structure of the information system was discarded in the process. First, the bottom-up construction of the tool and of political processes of accountability between citizens and local mayors was lost in the process. Now, municipalities became receptors of a uniform technological package of computers, connectivity, and applications, with a standard template of contents to be filled. Instead of having engineers and civil society organizations working along with citizens in collaborative designs for public accountability, both citizens and public employees from municipalities were faced with a pre-configured web tool that they were required to use by the decree of the Connectivity Agenda.

One clear achievement of the NGO, though, was to infiltrate free software in e-government. By adopting IPRC as part of GELT, The Connectivity Agenda also opened the doors for free software to go along with their own proprietary applications like PUC. This technological frankestein is an object that is composed by technical components coming from ideologically different social worlds. Some components come from the non-governmental ICT4D world represented by COLNODO, defender of free software, critic of the neoliberal state and more identified with grassroots work, and some other components come from the social world of governmental ICT4D represented by the Agenda, ambiguous about free software, supporter of the neoliberal state, and more identified with top-down approaches to e-government. Artifacts like GELT show how the intersections between Agenda with actors committed to different ideologies and perspectives of e-Government create loopholes through which e-Government technologies can be shaped by other non-governmental perspectives more closely identified with social values such as inclusion and local democracy. The result is that cooperation without consensus, a long recognized feature in social worlds/arena theory, is also imprinted within technologies. GELT, in this case, is a hybrid technology that works on the basis of cooperation among components that are coming from different social worlds (IPRC from COLNODO and PUC from Agenda). Worlds that among them do not agree about many issues can under certain circumstances, be put together to work towards a common objective, in this case e-government. Technological patches representing conflicting ideologies, dissimilar approaches, different commitments, disagreements, and contradictions fit together in a frankentechnology that is representative of the intersections between dissimilar social worlds interested in contributing to the construction of e-Government.

5.7 Conclusion

An initial interpretation of the role of the Agenda as a central agent in the symbolic and material construction of e-government in Colombia might conclude that the social world these engineer-entrepreneurs are constructing is but an instantiation of a structure constituted by informational capitalism and developmentalism. However, the situation described here is more complex than that.

5.7.1 Situated Engineering

The construction of e-government is also local, situated and shaped by human agency up to certain degree. In the situation faced by Agenda engineers, some elements of the informational capitalism and developmentalism discourse filter into the discourse of the engineers. Among these are notions of the digital divide and technological justice, the modernization of the State by the use of ICT, and the construction of a competitive market by using ICTs in creating a more effective regulator (the unified government or the network government). Some of these notions become constitutive of the situation (structure of action) because they are brought by a conscious commitment of individuals engineers to them. For example, Agenda engineers are explicitly committed to creating the unified government or the network government, and to advance technological justice among governmental agencies. Some other notions of informational capitalism and development become constitutive of the situation for Agenda engineers because the Colombian government has generated commitments to implement developmentalism and neoliberalism. Ultimately, Agenda engineers are also bureaucrats and they need to be compliant with these commitments, whether they agree with them or not. This is evident in their silenced support for free software in the government and their apparent endorsement of technological neutrality. It is also evident in the undesirable use of coercive measures to diffuse their technologies in the government.[74] Within these limits and restrictions, Agenda engineers are able to advance only technological vision of e-government compliant with broader commitments to informational capitalism and development.

Although central to e-government, Agenda engineers are not the only actors in the construction of e-government. Some of the other actors they work with also influence the shape of e-government technologies, such as COLNODO engineers or Telefonica engineers, who bring with them their commitments to other social worlds (NGOs, Corporate Capitalism).

Overall, engineers of the Agenda have developed their own version of e-government that is, in the end, strongly aligned with informational capitalism. Their commitments to technological justice in the government, a vision of a unified network government, and their ambiguous endorsement of technological neutrality move forward symbolically and materially the construction of the neoliberal government and informational capitalism. Their being situated in the bureaucratic field comes with the willing or unwilling commitment to the official neoliberal structure of the government. Thus, the network government being constructed by Agenda engineers is a version of an infocapitalist, neoliberal government: modern, efficient, networked/unified, supporting free market, immersed in business logic, attractive for foreign investors, and a good client of the private sector.

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[74] For most of the engineers interviewed, the use of coercive tools as a resource was something proper of the bureaucratic field rather than something from the engineering field. Agenda engineers, overall, always mentioned that they wanted their technologies to be used because they were good for the job they were designed for. They considered their designs technically sound and they wanted people to use their designs because they were quality tools, not because they were obligated to do so. That was why initially they always attempted to enroll agencies voluntary to use their tools. Because of the way Colombian government works, this strategy is not successful. In the bureaucratic field, the organization of tools, tasks and procedures need to be established by official decrees if it is expected to cover ALL the bureaucratic world, which is the ambitious goal of e-government (the network government).

Agenda engineers construct the reality of this vision in a variety of symbols, discourses, procedures, protocols, standards, infrastructures and technologies. They see themselves as entrepreneurs of social and technological change in the government, enrolling agencies in their technological vision. But, they also see themselves as being unwillingly enrolled by others in broader discourses of bureaucracy and ICT4D they do not identify with. For example, the concept of an "information society" so common at the level of international informational developmentalism is not prevalent in the internal discourses of Agenda's engineers. They do not identify with it. Instead they have committed to a technical vision closer to engineering, that of e-government. However, the social world of e-government is not only constructed by Agenda engineers in isolation and they need to interact with other governmental agencies to design it and implement it, especially with the National Department of Planning (DNP), which approves Agenda's projects and budgets. DNP is deeply committed to ICT4D and it has made it clear in National Development Plans. Thus, the influence of informational development in shaping the work of Agenda engineers has filtered through the obligatory connection Agenda needs to make between its vision and projects and those of the National Development Plan.

Citizens, supposedly the ultimate beneficiaries of e-government, are always absent from the daily life of Agenda engineers. Although present in engineers' discourses and visions, in engineering designs citizens are always interpreted, and represented by the engineer's imaginaries of the citizen. The citizen is merely an abstract category. Her/his behaviors are assumed, and s/he remains a silenced presence in the world of e-government. Underwater, where the big chunk of the iceberg relies and the infrastructure of e-government is being constructed, citizens exist only as imaginary creatures from the surface, who engineers will eventually encounter with in the future. Therefore, the social commitment of Agenda engineers is towards governmental agencies, not towards the citizens. That is why they see their social role in creating fairness and technological justice among governmental entities, not among citizens. This is especially evident if one compares their version of top-down e-government to alternatives created by NGOs, like

COLNODO, who have attempted to construct experiments of e-government from the grassroots.

The technologies created are not just the product of Agenda engineer's agency but the result of encounters with different social worlds, that of non-governmental organizations, that of neoliberalism, and that of ICT4D. Within these interactions and limits, engineers maneuver and exercise their own agency. They propose designs, convince and enroll others in their visions, and attempt to gain more power by positioning themselves in places of power and decision-making in the government. Having helped create the architecture for e-government gave Agenda engineers recognition and a place in government to make this vision a reality, but it only happened because this vision could be integrated with broader commitments in the government to informational capitalism and developmentalism.

5.7.2 Engineering Infocapitalism in the Connectivity Agenda:

This situation I have described makes it evident that Agenda's engineers' have enacted a particular version of the information society, one that is furthering informational capitalism in Colombia. Using Herbert Schiller's conceptual insights to evaluate this version of the information society (See Chapter 2), it is evident that capitalism is being reinforced by the work of Agenda's engineers. Although the work of Agenda's engineers is not to maximize profits in the information market, their work is framed by the national plans of competitiveness that focus on the construction of the infrastructure needed to attract foreign corporations to the country. Moreover, one of the key neoliberal market principles is that government must become one of the best customers for the private sector. E-government is re-structuring governmental entities in a network government. This network, explained by Castells (1996), integrates individual projects into macro-projects of national coverage. In Colombia, this includes GELT, the governmental intranet, and PUC. These macro-projects produce gigantic contracts that are offered to the private sector to implement. Agenda engineers design the architectures of e-government, but its implementation is contracted with the private sector. For example, in December 2006, the extension of PUC to a transactional phase for e-procurement, was grated in a public bidding to a Consorcio SONDA, a Colombo-Chilean private alliance, for $ 2 million dollars (AdC, 2006). Thus, the unified, network government, is also a unified gigantic customer of the private sector.

Paying taxes, fees, or fines online, also requires citizens to use electronic means of payment. This phase is not yet implemented because most of the people in Colombia are not customers of the banking sector or of credit cards companies.[75] Eventually the government will have to offer a channel for poor people and people out of the banking system to be able to make online payments.[76] In so doing it, the government will provide new customers for credit companies and other companies that provide safe payment on the Internet. Thus, poor citizens in Colombia will find a way to become online consumers, not only of government services, but also of the rest of the products and goods available online. In other words, an additional step for e-government is to expand consumerism and the "per-pay" society in the poorest sectors of Colombian society (Mosco, 1988).

One last evidence of the relation between e-government and capitalism in the Agenda, is the diffusion of new technologies and innovations from the public sector to the private sector, as noted in the case of on-demand computing. The collaborative work of Agenda engineers (public employees) and Telefonica engineers (private employees) allows Telefonica to develop and test new business models and new products to be offered to clients other than the Colombian government within a stable environment. Agenda, by assuming risks of investing in innovation of new technologies and business

[75] In December 2006, 51% of Colombian adults (>=18yo) had access to financial services (saving accounts, checking accounts, credit, or credit card) (CIFIN, 2008). In the USA this number is 91% (Solo, Manroth, 2006). Only 18% of Colombian adults had at least one credit card. The poorest people are less likely to have access to financial services. In Bogota, for example, in 2003, of the people without access to financial services, over half (53%) earned less than half the minimum wage and 70% earned less than one minimum wage. On the other hand, of those earning over 4 minimum wages, 84.22% had access and 15.78% did not have access to financial services (Solo, Manroth, 2006).

[76] Pre-paid cards are but one of the options contemplated.

models, externalizes costs of R&D for private companies, like Telefonica, making private R&D less costly for a corporation as big as Telefonica.

Schiller's framework also points out to evaluate the impact of ICT policies and new technologies in the commodification of public information, and in mirroring current social stratifications. In the case of Agenda, at this point it is too early to evaluate if e-government is having a positive or a negative effect in these matters. However, prospects do not look good. The alignment with neoliberal infocapitalism, the exclusive focus on governmental entities, and the exclusion of citizens from the design of e-government do not seem to alleviate the negative effects of neoliberal infocapitalism in society.

5.7.3 Identity

The social world of e-government gave engineers a respected position among engineers and bureaucrats as well, nationally and internationally. They are continually invited to engineering conferences, and e-government conferences. In fact, the Colombian model, considered along with Brazil's model an example for e-government in Latin America, has been constitutive of the Connectivity Agenda for the Americas, a plan drafted by ECLAC (UN's Economic Commission for Latin America and the Caribbean). In 2007, Hernan Moreno, ex-director of the Agenda and current ECLAC's Information Society Expert, Hugo Sin, technical director of Colombia's Connectivity Agenda, and Sergio Silveira-Netto, independent consultant from Brazil, integrated their knowledge and experiences in a conceptualization of architecture for e-government and a platform of interoperability for Latin America (Moreno-Escobar, Sin-Triana, Silveira-Netto, 2007). Thus the Colombian architecture for e-government developed by Agenda engineers is now being used as a basic model for the integration of e-governments in Latin America.

Agenda engineers believe that their identities exemplify a model of excellence for engineering in the public sector. They are proud of being recognized by others as breaking the stereotypes of inefficient, and red tape constrained engineers. They are proud of having created a space for themselves in the private sector where they can be challenged technically and socially, and where they are breaking paradigms of doing engineering in the Colombian government. They see themselves as helping create a new type of engineer in the government: a good technician, an ethic bureaucrat, an entrepreneur, and a socially responsive innovator. It also helps to further these identities that their work has been recognized in the World Bank's and UN's rakings of informational development, ranking e-government in Colombia as third in Latin America, after Brazil and Mexico (AdC, 2008).

6. ENGINEERING THE NON-PROFIT NETWORK

6.1 Introduction

In Colombia since the 1980s, non-governmental organizations (NGOs) and other non-profits have gradually occupied social and political spaces left unattended by the withdrawal of central governments and the disappearance of the Welfare State from local communities. Often NGOs in Colombia identify with ideologies that oppose neoliberalism. They criticize government's lack of identification with local needs and concerns. They also fault the government for overestimating the market as the distributor of the benefits of economy in society and for favoring business interests over the interests of the citizenry as a whole.

Most of these non-profit organizations and NGOs strive to channel national and international aid funds for the defense of human rights and the promotion of development in local, poor communities in Colombia. They initiate programs of sustainable productive activities and denounce abuses to human rights. They also promote political mechanisms to enhance local democracies. However, rarely do they engage in the production of technologies for development by themselves; when they do so, they tend to favor the promotion of low tech approaches using appropriated technologies. Thus, NGOs developing "high-tech" technologies to address the needs of local, poor communities are very uncommon. Those few who dare to take the "high tech" route face criticism from other NGOs for being out-of-touch with the realities of poor communities, developing and deploying technologies that do not respond to cultural realities, development needs and local concerns of poor communities, wasting resources, alienating people and promoting the growth of neoliberalism.

This dissertation identified several NGOs in Colombia that are constructing technological visions that respond to these familiar criticisms. Common to all of them is that systems and computing engineers play a major role in the construction of alternative versions of how to use or take advantage of "high tech" information and communication technologies to accomplish social goals. Moreover, some of these NGOs are led and staffed by engineers rather than by social sciences professionals or development experts. I call these engineers, who are strongly committed to the social world of NGOs in Colombia, NG(o)neers.

NG(o)neers and other engineers who occasionally work with NGOs, engage in four main types of interactions observed during the fieldwork of this dissertation. The outcomes of these interactions, always including design or redesign of engineering technologies, help populate the world of objects (symbols, artifacts, infrastructures) of ICT4D in Colombia. In the first type of interaction, NG(o)neers engage as "NGOs' technical consultants," interacting with other NGOs as their clients. The main goal in these interactions is to design and implement ICTs in NGOs to improve the efficiency of their work with communities. The second type of interaction engages NG(o)neers as "grassroots organizations' technical consultants," interacting directly with grassroots organizations as their client. The main purpose here is to use ICTs to support development goals, human rights and/or social justice in local communities. In the third type of interaction, NG(o)neers interact with other social worlds (i.e. government, private sector) in arenas of design, creating hybrid technologies, which reflect not only the commitments of NG(o)neers but also the commitments of the other participant worlds. A fourth type of interaction occurs between non-profits and corporate engineers. These corporate engineers enter in contact in arenas of design with non-profits usually through temporal alliances. The purpose of these alliances from the perspective of non-profits is to "infiltrate" existing information and communication technologies being used for private purposes, in order to implement social visions endorsed by the non-profits. Arrangements of this kind also take advantage of the now widespread discourse of "Corporate Social Responsibility."

The universe of discourse of ICT4D being produced by NGOs in Colombia is extremely diverse. As in the case of governmental ICT4D (See Chapter 4), non-governmental ICT4D has also been constructed (situated) locally and it has responded to the global discourse of informational development and informational capitalism, connecting to them, but also distancing itself from these hegemonic discourses by being grounded in local conditions, negotiations, interests and ideologies. Each of the ICT4D versions explored in this chapter also presents a symbolic universe that shapes styles of engineering in sharp contrast with those of engineering in e-Government, reviewed in the last chapter, or that of engineering in the private sector. In this chapter, I will explore these ICT4D versions informed by fieldwork done in one NGOs in Colombia: Somos Más, and one non-profit: Minuto de Dios, and primary data collected about COLNODO, another Colombian NGO.

6.2 NGOs in Colombia

Non-Govermental Organizations (NGOs) in Colombia are classified as belonging to the "third sector[77]." They are considered to be a subset of a broader category of civil society organizations, the non-profits or ESALs, by their initials in Spanish ("Entidades Sin Animo de Lucro") (Villar, 2001a). NGOs act as a third alternative between the market and the State for social advocacy or to provide social goods or services for individuals, which are not being produced by the State or the market. As some authors have noted, NGOs are not a monolithic category (Salamon, Anheier, 1997). They differ in size, scope, goals, political ideology, corporate governance, sources of funding, social values promoted, cultural and religious traditions.

During the last two decades of the 20th century Latin America in general, and Colombia in particular, experienced an explosion of NGOs. Virtually non-existent during the 1970s, by 2001 conservative approximations estimated that in Colombia there were over 5,000 NGOs (Villar, 2001a). This phenomenon reflects the gradual transition of

[77] In Colombia, the term "third sector" is used to refer to civil society organizations, understood to be in a different sector than the private sector or the governmental sector (Villar, 2001a).

Colombian government to a neoliberal model initiated in the late 1980s which delegated welfare state functions to the third sector (Olvera, 2003).

The origin of NGOs in Colombia can be traced to the beginning of the 1970s. Between 1958 and 1974, Colombia had a bipartisan system of government (Frente Nacional) that excluded political parties other than the traditional liberal and conservative ones. Citizens that did not identify with either political ideology did not find a channel of representation in the government. This resulted in the creation of different civil society-organizations that grew independently from political parties. During the 1970s, some of these organizations, began specializing in social advocacy and economic development for poor and marginalized communities. These specialized organizations, now known as NGOs, were also characterized for their advocacy of social justice, their focus on local-participative solutions, and their commitment to the poor. In more political terms, NGOs represented a leftist politics criticizing the undemocratic bipartisan government and the incompetence of government efforts in promoting development (Villar, 2001b). Until the 1980s, NGOs would normally take and oppositional position about government's actions and policies. This opposition was very well received among regular citizens concerned about the inefficiency of government in bringing development to their regions.

During the 1980s the relation between government and NGOs became less polarized and more cooperative. The end of the bipartisan system of government, the beginning of policies to decentralize government and the neoliberal policies to privatize state-owned companies, changed completely the political scenario for the NGOs. The marked confrontation between NGOs and government shifted to scenarios of alliances and "partnerships" for governance (See Chapter 4). Former protests and radicalized confrontations gradually dissolved with the inclusion of NGOs into the neoliberal establishment, whether as participants in policy-making processes or as producers/distributors of governmental goods/services to the citizens (Villar, 2001a). Today, very few NGOs, especially those with an elaborated critique against neoliberalism and non-governmental sources of funding, keep ideological and operational distance from the current Colombian government.

The orientation to development and the provision of goods and services for grassroots organizations and marginalized communities opened the doors for some NGOs to specialize in information and technologies for development (ICT4D). Currently, in the non-governmental world of ICT4D in Colombia, there are two kinds of non-profits providing ICT goods or services. One type of non-profit is in charge of appropriation of ICTs in poor communities and is usually committed to the official discourse of the digital divide. In general, these non-profits set up and manage telecenters or channel the implementation of ICT4D projects created overseas, such as the OLPC's XO laptop (Negroponte's $100 laptop). El Minuto de Dios and COLNODO, in Bogotá, for example, are two non-profits that have implemented telecenters in poor neighborhoods. They are in charge of their administration and run programs of computer literacy in the telecenters. Tecnovo, another example of non-profit in Bogotá, provides computer literacy programs for wounded soldiers to find jobs as "knowledge workers."

The second type of non-profit is constituted by a very small number of local NGOs with a strong orientation to R&D, design and implementation of information and communication technologies for development. These NGOs are mainly staffed by systems and computer engineers, or, if they include other professionals, engineers constitute the staff in charge of primary activities around which other activities revolve. For example, Somos Más, in Bogotá, is an NGO mainly constituted and operated by systems and computers engineers. They have designed several web applications, and standalone applications for other NGOs and for grassroots organizations. While the first type of non-profit focuses upon adaptation and assimilation to ICTs developed elsewhere, this second type of non-profit focuses on the creation of new ICTs, or on the redesign of existing ICTs tailored to local, specific needs. Given my emphasis in engineering practices and engineering design, I am more interested in this second type of non-profit. Although, there are very few organizations of this type in Colombia[78], they offer an

[78] During the design of research phase for this dissertation I only found the following non-profits specialized in ICT engineering services/products in Colombia: In Bogotá, COLNODO, Somos Más, Fundación Telefónica, and Fundación Microsoft. Some other attempts to create similar organizations in Colombia had not been successful (COLDI in Bucaramanga, Fundación Para el Desarrollo Urbanístico Económico y Social de Risaralda).

empirical window to a social world where engineering is confronted with alternative versions to those dominant in neoliberal governments and in the corporate world. They also present themselves as a "third way" for the exercise of the profession and offer new insights for engineering professionalism in Colombia, which has existed under the umbrella of corporate capitalism during most of its history (See Chapter 3).

6.3 Constructing the Network Society of NGOs in Colombia: COLNODO and "Somos Más"

A first analytical approximation to what engineers actually do in the social world of non-governmental ICT4D shows that some of these engineers engage in activities of ICT consultancy for other NGOs. When NGOs in Colombia demand services of ICT consultancy or when they need an information system, they usually resort to the private sector where most of this expertise resides. However, some of these NGOs find themselves confronted and frustrated when interacting with private-sector engineers:

> "We [PCS] had a previous bad experience with a private independent contractor, expert in software development and web design to create a website for a grassroots organization. It is not that they did a bad job; it is that we were left in a gap. The grassroots organization said "we want this," and the engineers interpreted it in their way, which was not a good interpretation of what the people wanted. They never offer to the grassroots organization several design alternatives in which the communities could provide some feedback and choose on the best option for them … They [private contractors] were focused on selling us a service, in a situation where the community did not know exactly what the service they needed was. So we were left in a gap with a website that did not satisfy the community." (Interview with Oscar Rodriguez, PCS -Project Counselling Service-)

These NGOs also complain that private-sector engineers do not understand how things work in the third sector or in poor and marginalized communities. They believe that corporate engineers are only interested in selling a product or a service rather than improving the conditions of a community through technical means. NGO workers and grassroots organizations are also confronted with problems of translation when talking to engineers about the kind of technologies they may want. This language gap adds to create a mutually unsatisfactory interaction. In the imaginaries of NGOs and grassroots communities, systems and computer engineers are usually represented by a stereotype that has been reinforced by past interactions with private-sector engineers:

> "For me, systems and computer engineers normally are grumpy and stubborn people. They do not understand about worldly affairs, and one can not understand them either. They have a certain difficulty in understanding … they are too focused on the computer and their world revolves around it … In the end, they make a living out of that, out of administrating information systems in a corporation. They do it not taking into account what people need, but what they consider how things should be ... arrogant people with knowledge that they do not share with others, who speak a different language and who do not want people to speak their language as well … similar to what physicians do." (Interview with Oscar Rodriguez, PCS -Project Counselling Service-, NGO)

> "It is not the same to talk to an engineer than to talk to Rosmira, who is not an engineer. I am a peasant, and I know about farming, because one needs to consider when one is talking to someone with his/her same level or experience or not … so, from that point of view, there are some engineers who come to work with peasants and they get here talking to us in their terms … thinking that they are talking to other engineers, just like them, and they do not realize that they are talking to someone who lives in the 'campo' [country side]. Do not talk to me about traffic lights … talk to me about my river, about my things here." (Interview with Rosmira Salas – COCOMACIA – Choco, grassroots organization)

In this context, a few NGOs have specialized in providing technical consultancy in ICT for other NGOs. These NGOs have usually been created by engineers. They also share a technological vision of having NGOs use "high tech" information and communication technologies to connect with each other in networks of NGOs. These networks of NGO seek to provide an organizational and technological infrastructure to connect offers and demands for goods and services among NGOs. The organization of NGOs in networks also promises to unify the diverse and disconnected offers and demands of Colombian NGOs within single points of access (web portals) for beneficiaries and people interested in volunteering in these organizations. The NGO network also provides an entry point for sponsors and international cooperation aid agencies to find projects and NGOs they could finance, or to keep a high level of communication and online interaction to monitor the progress of ongoing projects. One early attempt of offering ICT consultancy for other NGOs in Colombia came from COLNODO.

6.3.1 COLNODO and the first Colombian Internet of NGOs

In 1985, Julian Casabuenas, a chemical engineer from Las Americas University in Bogotá, was a consultant for NGOs in environmental issues. He was invited to a forum in Peru to present the current state of electronic communication in Colombia. At the time only a few universities in Colombia: University of Los Andes in Bogotá Eafit in Medellin, and University of Valle in Cali had begun technological initiatives to connect to BITNET, an international academic network in the USA. Thus, there was not much for Casasbuenas to present.

While in Peru, Casabuenas joined a group of Latin American representatives of NGOs interested in using modem technology for communication among local NGOs and international cooperation organizations. He also got in Contact with Michael Polman, a Dutch director of the Antenna-Holland foundation, who was already using the international network Interdoc for electronic communication among NGOs. Polman made a formal presentation to all of the NGO representatives and invited them to create a pilot of communication among them on Interdoc. Having committed to connect to Interdoc, Casasbuenas returned to Colombia and attempted to connect through the local national company of telecommunications, TELECOM. After one week of unsuccessful attempts to find how to contract this service, Casasbuenas finally contacted an employee in charge of the service of transmission of data via .X25. In the 1980s, before TCP/IP became the dominant standard to connect different computer networks on the Internet, the protocol of connectivity .X25 was very popular (Abbate, 2000). According to Casasbuenas, the public employee found unusual that a NGO wanted to use this service intended only for private companies (Casasbuenas, 1993). The service provided by TELECOM worked at 1,200 bauds (120 characters per second) and Casasbuenas managed to get a modem that worked at that speed sohe could connect to Interdoc, via TELECOM.

During the following 5 years, Casasbuenas became a pioneer and advocate for electronic communication among NGOs in Colombia. He presented the idea of electronic communication to other NGOs as a cheaper channel than international phone calls to keep in contact with international sponsors and to share information with international peers. As a result, between 1985 and 1990, 20 NGOs connected to Interdoc.

In 1989, Casasbuenas negotiated with Aldato, a local company that offered national connectivity in their own network, to create an independent local network among the 20 Colombian NGOs connected to Interdoc, to exchange data among them without having to pass through international hubs (The hub for all the transmission of data of Interdoc at that time was London). This technological infrastructure constituted the first local, non commercial and independent electronic network in Colombia. This is especially remarkable considering that the first university that connected to BITNET, the University of Los Andes, did it in 1990. By the time universities were connecting to international networks for their first time, NGOs had already been doing it for years and they even had in place a national network connecting 20 different organizations.

Local connectivity and a national hub provided by Aldato reduced dramatically the prices of connectivity for NGOs. However, not too many more NGOs were convinced to join the national network promoted by Casasbuenas due to the technical skills that were required to connect to this network and the prices of the initial investment in technological equipment.

In 1992 in Holland, Casasbuenas, in a conversation with Polman, committed to the creation of a node of Colombian NGOs similar to the antenna network in Holland (Interview with Julian Casasbuenas). He called it COLNODO -Colombian Node-

(www.colnodo.apc.org). In Colombia, Casasbuenas contacted 30 NGOs and convinced them to create a central node where common interest information could reside, e-mail exchange was possible, and where NGOs could share their own produced content and made it publicly available to the other NGOs in the network. This group constituted the foundational base of COLNODO, created at the beginning of 1993. One month after it was created, COLNODO was operating 24x7, offering network connectivity for NGOs. In 1993, this network was operating in parallel to the academic BITNET network of Colombian universities and to the private networks in the banking sector. Collectively, these networks constituted the first wide area networks in Colombia, pre-Internet.

COLNODO eventually began offering its own international communication services via APC[79] (Association for Progressive Communications), an international NGO specializing in information and communication technologies. By connecting to APC, through its node in San Francisco, CA, COLNODO connected Colombian NGOs to the largest international network of NGOs in the world. By 1993, COLNODO had become the official Colombian node of NGOs in the APC network.

In 1994, Colombia connected to Internet for its first time via University of Los Andes. Hugo Sin, employee of the computer center of the university, established the first ISP (Internet Service Provider) in the country at Los Andes (Salcedo, 2002). Two years later, COLNODO switched all its operative systems to free software (Linux) allowing the network of NGOs operated by COLNODO to have access to Internet in a low-cost platform at a time when Internet servers were a luxury for a few. In the process, the network of NGOs transitioned from the protocol .X25 to the now dominant protocol of the internet, TCP/IP.

The global privatization of Internet and the local privatization of the telecommunications sector in Colombia (see Chapter 5) brought prices of equipment and connectivity down. Soon, NGOs had many other alternatives to connect to Internet via

[79] http://www.apc.org/en

private ISPs and COLNODO was forced to expand their scope to other activities and other clients beyond the provision of Internet connectivity services to other NGOs.

The work of COLNODO, connecting the first Colombian NGOs to Internet, began a trend that was going to become more common during the 2000s. And, even though there are still today many NGOs that are not connected to Internet, or which are not part of networks of NGOs working on specific programs, the trend of connecting organizationally and technologically in networks began to form part of the language and discourse of NGOs in Colombia.

6.3.1.1 COLNODO and Development

By helping deploy the infrastructure and by convincing NGOs to connect to the network, COLNODO began to introduce NGOs in Colombia to the language of information and communication technologies for development. Through its connections with international NGOs such as APC and Antenna-Holland, COLNODO and the NGOs affiliated entered in contact with the international discourse of ICT4D. By the time COLNODO was formally constituted as a NGO in 1994, it had already appropriated the informational development discourse defining its mission as the "Strategic use of Internet for Development" (COLNODO, 2008). Several of its projects then began to be aligned with the international discourse of development and ICT4D. For example: COLNODO's project "Unidades Informativas Barriales[80]," developed in 1997, focused in developing telecenters projects managed by local communities to address the "digital divide" in poor neighborhoods in Bogotá. In 2001, with funds from the Colombian government and the World Bank, COLNODO developed a project called "Observatorios Ambientales Urbanos" (Urban Environmental Observatories). This project involved developing management information systems to monitor indicators of the quality of urban

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1.1.1.1 [80] **http://www.colnodo.apc.org/uib/**

environments determined by plans for sustainable development. More recently in 2006, COLNODO was financed by the German Agency for Technical Cooperation (GTZ) to develop an Internet application for Colombian municipalities to monitor their progress towards achieving the Millenium Development Goals.

6.3.1.2 COLNODO and Free Software

In its interaction with other NGOs, COLNODO has also introduced several NGOs to the social world of free software. Free software is software that can be run, copied, distributed, studied, changed and improved without paying for copyrights or asking for permission (FSF, 1996). In other words free software is an intellectual creation in the public domain. Since 1994, COLNODO uses free software platforms of development and licenses its products with a GPL license[81]. They are also active members of the Community of Free Software Users in Colombia (COLIBRI), and they have advocated through this group the approval of a national law for the promotion of free software in the country:

> "We use the GPL license so that people who benefit from our developments do not have to invest too much money on them. This is an element that permits mass distribution of our tools, without having people to incur in elevated costs of software development or licensing of software. We, in COLNODO, definitely believe that the use of free software helps spur the technological development in Colombia." (Interview with Julian Casasbuenas, director of COLNODO)

A strong commitment to free software is imprinted in the technological developments of COLNODO and in the GPL licenses used to protect the free distribution of the software they create for NGOs and other clients.

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[81] GPL (General Public License) licenses are a form of copyleft commonly used for free software creations. GPL uses the established copyright laws to ensure that intellectual works enter into the public domain. It ensures that software code protected under this license is made available to anyone to be used and modified; under the conditions that the resulting product is also protected by GPL (FSF, 2007).

6.3.2 Somos Más: Introducing Virtual Networks to NGOs in Colombia

Another technically oriented NGO that provides services of ICT consultancy for other NGOs in Colombia is "Somos Más[82]." Somos Más is an NGO in Bogotá constituted mainly by systems and computer engineers from University of Los Andes. Somos Más provides technical and organizational consultancy for other NGOs, helping them use ICTs to have an online presence and to use ICTs strategically for their social goals.

Somos Más is a relatively new NGO. It began informally in 2001, as a group of friends from Los Andes University, all of them systems and computer engineers, interested in developing ICTs for the third sector. Two of its founding members, Jefferson Ramirez and Nicolas Martin develop during two years the idea of creating a web portal of online news for NGOs. They called it "NGO ONLINE." The novel idea behind the web portal was that NGOs had to be the ones in charge of providing the content for online news instead of having a central organization in charge of collecting, filtering, editing and publishing the information. This Internet environment of user-generated content is what since 2004 came to be referred to as the "Web 2.0" (O'Reilly, 2005). Given the disconnection and the absence of a single entry point for NGOs to be in contact with similar or other NGOs, the idea of a web portal for online news seemed appropriate. The web portal was also intended for NGOs to have an institutional online presence in order to attract the attention of international cooperation agencies and to provide a sales channel for NGOs promoting fair trade (Ramirez, 2002).

This project was supported by several research centers in the University of Los Andes, especially a research center in social entrepreneurship in the management school called IESO, by COLNODO, and by another NGO called "Opción Colombia." As a result the web portal of online NGO's news was created. During the creation of the

[82] "Somos Más" translates in English as "We are Many More." According to their founding members, they named their NGO "Somos Más" because it connotes their interest in networking NGOs and in helping the third sector to keep growing.

portal, Ramirez and Martin contacted the national federation of Colombian NGOs and conducted several surveys with federation members that concluded NGOs were not only interested in an online web portal of NGO news, but also wanted to learn how to make use of Internet for other operational activities. Thus, Ramirez and Martin decided to formalize their work and were joined by two other engineers and one anthropologist in the official founding of "Somos Más" as a NGO in 2003 (http://www.somosmas.org). In their statement of purpose they defined the orientation of Somos Más towards general ICT consultancy for other NGOs:

> "We want not only to publish NGOs' news [in Somos Más web portal], we also want to help them be more visible, and help them use effectively new information and communication technologies."(Martin, 2003)

In 2006, when the fieldwork of this dissertation was conducted, Somos Más had five computer engineers and one social communicator employed. They had already been engaged in several projects with other NGOs, all of them promoting the idea of creating single entry points for Colombian NGOs to the web, and for people interested in contacting Colombian NGOs. In addition to the online news portal, they also implemented an Internet platform for social networking in the third sector (http://voluntarios.somosmas.org) financed by IESO. The purpose of the social networking website was to connect people interested in becoming volunteers with NGOs offering positions for voluntary work. NGOs would post positions available for volunteer work and volunteers could post their profiles and interests to find a match. Volunteers could also rate their volunteer work in previous organizations and make recommendations to other prospects about specific NGOs, based on their individual work experiences. Since its beginning, Somos Más has focused on constructing networks in the world of the Colombian NGOs, first designing a network of NGOs publishing and news, and later designing a network of volunteering work with NGOs.

In 2006, Somos Más also began presenting itself to NGOs, not only as a group of technical experts developing applications for networking, but also as organizational experts creating conditions useful in socio-technical networks. Somos Más offered consultancy services to other NGOs to work in organizational networks supported by ICTs. One example of this kind of work is provided by a project of Somos Más, in which it was hired by the Foundation Saldarriaga-Concha in Bogotá to create a network of non-profits dedicated to helping people with disabilities in Bogotá.

6.3.2.1 Networking NGOs helping people with disabilities

In 2006, Jefferson Ramírez, Nicolás Martín and Carolina Escobar teamed up to work in the project with a non-profit called Foundation Saldarriaga-Concha. The project's goal was to create a network of non-profits dedicated to provide medical services and rehabilitation services for people with disabilities. The project originated in a study of the Foundation on the state of the medical and rehabilitation services for people with disabilities in Colombia (Saldarriaga, 2003). The report showed that articulation among offer and demand of services from non-profits in the sector was inexistent. The sector as a whole did not have sufficient information about the demand for services to allow the sector to plan accordingly. By the same token, people with disabilities and their families did not have access to consolidated information about the complete offer of services available to them. The sector was also characterized for its absence of alliances between non-profits to complement services for people with disabilities. Therefore, the justification for a socio-technical network of non-profits serving people with disabilities came mostly from a vision of an integrated and unified sector (Saldarriaga, 2003).

In Somos Mas' design, this project, called "Red de Atención a la Discapacidad" (Network of Services for People with Disabilities) had two complimentary components, one organizational and another technological. The organizational component included a series of workshops involving a small number of non-profits who were invited to volunteer for a pilot project. Twelve non-profits responded positively. In these workshops, the goal was to come up with proposals for collaborative projects and to generate commitments from all participants to work together. The technological component included technological diagnosis in each organization to determine their specific technological needs to support internal operations with ICTs and to support a technical network connecting the computers of participant organizations.

The work of engineers was then two-fold. Escobar and Martín were in close contact with each organization, getting to know the way they operated, their interests in networking with others, and the way they were using information technologies to support their daily activities. Ramirez, on the other hand, was in charge of the organizational workshops and pushed for negotiations among non-profits to establish cooperative activities to be successful.

Non-profits, for their part, volunteered for the "Red de Atención a la Discapacidad" because they were invited to participate in it by the Foundation Saldarriaga-Concha, a very prestigious foundation in the sector serving people with disabilities. They were also attracted to the pilot because as part of the project, Somos Más was going to run participatory technological diagnosis in each of the organizations and produce reports for improvements in each non-profit. In addition, Saldarriaga also provided other specialized consultants in processes of certification required by the Ministry of Health. In other words, it was a free consultancy that non-profits definitely could use.

Participants were expectant about the possible outcomes of creating a network sponsored by the Foundation. Some of these non-profits already had an informal network in place, called REIRI[83]. In this network, a few small non-profits informally shared their expertise and equipment to attend collaboratively their clients. For example, if one of the non-profits needed to use a laboratory or a machine, owned by another non-profit in REIRI, to administer a medical exam on someone with a disability, this non-profit could

[83] REIRI stands for "Red de Instituciones de Rehabilitación Integral" (Network of Institutions for Integral Rehabilitation). REIRI was created in 2001 by a group of 10 non-profits working in attending people with disabilities facing the governmental imposition of tax. Working along with a Colombian Senator with disabilities, REIRI achieved for them and similar non-profits a tax exemption. Since then, it continues existing and developing other common projects (Interview with Doralisse Vallejo, member of REIRI).

use the services of this lab or machine. The same was true for expertise. For example, one non-profit in need of assistance in IT matters and without technical staff of its own could use the services of a systems and computing engineer working for another of the non-profits in the network without paying extra for his/her services. The informal arrangements to make this social network work grew organically from friendship ties among the directors of the non-profits involved.

Several of the members of REIRI accepted the invitation to participate in the "Red de Atención a la Discapacidad", and they had their technological diagnosis performed by Somos Mas engineers. This technological diagnosis was a participative process of identification of informational needs that could be satisfied with the use of ICTs. During the diagnosis, members of REIRI voiced their preoccupation with perceived imperialistic intentions of the Foundation to take over its pre-existing network (Interview with Patricia Arias, Palway). They also believed it difficult to network with some of the other non-profits participating in the project, some of which were very large and did not have anything to gain from collaborating with other smaller non-profits (Interview with Doralisse Vallejo, Fundación Niñez y Desarrollo).

Somos Mas engineers in close contact with the small non-profits took into consideration these preoccupations and dropped the initial idea of creating a new network of non-profits serving people with disabilities from scractch. Instead, Somos Mas engineers focused on the more realistic outcome of strengthening the pre-existing REIRE network and developed an information system to be used as common platform of communication among the previously existing participant organizations (http://www.redreiri.org/).

This project by Somos Mas, framed in the typology of interactions with other NGOs, shows that creating socio-technical networks in the non-governmental social world is strikingly different from the equivalent work done in the governmental world reviewed in the last chapter. NG(o)neers working within the social world of NGOs, as happened in this case, do not use coercive measures to create and sustain their networks, as Agenda's engineers often did. Creating a "unified" and voluntary network of non-profits by design is daunting task even when one uses bottom-up approaches. The participating non-profits were reluctant to work in a network that had not grown organically from them, but that seemed imposed from the Foundation Saldarriaga-Concha. To support technologically REIRE, a pre-existing social network of small non-profits, proved more useful for Somos Mas engineers than creating the new organizational network intended by the Foundation. In addition, top-down approaches to create and implement designs of networks are very likely to fail in the world of non-profits, where central hierarchies structuring relations among organizations, such as those in government, do not exist. As illustrated here, the bottom-up, organic processes of networking are more likely to succeed when common interests and collaborative activities are required. Here again, the role of NG(o)neers involves the identification and support of existing, home grown, networks of non-profits with information technologies.

6.3.3 Consultancy of ICTs for NGOs

Both NGOs, COLNODO and Somos Más, have by now created a lasting image of themselves within Colombia's third sector. They are seen by other NGOs and ESALs as groups of engineers that are tuned into the reality of the third sector and have the technical expertise to tailor appropriate solutions for specific non-profits. They are seen as engineers with strong social commitments, ones difficult to find in the private, economic sector or even in governmental agencies.

> "They [Somos Más] understand the social sector, they understand this pandemonium … that is different to other engineers I have worked with in the past in the public sector, who are more specialized in operative tasks." (Interview with Soraya Montoya, Fundación Saldarriaga Concha)

> "It is very pleasant to find that there are engineers with social sensibility, and that are committed to this type of work, and it is not the commitment that generates a

> contract for the selling of services, but it is a different commitment with the organizations of the third sector and the civil society." (Interview with Oscar Rodriguez, PCS)

Their ongoing concerns and commitments to using ICTs for development, and their commitments to the social world of NGOs have distinguished these ICT engineers from those of the private and the public sectors. This is something that can be observed in their language, their interactions, their ideologies, their interpretations of the social, and ultimately in their technologies. In the process, some system and computer engineers have found a new niche to do a different type of engineering committed to the "social sector," a vocation that did not exist in Colombia before the 1990s. NGOs have also found that there exist NG(o)neers who speak their own language and share with them the similar motivations, goals, and anxieties.

6.4 NG(o)neers in the fieldwork: Engineering and participant observation

A second type of interactions performed by system and computing NG(o)neers in Colombia is that of ICT consultancy for grassroots organizations. This activity is different than the previously mentioned activities of ICT consultancy for other NGOs. Here there are normally two clients. One is the sponsor financing the work done by NG(o)neers in the field. These sponsors can be agencies of international cooperation, international or national ESALs, government agencies, or private corporations. Sponsors sub-contract with NG(o)neers in the development of technical artifacts and infrastructures that are going to be used by grassroots organizations or communities. The second client is the ultimate user of the technology to be developed, the community itself. I distinguish activities of this kind because they require direct contact of

NG(o)neers with the otherwise implicated actors of development: poor and marginalized populations.

NG(o)neers in Colombia have constructed an image of themselves as effective translators between the social realities of the third sector and the technical possibilities offered by ICTs. This experience and know how makes NG(o)neers preferable to NGOs over corporate engineers, available in the private market, when technical services for their beneficiaries are required. One example of this type of activity, involving COLNODO and direct contact with citizens in several municipalities in Colombia, was presented in Chapter 5 (the initial pilot of IPRC). In this section I will present a case in which Somos Más was hired by the Project Counseling Service (PCS), an international consortium of European and Canadian cooperation agencies, to provide general help for introducing ICTs to a grassroots organization in one of the poorest regions in Colombia: Choco.

6.4.1 Choco and Cocomacia

Choco is a region in the Colombian Pacific, bordering Panama. It is characterized for its dense tropical forests and for having the highest pluvial precipitation in the world. These geographic conditions have historically made it sparsely inhabited. During the colonial period, towards the end of the 17th century, gold mining in this region attracted a few colonizers, who brought with them African slaves for the required labor. By the end of the 18th century, Choco was largely inhabited by descendants of these slaves. Circa 1778, 40% of Choco's inhabitants were black slaves, 20% were freemen of all colors, 35% were Indians, and less than 5% were white (Palacios, Safford, 2002). Since, 1852, when slavery officially ended by law, Choco has continued to be the only region mostly populated by afrocolombians in Colombia. In 2005, 73.1% of its inhabitants were afrocolombians (DANE, 2005).

Today, Choco is one of the regions in Colombia with the worst conditions of human living. While, overall, in Colombia 27.7% of its inhabitants live with unsatisfied basic needs, in Choco 79.2% of its inhabitants do so (DANE, 2005). In 2007, the economy of the region only added 0.4% to the national GNP (DANE, 2007).

Geographically, Choco is not distant from big urban centers in Colombia, like Medellin and Bogotá. However, the corruption and disinterest of the national government in the region has impeded the construction of paved roads from national urban centers to the biggest concentrations of population in Choco. Thus today's ground transportation between Bogota and Choco's capital city, Quibdo, takes over 20 hours on unpaved roads. All of these conditions have historically factored in to make this region one of the most neglected and abandoned regions in Colombia. During the 1990s, the Colombian armed conflict translated to this Region having disastrous consequences for local peasants and Indians in the region, who found themselves in the middle of a conflict between the guerrillas and the paramilitary groups. This conflict has taken the lives of many locals, removed people from their lands, and has imposed a constant state of fear in the region. The national government, on its part, has not only neglected this region but it has made things worse over the years by siding with corporate interests that have attempted to take over peasants' lands. These governmental injustices and the constant threat of guerrilla and paramilitary forces caused Chocoano peasants during the 1980s to organize for civil resistance in an organization called COCOMACIA (Consejo Comunitario Mayor de La Asociación Campesina Integral del Atrato).

COCOMACIA is an association of 120 different communitarian councils of peasants and fishers in the Choco region. It began as a civil resistance organization of afrocolombians from Choco that reacted to the land policies the Colombian government instituted in 1982 (COCOMACIA, 2006). These policies attempted to hand over traditionally-occupied peasant's lands to private corporations interested in developing industrial agriculture in the region.

> "COCOMACIA is born from internal refugees and other peasants from the middle Atrato region. We were unattended by the Colombian State and we suffered the invasion of our lands by lumber corporations and multinationals in territories that we considered were property of our communities, property of our ancestors, inheritance of what they had left to us. In that moment [1982], the State had been granting permits and concessions to our lands without asking us, without consulting with us … they covered behind an old law (Ley 2 de 1959) that had declared our territories as 'national vacant lands' to grant from Bogotá concessions to exploit the natural resources without consulting with the communities that for generations had taken care of these lands." (Interview with Nevaldo Perea, director of COCOMACIA)

In 1988 after continuous mobilization, COCOMACIA got from the Colombian government a collective land title for 800,000 hectares for the afrocolombian communities of Choco and a cancellation of the concessions given to the lumber corporations (COCOMACIA, 2006). In 1993, a Law of the Republic (Ley 70 de 1993) recognized COCOMACIA as an autonomous and legal political organization of afrocolombian and indigenous communities in Choco in charge of the administration of the collectively owned lands, now labeled as "tierras de las comunidades negras" (Lands of the black communities). According to the Law, every one of the 120 community councils of COCOMACIA had autonomy over the use and administration of their lands. Every council is also responsible for the protection of the collective ownership rights, the environmental protection of the natural resources and the internal resolution of minor conflicts among their members over the collective property. Currently, the organization[84] develops plans for environmental protection, and programs of education and health for its members. COCOMACIA also continues to denounce human rights violations in the region.

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[84] http://www.cocomacia.org.co

6.4.2 COCOMACIA, PCS and SOMOS MÁS

Since 1999, Project Counseling Service (PCS)[85], a Euro-Canadian cooperation agency, established a continuous and ongoing relationship with COCOMACIA to run programs of humanitarian help for internal refugees in Choco. By 2006, PCS interventions also included components of organizational strengthening that attempted to improve on the organizational capacities of COCOMACIA and to provide funds and political support to advance the defense of the rights of afrocolombian communities over their territories threatened by both the guerrilla and the paramilitary forces.

Part of the organizational diagnosis that PCS ran on COCOMACIA in 1999 concluded that the organization lacked formal procedures for the administration of its resources and any effective mechanism to track the use and destination of their expenses, mechanisms necessary to be accountable to its members and sponsors (Interview with Oscar Rodriguez, PCS). In response, PCS then financed a consultancy in COCOMACIA to formalize its administrative procedures. The restructuring of the administration also included in 2004 a communications strategy for their internal and external communications (Interview with Oscar Rodriguez, PCS).

PCS worked along COCOMACIA to develop an internal communications strategy that included a local newspaper (revista El Atrateño), and a radio-magazine in a radio station of the Choco Technological University. Such traditional media were going to be used to communicate COCOMACIA with their own members in villages and settlements in Choco. The external communication strategy, necessary to communicate with sponsors, international agencies for the

[85] http://www.pcslatin.org

protection of human rights, and the national and international general public, included intense use of new ICTs.

> "They had fax, telephone, a few computers, and e-mail … but everything was used wrongly or it was under-used … that made difficult to monitor our project with them. The telephone did not work, we could not send a fax … or if the fax was sent, then it was delivered to the wrong person, e-mailing just did not work … only by interacting face to face something could be done … they also had troubles finding their own documents" (Interview with Oscar Rodriguez, PCS).

Because sponsors visit the region sporadically, and PCS headquarters in Colombia are in Bogotá, ongoing communications needed to be forged by technology. Otherwise, monitoring of activities for PCS would be too costly, involving travel to the site constantly, which in Choco means to fly to the capital, Quibdo, and then to spend hours in non-paved routes or traveling by boats on the river. Thus, PCS decided to finance an ICT consultancy for COCOMACIA and chose Somos Más to do the job due to its expertise in ICT for organizations in the third sector.

> "We did not want to hire an expert in ICTs that could guarantee us a technical product, but who could not guarantee us meeting COCOMACIA's expectations. Somos Más offered that to us, and we thought that it was the best offer we had … They had an expertise in working with organizations in the third sector and they offered to us a service according to the demands of COCOMACIA, understanding their own specific situation … we also had many points in common such as their orientation to capacity building in organizations of the third sector to use ICTs … When talking to Somos Más engineers, I was not talking with a just graduated from systems and computing engineering from Los Andes or La Javeriana, who know mostly about technology, but I was talking to people who in addition to their technical expertise, also shared my same social and political interests " (Interview with Oscar Rodriguez, PCS).

The common social and political interests of PCS and Somos Más made it useful for Somos Más to apply their technical work with social organizations.

Somos Más methodological approach to ICT consultancy for non-profits and grassroots communities expresses their commitment to the growth of the third sector. Somos Más engineers see themselves helping in this process by promoting the efficient use of ICTs in non-profits and grassroots organizations. The approaches of both, PCS and Somos Más, shared an emphasis upon capacity building. Somos Más approach includes intense contact with the everyday conditions in social organizations, collaborative and participative design, and continuous coaching during the design and implementation of the ICTs. Their focus is on strengthening social organizations rather that on producing and selling technological artifacts.

> "[In their project in Choco] Somos Más aimed to develop organizational capacities to make efficient use of ICTs. Not teaching how to use technology, because that is achieved with training, but creating a context to appropriate technologies. We did not want to leave installed capacity in a technological infrastructure with people that know how to use the technology, but do not appropriate it and use it to defend their territory and their human rights … we could have hired a private company in Quibdo to install an electric and data network in COCOMACIA, but that was not what we wanted or what is was needed" (Interview with Oscar Rodriguez, PCS).

To do the job, Somos Más dedicated three of its engineers for this project and sent one of its engineers from Bogotá to live in Choco for more than seven months. This enabled close proximity with locals to identify clearly their interests and to keep a constant presence during the implementation of the technology and during the first months that the technology began to be used by COCOMACIA members.

6.4.3 "Asesoria y Acompañamiento"

Since the beginning of the project in COCOMACIA, Jefferson and Nicolas decided that one member of Somos Más was going to reside in Choco, for the whole duration of the project (seven months). Carolina Escobar, systems and computer engineer traveled in July 2005 to Quibdo, capital of Choco, where the headquarters of COCOMACIA are located. Since Escobar got to COCOMACIA, She began to insert herself into the daily activities and life of the organization.

> "It was basically … being there. Being there, to see if what one was doing or wanted to do was going to be useful or not. To see if they were interested or not … it was being inside, living, and seeing from their perspective how things are." (Interview with Carolina Escobar, Somos Más)

The idea behind "being there" was to be present in the organizational life. Gradually, Escobar entered into daily social interactions with peasants of COCOMACIA, and began learning more about their concerns and perspectives.

> "The interaction is above all communication. It is speaking the same language. It is difficult, but it is something necessary in these kinds of organizations that do not have too much experience with ICTs in their daily activities. So, when you get to those organizations, the first thing to do is to engage in conversations, and to catch up with their language." (Interview with Carolina Escobar, Somos Más)

Escobar began speaking the language of the social world of COCOMACIA and she also became a regular presence in the organization. In the process, she also had to adapt to the cultural specificities of the region, strikingly different from her urban life in Bogotá.

> "I had to adapt to their routine, their times and their customs. I learned that I could schedule meetings at 7:00 a.m. because nobody is going to make it. So, I decided to start working from 7:00 a.m. on my own doing something else, and after 9:00 am I knew I could schedule meetings." (Interview with Carolina Escobar, Somos Más)

She also began to draw upon elements from her conversations as well as observations of the dynamics of people interacting with their communication systems and to formulate requirements for a new information system:

> "It was like listening to their needs in their language. When they complained 'ay, we are tired of using diskettes and have viruses here, viruses there,' we translated that complaint into a technical requirement that was to build an infrastructure, a data network." (Interview with Carolina Escobar, Somos Más)

Detailed specifications for the network also came from her observations and her daily contact with members of COCOMACIA. For example, Escobar noticed that whenever the "aciaticos" (as members of COCOMACIA called themselves) needed to print something, they would use diskettes to save the data from their computers and then take it to the secretary for her to print from the diskettes, making the secretary's office a bottle neck for printing. This was also translated as a requirement for the information systems that should allowed computers connected to an internal network to share common resources such as the printer.

The influence of culture was also evident for Carolina in the way she observed aciaticos communicate among themselves during work hours. Aciaticos have lived most of their lives in small villages by any of the streams of water feeding the Atrato River. Living by the river and in open spaces they are used to speaking loudly in order to communicate with other people, sometimes across rivers and streams. Thus, in COCOMACIA Escobar found common that whenever someone needed to contact someone else in another part of the building, s/he would just shout out loud her/his name. If they were not accessible by this means, they would resort to make a local call, which also because of the influence of an oral tradition could quickly become an expensive means of communications. Several offices in the building had access to a fixed telephone line. Thus, it was not uncommon to find aciaticos calling other aciaticos by making local calls. Aciaticos, with a strong traditional oral culture, very often engage in long conversations. Thus, COCOMACIA's telephone bills were ultimately reflecting this.

The way aciaticos tried to control their telephone costs was by delegating the responsibility of monitoring phone calls to the secretary. This made her work difficult in several ways. First she needed to move around the building from time to time checking on others' use of the telephone. When confronted with a long conversation she had to let the other people know that s/he was wasting some of the resources of the organization and convince her/him to cut down on phone calls. In the process, the secretary had to leave other activities unattended and would often engage in uncomfortable supervisory frictions with other aciaticos.

When Escobar arrived to COCOMACIA, she observed this dynamic and noticed that telephone bills were a common complaint in executive board meetings. The secretary was often blamed for not controlling other people's behavior.

> "The board would say to the secretary: "Cecilia, you are the secretary, control the phone calls, nobody can take too long on the phone." So, when Cecilia noticed that someone was taking too long on the phone, she would confront the caller. Sometimes this person was a member of the board and would not even pay attention to her." (Interview with Carolina Escobar, Somos Más)

From all of these daily observations, attendance to meetings, and conversations with aciaticos, Escobar identified situations that the locals found as uncomfortable or undesirable, ones that could be addressed by technological means. A first design of hers was that of a network infrastructure for voice and data and an internally regulated electric network for electronic devices. The voice and data network would provide a local area network (LAN) to connect COCOMACIA individual computers among them to shared scarce resources, such as printers. The LAN looked to eliminate viruses and to speed up the sharing of data among individuals by eliminating the use of diskettes to share and mobilize data. It also aimed to eliminate bottlenecks that overwhelmed the secretary with cues of people, diskettes and print orders.

Including voice capabilities to the LAN and to the central server also offered the technical possibilities for creating a local telephonic network and computationally controlling telephonic conversations. This design addressed a reduction of costs in the telephone bill due to the elimination of local calls within the organization, and the use of a timer. The timer, residing in the network server, would keep track of external phone calls and it would monitor their duration. A system of alarms (beeps) would indicate whether the phone call was taking too long, and after several warnings it would drop the call.

When Escobar presented her design to the COCOMACIA board for its approval, she had collected information from observations, telephone bills, board meetings, and conversations with aciatiacos. She highlighted to the board the savings that this design could bring to the organization, already struggling with its budget. She also had the support of the secretary, a member of the board, who suddenly saw herself no longer in charge of the task of supervision and control of telephonic conversations. The board approved the design and focused on determining how long external conversations had to be before being dropped by the server. They settled on four minute long conversations. In a short period of time, after the system was implemented, telephone calls got shorter and telephone bills dropped.

> "They stopped making one-hour long phone calls, and replaced them with one, two, and three four-minute long calls to the same person, because they would get tired of dialing the phone too many times … frictions among board members due to control of phone calls also disappeared. Now it was not Cecilia on top of everyone scolding them, and the others talking back to her, but it was more like "eh, … this telephone cut my call." So, there was no blame on anyone." (Interview with Carolina Escobar, Somos Más)

In the process a technological system for controlling phone calls was incorporated, replacing social monitoring with technological constrains. Escobar's design was the result of her technical translation of the social life of the aciaticos in their organization. This design was not imposed unilaterally; it needed to be approved by the board of COCOMACIA. By the time Escobar presented her design, she was able to use the aciaticos language and interpret the benefits of her technological design from the aciaticos' perpectives and interests. When presented to the board, her design pointed out to specific concerns aciaticos were dealing with on a daily basis. It offered them technological solutions ultimately accepted by the board due to promised reductions in costs as well as the elimination of irritating face-to-face control of behavior of the organizations members.

The functionality of the network was influenced by the deep immersion Escobar had in COCOMACIA's social life. So was the form of the design. When Escobar subcontracted a firm to install the physical infrastructure of the network, she gave them detailed specifications about the required height of the cable raceway mounted on the walls that reflects an insiders' perspective. This is evidenced in her positioning of the cable duct on the first floor and the second floor of COCOMACIA's building.

During her long stay in the organization, Escobar noticed that the first floor was affected by three agents that could interrupt the normal operation of the network: rats, rain and the Atrato River. Rats and floods on the first floor -from the constant rains or seasonal flooding from the river- required raising the standard height of the wall conduit from the floor, otherwise rats could destroy the cables and water could interfere with the provision of electricity in the building. On the second floor, the main issue to consider was humidity. Several walls on the second floor were severely affected by humidity, so Escobar had to design pathways for the wall conduits and the cable raceways that did not affect the structural integrity of some of the walls. Thus, rats, rain, the river and humidity were among the non-human actors that, from Escobar's perspective, influenced the positioning of the physical network. If an independent contractor from Bogotá would have been hired to install the network for COCOMACIA, the contractor would have come for a few days and would have installed a network according to the standard specifications of the industry. This approach, however, would have missed all the critical elements that Escobar included in her design due to her experiential knowledge of the conditions of life in COCOMACIA.

6.4.3.1 Participatory Design

During the training, the aciaticos learned how to use the technologies and they told Escobar about explicit requirements they wanted to see implemented in the new system. Escobar included these as functional requirements of the system making the design process participatory. For example, during the training on Internet and web pages, the aciaticos noted that the way they were feeding their current web site was troublesome. They had a website, which it was hosted in a server in Bogotá, and it was managed by a system and computer engineer also in the capital city. Whenever they wanted to change the content of the web site, they needed to send the content via fax or by phone to the engineer and he would post it on the web page. This burdensome process made very sporadic and unlikely the change of content in their webpage.

> "We identified that we had a web page in which providing new content was too difficult. We produced the content, but we had to send it to Bogotá for someone to include that content in the web page. That was a change we wanted to have and Carolina provided us with a solution so that any of the secretaries or any of the board executives, who already knew how to use a computer, could update the web page for our publications." (interview with Santiago Palacios, COCOMACIA)

The solution was to implement a local web server in Linux that would host the web page. The server would also provide a content manager system, developed by Somos Más from free software, so that a few internal users could be authorized to use this easy-to-use program, similar to a word processor, to produce new and update content without having to pass through intermediaries. Escobar worked with the executive board in the preliminary and final designs for the website[86].

Another element of design explicitly provided by the aciaticos was to improve their limited connectivity to Internet, previuosly constrained to just one computer for the whole organization, connected via modem. In the design of the network, Escobar had to

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[86] http://www.cocomacia.org.co

negotiate a corporate dedicated line with the local internet service provider, TELECOM. She negotiated a fixed rate on a broadband permanent connection to be managed by the central server in COCOMACIA. The server would become an Internet proxy offering permanent Internet connectivity for all the computers in COCOMACIA's network.

> "Now, we have all the computer connected to Internet and we pay a fixed monthly bill … we did not know that was possible … that is very good for us, because now everybody can connect to the Internet and we are not worried that it is going to generate extra costs, because now we now exactly how much we are going to pay monthly for Internet." (Interview with Santiago Palacios, COCOMACIA)

The aciaticos' demands were made from an increasingly sophisticated sense of technological possibilities. As Escobar listened, the design process opened new doors for aciaticos to influence the shape and content of their own technologies. Escobar's evolving design included also the aciaticos' perspective, not only Escobar's well-informed, but ultimately, individual perspective as master designer.

6.4.3.2 Coaching the aciaticos

During several months after the network was installed, Escobar also ran some training programs with all of the members of COCOMACIA to make use of the network, website, email programs, and web surfing. The aciaticos got used to seeing Escobar. They work with her everyday and increasingly regard her as one of them:

> "Carolina was another aciatica. We saw her as another member of our organization. She was here constantly in front of her work, always being kind, being patience, and having the attitude to adjust to our different commitments. We always had a special relationship with Carolina." (Interview with Nevaldo Perea, COCOMACIA)

In addition to the training Escobar provided, she also observed aciaticos using the voice and data network, and the content management system. Whenever they had a question, she was there coaching them in how to use the artifacts. Whenever she noticed that aciaticos were not fitting the disciplining required to use hardware and software, she was also there to correct behaviors, such as using the wrong electric plug for artifacts requiring regulated electricity, or leaving bottles with liquid on the cable raceway mounted on the wall.

To ensure that the infrastructure was going to be sustained, maintained and developed further locally, Escobar, with the support of COCOMACIA's executive board, contacted the program of teleinformatics engineering of the Choco Technological University. She advised the university to establish an alliance with COCOMACIA to create an internship in COCOMACIA for undergrad students interested in computer networks, web servers or organizational informatics. With university approval and with the presence of one of their professors also a member of the COCOMACIA as a supervisor, the internship began in 2006 with four senior students.

6.4.3.3 Gender in the Encounter of Social Worlds

Bringing the social world of academia in Choco to COCOMACIA, was another encounter that made different perspectives reflect on their own positions. The four undergrads were two male and two female students of teleinformatics engineering. Escobar gave them an initial training in the infrastructure, just before she was about to return to Bogotá. They took charge of the maintenance of the network, the web page, and the training for other members of COCOMACIA. In informal conversations with the interns, one of the male students commented on the job done by Carolina as something he would have expected coming from a male engineer rather than a female engineer. His way of expressing this was saying that "she works like a man." When the two male interns were interviewed about their expectations in terms of gender in their profession, they said:

"I see women in systems and computer engineering and telematics more in a role of management, administration and desk-related work. I do not see them tinkering, programming, or working installing and operating computer networks. Carolina is the first woman that I have seen doing that. I have never met any other woman who liked that. You see them more here on theoretical aspects of the career, in the rhetoric of it." (Interview with intern, COCOMACIA)

In fact, when splitting the work for the internship the practitioners assigned themselves to a gendered division of labor. The two male students went to work to the systems office with the server and assuming responsibilities on the management of the technology, and the two females got in charge of coaching and training aciaticos in the use of technology. For the female engineers, however, contact with Escobar brought different perspectives from that perceived by the male engineers. In my interviews with them, the female engineers were clear that the role of women in systems and computer engineer was by no means any different from the role of male engineers: programming, designing and installing computer networks and, so on. However, what they saw in their interactions with Carolina was that she showed an additional dimension of systems and computer engineering that was not previously evident for them, namely that of benefiting social and communitarian organizations:

"I used to think that as a teleinformatics engineer, I was going to earn lots of money by making software, networks, antenna connections, and I did not see how I could benefit other people without the means to access information technologies. After working with Carolina I have realized that by training and designing solutions of communications and connectivity I can enrich my career both professionally and socially, doing social work, if I can put it in those words." (Interview with intern, COCOMACIA)

The encounter with Escobar, then, brought up different interpretations for the male and the female interns. The male interns understood the situation from a perspective influenced by a gendered division of labor. The female interns saw it as an endorsement of the social role of engineering. It is also interesting to note that even though the males' female stereotype was not shared by the female interns they ended up performing it in the practice of their internship. The encounter of Carolina Escobar, a female engineer from Bogotá, with the interns, afrocolombian senior students of teleinformatics engineering in Choco, showed strikingly different ways of understanding the roles of engineers in these two regions.

6.4.3.4 "Asesoría y Acompañamiento"

At the end of her intervention in February 2006, the work done by Somos Más, represented by Escobar in Choco and Martin in Bogotá, was evaluated by the board of COCOMACIA and by a comptroller from PCS. It showed satisfactory outcomes for all the participants involved. PCS from Bogotá, for example, saw a dramatic change in their communications with COCOMACIA in Choco. The aciaticos began using and checking their e-mail continually and the telephonic communication with between PCS and COCOMACIA had improved.

> "Until now what we invested on the infrastructure has not been lost. The aciaticos are using it and they have appropriated the technology … it has been one year since the voice and data network began working, and ever since we have kept a fluid communication by Internet. When I go to COCOMACIA, I see the network working, and all the computers are using the net. That did not exist before. Several aciaticos are now using the computers, and some of them are not even fully literate … the secretaries are managing data from the server, the use of the telephone is now regular and there is a responsibility in taking care of the electric internal network and the infrastructure … when I send them an e-mail, they answer me back very quickly … so it is working." (interview with Oscar Rodriguez, PCS)

The aciaticos had also been using the Internet, especially their own webpage to further their original mission of the defense of their territory and human rights of their members. The posted news about internal refugees, violence and persecution of peasants and indigenous people by the guerilla, paramilitary or State forces:

> "With the network and the web page we have speed up the way we communicate with others. It is not the same as before. For example, with our commitment to the defense of human rights, we constantly need to make public and to denounce violations to human rights in our communities. Now, we can post our denunciations on the web page, or send e-mails immediately without intermediaries, letting the world know, nationally and internationally what is going on in our region. This is for us, who are poor, an invaluable means to spread information and protect ourselves, because once our collaborators know what is going on they can come quickly to where any difficult situation is happening." (Interview with Rosmira Salas, COCOMACIA)

The main methodology of Somos Más behind their work, know as "asesoria and acompañamiento" (consultancy and coaching), was considered critical for the success of the project, both by COCOMACIA, and PCS. Both organizations saw this as the right methodological approach to develop a technological project in a grassroots organization. Having an engineer living the reality of the organization, being connected to their needs, allowing participation in the design of the technology, and being present during the whole process were considered some of the strongest points in the work done by Somos Más in Choco. This methodology was considered also to be in tune with the way social organizations work.

> "I think that due to her previous experiences with social organizations, she knew about the methodology of the social organizations. She knows about our work, and our difficulties, because she is also immersed in the same system … when you work with people with technical knowledge, who know a lot about informatics, but who have not worked with social organizations, it is very difficult to understand their methodology … In COCOMACIA, she [Escobar] understood her job and our job, she understood the way we work. That was why we had a very good mutual understanding." (Interview with Santiago Palacios, COCOMACIA)

Overall, what engineers at Somos Más call "Asesoría y Acompañamiento" (consultancy and coaching) when identifying their methodology, can be compared to an engaged, ethnographic approach to ICT design. Different from “rapid” ethnographies, now common in design companies and ICT design firms (Norman, 1998), the engaged ethnography, as developed by Escobar, required a deep immersion in the cultural and organizational life of the community to be served by design. It also required a commitment to different politics of representation. “Rapid” ethnographies can be done in short periods of time (days) and keep a distant and “objective” reading of the social and cultural world of the targeted user of design (the other). The engaged ethnography, followed by Somos Más engineers, requires a more intimate contact with the social world(s) of the people being served by design. This approach demands that the designer, in some ways, “go native.” S/he needs to learn the language, the customs, and participate in the cultural and organizational rituals of the community. Belonging to the same social world of the third sector (social organizations, as they are also called in Colombia), has also helped these engineer-designers to develop attitudes and dispositions towards social interaction with their peer organizations. This includes a disposition to avoid technical jargon and to develop empathy with the social goals of their clients, which is interpreted by some of their clients as a “spiritual connection” (Interview with Adriana de Los Rios, SPB).

“Rapid” ethnographies of design are also basically oriented for the mass market and they represent a “generalized other” with needs to be attended by design, keeping their users as invisible, implicated actors rather than as active agents in the design process. On the other hand, in the approach followed by Somos Más of engaged ethnography, the aim is to tailor a design to the specific realities and needs of an organization or community. Both designers and future users of the design become present and visible in the design process, representing themselves in an arena of design. In this politics of representation, several perspectives are present and visible, including that of the intended users, and all of the perspectives can be changed in the process. Through a process of mutual change and adaptation, participants engage as co-designers in different degrees and from different perspectives.

From a social-worlds framework, we can understand this approach to design as an arena where social worlds meet, bringing in different perspectives, and multiple commitments. In their encounters within the design arena, social worlds redefine some elements of their discourses, perspectives and social practices, adjusting and creating new requirements for the design object. For example, in the case of Escobar, her commitment to create an appropriate design for the community of interest took her to appropriate the aciaticos' perspective, transforming herself and her perspective in the process. By the same token, the aciaticos' interactions with Escobar also changed their perspectives with respect about technology and helped identify several concrete needs that they wanted to include in the design. They also agreed to follow some new rules and changed some social behaviors accordingly, as in the case of the telephone calls, because they were responding to a broader internal commitment to reduce operational costs in their organization.

"Asesoria y Acompañamiento" is at the center of the methodological approach for Somos Más NG(o)neers. They now present it to other NGOs, and social organizations, as their way to develop appropriate technologies. I illustrated this approach extensively as that employed by Escobar in Choco. However, during my observations in the fieldwork for this dissertation, I noticed that this methodology has become the default approach to follow when Somos Mas engineers work as ICT consultants for grassroots organizations, and, in some degree, for other NGOs as well.

6.5 The Influence of Fields: The Infiltration of Neoliberalism and Informational Capitalism in the work of NG(o)neers

A third type of general interactions and activities performed by NG(o)neers in Colombia involves encountering the strong social worlds of neoliberalism and informational capitalism. The relative location of these social worlds in relation to each other is not symmetrical. In the arenas of design studied in this dissertation, for example, the terms of interaction of NG(o)neers with governments or with the private sector are usually pre-configured by contracts or "partnerships." When NG(o)neers enter arenas with these other social worlds, they usually do so bounded by a contract. The terms of the contract are decided by the one financing the project, either the government or a private company. As a consequence, the approaches followed by NG(o)neers working within their own social world, as seen previously in this chapter, get distorted to reflect the character of the dominant social world.

My research strongly suggests that as when NG(o)neers interacts with these social worlds in design arenas their modus operandi changes dramatically. NG(o)neers' methodologies and approaches adapt, in general, to the dominant discourses. However, NG(o)neers also leave a distinct imprint of rebellion in the form of subtle material marks of resistance to show their disagreement with the dominant discourse they disagree with. I will illustrate this with three examples. The first example is a project of COLNODO being subsumed by the government in the arena of e-government. The second and third examples are projects of Somos Mas, one with a city government, and the other, a failed attempt by the private sector to subsume one project of Somos Mas.

6.5.1 IPRC revisited

As we saw in Chapter 5, COLNODO and the Connectivity Agenda met in the arena of e-government. One of COLNODO's creations, IPRC (Internet for Making Local Governments Accountable), was adopted by the Agenda as part of GELT (Territorial Online Government) and it was distributed to all of the 1,100 municipalities in Colombia.

When IPRC was developed, COLNODO followed a similar approach to the one followed by Somos Mas in Choco of "Asesoria y Acompañamiento." It focused on four municipalities over long periods of time, entering in contact with citizens and local governors to create a social structure for accountability before designing software to help the process. COLNODO coached and trained all the participants, who voluntarily decided to participate in the project, engaging them in an evolutionary and participatory design process (See Chapter 4). However, once COLNODO entered to work as independent contractor of Agenda to include IPRC in the national platform for territorial e-government (GELT), COLNODO's methodology transformed dramatically. Given the scale of the project (more than 1,000 municipalities), COLNODO focused on an in-house technical development of a CD that would automatically install in a computer a pre-configured version of all the necessary software to run the basic platforms of e-government, including IPRC. In the process, the initial orientation to tailoring situated designs of IPRC was lost. Also lost was the participatory character of design, and citizens became again invisible, implicated others. Coaching and training was narrowed to training. There was no in-situ support when dealing with the technology in daily operations. In its place, decrees commanding public employees to attend training sessions and to comply with deadlines to use the information system were used to diffuse the technology and promote its use.

IPRC, on the other hand was developed using free software and it is protected by a GPL license. As mentioned previously, the Colombian government gives no official support for free software. On the contrary, by supporting policies of "technological neutrality," it fosters the interests of private companies profiting from the commodification of software.

The introduction of IPRC in every municipality in Colombia as part of e-government is a clear example of how COLNODO's commitment to free software has infiltrated the tacit commitment of e-government in Colombia to the commodification of code. Once COLNODO gained entrance into the e-government arena, it kept imprinting e-government with more technologies that represented its commitments to free software and to informational development. A second technological component, the system for monitoring advances in the achievement of the Millenium Development Goals,[87]

[87] The following link is an example of this tool implemented in the municipality of Paipa: http://www.paipa-boyaca.gov.co/odm.shtml?apc=a1w-1362783-1362783&m=I&s=a

developed using free software and also protected by a GPL license, also became part of the components of GELT.

Thus, by infiltrating the technological systems of the government with technological artifacts embodying its commitments, COLNODO has also left a mark of rebellion manifested in the material reality of free code and the GPL license for IPRC. In the process, GELT became a frankentechnology, a technological artifact with multiple components embodying commitments to different and sometimes contradictory social worlds. Franktechnologies materialize the fact that cooperation without consensus among different social worlds is possible.

6.5.2 "Socios Por Bogotá:" Networks of Control

6.5.2.1 The project

We have seen, the third sector in Colombia is fragmented, diverse, plural, numerous and largely invisible. In the context of neoliberalism, governments are called to establish partnerships with the private sector and the third sector to coordinate disparate and autonomous efforts of groups and individuals who attempt to provide public goods or services to citizens. However, to achieve this, the third sector needs to be visible and the government needs to be able to characterize it to create effective partnerships. On the other hand, the government has always tried to create some kind of control and regulation on the dynamics of the third sector that grew independently from the State. One example of these attempts to both regulate NGOs and align them with neoliberal principles can be observed in one of the projects undertaken by Somos Más during the fieldwork of this dissertation. The project was called "Socios Por Bogotá[88]: Distrital Network of Cooperation for Development."

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[88] "Socios Por Bogotá" translates as "Business Partners for Bogotá."

Socios Por Bogotá (SPB) was an organizational and technological innovation promoted by the Bogotá's Mayor's office. It began in 2005, with Luis Garzón as Mayor of the City. SPB was a network of organizations created to structure interactions between the public sector, the private sector and the third sector in order to "maximize resources, knowledges and generate more impact in processes of development in Bogotá" (SPB, 2006). SPB also aimed to channel financial resources coming from international cooperation agencies, development organizations, and private corporations into collaborative projects with Bogotá's government. The basic principles of SPB were: (1) organizations developing programs for development in Bogotá needed to be in the SPB network; (2) within the network, organizations and projects of development in the city would make visible the social map of actors and activities for development in the city to the city's government and other interested actors; (3) programs to strengthen organizationally some of these organizations would prepare them for partnerships;(4) collaborative designs for projects in the network would be created in the context of "partnerships" among members of SPB.

The emphasis of SPB on the "Network" was also technological. SPB had a technological component called "the social map of Bogotá." This social map consisted in a centralized data base with information about private actors developing social activities of development in Bogotá. It included information about their identification, location, activities, fields of action, target population, and location of targets. The information in the data base would be available on the Internet and could be consulted either graphically in a geographic information system or textually as direct textual queries to the data base. The conceptualization and the design of this technological system were developed in an alliance between a group of public employees from the Mayor's office and Somos Más engineers.

The incorporation of Somos Más within this project began when the director of the SPB, Angela Escallon, assisted to one presentation by Somos Más engineers on their information system for voluntary work in NGO's.

"We noticed that they had an aggregated value to what normally engineers in the market have. Their knowledge of the third sector and the creation of networks in this sector were instrumental to create the information system we needed. Without them, I had being left with an engineer that does or says whatever I want him to say, or he would had been to limited by my own ignorance on the subject … That was why we chose to work with Somos Más, they have the plus of being in the world of development and the social sector." (Interview with Adriana de Los Rios, Socios Por Bogotá)

Somos Más engineers' knowledge of the third sector and their ability to establish links between development and information technologies factored in to create rapport between them and public employees from the Mayor's Office.

"We had a relationship of mutual admiration, and of sharing several common ideals to do things together … because, I think that in the world of development and the social sector, you connect with the people with whom you can work with to make something for the city, or for a community … our relationship did not have a for-profit orientation or did not have a commercial motivation … we have something more spiritual in common … and from that we began thinking how we could connect what they were doing with NGOs and how their tools could be useful in our project." (Interview with Adriana de Los Rios, Socios Por Bogotá)

In 2006, Somos Más and the group in charge of SPB, worked together on a proposal for an information system to support the creation of networks of partnerships for development. The project was presented to the CAF[89], but eventually it was financed directly by the city of Bogotá. The team assembled for this project included Adriana de Los Rios, lawyer, public employee from the Mayor's Office; Nicolas Martin, engineer from Somos Más; and Diego Ramirez, engineer from Somos Más. Working together during several months, they worked on defining the fields of information they needed to collect from civil society organizations in Bogotá. Because several of the biggest organizations of the civil society already had an online presence, they decided that their online system

[89] CAF – Corporación Andina de Fomento. Multilateral bank for hispanic and Latin American countries. Its stokeholders are: Argentina, Brasil, Bolivia, Chile, Colombia, Costa Rica, Ecuador, España, Jamaica, México, Panamá, Paraguay, Perú, República Dominicana, Trinidad y Tobago, Uruguay, Venezuela

would allow manual feeding of information for small and "disconnected" organizations and automatic feeding of information through web services for big organizations with information systems of their own.

The design arena in this case was constituted by the social world of non-governmental ICT4D, represented by Somos Más, and the social world of government, represented by the SPB staff. The NGOs, users of the system, remain during this process as invisible, implicated actors. This design team had from the start several intersections that allowed tits members to work smoothly. Most important was their common commitment to social goals. During the several design meetings a common language began to develop around the information system being designed:

> "Designing with Adriana has been very interesting because she has a particular vision of the problems … she has even appropriated some of the technical language we use among us." (Interview with Diego Ramirez, Somos Más)

> "They have had a great disposition to translate for me. They translate all of their technical jargon and they put it in a very common language for someone who does not know about computer systems. On my part, I have learned a number of technical terms from them and now we talk about connectors, applications, prototypes … a number of things that previously I did not know what they were." (Interview with Adriana de Los Rios, SPB)

There were some notable disagreements, evident in clashes over different interpretations of the object being designed. The most visible difference between Somos Más Engineers and the SPB staff was about the role of coercion in the system.

For Somos Más' engineers, working on this project was a great opportunity to foster their ongoing work in social network platforms for NGOs. Having NGOs in Bogotá connected to this system sharing information about them and creating partnerships among them added to the earlier work done by Somos

Más in networking NGOs. In addition, they were also gaining experiential knowledge about the kind of organizational and technical elements needed to create and sustain networks of non-profits for development.

However, once the project took off other orientations for the network were introduced. The Mayor's office also saw this concentration of data of non-profits (ESALs) as a means to monitor and regulate these organizations in Bogotá. This was made evident with the creation of a resolution (Resolución 072 de 2005) from the Mayor's Office commanding Distrital agencies in charge of inspection, regulation and control of ESALs in Bogotá, to call on non-profits to update their information and legal status in the new system provided by "Socios Por Bogotá." Those ESALs that did not update their information in the new system developed by Somos Mas would become target of multiple disciplinary sanctions, and they would loose their legal status.

In 2006, a study by the Chamber of Commerce in Bogotá estimated in 40,000 the number of ESALs in the city. From these, only 12,000 responded to the public call ordered by the Mayor's resolution. These 12,000 non-profits fed the information system developed by Somos Mas with their basic data: identification, activities, target populations, location of their targets, and financial information. The rest of ESALs remained clandestine.

The inclusion of governmental coercive measures to obligate NGOs to input their data into the system developed by Somos Mas caused a major conflict within Somos Más engineers. They saw themselves going against their principles of voluntary participation in how their designs were used. They also feared their work might construct a means for the regulation of NGOs:

> "We [Somos Más] never liked that approach of threatening ESALs with the cancellation of their legal status if they did not update their data in our system. In front of that aspect, we initially were against it. What we wanted was to generate spaces of trust to motivate social networking, we preferred to start with just a few

who wanted to use the system and keep growing from there …" (Interview with Nicolas Martin, Somos Más)

This was a difficult situation because at that point Somos Mas was bound by a contract with the Mayor's Office. Gradually, Somos Mas engineers in their interactions with the SPB staff, changed their initial reaction to a point where they saw themselves justifying the use of coercive measures in the project:

> "In any case, the law orders that any organization should be registered in the Chamber of Commerce and in the City Hall … this is a necessary step for any organization to do its job." (Interview with Diego Ramirez, Somos Más)

> "It is necessary to know from a legal aspect what are the ESALs that are really doing their job … some of them will even benefit from having their legal status removed, in the sense that the process of liquidating an organization in Bogotá could cost two or three million pesos [USD$1,500] … So, if some of these organizations are already informally inactive, by formalizing this for free, we are making them a favor … now, sanctions will go especially to those organizations that camouflage under the label of ESALs to run illegal businesses like prostitution or to run a business for profit and not to pay taxes for it. In this point we agreed on this kind of depuration of ESALs and NGOs in Bogotá." (Interview with Nicolas Martin, Somos Más)

Constructing a discourse in which the use of coercion was going to be beneficial for NGOs, allowed engineers to remain consistent in their contract with the city government and to their commitments with the social world of NGOs. Their methodology used in other projects with NGOs and grassroots organizations, however, changed dramatically. Voluntary participation was no longer an option. Bottom-up approaches were deemed inappropriate, and since the inception of the project, dealing potentially with 40,000 non-profits made obvious that "acompañamiento y asesoramiento" was not going to be a feature of this network.

The agreement on the use of coercion was also realized in a material form. The information system incorporated a system of alarms that tracked how current the information entered by the 12,000 ESALs was. The idea behind this system of alarms was to impose a technological imperative (Winner, 1977) on ESALs. If an ESAL did not actualize their information, at least once every three months, the system would generate a series of alarms (e-mails and regular mails) that the legal representative of the ESAL would receive. These alarms would remind the ESAL to update their information. If no action from the ESAL was taken, six months after the last update of information, its legal status would be cancelled. The information system would then cancel the electronic record of the ESAL and would inform City Hall and the Chamber of Commerce to proceed with the formal cancellation of its legal status.

Hence, the end product was a result of conflicting and contradictory purposes somehow unified in the discourse of the arena of design. On the one hand, the web portal of SPB offered a space for NGOs to interact with each other in an online space for social networking and to create sub-networks and partnerships around projects for development. On the other hand, the system was also used for the government to monitor the activities of ESALs and NGOs in Bogotá, making the system less attractive for organizations that benefited from not being regulated by the city's government. In short, the price of benefiting from a network of NGOs and ESALs created by the city was to be regulated by the city's government. Engineers responded to this clash of perspectives by developing a discourse that would make sense of the paradox of using coercion to invite NGOs to organize voluntarily with others. This perspective was ultimately embedded in their physical design of the system.

The initial libertarian position of Somos Más engineers did not disappear completely. The final design of the information system also included a technological option[90] to allow anyone with technical skills to access the search center of the data base without being officially registered as an authorized user of the system (a back door). Thus, the arena of design of SPB, including ambiguous, paradoxical, and, somehow, contradictory social worlds produced an equally ambiguous, paradoxical and contradictory technology. Some components of this frankentechnology embodied coercion, while some other components embodied anarchy. Some components embodied obligatory use of the system, while some others invited voluntary association. Overall, however, the system was presented as a unified whole when it went public in an official presentation by Bogotá's Mayor. In 2007, 12,000 ESALs from Bogotá began using this system. However, as many times it happens in Colombia, the change of government in Bogotá in January 2008 brought this project to halt. Currently the system is not operational and the initial aspirations of one city government to create a network of NGOs and ESALs in Bogotá for development (and control) did not last long.

6.5.3 Somos Más Encounters Microsoft: A design arena that never happened

Not all of the interactions between NG(o)neers with other social worlds end up in alliances and cooperation. Some differences and conflicts in perspectives and commitments are irreconcilable to even make the space for interactions possible.

Ideologically, Somos Más, as COLNODO, promotes the goals of free software. The software they use, and the software they produce for other NGOs is free software. They see proprietary software as an object proper of informational capitalism. They reject it and they do not identify with it. Relying on free software also allows Somos Más to offer a cheaper product for NGOs that do not have big budgets for ICT infrastructure. Most of the engineers from Somos Más have also been members from the free software

[90] This option consisted in an open connector to which any one technically capable of developing a web service could connect freely. It had the obvious inconvenience that this option was restricted to people with expert knowledge.

community even before making taking part in Somos Más. For these engineers, the entrance into the social world of non-governmental organizations was very smooth because there is a basic similarity between both universes of discourses:

> "I began my professional development thanks to Linux and the free software. That is why I have a strong proximity to the idea of sharing with others. The idea of sharing the products of my work with others … I have my ideas, I ground them in a product, and when they are out there, they become a public good, something to be enjoyed by whoever who needs it … this is the idea behind public licenses and free software, and this is also the same idea behind my work in a NGO. A private firm acts in its own benefit. NGOs, and other organizations in the third sector, act for the benefit of others. So, in this spirit, developing software in the third sector can not be done thinking that what I am doing is for me, that is contradictory. When you work in a NGO, you can not believe that what you are doing is for your own benefit, because everything you do, you do it for the benefit of others." (Interview with Diego Ramirez, Somos Más)

This commitment to the ideals of free software is made visible when a controversy threatens the core ideology. In the case of Somos Más, one of these internal controversies was observed when the NGO was offered the possibility of an alliance with Microsoft, the king of proprietary software. The possibility of alliance arose from an intersection between the social world of NGOs and the social world of the private sector via "Corporate Social Responsibility" (CSR). Microsoft in Colombia runs a number of social programs and projects under their discourse of CSR. In one occasion, the director of CSR programs of Microsoft, contacted Jefferson Ramirez, director of Somos Más, to offer him the possibility of funding the expansion of their software pilots in social networking for NGOs called O2O (organization to organization):

> "When the director of social responsibility in Microsoft told us that she was going to give us money to make the O2O, we were tempted to accept the money. We thought it twice, "well … they are going to give us the money, but no …," in the end you say "no." Because the source of that money is not compatible with our internal policies, … so, no. We are very strict on that, we stick to our

principles. Someone once said that a mature software firm was that one which could be measured by how often it says "no." So, I think we have matured in that respect. It does not open our eyes wide that someone is going to finance us, but other things. So we are proud to say "Microsoft offered us money, and we said no." That is something that came from our principles. It was so important to me that I thought to myself "if Microsoft finances me, I will not work with that money, because that does not interest me." I think we have gained a tacit coherence between what we believe in and what we do here in Somos Más because we do not have that written." (Interview with Diego Ramirez, Somos Más)

This decision of rejecting the proposal of Microsoft to finance O2O was a collective decision, which it was not fully shared by all of the members. Jefferson Ramirez, director of Somos Más, without a formal commitment to the social world of free software, saw this as an opportunity to finance Somos Más' O2O project. He also carried some other previous commitments with Microsoft from a different project of his own. This made it difficult for him to say no to Microsoft's offer. Different perspectives about this hot topic prompted a vote in its assembly by all of the members of Somos Más. In the assembly, every person in favor and against the proposal expressed his/her arguments. Later they voted to turn down Microsoft's offer.

"We have been radical about free software … I was the one chosen to face the Microsoft people to let them know that we were not going to accept their offer. I had to do it alone, by myself, because here in Somos Más, we have different opinions and positions with respect to Microsoft, so we could not give a unified answer to those people. Jeff has his vision, Diego and I have a different vision, and more often it is Jeff who makes the talking, but this time I had to do it because he was in favor of accepting Microsoft offer." (Interview with Nicolas Martin, Somos Más)

For Ramirez, this commitment to free software by most of the engineers in Somos Más is sometimes not-beneficial. The organization needs to deal with the realities of scarce financing and must develop allies in strategic national and international positions in order to guarantee its organizational sustainability.

> "I agree with the principles of free software until the point where these principles become barriers to create relationships with someone who does not share them … because we also need to survive, and to survive we need to attract income and funding. Not everything is passion; we also need to pay wages." (Interview with Jefferson Ramirez, Director of Somos Más)

Although Somos Más, declined Microsoft's offer, Ramirez still maintains an ongoing relationship with Microsoft of his own on a different project. However, he does this as an individual, rather than as representative of Somos Más. In the end, the organization collectively rejected an alliance with Microsoft because it would conflict with deeply held ideological principles.

Corporate Social Responsibility (CSR) can be understood as corporate social world developed around a discourse of social responsibility. This social world intersects with some of the discursive elements of the non-governmental ICT4D social world making some alliances possible, at least theoretically. However, sometimes differences matter most than similarities in making real potential alliances. Differences can be irreconcilable and even cooperation without consensus turns unlikely. This was the case of Somos Más NG(o)neers, whose commitment to free software ultimately closed the doors to a potential intersection with the CSR world represented by Microsoft. Even though, both representatives were committed to ideals of social responsibility, they differed on their commitments to the construction of information commons. Strongly committed to the ideology of free software, NG(o)neers resisted a pending alliance with Microsoft because it would involve an indirect commitment to proprietary software. For these engineers, there was no way to conciliate these opposite ideologies of information commons (public goods) and informational capitalism to which these two different social worlds had committed. Thus a potential intersection of these two social worlds never materialized. In the process, important features of the social world represented by Somos Más were clarified for Somos Más insiders and outsiders, especially the organization's ideological position on proprietary software and its position about alliances that might arise in the future.

From a social worlds approach, we can understand that the multiple commitments to free software and non-profits define Somos Más' perspective. This perspective organizes the possibilities for action among Somos Más engineers, making some alliances possible and others unlikely. The resulting organization of social practices also determines which technologies will be approved for their economic rationality and which ones will be embraced for their underlying ideology. Concrete action and positions positively inspired by their commitment to free software also provide for Somos Más' engineers a source of identity, which distinguishes them from other systems and computer engineers from the private sector (i.e. Microsoft) or from other NGOs who do not have a radical position with respect to free software.

6.6 Minuto Infiltrates Informational Capitalism

A fourth general type of activity identified in the social world of non-governmental ICT4D in Colombia, is the redesign of existing information and communication technologies developed in the context of informational capitalism. The purpose of the redesign is to take a capitalist oriented technology and combine it with specific social ideals, such as distributive justice. In many ways, this combination is the reverse of the process reviewed previously, in which informational capitalism and neoliberalism attempted to infiltrate the technological world of non-profits. It does not necessarily requires the leadership of organized NG(o)neers, but it is usually led by an NGO or a civil society organization (non-profit), which provides the social vision and the original idea to be technologically implemented by corporate engineers.

The broader discourse that allows the social worlds of non-profits and for-profits to interact in this arena is again the discourse of "Corporate Social Responsibility" (CSR). In this section I will describe two instances of this approach by the same non-profit, a catholic philanthropic organization in Colombia called "Corporación Minuto de Dios."

6.6.1 "Done su Vuelto" and ATM donations: Introducing infocapitalism to distributive justice

The "Corporación Minuto de Dios" (El Minuto, for short) is a traditional religious-philanthropic organization in Colombia. It is also the most popular and well known non-profit in Colombia. "El Minuto de Dios" (God's minute) was created in 1950 by the Eudist priest Rafael García Herreros as a two or three minutes show broadcast daily in a local radio in Cali, Colombia (Jaramillo, 2004). In his program, Garcia preached about God, Christian values and the social commitment of rich Christians with the poor. At the same time, Garcia used mass media to spread Christian messages; he also aimed to attract financial support from rich Colombians. In his shows, he preached to rich people about supporting social projects of housing for the poor as a way for the rich to comply with their Christian duties (Jaramillo, 2004). As a result, Garcia initiated a series of philanthropic projects in Colombia to finance housing for poor families. The most famous of these projects is the yearly "One Million Supper," a very modest supper of soup and bread for which every patron pays a considerable amount of money.

In 1955, with the arrival of television in Colombia, Garcia received a daily space of one-minute in prime time national TV, which he also named "El Minuto de Dios" (God's minute)[91]. Every single night, for more than 37 years, Colombians watched Father Garcia Herreros in this TV show, until he was replaced by an equally prominent successor (Jaramillo, 2004). Thus, Garcia Herreros became one of the most popular figures in Colombia. Since the 1950s, when Garcia moved to Bogotá, he used his TV program to generate contributions of money, land, and food for poor people in Bogotá. Gradually over the years, he created a social emporium of housing, commercial, and educational projects for the poor. The steady growth of his projects and the channeling of resources coming from philanthropy and charity came along with the creation of a non-

[91] Today, 53 years later, the TV show is still on, making it the oldest TV show in Colombia.

profit organization also called “Minuto de Dios” in 1958. One of the most celebrated successes of this non-profit has been the creation of a whole neighborhood for the poor financed by charity also called the “Minuto de Dios.” In Garcia’s vision it was created as a decent, clean, Christian and dignifying neighborhood for poor people (Jaramillo, 2004). By the end of the 1980s this gigantic project was already housing more than 1,300 families and included a local church, a museum, a cinema, several parks, schools, one university and a radio and TV station. By 1995, the non-profit had also been constructed 15,000 housing units in other regions in Colombia (Trujillo, Gutierrez, Ruiz, 2003).

Since its inception, Minuto has been closely involved with information and communication technologies, first, with radio and then with television.

> “The Minuto was born in a communications technology … and Father Garcia Herreros was, without a doubt, a pioneer in developing communication media in Colombia in a dual dimension, first at the spiritual service of the Colombian people, and second, at the service of the social projects for the poorest.” (Interview with Father Camilo Bernal, Principal of Minuto University)

Mass media provided Minuto with the means to enter into Colombians’ daily life and helped channel disparate resources of philanthropy and charity to its projects. More recently, with the advent of Internet and the computationally-based information technologies of informational capitalism, Minuto has also found ways to use these technologies to keep alive the vision of Garcia Herreros, who passed away in 1992.

6.6.1.1 Done su Vuelto

One of the contemporary projects of Minuto, involving technologies of informational capitalism, is that of “Done su Vuelto” (Donate your Change). The project consists in asking clients of chain grocery stores to donate part of their change to Minuto’s projects. This project, inspired in a similar project created by another religious non-profit in Chile, took an opportunity created by Colombian law that demanded grocery stores to give exact change to their customers. Exact change is a troublesome process for both stores and customers given that it requires the use of low denominations coins ($50, $20, and $10 pesos) which do not have too much circulation in Colombia. These coins are so scarce that grocery stores need to buy them directly from the Central Bank of Colombia, and they need to pay extra for delivery and transportation fees. Customers on the other hand are stuck with low denomination coins with are not accepted by the regular market, only at banks. Minuto, then, decided to contact one of the biggest market chains in Colombia, Carulla-Vivero, to create a joint campaing called "Done su Vuelto" (Donate your Change). In the campaign, customers, when checking out, were asked by cashiers to donate part of their change, very small amounts of money, to round their bill up to the next multiple of $100 Colombian pesos, which did not require a change including low denomination coins. When presented the campaign to Carulla, Minuto highlighted the benefits of reducing the costs of buying low denomination coins, being complaint of the law of exact change, and having in place a program of social corporate responsibility that was channeling small money from their consumers to finance housing projects of "Minuto de Dios" (Interview with Cristina Arevalo, Minuto).

As part of the alliance Minuto-Carulla, Minuto provided training for Carulla's cashiers, and gave publicity for the campaign in mass media. Carulla on its part, had to re-configure its technological systems in all of its branches (156) to allow cashiers make this a quick process for consumers. Several elements had to be designed to make this system work at the technological level. For that, a systems and computer engineer from Carulla, Jorge Sanchez, was recruited for this project. First of all, the system needed to distinguish between what corresponded to Carulla incomes and the donation to Minuto. In terms of accounting, this money could not be registered and counted as Carulla's income. The engineer decided to apply to donations the same treatment that VAT (value aggregates tax) had. When it registered a buy, the system separated the amount of money being paid that corresponded to Carulla's income and what corresponded to the VAT that needed to be paid to the government. Now, the system needed to create a third category, reserved to donations to Minuto. In that way, donations would not be counted as income and would not cause to be taxed. The system also needed to provide an easy an expedite way for the cashier to ask the customer how much money s/he could donate to Minuto. Before finishing the transaction with the customer, the system at the point of sale (P.O.S.) would present the cashier the total of the customer's bill, and the exact change. Then a menu with several options for both, donation and rounding change to a multiple of $100 pesos, was presented to the cashier to inform the customer if s/he wanted to donate the residual amount of money to round up his/her change. If the customer decided to donate, then the cashier just needed to select one of the available options in the POS menu.

After Sanchez redesigned the system to manage the donations and to generate monthly checks to Minuto, the campaign was formally launched in 2001. By December 2006, the campaign "Done su Vuelto" had funded 125 housing units for poor families[92] in 15 Colombian cities (interview with Cristina Arevalo). Sanchez's participation in this project was circumstantial to its location as a Carulla's employee. He was asked by his employer to do the job of redesigning the system, and even though it was part of his job, working with the people of Minuto on a different project than those he was used to do in Carulla was satisfactory for him:

> "I was very willing to go into this project. I wanted to collaborate to the work done by Minuto because I think the social work they do is beautiful. So I took that personally, no matter what it took … it was great to have an opportunity to apply my engineering knowledge to support a social project. I wish I had more opportunities to create that type of technical developments." (Interview with Jorge Sanchez, Carulla)

The work of the engineering was mostly limited to his technical activities in the company and a few interactions with the market representatives of Minuto. Sanchez never got in contact with beneficiaries of "Done su Vuelto," the program he designed to work technically for Carulla and Minuto. Thus, even though the intersection of the social world of philanthropy represented by Minuto with the social world of CSR did not mean

[92] Weekly, Minuto receives an average of 500 applications of people asking for help to get housing for their families. The process of selecting beneficiaries is done by Minuto based on an analysis of the socio-economic conditions of the applicants. In 1998, the deficit of housing in Colombia was estimated in 1,200,000 units, with a projected growth of 12% annually (Trujillo, Gutierrez, Ruiz, 2003).

a major change in engineering tasks, interactions, or methodologies for Sanchez, it still opened a window for him to identify his work with broader social goals by providing and additional source of meaning to engineering work and engineering design that was not oriented to profit maximization but to redistributive justice.

For Carulla, modifying its sales information system meant that the company had another project to show in its "social balance[93]," a common practice in Colombia's firms that contemporarily make use of the discourse of Corporate Social Responsibility (CSR). CSR is a management concept that refers to transparent business practices based upon ethical values and compliance with legal requirements. These practices encourage companies to assume responsibility for the totality of their impact on people and environment (USAID, 2002). CSR has increasingly become part of the managerial language in Colombia since the end of the 1990s. Management schools in the country teach regularly courses on the subject, and several universities have set up centers of research around CSR. Management magazines give annual prizes to recognize companies that have been models of CSR. Since 2004, the National Association of Industrials (ANDI) has conducted an annual survey on the state of CSR in Colombia. In 2005, the survey showed that most of the CSR of Colombian companies centered on non-monetary donations, strategic alliances, sponsorships, donations to social foundations and social investments. Some 66.9% of Colombian industries affiliated with ANDI had CSR activities and had public records on these activities, 50.5% had annual social balances, and 35.5% reports of social impact. Overall, Colombian industries invested 3% of their sales in CSR programs in 2005 (ANDI, 2006). Thus, CSR offers strong motivation for private sector firms to engage in strategic alliances with non-profits, to show to the public that they are also socially conscious companies. In the case of "Done su Vuelto," an alliance with Minuto, is even more compelling because Minuto's 50 years of trajectory as a non-profit make it well positioned the popular culture of all Colombians.

In short, "Done su Vuelto" is a socio-technical campaign that a non-profit designed to channel charity for its projects. It required the participation of a national

[93] http://www.carullavivero.com/cavivero/responsabilidad.html

chain of super markets and technical modifications to their sales information systems. The encounter of the social world of Christian philanthropy and the social world of corporate social responsibility infiltrated an informational capitalist technology designed for profit maximization to open a parallel space for distributive justice. Some of the small money people could spare when buying groceries in this big corporation would now go to finance building one house a week for poor families in Colombia. In the process, a corporate engineering had the opportunity to redesign a technology from a social perspective that complemented profit maximization with social values of distributive justice.

6.6.1.2 ATMs: Servibanca

Another example of infiltration of informational capitalist technologies by Minuto is using ATMs in Colombia to channel funds to Minuto's charities. In 1997, Juan Carlos Rodríguez, CEO of Minuto, with experience in the operation of ATMs, suggested to the board the possibility of creating a channel to collect donations directly from ATMs in Colombia. Father Diego Jaramillo, successor of Garcia Herreros, invited several banks and ATM companies in Colombia to incorporate in their ATMs the option for clients to donate to the projects of Minuto. Only Servibanca[94] joined the project.

Technologically, the operation consists in a double transaction. First the ATM operates normally offering its regular options of withdrawals. Before sending the transaction to the customer's bank, the ATM holds the transaction (20 secs) to present the client a screen with several options for donations to the projects of Minuto in small amounts of money (No donation, \$200, \$500, and \$5000 pesos – \$0, 10 cents, 25 cents and \$2.5 dollars respectively). Once the customer selects an option, if the customer has donated any amount of money, the transaction adds the donation to the initial amount of withdrawal, and sends the transaction to the bank. Internally, Servibanca's ATM delivers

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[94] Servibanca is a Colombian firm that provides ATM services. It has the most extended network of ATMs in the country and affiliates 29 different banks in a network of 600 ATMs in Colombia (Trujillo, Gutierrez, Ruiz, 2003).

only the initial amount of money to the client and registers the donation in a separate account for Minuto.

> "Since 1997, Servibanca began designing the software to allow for a double transaction, which required deploying one transaction [donation] over another [withdrawal] … initially we thought it was going to be a short campaign of three or four months, however it is being very successful and it is still running [in 2007]." (Interview with Cristina Arevalo, Minuto)

The design of the double transaction was a collaborative work between Minuto and Juan Carlos Villegas, systems and computer engineer from Servibanca. The main objective of their design was to open the possibility of channeling donations to Minuto without generating any further costs. One possibility contemplated by the design team was to generate a different transaction for donations.

> "The user could select in the transactional menu the option for donations. However, that was not practical because it obligated the client to run a single transaction just to donate, and transactions are not free, the have an associated cost. So, the user would have ended up paying for the cost of the transaction to make his/her donation, and the banking system would have gotten some percentage of this money every time s/he wanted to make a donation to Minuto." (Interview with Juan Carlos Villegas, Servibanca)

Externalizing costs of the transaction to the clients would have also prevented clients to make donations. The second alternative, and the one implemented, contemplated merging the two transactions in one withdrawal from the client's bank and keeping different internal registers Servibanca's ATMs for the amount of money delivered to the client and the amount of money to be delivered to Minuto.

The implementation of the process had some complications. Among some of the many affiliates banks, some of their information systems rejected the transactions because the transaction requested an odd denomination (standars withdrawals + small donation), not commonly delivered by their systems. So, all of the affiliated banks also had to make changes to their systems accordingly. To change Servibanca's system and associated systems had an elevated cost that the company assumed as part of its "Corporate Social Responsibility:"

> "Servibanca asummed the costs of implementation as a social contribution. The executive board in that moment, assumed those costs as return to society." (Interview with Juan Carlos Villegas, Servibanca)

After 8 months of development, in 1998 Servibanca's ATMs began operating with a system of donations for Minuto. That year, the average monthly amount of total donations amounted to U$30,000 dollars. The system was so successful that immediately other Colombian banks, such as Davivienda[95], implemented the same system in their ATMs to channel donations not only for Minuto, but for other social causes and projects run by UNICEF, and other Colombian foundations (i.e. Corporación Matamoros for disabled veterans). Today, this system of donations to charities by ATMs is very well positioned in Colombia, and users of ATM just consider it part of the way ATMs normally work. Since 1998, it has provided enough funds to finance 90% of 3,000 housing units for poor families, who get credits to pay from their own funds for the other 10% (Interview with Cristina Arevalo, Minuto).

As in the case of "Done su Vuelto," Servibanca also gained recognition for being allied with a recognized non-profit in Colombia and showing that it is a corporation that concerned with distributive justice. Using their informational capitalist technologies to channel small amounts of money from middle and upper classes to poor families through Minuto and other charities, Servibanca presents itself as a socially responsible corporation that supports housing and other social projects for poor families. However, considering that these kinds of programs pragmatically only provide about 370 housing units for poor families annually in a country with an approx. average housing deficit of 1,200,000 units annually, the real impact of using ATMs to channel donations to social

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[95] In 2002, when Davivienda joined the program provided a bigger national network of ATMs that gave to Minuto other $35,000 dollars monthly in average (Trujillo, Gutierrez, Ruiz, 2003).

projects can be seen in the "social washing" of corporate image for those firms that participate in a modest exercise in redistributive justice.

On the side of engineering, Villegas, the engineer in charge of this project, was assigned by his employer to implement the changes required and had no exposition to the ultimate beneficiaries of his technical work. So, his work remained as a traditional work of engineering for a company that opened a philanthropic channel in its ATMs.

6.6.1.3 Infocapitalism and Distributive Justice

The intersection of the social world of philanthropy represented by Minuto with the social world of Corporate Social Responsibility (CSR) represented by Carulla and Servibanca has shown in Colombia that it is possible to infiltrate ICTs that had been designed primarily to boost informational capitalism with social values. The experience of Minuto shows that non-profits can be a big force in Colombia in pushing for the creation of frankentechnologies that boost capitalism on the one hand, but that on the other hand, also attempt to redistribute financial resources in society, at least for a few ones. In the process, capitalism is not weakened. On the contrary, firms use the benefits brought by the social field of NGOs and non-profits as Minuto to boost their image as socially responsive corporations, despite the fact that their overall impact in redistributing wealth equitably in society is minimal.

The impact for corporate engineering within these intersections is also minimal. Engineers in charge of designing the technical adaptations for these technological systems are usually assigned to the task by their employers as part of their job. While it could be meaningful for them to work in a project that will benefit poor families, they just take this as a collateral impact of the work they need to do for their employers. In general, they remain far removed from the ideas that inspire of the general project and its ultimate beneficiaries. Corporate engineers have been relegated to fill in the technical voids.

6.7 NG(o)neers, Free Software and InfoCapitalism

The compatibility between the universes of discourse of non-profits and of free software, make people committed to these two social worlds potential allies. This happens at two levels of discourse, at the ideological level and at the economically rational level. At the ideological level, we find similar elements in both universes of discourse, such as "sharing" and "doing things for the benefit of others." In contrast to the informational capitalist discourse that aims to profit maximization and to what Daniel Bell called "economizing," these elements of discourse refer to what Bell called "sociologizing." The ethos reflected in the work of NG(o)neers, with multiple memberships in the free software and the NGO's social worlds, is professionalism, not profit maximization. Profit maximization, in this ethos, declines in favor of maximal welfare for the public at large. This point was evident in Somos Más encounter with Microsoft.

At the economically rational level, "getting more with less" is a maxim widely shared in the third sector. The goals is not profit maximization, but rather reducing operational costs and maximizing the social impact of information and communication technologies with small budgets. This point was made evident by Somos Más in Choco. Using free software and developing technological artifacts for reducing operational costs (phone bills) was a critical component in the social orientation of Escobar in Choco. Not paying for expensive licenses in proprietary software and reducing operational costs in phone calls responds to a reality for most non-profits, who have to deal with small budgets and variable sources of funding. For Somos Más engineers and COLNODO engineers, this type of "economizing" in social organization, not profit-oriented, pursuits also a type of "sociologizing." In other words, reducing operational costs is another way of ensuring the maximal welfare for organizations in the third sector:

"Our social impact is evident in that whenever we work with social organization we do not waste resources, not only money, but also time and complexity. A private company could provide a similar but more complex system than the one we provide. But the social organizations would not use their capabilities at the fullest, wasting then informational resources." (Interview with Carolina Escobar, Somos Más)

"We contribute to the third sector and to the community in reducing costs of access to ICTs [by using free software] and to the philosophy of sharing, not only code and software but also knowledge, for example by promoting in Colombia licences inspired by free software, such as creative commons ... that is the philosophy of free software, and by adopting these principles of sharing knowledge in the third sector we can build the basis for a more just human development." (Interview with Julian Casasbuenas, COLNODO)

6.8 What is a NG(o)neer? : Identity

6.8.1 As seen by others

The construction of professional identity for NG(o)neers depends on their commitments to social worlds. Through these commitments, NG(o)neers adopt a perspective (processes of indication and interpretation) that shapes their discourses, their interactions, their methodologies, and their technologies. This perspective is also constructed in arenas where they meet with other social worlds, sometimes clashing with other perspectives, some other times identifying with other perspectives. Through these processes of mutual adjustments, engineers shape an identity, a sense of what they do, the way they do it, and the reasons why they do it. Common to the NG(o)neers included in this study is the fact that they are perceived by people from other NGOs, government, grassroots organizations and corporations, as being different from "traditional" engineers. That is from engineers from corporate organizations.

People interacting with NG(o)neers perceive differences in the language NG(o)neers use, in their personality, their ideologies and discourses, the methodologies they use and the kind of technologies they develop.

With regards to language, NG(o)neers are perceived to speak both, the language of the organizations of the third sector and the technical language of engineering. Therefore, they are seen as translators between the technical language and the social language that social organizations use.

> "Nicolás and Carolina get people to listen to them. They are able to translate people's needs and their interests in the terms required by the project." (Interview with Irene Bello, Saldarriaga-Concha)

> "I found them [Nicolás and Diego] willing to turn their language to mine, and that has made things easier. They are always willing to translate all the technical jargon in a very colloquial language to me." (Interview with Adriana de Los Rios, SPB)

From other people's perspectives, NG(o)neers are seen as emphatic, patiente, approachable, and willing to share their knowledge with other NGOs and with social organizations. They are perceived to be different that corporate engineers who are too focused and concentrated in their technical jargon that do not mind to engage the users of their technologies in their monologues:

> "She [Carolina] is very patience, and she dedicates all the necessary time we require. When we do not understand in one way, she finds other ways for us to understand … We trusted her and she trusted us, and that made us closer, made us became friends. We have her now as one of us in this process." (Interview with Nevaldo Perea, COCOMACIA)

In their ideologies and discourses, NG(o)neers are seen to be connected to the world of non-profits and social organizations. They are perceived to understand the realities and difficulties of the social organizations they work with.

> "You can not imagine that there is an engineering organization like this [Somos Más]. So, we [PCS] were very glad to find that there are engineers with the disposition to make this kind of jobs, with all that sensibility, and that commitment … a commitment to strengthen socially the third sector organizations." (Interview with Oscar Rodriguez, PCS)

This connection to the realities of the third sector reflects their commitment to this world. As a consequence, they are able to develop methodologies appropriated for ICT consultancy within this sector such as their approach to "Asesoria y Acompañamiento." This methodological approach characterizes Somos Más and COLNODO in different degrees. They share the need to "be there," in a deep immersion with the realities of the communities being attended and to be involved in participatory designs of their technologies. The perception of this methodology by their clients was that it corresponded to an "adequate methodology of work with social organizations." (interview with Santiago Palacios, COCOMACIA).

The perception clients of NG(o)neers have of the technologies being developed is that these are appropriated technologies. They see these technologies responding to the needs, interests and realities of the communities being served. These technologies are products of participatory designs and are effectively used by community members to achieve the social goals of their organizations.

6.8.2 As seen by themselves

On their part, NG(o)neers also see themselves as considerably different from corporate engineers. They see themselves committed to a vision of strengthening the third sector by an appropriate use of ICTs.

> "In many ways, my work here in Somos Más opened a window that I did not think was going to exist for me. When I was at the university I did not want to be that systems and computer engineer working in a bank, or in an office, on the

development of a big information system." (interview with Nicolas Martin, Somos Más)

They also see themselves engaging in a politics of representation that demands users of their technologies be included in the design process.

> "We engaged in a participative process in which all parts were involved. Not only the Mayor and the City Hall employees were present, but also the representatives of the community interested in making their local government accountable. All of us collaboratively constructed the information system. It was not a technical process, in which COLNODO got to the community to show to teach them how to use an informatics tool. Instead, collectively we built the tool to facilitate accountability processes." (Interview with Julian Casasbuenas, COLNODO)

NG(o)neers also commit to ideals of a professionalism that benefits social organizations, and grassroots communities instead of a professionalism that works solely for their personal benefit or for the benefit of a capitalist corporation. They reinforce this version of professionalism with other commitments to share their knowledge and the products of their work with others under the ideology of free software and open knowledge.

> "When you work in a NGO, you can not believe that what you are doing is for your own benefit, because everything you do, you do it for the benefit of others." (Interview with Diego Ramirez, Somos Más)

NG(o)neers see themselves engaging in activities that are not common for mainstream engineers in corporations, such as being concerned with connecting with people and needs rather than focusing solely in developing technical artifacts.

> "At the level of what an engineer does, I know that we break with what people commonly think a systems and computer engineer does: programming, design software and write code. That is because that is not what matters the most here in Somos Más." (Interview with Carolina Escobar, Somos Más)

> "Coming to work here to Somos Más changed my perspective of systems and computer engineering. I always tried to be second line. I never wanted to interact with the client, I was the one in charge of making an idea a reality, but I never had direct access to the client. I tried not to have it. In the work in Somos Más, I have moved to first line, being face to face with the user of my applications. That changes things a lot, because now I have to enter into that dynamic of translation, and I am very technical … so, at the beginning it took me a while to leave aside the technical jargon to begin speaking in terms that the other person could understand. That was when my work changed, now I have to go and see what is what the person needs." (Interview with Diego Ramirez, Somos Más)

In the construction of their biographies, NG(o)neers connect what they are doing now in the third sector to an orientation they had in the past. They recognize "the social" in their voluntary work, being involved in communities of free software, or having worked with other NGOs in the past. They see this orientation to "the social" as one concern they have always had to direct their work, not only for themselves, but also for someone else in an altruistic way. In their narratives of identity, they see that being an NG(o)neer is the perfect fit to complement their interest for "the technical." Their concerns for "the social" are something they could not find in the private sector.

> "Since I was little, I always had a social orientation … always involved in social internships, supporting schools, and being involved in activities with the community." (Interview with Carolina Escobar)

> "I worked in the private sector, but I never felt happy there. I felt I was selling my skills for money, not for my own pleasure or for making something meaningful for others." (Interview with Jefferson Ramirez, Somos Más)

Prospectively, their individual life trajectories were also affected by their presence in the social world of non-governmental organizations. For example, Carolina Escobar in 2007 registered for a Masters program in Spain to study management in non-governmental organizations, and Diego Ramirez dropped out a M.Sc. in Computer Science in 2005 to look for a graduate program in the social sciences:

> "If I had specialized more in technical areas, while our team was not going in that direction, then I'd have become an island of knowledge, disconnected from whatever else was going on. Now, studying something from social studies, I think, enriches what I have done so far technically, grounding my perspective on the reality of the people who is going to use the technologies we develop. It is also going to allow me to contribute more to the work we do here in Somos Más." (Interview with Diego Ramírez, Somos Más)

In this light, the social world of non-governmental ICT4D has the effect of changing life trajectories for some of the more technically oriented engineers who commit to this world. It also reinforces the life trajectory of engineers with a previous orientation to work for the benefits of others. In the process, a renewed professionalism is consolidated for these engineers. They develop a socio-technical career for the benefit of the third sector and the society-at-large, in a field where they have a broad scope of autonomy to direct their work according to deeply held beliefs and principles. Their professional trajectories are different than the traditional trajectories of engineers working in corporate capitalism, who face de-professionalization and who link their status to their loyalty to their employers (Layton, 1986). In contrast, NG(o)neers in Colombia have created for themselves a social world where engineering professionalism is being renewed in the basis of enhanced autonomy and independence from businesses' and State's interests. In this space, NG(o)neers from Somos Más and COLNODO, develop their own perspectives about the kind of engineering they should be doing as well as their perspectives about the kind of social life they want to contribute to by means of socio-technical developments. They can do so because they are independent social entrepreneurs. Thus, these engineers have a degree of autonomy and independence from business interests that corporate engineer lack. They also are able to commit to ideologies not openly supported by the State. In consequence, it is not unusual to find NG(o)neers as activists defending their ideologies in public arenas, as noted in the case of free software. This activism and participation in the public sphere is something very rare to find in contemporary corporate engineers in Colombia, who, due to their loyalty to their corporations, are characterized for their conformity with the status quo and for their political "neutrality."

6.9 Conclusion

Even though they are few in number, today there are NGOs in Colombia that specialize in providing services of engineering for other NGOs and grassroots organizations. These sites offer an invaluable window to understand how other versions of engineering could be produced in social worlds which are not committed to corporate capitalism. Somos Más and COLNODO are illustrations of these NGOs. Other NGOs, including Minuto, are not centered on the production of engineering technologies but rather on their transformation. They also provide points of entry to understand alternative versions of informational capitalist technologies. In both cases, systems and computer engineering enters in contact with the social world of non-governmental organizations. In the process, identities, professionalism, discourses, methodologies, and technologies of engineers are transformed according to the degree of commitment these engineers have with the social world of non-governmental ICT4D.

I found three commitments to be the most determinant among these engineers. The first one was the commitment to strengthen the third sector in Colombia. This commitment involves the provision of appropriate ICTs services and technologies to make civil society organizations stronger in Colombia. I found this commitment to be endorsed by engineers in COLNODO, in their project of networking NGOs and in their project of democratic accountability in Colombian municipalities (IPRC). I also found this commitment to be endorsed by Somos Más, in their project of networking NGOs, and the ICT consultancy to COCOMACIA in Choco.

The second commitment I found was to the ideals of free software. For example, in COLNODO and Somos Más, this commitment was observed in their strong endorsement of free software principles as the means by which high tech could reach non-profits and grassroots organizations. In this vision, the benefits of ICTs in reducing operational costs, networking, and improving visibility by boosting internal and external communications, can be extended to the non-profit sector and to civil society organizations by focusing on free software without converting information and software into commodities. Sharing software developed for NGOs and contributing to a growing world of public technological goods for the third sector was a core principle for these engineers.

A third commitment I found was to the bottom-up, participatory approach to design of ICTs. The engineers I studied were strongly committed to include the users of their technologies in a collaborative design process. These processes in focus are ones in which translation, identification with other perspectives, and mutual adjustment of interests are deemed necessary during design. This commitment is expressed in specific methodologies being developed and used, such as "Asesoria y Acompañamiento," observed in Somos Más and in COLNODO. "Being there," connecting with participant's realities and engaging participants in the action of engineering, were common elements found in the methodologies of these organizations.

The three commitments define a type of engineer, which I have called here a NG(o)neer[96]. NG(o)neers and the information products they create break with the informational capitalist commitments to profit maximization and commodification of information. Commitments criticized by Schiller (Schiller &

[96] The word NG(o)neer came from an informal chat with one of the engineers from Somos Más. He mentioned that some of his friends from school, who are now working in private companies, use to tease him from having switch to work in a NGO, earning less money and becoming a rather "exotic" and uncommon type of engineer. One way of teasing him was calling him names. One of these names was "ONGero" or "oenejero," which is a rather pejorative word in Spanish to refer to people working in NGOs. Unsuccessfully trying to translate this word to English, I tried "NGOer" and I noticed how similar in English was the pronunciation of this make-up word with N-G-NEER, so I just added an extra (O) in the middle to connect the two meanings that were important in this term NGO and ENGINEER.

Schiller, 1986). Instead NG(o)neers are committed to the third sector (non-profit world) and to free software (public goods, information commons).

Rather than being a homogeneous group, NG(o)neers have multiple memberships in other social worlds that bring a variety of additional commitments to the table, ones not necessarily shared among and within organizations of NG(o)neers. For example, COLNODO has had a history of being involved with the international discourse of informational developmentalism. This can be observed in its ongoing alliances and interactions with international NGOs, such as APC and Antenna. COLNODO's representatives are often participants of the international arena of ICT4D in scenarios such as the WSIS (See Chapter 3). Somos Más, on the other hand, maintains commitments with international NGOs working on social networking for other NGOs, such as Ashoka.

Finally, other non-profits, those that are not providers of technical services, have also developed a perspective about the role of ICTs which it is producing a different type of technological object in the intersection between the social worlds of non-profits and private sector. For example, Minuto from a philanthropic-Christian vision of distributive justice has infiltrated technologies of informational capitalism to provide a channel for donations that have benefited more than 3,000 poor families in Colombia. I included and considered this type of non-profit in this dissertation because even thought it is indirectly involved with engineering work, it has been able to modify the materiality of corporate engineering technologies. I also wanted to explore the work of Minuto because when the fieldwork of this dissertation was done, the Minuto University was already working on the creation of its own school of systems and computer engineering, which certainly it is going to be shaped by Minuto's perspective of distributive justice and Christian values (Interview with Father Camilo Bernal, Minuto; Interview with Manuel Davila, Minuto). This Christian-oriented perspective of engineering will surely provide alternative versions of engineering worthy of analysis in the future.

Taken together, the cases mentioned in this chapter show that systems and computer engineering in Colombia is finding other fields of work beyond those of corporations and government. They also show that some NGOs are engaged in the production of “high tech” technologies to address the needs of other NGOs and poor communities. Rather than being “out of touch” with the reality of poor communities, these technologically oriented NGOs are thoroughly grounded in the realities the communities with which they work, a condition evident in the projects of Somos Más and COLNODO. However, they are not immune to influence by dominant discourses coming from informational development and informational capitalism. Through processes of negotiation and contracts with sponsors of their projects, these dominant discourses filter into the work of NG(o)neers and NGOs. This could be seen in Somos Más helping Bogotá’s government exercise control and monitoring over the activities of NGOs in the city. It is also evident in the way COLNODO dropped off its bottom-up approach to design to go massive in all of the municipalities in Colombia with a project of Connectivity Agenda. In these cases, the intersection with other social worlds through contracts and alliances makes it all but impossible for NGOs to escape the influence of other discourses and commitment brought by the social worlds of corporate capitalism and neoliberal government. To certain degree, NGOs infiltrate some libertarian and anti-capitalist values, but their agency is limited by their location with respect to the other social worlds involved (i.e. mediated by a contract, for example).

NGOs have greater space, autonomy and agency when they are financed by sponsors more ideologically aligned with their social world, for example when financed by international or national NGOs or international cooperation agencies, as happened in the project of Somos Más in Choco, or in the project of Colnodo (IPRC) in Paipa. Ultimately, these organizations dream of achieving economic and ideological independence from private organizations and government. However their income gained by providing services to other NGOs is simply not enough to cover their operational costs and does not leave a margin for R&D on their own products. For example, the internal O2O project of Somos Más is always looking for sponsors.

Whether as technical consultants of NGOs and grassroots organizations, or as infiltrators of informational capitalist technologies, NGOs in Colombia are active actors in populating the world of discourses and objects of information and communication technologies oriented to social goals. They enrich the simple and monolithic discourses of informational capitalism and development with complex and concrete discourses and artifacts connected to the situated realities of non-profits and grassroots communities in Colombia. They also contest these dominant discourses and technologies by transforming informational capitalist technologies and by advocating alternative ideologies. In the process, they open new spaces for engineers to reinterpret their professional identities, their methodologies and their technologies, from a "third sector perspective." These spaces, which came to exist during the 1990s, offer relative positions of enhanced autonomy and independence from business interests and State ideologies for engineers. Such locations also offer engineers the possibility of becoming independent socio-technical entrepreneurs, who can create and run their own NGOs. In the process, these NG(o)neers are redefining conceptions of professionalism in engineering by opening alternatives to the de-professionalized exercise of the profession in public and private corporations.

7. CONCLUSION

In this dissertation, I explored some of the effects of the increasing participation of systems and computer engineers in organizations oriented to social goals rather than to profit-oriented goals. One of my initial assumptions was that these engineers being committed to different aims than profit maximization were developing technologies that, instead of fostering informational capitalism, tended to emphasize the accomplishment of social goals benefiting the poorest people in Colombia. In so doing it, I also expected to find in the work of these engineers, changes in engineering professionalism, which since the end of 19^{th} century declined to favor the interests of private corporations over those of the general public. Thus, this dissertation aimed to answer the following question:

"*How does the increasing participation of systems and computer engineers in public-oriented ICT organizations in Colombia, help stabilize or destabilize capitalist discourses of the information society and, in the process, alter engineering ideologies, practices, technologies and understandings of professionalism?*"

The results I found show that the contemporary work of systems and computer engineers in governmental and non-governmental organizations is helping stabilize the dominant discourse of informational capitalism. They do it in two main ways, either by being committed to discourses that help spur informational capitalism directly or by being committed to discourses that both recognize informational capitalism and lend support to it indirectly.

7.1 Stabilizing Capitalism Directly

In the first scenario, we find the systems and computer engineers from Connectivity Agenda. Their commitment to a socio-technical vision of creating the network government directly links them to elements of the dominant discourse, such as government as efficient business, citizens as clients and consumers of government services, government as client of the private sector, and government as supporter of electronic consumerism. These elements align with the dominant and intersecting discourses of global informational capitalism, neoliberalism and informational development. A prime example is GELT, online territorial government, still an ongoing project of the Agenda. This project attempts to reduce the internal digital divide among City Halls in small towns and rural areas in Colombia and to distribute e-government applications that foster interactivity with constituencies. In the process, informational capitalist, neoliberal, and informational development goals are supported. For example, by allowing citizens from urban areas, far from administrative centers of government, to register in the national system of health beneficiaries (SISBEN) from their local City Halls and to have access to attention in local hospitals, GELT is promoting one development goal by helping reduce mortality in the poorest population. The same system, GELT, is also used to aggregate demand of procurement for local municipalities in one single system (PUC), a service that makes it easier for big companies to participate in these markets because the information and auctioning of local government procurement is now consolidated and made available online. Thus, GELT also promotes informational capitalism. Finally, the whole platform of GELT, which is national and covers more than 1,100 municipalities, is operated by private corporations. Given the magnitude of this technological infrastructure, only a small group of companies in Colombia can operate it. The current operator for Colombia is Telefónica-TELECOM a Spaniard-Colombian mixed corporation, product of the privatization of telecommunications during the 1990s. By making government become one of the best clients of big corporations in Colombia, GELT also complies with neoliberal policies[97].

The alignment of Agenda engineers to support these discourses was documented in this dissertation by evidence of their ambiguous commitment to "technological

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[97] Ultimately, what is expected from e-government is a smaller, more efficient state, which provides citizens and corporations with online provision of services and helps to maintain fiscal policy discipline. This fiscal policy discipline is achieved by providing economies of scale and by increasing the efficiency of recollecting taxes. For instance, in e-procurement government reduces the cost of goods and services it demands from the private sector, thus it reduces government spending. By creating online systems of payment for taxes and payment of fees for governmental services, the government also hopes to facilitate payment, and reduce evasion, thus it increases government income.

neutrality," their constructions of "technological justice" among governmental agencies, and their commitment to a vision of a "unified government."

Technological neutrality in e-government, contested by advocates of free software communities in Colombia, has been endorsed by Agenda engineers due to their position in the government vis-a-vis official commitments to free trade the government has made with the WTO. Its consequences have been the absence of official support for free software in e-government, the ongoing use of proprietary platforms and tacit support for Microsoft and Oracle products in e-government.

Technological Justice, constructed by Agenda engineers, is a version of an internal digital divide among governmental agencies that Agenda engineers look to eliminate by offering governmental agencies equal access to the same informational environments regardless of their budgets. This discourse was illustrated in this dissertation as the prime mover for one of their designs: on-demand computing developed in partnership with Telefónica-TELECOM. This design also allowed a private corporation to develop a new business model, which turns computational units into commodities (processing time, storage capacity), to be offered to other clients in Colombia and elsewhere. In other words, the Colombian government financed the R&D of an informational capitalist technology.

In addition, the Unified Government is an image constantly used by engineers to refer to the network linking information systems of individual governmental agencies. It depicts a common core of infrastructure and applications that makes transactions among these information systems possible. This network government compacts in a black box the inner workings of governmental agencies when delivering services to citizens and businesses. It presents government as a unified entity instead of a complicated bureaucracy. The first engineering applications to make this "unified government" possible have been oriented to satisfy the needs of corporations. After all, the Connectivity Agenda was born from a set of policies to improve Colombia's competitiveness globally. VUCE, an information system to make paying duties for imports possible online, was one of the fist e-government applications. Paying taxes online is also going to be more beneficial to private interests than to the general public, because only half of the people in Colombia have credit cards or bank accounts to make online payments[98]. Providing alternative means for the "unbanked" to make electronic payments for their transaction with the government, an ongoing project of Agenda, will also provide entrance for poor people to become online consumers.

7.2 Stabilizing Capitalism Indirectly

In the second scenario, we find the engineers from Somos Más and Colnodo, and the work of Minuto with corporate engineers. NG(o)neers, engineers from Somos Mas and Colnodo, and engineers from Minuto University, were the most radical advocates of anti-informational capitalist principles, especially due to their commitment to free software. These engineers endorse copyleft for their technological creations rather than copyright. They use free software to provide cheaper products for their clients. They have a philosophy and design technologies for "sharing" knowledge and products of their knowledge with others without having to pay for it. Some of them, including COLNODO and Manuel Davila from Minuto University, are public advocates for national laws and policies to support the use of free software in e-government.

By committing to free software, these engineers would appear to create an alternative discourse to informational capitalism that it is manifested in their technological creations and in their position vis-a-vis other social worlds. Technologies and services provided by NG(o)neers fill in several gaps not served by informational capitalism. They provide customized, tailored and "high tech" technologies to NGOs and

[98] In December 2006, 51% of Colombian adults (>=18yo) had access to financial services (saving accounts, checking accounts, credit, or credit card) (CIFIN, 2008). In the USA this number is 91% (Solo, Manroth, 2006). The poorest people are, the less likely they are to have access to financial services. In Bogota, for example, in 2003, of the people without access to financial services, over half (53%) earned less than half the minimum wage and 70% earned less than one minimum wage. On the other hand, of those earning over 4 minimum wages, 84.22% had access and 15.78% did not have access to financial services (Solo, Manroth, 2006).

grassroots organizations, supporting their defense of human rights and democracy (See Chapter 6). NG(o)neers also help build the information commons by making publicly available their software creations and, indirectly, by allowing grassroots organizations to populate Internet with their content, their perspectives, and their concerns. As advocates of free software, NG(o)neers also make their voices heard in the public arena, and some of them, like Manuel Davila from Minuto, have publicly confronted the neoliberal rationale of the principle of "technological neutrality" endorsed by the government and the Connectivity Agenda (Davila, 2007).

On the other hand, however, by directing their opposition and confrontation to informational capitalism and neoliberalism, NG(o)neers inscribe themselves and their own social world within the dominant discourse. In other words, in order to criticize informational capitalism, to attempt to change it, and to make sense of what they do, NG(o)neers accept the reality of informational capitalism as one of the defining features of society and of their own social world. They often use the same rational and conceptual elements to define their own project (i.e. copyleft vs. copyright). Moreover, in Colombia, NG(o)neers owe their own existence to the rise of neoliberalism. In Colombia of the 1990s, the growth of the third sector accompanied the rise of neoliberal policies and the shrinking of the government (See Chapter 6). This explosion of NGOs and other non-profits in Colombia generated demand for the specialized work of systems and computer engineering in the third sector. These conditions helped make possible the rise of NG(o)neers.

More compelling is the NG(o)neers' collateral support of neoliberalism as they ally with the government to design and deploy technologies to support the "coordinating" role of the neoliberal state in the contemporary networks of power (Castells, 1996). Two examples of such technologies were provided in this dissertation. One was the IPRC developed by COLNODO and mass produced for the Connectivity Agenda. Second was the failed attempt to create a network of NGOs in Bogota (Socios Por Bogota) by Somos Mas and Bogota's City Hall. In these circumstances when NG(o)neers work under the umbrella of the State, their perspectives and commitments conflict with those of the

State. The result is the making of hybrid technologies that embody ambiguous, and contradictory technological components, ones I call “frankentechnologies” (See Chapter 5, 6). The technological infiltration of NG(o)neers, though, is not enough to change the ultimate purposes of these technologies as defined by the State. In the case of networking NGOs in Bogota, for example, identifying, monitoring and controlling NGOs became a more predominant feature than the voluntary social networking, advocated by Somos Mas engineers.

Non-profits also help stabilize informational capitalism collaterally when infiltrating these technologies in the private sector with values of distributive justice. In this dissertation I showed how Minuto de Dios, a Colombian non-profit, has established alliances with corporations to use their ATMs and POS to create donation channels for its housing projects. The funds recollected through these technologies go to finance 90% of the total value of houses for thousands of poor families in Colombia (See Chapter 6). These distributions of resources to poor people supported by corporate ICTs also help corporations present themselves as committed to goals of Corporate Social Responsibility. In this way, informational capitalist technologies that have been slightly modified to incorporate values of distributive justice become living proof that such technologies can not only serve private interests but also help society at large. In this dissertation, I have argued that this is actually a variety of a “social washing” of informational capitalism because the impact on the demand of housing for poor families is actually minimal.

The work done by NG(o)neers and non-profits in Colombia in incorporating social values in informational capitalism through their technological designs or redesigns is indeed fairly modest in scope. Even though we can not talk about an overturn of the dominance of informational capitalism and neo-liberalism by the work done by NG(o)neers and non-profits, these actors have done a judicious work in confronting informational capitalism and in transforming some of Colombia’s technological landscape. NG(o)neers have infiltrated informational capitalism with values and targets currently being downplayed by the market and the State. They have for example, strongly defended the information commons. They have also responded better than private engineering corporations to the informational needs of NGOs, non-profits and grassroots organizations by developing appropriate engineering technologies and methodologies such as "Asesoramiento y Acompanamiento" (See Chapter 6). In addition, they have demonstrated concrete and specific possibilities for using ICTs to realize principles of social justice through the recognition of marginalized people's voices, and the strengthening of participatory, local democracies. A world without these organizations and engineers committed to these values is a bleak informational capitalist world that just constructs an even more unjust society.

7.3 Engineering ideologies, practices, technologies and understandings of professionalism

A second question asked by this dissertation points to the impact upon engineering of the participation of these technical professionals in socially oriented organizations.

As corporations became the main habitat of engineers a century ago, the independent and autonomous professional expertise of engineers was strongly linked to private and corporate interests in contrast to those of the general public (See Chapter 3). Engineering became responsive primarily to the capitalist ethos that Daniel Bell calls "economizing" -profit maximization in the market. In my research on the work of engineers out of the private sector, in governmental and non-governmental organizations in Colombia, I expected to find engineers committed to what Daniel Bell calls "sociologizing," a variety of professionalism in which profit maximization of the market declines in favor of maximal welfare for the public at large. I found that engineers working in one governmental agency, Connectivity Agenda, do not differ from engineers working within the private sector as regards their interest with "economizing." In fact, one of the outcomes of their work is to make the government resemble contemporary corporations. I also found that these engineers generate ideologies that are compatible with the current neoliberal government and its commitments to principles and programs of the WTO. In many ways, the space for independent agency of the engineers within the bureaucratic field is restricted by the configuration of the field itself. Bureaucrat-engineers must adapt to the government's current principles, procedures, budgets, international commitments, and ideologies, which, in the Colombian case, are more responsive to the interests of private corporations. For Agenda engineers, citizens remain invisible, implicated actors in technological designs. The social impact of their e-government programs is still pending. Future measurements and evaluations will determine if these technologies actually reduce social gaps and improve the life conditions of the poorest people in Colombia.

By and large, NG(o)neers, are profoundly ideological. It was actually this commitment to social justice that motivated them to move out of the private sector into the "third sector" to pursue a professional career. The characteristics of the sector makes possible for engineers to become "social entrepreneurs" in non-governmental organizations and preserve some degrees of independency and autonomy from corporate interests. These NG(o)neers can be identified with the ethos of professionalism that Bell calls "sociologizing." In many ways, NG(o)neers respond to many of the concerns of professionalism, especially keeping an independent opinion and orienting the profession to the welfare of the poorest people in Colombia, and the general public at large. The commitment of COLNODO and Somos Mas to develop tailored, appropriated technologies for grassroots organizations shows clearly their commitment to develop "high tech" solutions that respond to the realities and goals of these organizations. Whether they are supporting the improvement of local democracies and accountability of local governments or the defense of human rights for marginalized peasants and afrocolombian in Choco, these NG(o)neers align with the ideals of democracy and social justice ideals pursued by social organizations. By including the users of their technologies in the design process, they also differentiate themselves from other approaches to design where the ultimate client is an invisible, implicated actor, an imaginary "user" brought into the design only as an abstract representation of the designers.

Their independence from private interests hinges upon their sources of funding. As long as NG(o)neers can remain independent from corporate sources of funding, they can keep their ideological autonomy. In this dissertation, I presented one illustration of an internal controversy in which NG(o)neers of Somos Mas were confronted in their ideology by potential funding from the Microsoft. This internal conflict showed how ideology and funding play a major role for NG(o)neers to keep their independence from corporate interests.

NG(o)neers ideological separation from corporate interests was also observed in their enthusiastic advocacy of free software and the public confrontation against the "technological neutrality" principle advocated by the government. Working in the "third sector" with some degrees of separation from government and corporate interests gives NG(o)neers an opportunity for professionalism. Opportunities not found either in the public or the private sector, which in Colombia now strongly resemble each other. This disconnection has allowed NG(o)neers to create an alternative space for professionalism that can be compared to the one enjoyed by engineers in the 19th century, before corporations became the main habitat for engineering (See Chapter 3). This dissertation argues that if this space of professionalism is to be maintained and extended, NG(o)neers need either to restrict their sources of funding to other non-profits, philanthropists and international aid agencies. If sources of funding are unavoidably coming from government and private sector, NG(o)neers need to be completely explicit about how some of their basic commitments cannot be altered by pressures coming from their sponsors (non-negotiable).

7.3.1 Practices and Technologies

This dissertation also found that the commitments of Agenda engineers to e-government and bureaucracy as well as the commitments of NG(o)neers to the third sector, free software and participatory design had another important result: configuring different social worlds for new practices of engineering.

In the case of governmental engineers, a clear commitment to realize a socio-technical vision of e-government a reality required them to engage in political interactions with governmental agencies. As a whole, it also took them to develop discursive elements such as "technological justice" to justify their work for the government and public audiences. This commitment also encouraged them to use coercive measures, a resource at their disposition in the bureaucratic field, to diffuse their technologies within the government. Their commitment to the bureaucratic field came with procedural restrictions upon access to funds needed for their technological projects. This required engineers to establish alliances with other top level planning agencies, such as the National Planning Department to ensure financial resources. It also made it necessary to defend their technological projects as financial investments. Thus, the bureaucrat-engineers of the Agenda are not only technically sound experts, but also lobbyists, benevolent dictators, public speakers, system builders, and negotiators. Engaged in so diverse activities in government, Agenda engineers, who mostly came from the private sector, began to see themselves not only as constructors of technology but as constructors of governmental structures, points of decision making, laws and, ultimately, a new, more efficient and unified, kind of government.

Governmental engineers' perspective was also materialized in their technologies. For example, "technological justice" is the rationale behind the on-computing demand model installed in their data center. Their tacit support for "technological neutrality" also justifies the use of proprietary software by Microsoft and Oracle in e-government (See Chapter 5).

In the case of NG(o)neers, commitments to the third sector, free software and participatory design provided a novel perspective to perform engineering. Including users in the design of technology, translating between social worlds, and developing approaches such as "acompañamiento and asesoramiento" (See Chapter 6) gave these engineers imprints for their methodologies not common among corporate engineers. Use of free software and the introduction of social values in design were also characteristic features of the technologies being developed by NG(o)neers. They also understood themselves as to be far more than constructors of technology. They saw themselves as builders of a strong third sector in Colombia. They understood themselves as "social engineers," who could perform technically and yet also speak the language of social organizations, able to translate their requirements and interests into appropriated technical solutions. My observations indicate that as expressed in the practices and artifacts being they design, the work of NG(o)neers is helping build the technological field (Hess, 2007) of the information society in Colombia, mostly dominated by corporate informational capitalism. In the process they have introduced methodologies and artifacts that embody social values and social targets that are downplayed or plainly ignored by the market and the State.

7.4 Remarks for Science and Technology Studies

Ethnographic studies of engineering design are usually carried out in corporate settings (Bucciarelli, 1994; Vinck, 2003), simulating the tradition of "lab studies" in STS. Confined to these sites, engineers are usually framed within the corporate setting for a division of labor where they perform activities of engineering design, and interact only with other members of their organization. However, these approaches to the ethnography of engineering design are inadequate when applied to engineering in the public sector or in the third sector. The world of design in these cases includes representatives from other social worlds, often not engineers, who participate and interact with engineers to construct the situation of design, its constraints and possibilities. Some of the givens and the assumptions of the corporate world (profit maximization, orientation toward mass production) do not fit these other social worlds very well, nor do they contemplate the influence of ideology in shaping processes and technologies very common in the public and the third sector. Even though some scholars have undertaken analyses to understand the work of engineers in government (Hecht, 1998; Amir, 2005), these studies are historic analyses rather than ethnographies of design. This dissertation contributes then to our knowledge of engineering by developing an approach to ethnographies of engineering design within the public or the third sector.

Using social worlds/arena theory to understand design as an arena where social worlds meet points out to a richer process of construction of meanings, encounters of commitments and perspectives, and processes of negotiation that take place among participant social worlds. Social worlds/arena theory also highlights one of the most visible findings of this dissertation, namely that the agency of engineers in government and the third sector is dependent on their interactions with other social worlds and on the structure of their own social worlds. Engineers in these design arenas attempt to imbue values in their designs. However, engineers are not the only actors attempting to influence the shape of their technologies and in some circumstances they are downplayed by other actors better positioned in the arena of design. For example, in one of the projects illustrated in Chapter 6, Somos Mas engineers included technological features that favored monitoring and control of NGOs in Bogota, even though initially they were not supporters of this approach preferring their technologies to be used voluntarily, as a necessary condition for organic social networking among NGOs. Even, engineers with political capital in the bureaucratic field and credibility in the engineering field like Hugo Sin (See Chapter 5) had to convince the National Planning Department representatives and the viceminister of communications that components of his proposed architecture of e-government were worth supporting with public funds because they were financially sound. These negotiations with other social worlds make it difficult for engineers to achieve whatever they want to pursue in terms of design. Thus, understanding design as an arena places designers in a web of negotiations in which agency ultimately resides.

Using social worlds/arena theory for engineering design studies or engineering studies also involves theorizing about the existence of technologies which embody conflicting commitments and perspectives. STS has conceptualized technologies as black boxes which resemble agreements among social groups (Bijcker, Hughes, Pinch, 1987), or as socio-technical networks that are tied under agreements (enrollments) to support the existence and use of technologies (Latour, 1996). In all of these approaches, the stabilization of an artifact, or a network, requires the conciliation, translation or assimilation of interests and perspectives. Thus, conflicts among perspectives tend to disappear once the artifact or network becomes stable. In this dissertation, I found that conflicts and differences in perspectives can also coexist with technological artifacts. In these cases, a full stabilization of social and technological worlds was never reached. However, technologies were still produced. Taking advantage of the emphasis of social worlds/arena theory on "cooperation without consensus," I theorized the materialization of frankentechnologies. Different than boundary objects, which also emerge from this theoretical perspective, frankentechnologies are not technologies that mediate between different social worlds. Frankentechnologies are the material product of incompatible differences and irreconcilable conflicts of perspectives. They are actually the product of the absence of consensus between conflicting ideologies of social worlds. These technologies materialize conflict in a technology by putting together a collage of different components that can work and coexist together even though they embody conflicting values. Two examples of these technologies were provided in this dissertation. One technology produced by COLNODO, but mass produced by Agenda, combined free software components that with proprietary components in one single system (See Chapter 5). Another technology produced by Somos Mas, provided a component for free and unrestricted access to a data base which it was designed to monitor and control their users (See Chapter 6). These collages reflect the lack of agreement of NG(o)neers with their sponsors and the co-existence of technological components that embody conflicting values.

The incorporation of Schiller's insights in a set of heuristics proposed in Chapter 2, also enriched the methodology I used by connecting the empirical observations of engineering studies provided by social worlds/arena theory to a critical analysis of informational capitalism. This also addresses one of the common critiques of interactionism as being politically insipid. Engineering studies, on the other hand, fall also short in developing critical analyses of the relationship between engineering and power, as noted by Downey and Lucena (1995). The perspective offered by Schiller provides a starting point to develop one type of critical analysis for engineering studies enframed in the broader framework of informational capitalism.

The results of my research also make visible the work of NG(o)neers. Due to the few number of NG(o)neers, at least in the Colombian case, studies of engineering work in NGOs and non-profits have not been incorporated their work and their perspective into engineering studies yet. However, the work of NG(o)neers offers empirical windows to understand other cultures of engineering which are not defined by their commitments to global informational capitalism.

7.5 Future Studies and Final Considerations

This dissertation is a preliminary analysis of the role of systems and computing engineering in constructing the information society in a country labeled "developing." Given the historical and contemporary specificities of Colombia I would expect to find similar patterns in this specialty engineering in other Latin America countries which have also been influenced by developmentalism and neoliberalism. However, that is an open empirical question that would require additional research.

It would also be fruitful to explore the involvement of engineers constructing the information society in socialist countries such as Cuba, or in countries where capitalism is receding or it is being mixed with socialist ideas, such as in Brazil, Venezuela, Bolivia, Ecuador and Nicaragua. In several of these countries, Brazil and Venezuela for example, free software is officially supported and it is used to construct applications of e-government.

The work of NG(o)neers in the United States and in other wealthy countries would also be an interesting topic for study. This would serve as complement to contemporary engineering studies focused upon government and private corporations. The use of social worlds/arena theory in ethnographies of engineering design, engineering studies, and politics of design needs to be explored further in other empirical analyses to highlight both strengths and weaknesses in this theory/methodology as compared to other approaches in STS.

Finally, for systems and computer engineering and for engineering education, the existence of NG(o)neers opens important questions that need to be addressed by educators and universities that now stress ways to prepare engineers for the corporate world. Evidence of engineering R&D in governmental agencies such as the Connectivity Agenda and the creation of socio-technical innovations such as IPRC developed by COLNODO, show that engineering innovation happens not only within private corporations, but can also exist in government and non-profits. The social and technological challenges to engineering in the public and the third sector call for engineers that are not only technically sound, but also knowledgeable about the social and political realities of their countries. This professional prospect could be very attractive to engineers who may understand that their careers would be more fulfilling if they served organizations with a strong sense of social purpose rather than private corporations.

REFERENCES

Abbate, J., 2000. Inventing the Internet. The MIT Press, 272 pp.

AdC, 2006a. Adjudicado el desarrollo del Sistema Electrónico para la Contratación Pública. Agenda de Conectividad.

AdC, 2006b. Colombia: décima en el ranking mundial de participación electrónica. Agenda de Conectividad.

AdC, 2007. La Estrategia de Gobierno En Línea y el Proyecto Gobierno En Línea Territorial - GELT". Agenda de Conectividad - Ministerio de Comunicaciones, Bogotá, Colombia.

AdC, 2008. Colombia, tercer país de América Latina en Gobierno Electrónico. Agenda de Conectividad, Bogotá, Colombia.

Amir, S., 2005. Power, Culture, and the Airplane: Technological Nationalism in the New Order Indonesia, Science and Technology Studies. Rensselaer Polytechnic Institute, Troy, NY-219.

ANDI, 2006. Encuesta sobre Responsabilidad Social Empresarial en Colombia. ANDI, Bogotá, Colombia.

Angulo, E.C., 2000. Banda Ancha Y Continuidad, El Tiempo.

Arias-DeGreiff, J., Helena-Sanchez, C., 2004. La Universidad Nacional en el Siglo XIX: Documentos para su Historia. Facultad de Ciencias Humanas UN, Bogotá, Colombia.

Aspray, W., 2004. Chasing Moore's law : information technology policy in the United States. SciTech Pub., Raleigh, NC.

ASEE, 1930. Report of the Investigation of Engineering Education, 1923-1929. American Society for Engineering Education, Pittsburgh.

Becker, H.S., 1960. Notes on the Concept of Commitment. The American Journal of Sociology 66, 36-40.

Becker, H.S., 1986. Doing things together : selected papers. Northwestern University Press, Evanston, Ill.

Bell, D., 1973. The coming of post-industrial society : a venture in social forecasting. Basic Books, New York.

Bell, D., 1980. The Social Framework of the Information Society. In: Forrester, T. (Ed.), The Microelectronics Revolution. Blackwell, Oxford, pp. 500-549.

Benkler, Y., 2006. The wealth of networks : how social production transforms markets and freedom. Yale University Press, New Haven [Conn.].

Bijcker, W.E., Hughes, T.P., Pinch, T.J., 1987. The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology. The MIT Press, Cambridge, 405 pp.

Bledstein, B.J., 1976. The culture of professionalism : the middle class and the development of higher education in America. Norton, New York.

Blumer, H., 1962. Society as a Symbolic Interaction. In: Manis, J., Meltzer, B. (Eds.), Symbolic Interaction: A Reader in Social Psychology. Allyn & Bacon, Boston.

Blumer, H., 1969. Symbolic Interactionism: Perspective and Method. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 208 pp.

Bourdieu, P., 1975. The Specificity of the Scientific Field and the Social Conditions of the Progress of Reason. Social Science Information 14, 19-47.

Bourdieu, P., 1988. Homo Academicus. Polity Press, Cambridge, UK, 344 pp.

Bourdieu, P., 1998. Practical reason : on the theory of action. Stanford University Press, Stanford, Calif.

Bowker, G.C., Star, S., 1999. Sorting things out : classification and its consequences. MIT Press, Cambridge, Mass.

Bucciarelli, L.L., 1994. Designing engineers. MIT Press, Cambridge, Mass.

Buchanan, R., 1983. Gentlemen Engineers: The Making of a Profession. Victorian Studies 26, 407-429.

Calhoun, D.H., 1960. The American Civil Engineer: Origins and Conflicts. The MIT Press, Cambridge, Massachusetts, 295 pp.

Canada, 2001. Government of Canada and Partners Reach Target of 250,000 Recycled Computers Donated to Schools and Libraries, Press Release, Industry Canada.

Canada, 2003. Canada's Journey to an Information Society. Statistics Canada - IDRC - Industry Canada.

Casasbuenas, J., 1993. El Internet Colombiano: Mi Experiencia. Colnodo, Bogotá, Colombia.

Casper, M.J., 1994. At the Margins of Humanity: Fetal Positions in Science and Medicine. Science, Technology, & Human Values 19, 307-323.

Castells, M., 1996. The rise of the network society. Blackwell Publishers, Malden, Mass.

Castells, M., 1997. The power of identity. Blackwell, Malden, Mass.

Castells, M., 1998. End of millennium. Blackwell Publishers, Malden, MA.

Cavanagh, J., 2002. Alternatives to economic globalization : a better world is possible. Berrett-Koehler, San Francisco.

Chandler, A.D., 1977. The visible hand : the managerial revolution in American business. Belknap Press, Cambridge, Mass.

CIFIN, 2008. Reporte de Bancarización a diciembre de 2007. Asobancaria - Vicepresidencia Económica, Dirección de Estudios y Regulación Financiera (CIFIN), Bogotá, Colombia.

Clarke, A., 1998. Disciplining reproduction : modernity, American life sciences, and "the problems of sex". University of California Press, Berkeley.

Clarke, A.E., 1995. Research Materials and Reproductive Science in the United States, 1910-1940. In: Star, S. (Ed.), Ecologies of Knowledge: New Directions in Sociology of Science and Technology. University of New York Press, Albany, pp. 183-219.

Clarke, A.E., 2005. Situational analysis : grounded theory after the postmodern turn. Sage Publications, Thousand Oaks, Calif.

Clarke, A.E., Gerson, E.M., 1990. Symbolic Interactionism in Social Studies of Science. In: Becker, H.S., McCall, M.M. (Eds.), Symbolic Interactionism and Cultural Studies. University of Chicago Press, Chicago, pp. 179-214.

Clarke, A.E., Montini, T., 1993. The Many Faces of RU486: Tales of Situated Knowledges and Technological Contestations. Science, Technology, & Human Values 18, 42-78.

Clarke, A.E., Star, S., 2008. The Social Worlds Framework: A Theory/Methods Package. In: Hackett, E., Amsterdamska, O., Lynch, M., Wacjman, J. (Eds.), Handbook of Science and Technology Studies. The MIT Press, Cambridge, pp. 113-137.

COCOMACIA, 2006. Experiencia Organizativa de Cocomacia - Web Site. COCOMACIA - http://www.cocomacia.org.co/index.php?id=11.

COLNODO, 2003. Internet Para la Rendición de Cuentas. Colnodo - Transparencia por Colombia, Bogotá, Colombia.

COLNODO, 2008. Memoria Institucional. Colnodo, Bogotá, Colombia.

DANE, 2003. Modelos de la Medición de las tecnologías de la Información y las Comunicaciones - TIC. DANE, Bogotá, Colombia.

DANE, 2005. Censo Nacional 2005. DANE, Bogotá, Colombia.

DANE, 2007. ICER 2007. DANE, Bogotá, Colombia.

Davila, M., 2007. La Neutralidad Tecnológica y el Software Libre. ComputerWorld Colombia, Bogotá, Colombia.

de Alcantara, H.C., 1998. Uses and Abuses of the Concept of Governance. International Social Science Journal 50, 105-113.

Denzin, N.K., 1969. Symbolic Interactionism and Ethnomethodology: A Proposed Synthesis. American Sociological Review 34, 922-934.

Development, P.o., 2008. The Global Information Society: a Statistical View. United Nations, Santiago - Chile, pp. 1-157.

DNP, 1999a. CONPES 3032: Programa Compartel de Telefonía Social 1999 - 2000. Ministerio de Comunicaciones - Fondo de Comunicaciones - DNP:UINFE-DITEL.

DNP, 1999b. CONPES 3063: Programa de donación masiva de computadores a colegios públicos"Computadores para Educar". Departamento Nacional de Planeación - Ministerio de Comunicaciones - Ministerio de Educación - SENA.

DNP, 2000. CONPES 3072: Agenda de Conectividad. Ministerio de Comunicaciones - DNP:UINFE- DITEL.

DNP, 2002. CONPES 3171: Lineamientos de Política en Telecomunicaciones Sociales 2002 - 2003. Ministerio de Comunicaciones - Fondo de Comunicaciones - CRT - DNP:UINFE- DITEL.

DNP, 2008. Evaluación y seguimiento del PRAP. Departamento Nacional de Planeación, Bogotá, Colombia.

DNP, Presidencia, 1991. La Revolución Pacífica: Plan de Desarrollo Económico y Social 1990-1994. Presidencia de la República de Colombia - Departamento Nacional de Planeación, Bogotá, Colombia.

DNP, Presidencia, 1995. El Salto Social: Plan Nacional de Desarrollo 1994-1998. Presidencia de la República de Colombia - Departamento Nacional de Planeación, Bogotá, Colombia.

DNP, Presidencia, 1999. Cambio para Contruir la Paz: Plan Nacional de Desarrollo 1998-2002. Presidencia de la República de Colombia - Departamento Nacional de Planeación, Bogotá, Colombia.

DNP, Presidencia, 2003. Hacia un Estado Comunitario: Plan Nacional de Desarrollo 2002-2006. Presidencia de la República de Colombia - Departamento Nacional de Planeación, Bogotá, Colombia.

Downey, G.L., Lucena, J.C., 1995. Engineering Studies. In: Jasanoff, S., Markle, G.E., Petersen, J.C., Pinch, T.J. (Eds.), Handbook of Science and Technology Studies. Sage Publications, Thousand Oaks, Calif., pp. 167-188.Drucker, P.F., 1993. Post-capitalist society. HarperBusiness, New York, NY.

Edosomwan, J.A., Savage-Moore, W., 1990. Developing minority, women, & disabled engineers. Industrial Engineering 22, 1S.

Education, S.f., 1930. Report of the Investigation of Engineering Education, 1923-1929, Pittsburgh, pp. 1-232.

Eglash, R., Croissant, J.L., Di-Chiro, G., Fouché, R., 2004. Appropriating technology : vernacular science and social power. University of Minnesota Press, Minneapolis.

Epstein, S., 1996. Impure science : AIDS, activism, and the politics of knowledge. University of California Press, Berkeley.

Escobar, A., 1995. Encountering development : the making and unmaking of the Third World. Princeton University Press, Princeton, N.J.

Eubanks, V., 2004. Popular Technology: Citizenship and Inequality in the Information Economy, Science and Technology Studies. Rensselaer Polytechnic Institute, Troy, NY.

Everett, M., 1998. Latin America Online: The Internet, Development and Democratization. Human Organization 57, 385-393.

Fine, G.A., 1993. The Sad Demise, Mysterious Disappearance, and Glorious Triumph of Symbolic Interactionism. Annual Review of Sociology 19, 61-87.

Fujimura, J.H., 1987. Constructing 'Do-able' problems in Cancer Research: Articulating Alignment. Social Studies of Science 17, 257-293.

Fujimura, J.H., 1988. The Molecular Biological Bandwagon in Cancer Research: Where Social Worlds Meet. Social Problems 35, 283.

FSF, 1996. The Free Software Definition. The Free Software Foundation. URL: http://www.gnu.org/philosophy/free-sw.html. Accessed: September 15th, 2008

FSF, 2007. GNU General Public License. The Free Software Foundation - URL: http://www.gnu.org/philosophy/free-sw.html. Accessed: September 15th, 2008

Gairola, B., et-al, 2004. Information and Communications Technology for Development: A Sourcebook for Parliamentarians. Elsevier, New Delhi, India.

Gans, H.J., 1995. Fitting the Poor into the Economy, Technology Review, pp. 72-73.

Giddens, A., 1990. The consequences of modernity. Stanford University Press, Stanford, Calif.

GKP, 2001. Global Knowledge Partneship Annual Report 2001: Partners in Knowledge for Development.

Glaser, B.G., Strauss, A.L., 1968. The discovery of grounded theory: strategies for qualitative research. Weidenfeld and Nicolson, London.

Gordon, E.W., 1988. Educating More Minority Engineers. Technology Review 91, 68-70.

Governance, C.o., 1995. Our Global Neighborhood. United Nations.

Hecht, G., 1998. The Radiance of France: Nuclear Power and National Identity after World War II. The MIT Press, Cambridge, Massachusetts, 453 pp.

Heeks, R., 2008. ICT4D 2.0: The Next Phase of Applying ICT for International Development, Computer. IEEE, pp. 26-33.

Hess, D.J., 2007. Alternative pathways in science and industry : activism, innovation, and the environment in an era of globalization. MIT Press, Cambridge, Mass.

Hughes, T.P., 1979. The Electrification of America: the System Builders. Technology and Culture 20, 124-161.

Hughes, T.P., 1983. Networks of power : electrification in Western society, 1880-1930. Johns Hopkins University Press, Baltimore.

Hunter, R.F., 1963. Turnpike Construction in Antebellum Virginia. Technology and Culture 4, 177-200.

IBM, Economist, 2008. E-readiness rankings 2008. Economist Intelligence Unit - The Economist.

ITG, 2000. Readiness for the Networked World: A Guide for Developing Countries. Information Technologies Group at the Center for International Development at Harvard University, Cambridge.

ITU, UNCTAD, 2007. World Information Society Report 2007. International Telecommunication Union (ITU), Geneva.

Jaramillo, D., 2004. Rafael García Herreros: Una Vida y Una Obra. Corporación Centro Carismático Minuto de Dios, Bogotá, Colombia.

Jaramillo-Marin, M., 2004. Computación Por Demanda Para Pymes, El Tiempo, Bogotá, Colombia.

Kalmanovitz, S., 2004. Recesión y Recuperación de la Economía Colombiana. Nueva Sociedad, 98-116.

Klein, H., 2004. Understanding WSIS: An Institutional Analysis of the UN World Summit on the Information Society. Information Technologies and International Development 1, 3-13.

Kleinman, D.L., 1995. Politics on the endless frontier : postwar research policy in the United States. Duke University Press, Durham.

Kumar, K., 1978. Prophecy and progress : the sociology of industrial and post-industrial society. Allen Lane, London.

Kumar, K., 2005. From post-industrial to post-modern society : new theories of the contemporary world. Blackwell, Malden, MA.

Kurbalija, J., Gelbstein, E., 2005. Internet Governance: Issues, Actors and Divides. DiploFoundation and Global Knowledge Partnership, Msida, Malta.

Lamb, J.L., 2008. Software as a Service gets a second chance, Computer Weekly. September 2, 2008.

Latour, B., 1996. Aramis, or, The love of technology. Harvard University Press, Cambridge, Mass.

Latour, B., Woolgar, S., joint author., 1979. Laboratory life : the social construction of scientific facts. Sage Publications, Beverly Hills.

Launay, C., 2005. La Gobernanza: Estado, Ciudadanía y Renovación de lo Político. Origen, Definiciones e Implicaciones del Concepto en Colombia., Controversia. CINEP, pp. 92-105.

Layton, E.T., 1986. The revolt of the engineers : social responsibility and the American engineering profession. Johns Hopkins University Press, Baltimore, Md.

Lessig, L., 2000. Code and Other Laws of Cyberspace. Basic Books, 297 pp.

López-Colomer, M., 2002. Telecentros comunitarios: Análisis de Experiencias en Países en Desarrollo, Ingeniería de Sistemas Telemáticos. Universidad Politécnica de Madrid.

Lucena, J.C., 2005. Defending the Nation: U.S. Policy Making to Create Scientists and Engineers from Sputnik to the 'War against terrorism'. University Press of America, Lanham, 183 pp.

Martin, N., 2003. Tecnologías de información y comunicación para el desarrollo : casos de estudio, Ingeniería de Sistemas y Computación. Universidad de Los Andes, Bogotá, Colombia.

Mayor-Mora, A., 1984. Ética, Trabajo y Productividad en Antioquia, Bogotá, Colombia, 537 pp.

McChesney, R.W., 1952-, 1999. Rich media, poor democracy : communication politics in dubious times. University of Illinois Press, Urbana.

Mead, G., 1972. The Philosophy of the Act. University of Chicago Press, Chicago.

Meiksins, P., 1988. The "Revolt of the Engineers" Reconsidered. Technology and Culture 29, 219-246.

Mejia, M.I., 2006. Gobierno En Línea - Presentacion Power Point en el Foro de Gobierno Electrónico - ESAP, Noviembre de 2006. Agenda de Conectividad, Bogotá, Colombia.

Melo, G., 2004. Las Elites: un Espacio de Construcción y de Legitimación del Orden Neoliberal en Colombia: Una Perspectiva Histórica. Chaire de Recherche du Canada in Mondialisation, Montreal, Quebec.

Merton, R.K., 1973. The sociology of science : theoretical and empirical investigations. University of Chicago Press, Chicago.

MinComunicaciones, 2007. Frente a software libre la neutralidad tecnológica prevalece como principio. Ministerio de Comunicaciones, Bogotá, Colombia.

Moreno-Escobar, H., Sin-Triana, H., Silveira-Netto, S.C., 2007. Conceptualización de arquitectura de gobierno electrónico y plataforma de interoperabilidad para América Latina y el Caribe. United Nations - CEPAL - ALIS.

Mosco, V., 1988. The Political economy of information. University of Wisconsin Press, Madison, Wis.

Murray, P.S., 1997. Dreams of development : Colombia's National School of Mines and its engineers, 1887-1970. University of Alabama Press, Tuscaloosa.

Negroponte, N., 1995. Being digital. Knopf, New York.

Nicholls-Nicholls, I.J., 2004. Infraestructura de Transporte Terrestre Colombiano en el Siglo XX. 1950 a 1970. In: Hist, A.C. (Ed.), Apuntes para la Historia de la Ingeniería. Academia Colombiana de Historia de la Ingeniería y de las Obras Públicas, Bogotá, Colombia, pp. 43-58.

Noble, D.F., 1977. America by design : science, technology, and the rise of corporate capitalism. Knopf, New York.

Noble, D.F., 1984. Forces of production : a social history of industrial automation. Knopf, New York.

Norman, D.A., 1998. The invisible computer : why good products can fail, the personal computer is so complex, and information appliances are the solution. MIT Press, Cambridge, Mass.

Norris, P., 2001. Digital divide : civic engagement, information poverty, and the Internet worldwide. Cambridge University Press, Cambridge ; New York.

Obregón, D., 1992. Sociedades Científicas en Colombia: La Invención de una Tradición 1859-1936. Banco de la República, Bogotá, Colombia.

Ocampo, J.A., 1984. Colombia y la Economía Mundial, 1830-1910. Siglo Veintiuno, Bogotá, Colombia, 456 pp.

OECD, 2007. OECD Labor Force Statistics: 1986-2006. OECD Publishing, Paris - France.

Olvera, A.J., 2003. Sociedad Civil, Gobernabilidad Democrática, Espacios Públicos y Democratización: Los Contornos de un Proyecto. IV Conferencia Regional ISTRC-LAC, 8-10 Octubre de 2003, San José, Costa Rica.

O'Reilly, T., 2005. What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software.

OSILAC, 2006. Informe Tercer Taller sobre la Medición de la Sociedad de la Información en América Latina y el Caribe. Observatorio para la Sociedad de la Información en América Latina y el Caribe - CEPAL, Ciudad de Panamá.

Otis, F.N., 1867. History of the Panama Rairoad and of the Pacific Mail Steamship Company. Harper & Brothers, Publishers, New York, 317 pp.

Palacios, M., 1994. Modernidad, Modernizaciones y Ciencias Sociales. Misión de Ciencia, Educación y Desarrollo, Bogotá, Colombia.

Palacios, M., Safford, F., 2002. Colombia : fragmented land, divided society. Oxford University Press, New York.

Pardo, C., 2005. En Línea con el Desarrollo, El Tiempo, Bogotá, Colombia.

Partnership, 2005a. Core ICT Indicators. Partnership on Measuring ICT for Development, Beirut.

Partnership, 2005b. Measuring ICT: the global status of ICT indicators. Partnership on Measuring ICT for Development - United Nations ICT Task Force, New York.

Pastrana, A., 2000. Directiva 02 de 2000 - Gobierno en Línea. Presidencia de la República de Colombia, Bogotá, Colombia.

Paz, O., 2004. Comentario sobre la Agenda de Conectividad de Colombia, Documentos Internos. Colnodo, Bogotá, Colombia.

Perez-Angel, G., 2005. Historia de la Construcción del Ferrocarril de Girardot. In: Públicas, A.C. (Ed.), Apuntes para la Historia de la Ingeniería. Academia Colombiana de Historia de la Ingeniería y de las Obras Públicas, Bogotá, Colombia, pp. 187-222.

Pimiento, J., Gonzalez, M., Quiroga, J.P., 2006. Utilización de la PDI para la Integración de Sistemas de información con el Portal Único de Contratación (Dic. 7, 2006). Agenda de Conectividad, Bogotá, Colombia.

Piñeros, G., 2007. Colombia: En Ascenso Pero Quedada, El Tiempo, Bogotá, Colombia.

Porat, M.U., Rubin, Michael Rogers, joint author., 1977. The information economy. The Office : for sale by the Supt. of Docs., Washington.

Porter, M.E., 1998. The competitive advantage of nations : with a new introduction. Free Press, New York.

Poster, M., 1994. The Mode of Information and Postmodernity. In: Crowley, D., Mitchell, D. (Eds.), Communication Theory Today. Polity Press, Cambridge, pp. 173-192.

Prahalad, C., Hammond, A., 2002. Serving the World's Poor, Profitably. Harvard Business Review 80, 4-11.

Preston, R., 2008. Will Cloud Computing Rain On IT's Parade?, Information Week. February 18, 2008, pp. 52.

PUC, 2008. Estadísticas de Montos y Registros Acumulados.

Putnam, R.D., 2000. Bowling alone : the collapse and revival of American community. Simon & Schuster, New York.

Rae, J.B., 1975. Engineers are People. Technology and Culture 16, 404-418.

Ramirez, J., 2002. ONG Online-Noticiero en línea para ONGS, Systems and Computer Engineering. Universidad de Los Andes, Bogotá, Colombia.

Reed-Danahay, D., 2005. Locating Bourdieu. Indiana University Press, Bloomington, 208 pp.

Reich, R.B., 1992. The work of nations : preparing ourselves for 21st century capitalism. Vintage Books, New York.

Reuss, M., 1985. Andrew A. Humphreys and the Development of Hydraulic Engineering: Politics and Technology in the Army Corps of Engineering, 1850-1950. Technology and Culture 26, 1-33.

Reynolds, T.S., 1991. The Engineer in America : a historical anthology from Technology and culture. University of Chicago Press, Chicago.

Rivlin, G., 2007. Software For Rent - 13/11/2007, The New York Times, New York, pp. C-1.

Rodriguez, M.C., 2006. Investigación sobre el estado de avance del gobierno electrónico en Colombia a nivel municipal, regional y nacional. Universidad de Los Andes, Bogotá, Colombia.

Rodriguez, M.C., Forero, C.E., 2006. Caracterización de la Ingeniería de Sistemas. Asociación Colombiana de Ingenieros de Sistemas - ACIS, Bogotá, Colombia.

Rostow, W.W., 1990. The stages of economic growth : a non-communist manifesto. Cambridge University Press, Cambridge [England] ; New York.

Safford, F., 1976. The ideal of the practical : Colombia's struggle to form a technical elite. University of Texas Press, Austin.

Salamon, L.M., Anheier, H.K., 1997. The Third World's Third Sector in Comparative Perspective. The John Hopkins University Institute for Policy Studies: Working Paper #24, Baltimore.

Salcedo, F., 2002. Colombia : Historia de la conexión de Uniandes a Internet. Interred WordPress.

Saldarriaga, 2003. Estudio nacional de necesidades, oferta y demanda de servicios de rehabilitación. Colombia. Fundación Saldarriaga Concha, Bogotá, Colombia.

Sanclemente-Orbegoso, C., 2005. El Devenir de la Ingeniería Colombiana. In: Públicas, A.C. (Ed.), Apuntes para la Historia de la Ingeniería. Academia Colombiana de Historia de la Ingeniería y de las Obras Públicas, Bogotá, Colombia, pp. 89-98.

Santos, F., 2007. Speech of Colombian Vicepresident Francisco Santos Calderón. Measuring the Progress of Societies - OECD - Istanbul 2nd World Forum 2007., Istanbul, Turkey.

Schiller, A., Schiller, H.I., 1986. Commercializing Information, The Nation, pp. 306-309.

Schiller, H.I., 1981. Who knows : information in the age of the Fortune 500. ABLEX Pub. Corp., Norwood, N.J.

Schiller, H.I., 1983. The World Crisis and the New Information Technologies, Columbia Journal of World Business, pp. 86-90.

Schiller, H.I., 1984. Communication and cultural domination. M.E. Sharpe, Armonk, N.Y.

Schiller, H.I., 1985a. Breaking the West's Media Monopoly, The Nation, pp. 248-251.

Schiller, H.I., 1985b. Information - a Shrinking Resource, The Nation, pp. 708-710.

Schiller, H.I., 1986. Information and the crisis economy. Oxford University Press, New York.

Schiller, H.I., 1987. Information: Important Issue for '88, The Nation, pp. 1-6.

Schiller, H.I., 1989. Culture, Inc. : the corporate takeover of public expression. Oxford University Press, New York.

Schiller, H.I., 1993a. Highway Robbers, The Nation, pp. 753-768.

Schiller, H.I., 1993b. Public Way or Private Road?, The Nation, pp. 64-66.

Schiller, H.I., 1996. Information inequality : the deepening social crisis in America. Routledge, New York.

Schulz, C., Olaya, D., 2005. Toward an Information Society measurement instrument for Latin America and the Caribbean: getting started with Census, household and business surveys. United Nations, Santiago - Chile.

Scott, J., 1997. Corporate business and capitalist classes. Oxford University Press, Oxford [England] ; New York.

Sewell, G., 1998. The Discipline of Teams: The Control of Team-Based Industrial Work through Electronic and Peer Surveillance. Administrative Science Quarterly 43, 397-428.

Sewell, G., Wilkinson, B., 1992. Someone to Watch Over Me: Surveillance and Discipline and the Just-In-Time Labour Process. Sociology 26, 271-289.

Sinclair, B., 1969. At the Turn of a Screw: William Sellers, the Franklin Institute, and a Standard American Thread. Technology and Culture 10, 20-34.

Solo, T.-M. , Manroth, A., 2006. Access to financial services in Colombia : the "unbanked" in Bogota. World Bank.

SPB, 2006. Red Distrital de Cooperacion Para el Desarrollo - Presentacion.Alcaldia Mayor de Bogota, Bogotá, Colombia.

Star, S., 1999. The Etnography of Infrastructure. American Behavioral Scientist 43, 377-391.

Star, S., Griesemer, J., 1989. Institutional Ecology, "Translations" and Boundary Objects: Amateurs and Professionals in Berkeley's. Social Studies of Science 19, 387-420.

Strauss, A.L., 1977. Mirrors and masks : the search for identity. M. Robertson, London.

Strauss, A.L., 1991. Creating sociological awareness : collective images and symbolic representations. Transaction Publishers, New Brunswick (U.S.A.).

Terranova, T., 2004. Network culture: politics for the information age. Pluto Press, London ; Ann Arbor, MI.

Transparencia, 2003. Propuesta de Metodología para la Rendición Pública de Cuentas a la Ciudadanía. Transparencia por Colombia, Bogotá, Colombia.

Trujillo, D., Gutierrez, R., Ruiz, J., 2003. Los desafíos para el Minuto de Dios, Revista Latinoamericana de Administración. Consejo Latinoamericano de Escuelas de Administracion, pp. 23-52.

Turkle, S., 2005. The second self : computers and the human spirit. MIT Press, Cambridge, Mass.

UNDP, 2001. Human Development Report 2001: Making New Technologies Work for Human Development. United Nations Development Program, New York City.

UNDP, 2005. Human Development Report 2005. United Nations Development Program, New York City.

UNDP, 2007. Human Development Report 2007/2008. United Nations Development Program, New York City.

UNSecretary-General, 2001. Road map towards the implementation of the United Nations Millennium Declaration. United Nations.

USAID, 2002. What is Corporate Social Responsibility?. USAID, Washington, D.C.

USDeptCom, 1975. Historical Statistics of the United States: Colonial Times to 1970. U.S. Department of Commerce.

USDeptCom, 1995. Falling Through the Net: A Survey of the 'Haves' and 'Have Nots' in Rural and Urban America. U.S. Department of Commerce.

USDeptCom, 1998. Falling Through the Net II: New Data on the Digital Divide. U.S. Department of Commerce.

Veblen, T., 1983. The engineers and the price system. Transaction Books, New Brunswick [N.J.].

Villar, R., 2001a. El Tercer Sector, La Sociedad Civil y la Gobernabilidad Democrática en Colombia. Ponencia del autor presentada en el Foro: Pensando el Desarrollo Rural desde la Formación de Capital Social, Colombia, enero 18 y 19 de 2001, Bogotá, Colombia.

Villar, R., 2001b. La institucionalidad política y el tercer sector en Colombia: notas para un reflexión. III Encuentro de la Red Latinoamericana y del Caribe de ISTR, Buenos Aires, septiembre 2001, Buenos Aires, Argentina.

Vinck, D., 2003. Everyday engineering : an ethnography of design and innovation. MIT Press, Cambridge, Mass.

Webster, F., 2002. Theories of the Information Society. Routledge, New York and London, 304 pp.

Webster, F., 2004. The information society reader. Routledge, London ; New York.

Winner, L., 1977. Autonomous technology : technics-out-of-control as a theme in political thought. MIT Press, Cambridge, Mass.

Winner, L., 1986. The whale and the reactor : a search for limits in an age of high technology. University of Chicago Press, Chicago.

World Bank, 1998. Information for Develoment: Annual Report 1998. The World Bank.

WSIS, 2003. Declaration of Principles: Building the Information Society: a global challenge in the new Millennium. United Nations.

WSIS, 2005a. Tunis Agenda for the Information Society. United Nations.

WSIS, 2005b. Tunis Commitment. United Nations.