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Information seeking behavior of scientists in Venezuela

Simon Luis Aristeguieta Trillos
The University of Tennessee, Knoxville, saristeg@utk.edu

To the Graduate Council:

I am submitting herewith a dissertation written by Simon Luis Aristeguieta Trillos entitled "Information seeking behavior of scientists in Venezuela." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Communication and Information.

Edwin-Michael Cortez, Major Professor

We have read this dissertation and recommend its acceptance:

Carol Tenopir, Suzie Allard, Jon Shefner

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Information seeking behavior of scientists in Venezuela

A Dissertation Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Simon Luis Aristeguieta Trillos
December 2010

Dedication

This dissertation is dedicated to best team in the World, my family. To my wife Susana and to my kids: Leandro and Isabella.

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I would like to express my gratitude to the University of Tennessee, faculty, staff and students of the Knoxville campus for letting me complete my doctoral degree in a highly stimulating and inspiring learning environment.

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Abstract

Information is one the essential elements of science. It is an imperative condition that researchers review antecedent works as they advance and create new knowledge. Knowledge creation in science is a process of adding and refining new pieces of data, information, and knowledge to what has already been accomplished by others. Few scientific communities have unlimited access to scientific information sources. Most communities' access to information is limited by economic, social, cultural, and technological conditions.

This study investigates information seeking behavior and information dissemination practices of the Venezuelan scientific community. A model of scholarly communication in a context of dependency emerges from the following major themes: persisting interpersonal communication with the international scientific community; publication in international journals; prestige and name recognition; and contacting the authors to access full-text journal articles.

A qualitative approach is used to illuminate the information seeking behavior of scientists in Venezuela, to discover the barriers experienced by the Venezuelan scientific community when accessing scientific information, and to explore their scientific information dissemination practices. Interviews were conducted in July 2009 with thirteen Venezuelan scientists from the fields of biology, chemistry, or physics. Interviews were recorded, transcribed, and analyzed in Spanish. Coding, categories, data analysis, and theory building followed a general inductive approach.

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CHAPTER ONE: INTRODUCTION

1.1.Organization of the Dissertation

The study is organized in five chapters. Chapter 1 is the introduction; it describes the problem, explains the importance of the study, and presents the research questions. Chapter 1 also describes the state of science in Venezuela, then presents the approach of the study, and concludes with a summary. Chapter 2 is a literature review; selected works on information seeking behavior, information dissemination, and dependency theory are presented and discussed. Chapter 3 is about the methodology; it describes the qualitative research methods used for the study, the criteria for participant selection, the techniques for data gathering, and the application of inductive analysis. Chapter 4 contains the findings and discussion; the results and data that address the research questions are

presented and discussed. Chapter 5 is the conclusion; a summary of the major findings is presented, as well as ideas for future research.

1.2.The Problem

Access to scientific information is essential to the scientific endeavor, the process of creating scientific knowledge, and the scientific community. The primary channel for the communication of scientific information is the scholarly journal (McCain, 1989). Journals are composed of papers that are linked to each other by the use of citations, forming networks of knowledge (Price, 1965). There are other ways to communicate and disseminate scientific information, including personal communication, textbooks, conference attendance, conference proceedings, preprints, social media and digital content (Brown, 1999; Price, 1963; Tenopir, King, Edwards & Wu, 2009). However, accessing and examining current research published in refereed journals is paramount to scientific research (Kirsop, Arunachalam & Chan 2007).

The accessibility of sources of scientific information is determined and mediated by the availability of funds and by the existence of an infrastructure capable of supporting access to the information by the scientific community (Arunachalam, 2003). The rising price of scientific information is a concern in academic libraries around the world, because it is limiting the number of subscriptions that a library can afford to hold (Kirsop, Arunachalam & Chan 2007; University of Illinois, 2009). Many academic libraries are canceling the subscriptions to individual journals and specialized databases and indexes. There has been a price increase in journals of 178.3% between 1990 and 2000. It is reported that a subscription to one scholarly journal may costs in an excess of $ 20,000 a

year. Many academic libraries have seen their budgets decrease by at least 3% from the 1980s to the present (Scientific Journals International, 2008). The increasing cost of scientific information is affecting universities and research institutions all over the world. Only those institutions with enough funds are able to maintain their collections of print and electronic subscriptions, and thereby continue to provide to the scientific community the desired level of access to current and reliable sources.

This situation, which has become increasingly problematic in the U.S. and Europe, has become critical in the case of countries in the periphery. "Periphery" refers to regions with monopolized, underdeveloped or developing economies. "Core" refers to highly developed regions with diversified economies (Cardozo, 1972; Valenzuela & Valenzuela, 1978). For nations in the periphery, access to scientific information is even more limited by a lack of funds, inadequate infrastructure, and in some cases, language difficulties (Kirsop & Chan, 2005; Kirsop, Arunachalam & Chan 2007; May, 2006).

There is an asymmetrical trade relationship between nation in the core and those in the periphery. The periphery exports raw natural materials and agricultural products, while the core specializes in the production of manufactured goods (Cardozo, 1972; Peet, 1999; Valenzuela & Valenzuela, 1978), which results in a cycle of continually increasing amounts of high tech products and informational services being offered to peripheral countries. Scientific information is a marketable good (Kingma, 2001) that is mainly produced and controlled in Europe and the U.S. For example, The *Journal Citation Report* (JCR) publishes usage and visibility indicators from 6,166 research and academic journals, and only 9.03% are published outside North America and Europe (Thomson,

2008a). This situation has placed peripheral countries at a disadvantage when they attempt to negotiate for access to sources with the oligopoly conglomerate providers of scientific information. Oligopoly refers to a group of suppliers that exercise market control by setting prices and establishing output quotas of goods and services (Kingma, 2001). The access to information sources acquired by the periphery is in most cases very limited, which in turn affects the access of relevant material by the scientific community. Kirsop, Arunachalam & Chan (2007, Technology transfer/Capacity building, para. 1) point out that "any limitation on the selection of material available and barriers to access lead to reduced scientific progress and continuing dependence."

Many countries outside of North America and Western Europe lack the necessary information and communication technology (ICT) infrastructure to be part of the global communication network, and have not been able to enter the global information society (May, 2006). A robust ICT infrastructure is necessary to access and interact with digital content, social media, and the international community. Many scientists in the periphery feel left out and excluded from scientific communication and dissemination processes because they lack the proper ICTs; they are "technological deprived" (Arunachalam, 2003, p.136). By the same token, library collections and services offered to the scientific community are limited by insufficient funding and staff. In some cases, the library staff lacks sufficient training and do not offer enough services to the community (Majid, Anwar & Eisenschitz, 2000).

Language also limits the access to scientific information. In selecting journals for indexing for databases and other informational goods, the scholarly publisher Thomson

favors English language journals (Thomson, 2008b). Vickery (2000) points out that even though English is the mother tongue of only 8% of the world, up to 46% of all scholarly journals are published in English. The language barrier affects science because it limits knowledge transfer and dissemination. On the one hand, scientists with limited English proficiency are forced to search, find, and use information written in their mother tongue, while on the other hand, English-speaking scientists have limited exposure to publications in other languages. Research published in the periphery has very little visibility (Arunachalam, 2003). Kirsop & Chan (2005) affirm that there is large gap in the "global knowledge pool" (p. 247) because there is a large portion of scientific research lost in the literature published in the periphery.

This study takes place in Venezuela, a country situated in the northern part of South America. Venezuela is a former Spanish colony that gained its independence in 1821. The official language is Spanish. It is a developing nation located in a peripheral region. Venezuela's economy is dependent on oil exports. Extracting, producing and exporting oil generate revenue for the Venezuelan state; oil revenues account for 90% of the nation's export earnings (CIA, 2009). Venezuela has an active scientific research community. The National Observatory of Science, Technology and Innovation (ONCTI, 2009) reports that in 2007, Venezuela had 5,222 scientists doing research in the following knowledge areas: biology, health, agriculture, environment, physics, chemistry, math, engineering, earth science, and the social sciences.

This study's main goal is to build a model that explains scholarly communication in a context of dependency. The study's specific objectives are: the identification of

Venezuelan scientists' information seeking behavior, the discovery of the barriers experienced by them in accessing scientific information, and the exploration of scientific information dissemination in Venezuela.

1.3.Importance of the Study

This study provides unique insights by illuminating the Venezuelan scientists' information behavior from their own perspectives, expressed in their own words. In light of the adverse conditions identified above, this study's findings document how these scientists experienced these barriers, and how in spite of them, scientific research is accomplished. The discoveries presented in this study add to the body of knowledge in information science, on the important topics of information seeking behavior and the dissemination of scientific information especially in a context of limited access to international information sources. The study is relevant because it reveals how a disadvantaged scientific community interacts with information sources in order to stay current on existing research and scientific discovery, and to make their own research available to others.

In addition, Venezuelan authorities, and those in other developing nations, could use the study as an additional informative source for the design and implementation of scientific information policies that would enhance and facilitate scientific activity in Venezuela. The examination of the insights and experiences of the participants in the study might also be useful to new scientists in accessing information and publishing research.

1.4.Research Questions

The study seeks to understand how scholarly communication takes place in Venezuela by exploring information seeking behavior and information dissemination of the national scientific community. The following research questions guide the study:

How do Venezuelan scientists keep current with scientific literature?

What are the difficulties experienced in accessing scientific information?

How is scientific information disseminated?

1.5.Background: Science in Venezuela

It has been nearly six decades since Venezuela began the drive to institutionalize science, and during that time, there have been major efforts to modernize the scientific infrastructure. In the present time, one research laboratory and three public universities: Instituto Venezolano de Investigaciones Científicas (IVIC); Universidad Central de Venezuela (UCV); Universidad de Los Andes (ULA) and Universidad Simon Bolivar (USB) are in the forefront of scientific research in Venezuela. These institutions exemplify the results of the modernization effort and prioritization of science that began in the 1950s. There are other private and public institutions of higher education in the country; however, their contribution to research publication has been modest (26.8%) when compared with the four institutions mentioned above (73.2%) (Aristeguieta-Trillos & Maura Sardo 2006).

Web of Science (WOS), Fondo Nacional de Ciencia, Tecnología e Investigación (FONACIT, 2009), Ulrich's Periodical Directory (Ulrichweb.com, 2009), Sistema Regional de Información en Línea para Revistas Científicas de América Latina, el Caribe, España y Portugal (LATINDEX, 2009) and the Scientific Electronic Library online

(SciELO Venezuela, 2009) present a concise depiction of international scientific output and the state of the national scientific journals. It is interesting to note that the national editorial sector is very dynamic and active; there are 183 (FONACIT, 2009) journals edited and published in the country covering the major scientific knowledge areas.

1.5.1. Modernization

"Big science", refers to well-funded, large-scale modern science (Price 1963) and the "institutionalization of science", refers to modernization of science in Venezuela (Requena, 2004; 2005). This phenomenon started in Venezuela with the creation of the Institute of Neurological Research (IVNIC) in 1954. In 1958, the IVNIC then became known as the Venezuelan Institute of Scientific Research (IVIC), as it is known today (IVIC, 2006). The IVIC was created to echo the structure and organization of the national laboratory model of North America. During the same period, the Central University of Venezuela (UCV) in Caracas and the Andean University (ULA) in Merida reached levels of investment in scientific research that were comparable to IVIC's (UCV, 2001). In the past, UCV and ULA had been primarily teaching universities. In 1967, the Simon Bolivar University (USB) was founded as a teaching and research institution in the engineering, computer and basic sciences (USB, 2008).

A major component of the "institutionalization of science" was the development of highly trained human resources. The Venezuelan government instituted a policy of sending Venezuelans to be trained at core institutions of scientific research in North America and Europe. During the 40-year period from 1950 to 1990, 2,702 Ph.D. degrees were awarded to Venezuelans by international universities (Requena, 2004).

1.5.2.International Scientific Output

In 1990, the Incentive Research Program (PPI) was created by the national government to encourage the scientific community to publish research in journals indexed in Web of Science (WOS). The program had 1,802 scientists registered as of 2000. However, in 2001, the PPI policy was redefined to include peer reviewed national journals. In 2007, there were 5,222 active scientists registered in the program (ONCTI, 2009). Aristeguieta-Trillos & Maura Sardo (2006) found 10,170 records in WOS, from the period 1994-2003, that listed at least one author with a Venezuelan address. In comparison with other countries of the region, Venezuela ranked fifth after Brazil, for which 106,564 records listed an author based in that country. Mexico ranked second with 62,731, Argentina with 44,096 and Chile with 20,387 records indexed in WOS (See Table 1-1).

Table 1-1
Scientific output: five countries of the Latin American region

Countries	**Papers indexed in WOS 1994-2003**
Brazil	106,564
Mexico	62,731
Argentina	44,096
Chile	20,387
Venezuela	10,170

In terms of the various institutions in Venezuela, the bulk of the Venezuelan scientific production (73.2%) during the period of that study was concentrated at four of them: UCV was the author's base on 2,616 records, IVIC on 1,745, ULA on 1,592 and USB on 1,498, for a total of 7,451 records indexed in WOS. The Venezuelan articles published during that study's period were distributed as follows among the following disciplines: chemistry 13.82%, clinical medicine 13.61%, physics and astronomy 13.06%, biomedical sciences 11.52%, engineering sciences 9.95%, agriculture and food sciences 9.32%, basic life sciences 7.41%, and biological sciences 7.40%. Disciplines represented by fewer than 5% of the articles were found to be: mathematics and statistics 4.89%, earth and environmental sciences 4.41%, multidisciplinary sciences 3.11%, and computer science 1.49%.

1.5.3. National Journals

The National Fund of Science, Technology and Innovation (FONACIT) is the Venezuelan government agency in charge of promoting scientific research in the country (FONACIT, 2009). This agency was created in 1967, to promote science research by offering grants to individual scientists and research institutions. It also promotes the publication of national scholarly journals. Journals funded by FONACIT must comply with periodicity, formatting and publication standards.

According to FONACIT (2009), there are 183 Venezuelan-based scientific and academic journals being promoted by the agency. The 183 journals registered with the agency are distributed in the following knowledge areas: basic science 3, biology and

ecology 15, biomedicine 34, agriculture 12, social sciences 46, humanities 54, engineering and technology 10, and multidisciplinary 9.

Ulrich's Periodical Directory reports a total of 189 academic journals published in Venezuela, out of which 91 are reported to be refereed (Ulrichsweb, 2009). There were three journals reported in the 2007 edition of the Journal Citation Report (JCR): Archivos Latinoamericanos de Nutricion, Interciencia, and Revista Cientifica de la Facultad de Ciencias Veterinarias. The first journal was in the area of nutrition and dietetics; the second was listed in multidisciplinary sciences and the third was in veterinary sciences (Thomson, 2009). The 2009 edition of the JCR added four more Venezuelan journals: Kasmera, Revista Latinoamericana de Hipertensión, Revista Técnica de la Facultad de Ingeniería Universidad del Zulia, and Visión Tecnológica, for a total of seven (Thomson, 2010)

LATINDEX, a journal index covering Latin America plus Spain and Portugal, includes journals from 31 countries. It is divided into two databases: the directory and the catalog. The directory is a comprehensive list of the region's journals, while the catalog includes journals that comply with internationally recognized publication standards, similar to those of FONACIT. There are 360 Venezuelan journals registered in the LATINDEX directory and 170 journals registered in the catalog (LATINDEX, 2009).

SciELO is an open access digital library of scientific and academic journals. Its conceptualization began in Brazil as the digitization phase of the health science regional library (BIREME, 1967) in 1997. By 1998, there were ten Brazilian journals published on line. At the time of the dissertation study, there were more than 541 journals and 14

countries involved in the library. In 2002, the Venezuelan Ministry of Science and Technology (MCT, 2009) decided to adopt SciELO to publish full text open access scholarly journals. The Venezuelan SciELO (SciELO Venezuela, 2009) collection contains 47 journals in the following areas: agricultural sciences 5, applied social sciences 1, biology 6, chemistry 1, engineering 9, geosciences 2, health sciences 16, human sciences 19, mathematics 1, and physics 2.

1.6. Approach

A qualitative research approach was selected to answer the research questions and to address the study's objective of building a theoretical construct or a model that explains scholarly communication in a context of limited access to information sources and outlets. A qualitative approach uncovers how scientists in Venezuela access sources of information, what difficulties they confront, and how scientific information is disseminated. Ellis & Haugan (1997) point out that information seeking studies have switched from studies of large groups to studies of small groups using observation and interviews, a design that allows for the development and generation of models derived inductively from the data.

The participants in the study explicate through their first-hand accounts how scientific research is accomplished in Venezuela. Long interviews are used to collect the stories of the participants. Inductive analysis is used to identify the dominant themes to emerge from the data (Thomas, 2006).

1.7.Summary

This chapter has introduced the study. The problem of limitations on scientists' ability to access to scientific information was discussed. Three factors were mentioned that might hinder the flow of information both into and from the periphery. The first one has to do with the high cost of scholarly and scientific information, the second one notes the importance of the status of the ICT infrastructure, and the third one focuses on the language barrier.

The significance of the research is established by an explanation of how the results and conclusions of the study add new knowledge to the field of information science. In addition, its findings could help to inform new developments in scientific policy, as well as to guide new scientists in their quest for current scientific information.

The research questions stated in this chapter guide the study and contextualize the research in a very specific professional community and geographical location. They allow the exploration of other scientific communication issues that appear during the development of the research, but they are also narrow enough to maintain the focus on information seeking behavior and dissemination of scientific information.

The background discourses on Venezuela's development of science and scientific performance. More importantly, it shows the existence of an active scientific community and of a very dynamic editing and publishing sector. Finally, the methodological approach that guides participant selection, data collection methods and analysis is introduced in this chapter.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

According to Corbin & Strauss (2007), the literature review in qualitative research is useful for the following: it provides questions for the initial interview, it enhances sensitivity, and it facilitates to making comparisons. The literature review presented in this chapter will help to bring the study's focus closer to the research phenomena, and it has informed the design of the interview guides. In addition, it has increased awareness of the field, and it has offered clues for further exploration and comparisons during the data collection stage that have improved the research.

Selected works on the information seeking behavior of scientists and the dissemination of scientific information are reviewed. Modernization and Dependency

theories are reviewed as explanations of economic development. Key assumptions of Dependency Theory are explored because they provide a historical framework that explicates economic and technological development in the periphery, and offer a theoretical explanation that contributes to the understanding of the context in which this study takes place. A contemporary study of dependence in Taiwan and India is also reviewed.

2.2. Information Seeking Behavior

2.2.1. The Ellis Model

Ellis (1989) studied information seeking behaviors and patterns of social scientists from the University of Sheffield. The objective of the study was to gather information and recommendations to aid in the design of information retrieval systems. Data were collected through interviews, and analysis was done by inductively deriving concepts, categories and properties. Ellis & Haugan (1997) declare that many studies on information use are being investigated using a qualitative approach. Data collection is being done in small groups through observation and interviews. Information science researchers are attempting to generate models that explain information-seeking behavior in a wide array of situations and contexts.

In the 1989 study, Ellis developed a model of six information seeking activities that comprise a consistent pattern of information seeking behavior often exhibited by academic researchers: starting, chaining, browsing, differentiating, monitoring, and extracting. The first activity of the model, starting, involves the seeker's need to gather new ideas, form an impression of the subject area, and identify important existing studies

on the topic. This activity normally centers on the individual's first search. It may also include sources the seeker was already aware of and had used before. The second activity, chaining, involves tracing the paths back and forth in the related literature that are created by following the citations for each article. The activity of browsing permits access to materials by authors, journals, conference proceedings, working papers, publishers' lists, cited works, subject terms, and broad or narrow subject headings. It is a more spontaneous, semi-directed way of looking and searching for literature in areas of particular interest. The fourth element, differentiating, implies a process of comparatively evaluating the quality, appropriateness, and relative utility of each of an array of materials that are related to the subject of interest by topic, methodology, or treatment. Differentiation is a way of filtering the results of a search. The fifth activity, monitoring, involves routinely searching specific sources and recently indexed articles, in order to keep up with new developments in a particular area of interest. The last activity, extracting, means systematically searching for material of interest in a particular database, journal collection or journal issue. Ellis & Haugan (1997) also studied information seeking patterns of engineers and other scientists in industry. The results refined and extended the original model by identifying eight activities: surveying, chaining, monitoring, browsing, distinguishing, filtering, extracting and ending.

Meho & Tibbo (2003) revised the Ellis (1989) model described above. The participants were social science faculty doing research on stateless nations. The rationale for participant selection was that this group of scholars had never been targeted before and they were diverse with regard to disciplines, institutions, countries and language.

Participants were chosen from a pool of authors indexed in the Arts & Humanities Citation Index, Geobase, the Social Science Citation Index, and Sociological Abstracts. Sixty scientists were interviewed by email. The data was coded twice. Information sources used by this group were found to be: their own personal collection of sources, fieldwork and archives. Though the study confirmed the value of Ellis' original model, four more categories were added: accessing, networking, verifying, and information managing. Accessing is having the materials and sources of information on hand. Networking refers to sharing and interacting with colleagues, in the context of their research. Verifying was regarded as crucial for this group because information had to be accurate, especially sensitive information. Information managing refers to the scientists' organizing the information they have found in order to facilitate using it for their research.

2.2.2. User Studies

Five studies are examined here to illustrate information seeking behavior research. The first three studies: Grefsheim & Rankin (2007); Hemminger, Lu, Vaughan & Adams (2007), and Tenopir, King & Bush (2004), took place in the United States. The other two studies: Majid, Anwar & Eisenschitz (2000) and Schwartz (1995) were performed in Asia, one in Malaysia and one in India. Participants in the studies were from the health, basic, and agricultural sciences.

Grefsheim & Rankin (2007) surveyed 500 National Institutes of Health (NIH) scientists and administrators. The survey was administered by telephone. It was found that the information sources their respondents used were (in rank order according to the

respondents' preference): journals, databases, books, conference proceedings, newsletters, technical reports, newspapers, statistics, lab manuals, standards, legal sources, study guides, patents, and market research. The overwhelming majority (84%) of the participants in the survey indicated that they prefer using electronic journals; only 5% of the participants prefer using printed journals. 11% of the participants responded that they like both formats.

In terms of information seeking behavior, it was found that the majority of the participants (91%) prefer to look for information themselves. Grefsheim & Rankin call them "self-sufficient information users" (p.430). The NIH library website was mentioned as the main gateway for searching for information. The search engines Google and Yahoo were also mentioned. Participants reported spending an average of 9.3 hours a week in activities of searching, reviewing and analyzing scientific information. However, there were three problems mentioned by the participants regarding information seeking: 1) "Not enough time to search for and gather information", 2) "Not knowing what is available", and 3) "Information is too hard to find" (p. 430). The authors of the study conclude that there needs to be a better synchronization between the services provided by the library and the scientists' work habits and information needs.

A 2007 study by Hemminger, Lu, Vaughan and Adams, surveyed 902 scientists from the basic sciences and the medical science departments at the University of North Carolina. The web based survey consisted of 28 questions. This study found that the most used information sources were: journals, web pages, databases, personal

communications, books, preprints, proceedings and conferences. The journals *Science* and *Nature* were listed as the two sources used the most by basic and medical scientists.

Bibliographic and citation databases and general web searches were the two most frequently used tools for information searching. The study revealed a preference for electronic access and electronic retrieval of materials. This study also showed that the number of library visits made by these scientists was very small; 23% of those surveyed indicated that they visited the library fewer than two times in a period of twelve months. When asked why they visit the library, 23% of the participants answered that it was to make photocopies. A librarian's assistance was mentioned by only 7% of the participants. Infrequent library visits may be explained by the availability of electronic resources online (Hemminger et al., 2007), although this contrasts with the findings of the Majid, Anwar, & Eisenschitz (2000) study, that the proximity of a library accounts for its users' keeping current with scientific information.

Tenopir, King, & Bush (2004) studied medical doctors at the University of Tennessee Health Science Center (UTHSC). A critical incident technique approach was used to analyze information seeking behaviors. In the study, the incident was defined as the most recent "reading"; the participant is then asked a series of questions about their reasons for reading, reading habits, and searching strategies. It was found that the respondents read an average of 322 journal articles per year. "Reading" is defined as "going beyond the table of contents, title, and abstract to the body of the article" (p. 236). Participants reported several reasons for reading articles: primary research, current awareness, teaching, writing, background research and consulting. Supporting primary

research was the main reason given for reading journal articles. The preferred format for reading was the print journal. One explanation provided in the article is that this scientific community holds a significant number of personal subscriptions to scholarly journals. It is reported that this community averages 6.3 subscriptions per person, as compared to 3.8 for the University of Tennessee, Knoxville faculty (Tenopir et al., 2004).

Majid, Anwar & Eisenschitz (2000) surveyed 234 agricultural scientists from the University of Putra Malaysia (UPM), Malaysian Agricultural Research (MARDI), Palm Oil Research of Malaysia (PORIM), Rubber Research Institute of Malaysia (RRIM), and the Forest Research Institute of Malaysia (FRIM), about their information needs and information seeking behavior. It was found that scientists from UPM spent 9.3% of their time in searching and reading scientific literature. Participants from the other institutions were spending an average of 16% of their time in the same activities. Fifty-seven percent indicated that they are able to keep up to date on the scientific literature in their area of interest. A correlation was found between proximity to the library and keeping current with scientific information. Participants closer to libraries were able to keep current with the literature. Libraries proved to be very effective in providing access to current scientific information.

Forty-three percent of these respondents are unable to keep current with scientific information; the reasons given for this were: being too busy with research, having to attend too many administrative meetings, being uncertain about where to look for information, needing information that is not available, and contending with deficient library collections and services.

The information sources that this study's respondents felt were most important for keeping current on scientific research were (in decreasing order of importance): journal articles, review articles, interaction with professional colleagues, conference abstracts and proceedings, professional meetings, sources of current contents, indexing and abstracting journals, research reports/patents/fact books, books, newsletters, bibliographies, and theses and dissertations.

Schwartz's (1995) study on physicians and biomedical scientists identified three issues that obstruct access to scientific information in India. They are as follows: 1) academic and hospital libraries do not maintain a core collection of journals, 2) national journals are not published in a consistent periodic schedule and are seldom indexed internationally, and 3) there is not a national indexing system.

Participants in the study were forty-nine medical doctors and Ph.D.s. Data were collected in six focus group sessions. Two head librarians carried out interviews. All participants belong to the All India Institute of Medical Science in New Delhi and the Tama Memorial Cancer Centre in Bombay.

Participants partially met their information needs by consulting the Biological and Chemical Abstracts and the Current Contents databases. Participants reported that articles from international journals were very hard to find. Journals issues were passed from institution to institution in order to be photocopied for local use. MEDLINE was only available on CD-ROM and access to it was limited. Librarians were considered to be poorly trained by the scientists.

2.3.Dissemination of Information

2.3.1. The Garvey & Griffith Model

Garvey & Griffith (1972) developed a model of scientific information dissemination based on a secondary analysis of data collected from 1961 to 1968 by the American Psychological Association. Dissemination or information flow in this context is a process that begins at the moment a scientist starts scientific research. These authors point out that ideas and problems for research are sparked by researchers' interactions within small scientific networks; relatively little is inspired by formal channels of scientific communication, such as the scholarly journal, and venues like conference gatherings and academic presentations. There are highly specialized clusters of scientists who constantly communicate with each other. A key aspect that accounts for successful research is the feedback and encouragement that can occur during the initials stages of research. Later, when the scientist feels that the study can be disseminated, the audience will grow from the specialized cluster of colleagues to national conferences. It is important to point out that, until this moment, the scientist has complete control on the process of information flow. Presentations at conferences are important because the research is discussed and attracts feedback, and the scientist will be made aware of other research in the same subject area. Presenting at conferences is also important for scientists because it validates their work with a larger audience.

Distribution of preprints to the scientist's personal network is another way to disseminate scientific research. The authors point out that preprints are important because the researcher will get substantial feedback before its ultimate submission to a journal. According to the statistics presented by Garvey and Griffith (1972), 60% received

feedback on a preprint that resulted in changes to the manuscripts. A salient element in research dissemination is that it actually stops when the manuscript is sent to be reviewed and published. Garvey and Griffith point out that scientific research also stops once the manuscript is sent for publication, because the scientist begins a new project at this stage. It is worth noting that this study found that researchers would send manuscripts to highly regarded journals first. Then, if rejected, they would resend the manuscript to a lower regarded journal, and so on. By the same token, they found that established scientists find an outlet for research, and if the scientist persists, sooner or later the work will be published.

Once the research is published, the information has left informal channels of communication. It has become a part of the scientific literature. It is at this point when information becomes a source for informing further scientific research. The acceptance of the source as scientific literature by the community is expressed in repetitions, by being cited in subsequent research, and by its validation in review articles. As part of the literature, it becomes established scientific knowledge and a foundation on which new research can be built. The process of information being consolidated into knowledge and becoming part of the domain may take as many as ten years after publication to occur (Garvey and Griffith, 1972).

It is important to point out that the Garvey and Griffith study took place more that 30 years ago; Brown (1999) notes that this model is being challenged by the impact of current-day information technologies, and that the model was constructed using psychology research data only. Present day information technologies and research

practices in different scientific domains might mean that information is communicated differently today. However, the scientific journal either in print or in electronic format remains the primary formal channel of communication today. The model presented by Garvey and Griffith is very valuable because it shows that scientific information dissemination is a process, where information moves from informal channels of dissemination to journal publication. It also establishes the importance of clusters and networks of scientists during the early stages of research.

Brown (1999) set out to understand how science has been disseminated in what she calls the "electronic age". The author points out that the Garvey and Griffith model of dissemination (reviewed above) is being challenged today by the communication technologies available to science. This study surveyed forty-nine University of Oklahoma astronomers, chemists, mathematicians, and physicists.

The author found that for teaching purposes, textbooks are used in the four domains. Also, to a lesser extent, monographs and journal articles are tools used for teaching. Research is supported by journal articles in all of the disciplines surveyed, although there are some variations by discipline. For example, mathematicians depend heavily on conference proceedings, conference attendance, and oral communication. Chemists keep current in their field by browsing journals and by attending conferences. Two of the chemists Brown surveyed maintained personal subscriptions to databases that were not available to their universities at the time the research was being conducted. Mathematicians also browse journals but mostly stay current with their domain by attending conferences and by personal communication. One mathematician reported

using the Internet to stay current. Physicists and astronomers browse journals as well as rely on conference attendance and personal communication. Some also reported being subscribers to a public information system. Science Citation Index was mentioned as the only indexing tool known to all of the participants in the survey. In addition, 65% of the respondents preferred printed journals rather than the electronic versions. According to the author, scientists' preference on printed journals will remain for sometime. Nonetheless, Brown (1999) suggests that science and academic libraries must offer access to electronic databases and indexes to assist scientists who are seeking information.

It is important to note that there are other tools of information dissemination today that were not present at the time of the classic Garvey & Griffith (1972) study; however, as long as the journal article remains the cornerstone of scientific communication, their model remains an appropriate vehicle to describe and explain scientific information flow from the informal to the formal realm. What is changing rapidly are the strategies for searching information, especially information contained in journal articles. Tenopir, King, Edwards, & Wu (2009) reported that in the last three decades, information seeking patterns of scientists have been influenced by the use of ICTs. Scientific information is still found by browsing the literature, citation chaining, and through leads provided by other scientists. However, electronic publication has grown so much that searching for and locating articles has increased (Tenopir et al., 2009).

2.4. Theories of Development

2.4.1. Modernization Theory

Modernization Theory is an economic explanation of a society's journey from traditional forms of subsistence to modernity. According to Huntington (2000), traditional and modern society can be differentiated by how much control is exercised over nature by mankind. In traditional society, the transformation and exploitation of nature is minimal, while in modern society, there is a high rate of transformation of nature, with the purpose of generating wealth and achieving development and progress. This high rate of transformation is possible by the application of science and technology to the production system. Huntington (2000) points out, in page 145, that "*modern society is characterized by the tremendous accumulation of knowledge"*. This knowledge is applied to the production system in order to transform nature more efficiently and effectively and to create added-value goods and services. Thus, being able to controlled and manipulate knowledge to improve the production process is one of the key components to achieve development.

The following dimensions define the modernization process according to Huntington (2000). It is revolutionary; the journey to modernization is a complex phenomenon that affects the lives of those subject to this process and transforms the organizing principles of traditional society. It is complex because it cannot be reduced to a single aspect and element. Modernization implies change, in demographics, education, working conditions, specialization, and personal and political organization. It is systemic because factors that change affect other factors. For example, changes in the workplace affect the family structure and the educational system. Modernization is a process that

affects society as a whole. Although it started in Europe in the fifteen and sixteen century, it has disseminated around the world by both peaceful and violent means. It is a lengthy process that is measured by generations. It is a phased process because several stages of modernization can be identified. It is a homogenizing process because modern societies tend to look alike, sharing many of the same characteristics. It is an irreversible process because once it has started, the society will not return to the original state. It is considered beneficial to society because modernization means progress and development, which implies better living conditions.

Rostow (2000) differentiates five stages of economic growth in the journey to modernization. These stages are: the traditional society, the preconditions to take-off, the take-off, the drive to maturity, and the age of mass consumption.

Traditional society is characterized by limited production and productivity. Science and technology that could enhance economic production are absent, do not exist, or cannot be consistently added to the production system. Production is concentrated in the agricultural sector. The economic stage of preconditions to take-off means that a society has entered a state of transition and has parted from traditional society. Science and technology are applied to the system to enhance agricultural production. This economic stage started in Europe and was transferred to the colonies and newly discovered territories by violent means, or by the dissemination of the ideas of progress and modernization. The take-off stage happened in Europe and North America as more and improved scientific and technological developments were implemented in agriculture

and the industrial sector. There is steady economic growth during this stage and profits are re-invested in agriculture and more complex industries.

In the drive to maturity stage, there is constant economic growth and progress. New and more sophisticated industries are created. New products are sold and bought in the international market. The rate of output of goods and services is higher than the population growth rate. Finally, the last stage of modernization is the age of mass consumption. During this economic stage, consumption shifts from basic goods to more sophisticated products because large portions of the population enjoy surplus income that can be spent on products and services that go beyond those necessary for subsistence. At this stage, the population has become mainly urban, and benefit from modernity.

Modernization Theory is criticized (Gunder-Frank, 2000; Shanon, 1989) because it fails to take into account social, cultural and economic factors that define and shape development in nations outside Europe and North America. It also fails to understand the relationship between developing and developed nations. This interaction affects development in the metropolis and the periphery because both processes are interrelated; it benefits one, to the detriment of the other. Slow development in peripheral nations is attributed solely to internal factors without considering the consequences of conquest, slavery, exploitation, and colonization in South America, Africa and Asia by colonial power and multinational corporations. Modernization Theory ignores the reality of the world market, and how developed nations benefit from competition or by controlling it with tariffs and regulations.

Alternative explanations of development are offered by critical theories inspired by Marxist thought. These theories are grounded in historical and empirical evidence; examples of these theories are Dependency Theory and World System Analysis. For this dissertation study, Dependency Theory has been chosen as a tool to understand the conditions of development in Venezuela and the relationship of the dependence of the national scientific community on the international scientific community to access information sources and publication outlets.

2.4.2. Dependency Theory

Peet & Hartwick (1999) describe Dependency Theory as a neo-Marxist, critical theory of development. Latin American writers, such as Osvaldo Sunkel, Celso Furtado, Fernando Cardoso, Enzo Falleto, and Teontonio Dos Santos, shaped this theory in the 1960s and 1970s. According to Peet & Hartwick (1999), the central message of the theory is that European development was only possible because of the under-development of non-European nations. The Age of Discovery brought about new world geography, with the colonial powers at the center and the colonies at the periphery.

Dependency is an economic relationship between the core and the periphery, whereby the core or dominant countries are able to achieve economic growth while the periphery countries grow as a "reflection of the changes in the dominant countries" (Peet & Hartwick 1999, p. 107). Under-development in the colonies is expressed by the extraction and destruction of their natural resources and economic surpluses. Raw materials and agricultural products extracted from the colonies were transferred to the European powers to feed their economies and produce industrial and economic growth.

The metropolis controlled the exploitation and extraction of these materials from the colonies. This control was accomplished by violent means, including warfare, slavery, and in some cases, genocide.

Though economic growth in the periphery is also achieved, it is not equally distributed across industrial and commercial sectors. It is concentrated and focused on exporting raw materials and agricultural products to the core. The economies at the periphery experience growth in their export-oriented sectors while becoming dependent on industrial and technological goods imported from the core.

According to Valenzuela & Valenzuela (1978) and Cardoso (1972), the following assumptions shape dependency theory: it is a historical explanation that emerges from a factual and observable economic relationship and context. The explanation has been derived from the phenomenon by inductive reasoning. Development at the core and under-development at the periphery coexist simultaneously with each other, and are part of the same dynamic. The economies of the peripheral countries react to the needs of the economies of the core nations by providing them with the materials to sustain development. Development at the core is only possible by extracting raw materials and natural products from the periphery while the core produces manufactured goods and technology.

Several stages of dependency are recognized in the literature. Dos Santos (1970) describes three historical stages of dependence: colonial, financial-industrial, and technological-industrial. Colonial dependence is defined by the following characteristics: complete control of the colonies by the colonial powers, the colonial power maintains a

monopoly on trade with the colony, and a monopoly on ownership of the colony's natural resources and labor.

The financial-industrial dependence stage is defined by the core country's making capital investments in the periphery in export-oriented industries, and by the exploitation of the peripheral markets. In these first two stages of dependence, production in the periphery is determined by the needs of the core markets. Economic growth is experienced at the periphery in those export-oriented industries set up by the core country's capital investment to feed the needs of the core markets.

The technological-industrial stage of dependency is defined by the investment of multinational corporations in export-oriented industries, and local production of goods and services, in order for the core countries to extract economic surplus from the peripheral markets. The multinational corporations and local elites in the peripheral countries share control of capital, industry, and labor. Revenue generated by the export-oriented industries, foreign investment, loans and aid is utilized to purchase machinery and supplies to achieve partial and dependent industrialization in the periphery.

2.4.2.1.A Contemporary Application of Dependency Theory

Shie & Meer's (2010) journal article on the development of India's and Taiwan's information technology industries seeks to demonstrate that Dependency Theory is a valuable theoretical construct that explains how high-tech industrialization increases technological dependence. They chose India and Taiwan for the study because these countries are considered to be highly industrialized and significant producers of information technology products and services. According to the authors, the rise of the

knowledge-based economy (KBE) has given birth to a new form of dependency, which is based on the control of technology. The authors have named this form of dependency "technological monopoly". Advanced or core countries enjoy technological monopolies in the global market and have found ways to accumulate wealth and capital in today's economy.

The article draws a comparison between India, Taiwan, Japan, and the United States of America (USA) regarding the following variables and indicators: research and development (R&D) expenditure, patent filing in the country of residence, and patents granted by the United States Patent and Trademark Office (USPTO). These three indicators were selected because R&D is a measure for evaluating a nation's technological capabilities, patent filing reveals the capacity for innovation of a country, and patent granting by the USPTO shows the nation's level of performance in a highly competitive market. (Shie & Meer , 2010).

In terms of R&D expenditure, the study shows that even though India and Taiwan have significantly increased their investment in those areas, they still lag behind Japan and the USA. For example, in 2004, the percentage of their gross domestic product (GDP) invested in R&D by Japan was 3.33%, and for the USA it was 2.62%, while for Taiwan it was 2.38% and for India only 0.77 %.

The number of patent filings in the filer's country of residence was not only higher in actual numbers for Japan and the USA versus for Taiwan and India, but when the growth rate difference in this statistic was compared for three time periods (from 1991 to 1995, from 1996 to 2000, and from 2001 to 2006), it becomes evident that the

gap between the two types of countries regarding innovation capacity is growing larger. In the case of the USA and Taiwan, the growth rate differences for this metric for the three periods are: 36%, 33%, and 44%. In the case of the USA and India, the growth rate difference in resident patent filings for the periods are 38%, 30% and 38% respectively. In regards to patent granting by the USPTO, the growth rate difference between the USA and Taiwan for the period from 1996 to 2000 was 33%, versus 12% for the period from 2001 to 2006. When Japan and Taiwan are compared in the same periods, the growth rate difference is 20% for the first period and 16% for the second period.

The Shie & Meer (2010) study reached the following conclusions:

> *… dependency theory is regaining its potency in the new age, because the knowledge gap between industrial and industrializing countries has become wider or remains wide. Data tell us that hardware Taiwan and software India have grown rapidly in the global IT industry…However, thanks to the widening knowledge fracture, the economic development of these countries strangely parallels more technological dependence. And this is the great irony. Not even Taiwan, and India even less so, can catch up with the advanced economies technologically. We doubt that other developing countries can escape from the cruel fate to which they seem doomed… (p. 95)*

2.5. Summary

In this chapter, a literature review on selected works about scientists' information seeking behavior, the dissemination of scientific information, and dependency theory are presented. The Ellis (1989) model describes information-seeking patterns of scientists, beginning with the initial search to the extraction of the needed information from sources. The extension of this model tested by Meho & Tibbo (2003) adds four more categories, expanding the model to include social scientists' information seeking behavior.

Five studies on the information seeking behavior of scientific researchers as users of information sources are reviewed. The studies' findings can be commented from the perspective of their setting, the respondents' disciplines, the level of availability of sources, user skills, and level of library use. Regarding location, three studies were carried out in the United States and two in Asia. For most of the studies, the discipline of the respondents were the health sciences or the basic sciences, with the exception of the Majid, Anwar & Eisenschitz (2000) study on agricultural researchers. In terms of the availability of information sources, the studies based in the U.S. showed that scientists in major academic and research institutions such as the National Institutes of Health, the University of North Carolina, and the University of Tennessee Health Science Center, have access to a much greater array of sources of information, either provided by the libraries or through personal subscriptions, in comparison to the participants from Malaysia and India. Participants in the U.S. studies appeared to have more skills in searching, accessing, and managing scientific information, prompting Grefsheim & Rankin (2007) to call them "self-sufficient information users". A final area of contrast is the nature of the respondents' use of the library. Participants in the U.S. studies use and

access library collections remotely, while for the other participants, physical location, proximity to the library, and frequency of visiting the library were crucial factors in determining their ability to keep current with scientific information. The Garvey and Griffith (1972) model serves the purpose of describing the process of the dissemination of scientific information, as it flows from being an initial research idea to becoming a part of the established knowledge base in a specific domain.

Two theories of development were reviewed: modernization and dependency. The major assumptions of Dependency Theory were presented in an effort to provide a theoretical framework that explains development in Latin America. These assumptions complement the introduction of the dissertation in Chapter One, where the state of science in Venezuela is presented. A contemporary application of dependency theory is reviewed, and a new form of dependency, called technological monopoly, is identified and discussed.

CHAPTER THREE: METHODOLOGY

3.1.Theoretical Framework and Assumptions

A qualitative exploration is the preferable approach for conducting this study of the Venezuelan scientific community because the participants are the experts on the subject of the study. Each scientist's ideas, procedures, values and meanings are the result of each participant's individual biography, context and thinking. This approach aims to find the explanations of the phenomena targeted by the objectives of the study in the stories told by the participants (Gurwitsch, 1974; Powel, 1999; Punch, 2004).

Scientists in Venezuela inform the study by telling about their strategies and procedures designed to access scientific information, what difficulties they have encountered, and how they have disseminated information about their research in both the academic and professional contexts. The information seeking activities and dissemination practices described by the participants in the study are products of their

work as professional scientists. The study creates an understanding of the real-world behavior and practices of the participants that arises from their own words. The study does not pretend to tests hypotheses or preconceived explanations of information seeking behavior and information dissemination. On the contrary, the study is designed to understand the science-making reality of researchers in Venezuela. In accordance with this objective, qualitative methods were selected as the appropriate approach to build up the study from the information and data provided by these experts on their own experiences.

Denzin & Lincoln (1994) point out that a definition of a qualitative exploration or qualitative research is tied to a historical time period, such that qualitative research may mean several things in terms of its history and how it has developed and evolved over time. The authors nevertheless offer a general definition. Qualitative research involves a naturalistic approach, interpretation, and several distinct methods of acquiring and analyzing data. In other words, qualitative research is an interpretation of the reality by the participants and the researcher. Qualitative research is also attached to a number of research perspectives and traditions, strategies, and methods that provide insights into exploring the nature of reality. Some of these traditions or perspectives are: constructivism, Marxism, and cultural models. Some of the accepted qualitative research strategies are: case study, ethnography, phenomenology, and grounded theory. Some of the methods to collect data are interviews, observation, participation, and participant observation.

According to Janesick (1994), some salient elements or key characteristics that define qualitative research are: "…Qualitative design is holistic. It looks at the larger picture, the whole picture, and begins with a search for understanding the whole…qualitative design looks at relationships within a system and culture…" (p. 212).

The context of science in Venezuela is explored in Chapter One. The following elements of scientific information are examined: modernization, scientific output, and national journals. Dependency theory is reviewed in Chapter Two. It offers an explanation of economic development in Venezuela, Latin America, and other parts of the world. Both analyses describe a historical and theoretical framework like the one in which this study takes place: a peripheral oil-producing country whose development is driven by the needs of core countries.

Janesick (1994) also wrote, "Qualitative design is focused on understanding a given social setting, not necessarily on making predictions about that setting" (p. 212). As mentioned above, the study being presented is about understanding how science is performed in Venezuela in regards to procedures and practices; the study doesn't intend to offer predictions of those behaviors. Janesick points out that "Qualitative design requires ongoing analyses of the data" (p. 212). In this study, the analysis of data is carried out from the onset of the first interview. Ongoing analysis of data allows for the exploration of emerging phenomena and for data triangulation, by checking pieces of data and information from different sources (Denzin, 1978; Glazer & Strauss, 1967).

An inductive approach is used to analyze data and information voiced by the participants during the interviews. According to Thomas (2006), much of the analysis

done in qualitative research is inductive. He defines inductive analysis as an approach "… that primarily use[s] detailed readings of raw data to derive concepts, themes, or a model through interpretations made from the raw data by an evaluator or researcher…" (p. 238).

Moreover, Haley (1996) states that analytic induction is a process that "consists of scanning…line by line for themes and categories" (p. 26). This approach of going from the raw data to main themes and categories is performed with the purpose of identifying "findings" in the data (Thomas, 2006). Thomas points out that this approach permits the following:

> *1. To condense extensive and varied raw text data into a brief, summary format;*
>
> *2. To establish clear links between the research objectives and the summary findings derived from the raw data and to ensure that these links are both transparent (able to be demonstrated to others) and defensible (justifiable given the objectives of the research); and*
>
> *3 To develop a model or theory about the underlying structure of experiences or processes that are evident in the text data (p. 238).*

The results of applying inductive analysis to the objectives are presented in the subsequent chapters entitled Findings and Conclusion. There the reader will find a summary of findings that addressed the research questions and models with clear and

well-established connections to the data provided by the participants during the interviews.

As noted above, an inductive approach is a preferred way to address qualitative data. However, the strategy known as the general inductive approach (Thomas, 1996) used in this study has some differences from other common qualitative analysis approaches, such as phenomenology, grounded theory, and theory elaboration. The general inductive approach is selected because it offers a better fit with the research objectives in terms of a more direct approach to discover procedures, practices and behaviors of scientists in Venezuela.

Phenomenology "seeks to describe experience as it emerges in some context(s) or, to use a phenomenological term, as it is 'lived'" (Thomson, Locander, & Pollio, 1989, p. 135). The phenomenological approach seeks to discover meaning and common experience while the general inductive approach used for this research seeks to discover the "core meanings evident in the text, relevant to the research objectives" (Thomas, 2006, p. 241). In other words, it reveals the meanings found in the text that answer and address the research questions. In the context of this research, a phenomenological question would be: "What is the meaning of doing science in Venezuela*?",* while a general inductive approach question would be: "How do you conduct science in Venezuela? And how do you search for information?" Likewise, the findings of phenomenology are a narrative description of lived experiences while the findings of the general inductive approach are a description of the main themes and categories (Holstein & Gubrium, 1994; Thomas, 2006). Those findings are presented in the next chapter.

Grounded Theory (Corbin & Strauss, 2007; Glazer & Strauss, 1967) and the general inductive method are alike, in that both are inductive-deductive models that generate theory from data. In the case of Grounded Theory, analysis is done in a three-step procedure called open, axial, and selective coding. Then the major findings are contrasted deductively with data. The general inductive approach, on the other hand, does not separate the coding stage into three steps. Coding is performed as many times as is necessary until the main themes are identified. As is the case with Grounded Theory, findings are also contrasted with lower categories to test for consistency. Thomas (2006) points out that the categories that come out of the analysis may be incorporated into models, theories, and frameworks. From this perspective, Grounded Theory and the general inductive analysis are similar.

Another perspective that calls for models, constructs, and theories as part of the qualitative analysis is theory elaboration, which refers to "exploring a particular phenomenon in case studies of organizational forms of differing size, complexity, and function and improving/altering theory by alternating between units of analysis" (Vaughan, 1992, p. 175). It is a process of refining theoretical constructs by an iterative process, in other words, concepts and models are distilled by a repetition of steps or step-by-step process (Cortez & Kazlauskas, 2000; Vaughan, 1992). This approach is a case-oriented method that studies the phenomenon with a theory and/or a model that leads the research. In the case of the general inductive approach, research does not begin with a guiding principle such as theory; on the contrary, models, concepts, constructs, and theories appear from the data.

3.2. Methods

3.2.1. Participants

The participants in the study are active members of the Venezuelan scientific community affiliated with the Research Incentive Program (PPI) with a "research" rank of level 3 or higher. This rank and level of scholarship and research is comparable to the associate professor rank in the North American academic context.

The Research Incentive Program (PPI) has three main categories of affiliated scientists: candidate, researcher, and researcher emeritus. The categories or ranks and levels are defined by a combination of the highest educational degree achieved, accumulated time spent in prior categories, and the number of publications earned while at each level. For example, to be a Level 3 researcher, the scientist must have at least eight years of experience and earned 13 publications in previous categories (Candidate, Research Level 1 and Research Level 2). To advance to the next rank (Level 4), the scientist must spend at least four years as Level 3 and publish ten more papers, for a total of 20 publications, and 16 of those publications must be type A (see Table 3-1 on PPI research categories). The research emeritus rank level does not have any formal requirements; it is an honorary category that recognizes a lifelong career contribution to the sciences (ONCTI, 2009).

The Research Incentive Program (PPI) ranks scholarly publications (serials and/or monographs) in categories. Publication type A includes articles published in journals indexed in the following databases: Web of Knowledge (Science and Social Science editions), BIOsis, MEDLINE/PUBMED, Mathematical Review, Compedex, SciELO, CLASE, the LATINDEX catalog, and the FONACIT register. Type A also includes

books and book chapters from recognized publishers, and registered technological patents. Publication type B refers to articles published in refereed journals indexed in at least one international database, refereed books and/or book chapters, and published proceedings from conferences or congresses (ONCTI, 2009).

The research rank of Level 3 or higher is a precondition for inclusion in the study, because individuals within this group have a longer professional history and more publications than scientists in lower levels. Active scientists at this level have at least eight years of research experience and 13 publications in previous categories (see Table 3-1). It is assumed then, that scientists with this research history and background are more experienced in and familiar with behaviors, practices, and strategies of information seeking and information dissemination than scientists in lower levels, and are therefore able to provide more profound and thoughtful insights on their careers in science.

Table 3-1
PPI Research Categories

	Education Level	**Time**	**Publications**
Candidate	Master degree/Doctoral degree	3 years	1
Researcher Level 1	Doctoral degree	2 years	2
Researcher Level 2	Doctoral degree	3 years	10
Researcher Level 3	Doctoral degree	4 years	20
Researcher Level 4	Doctoral degree	5 years	35
Researcher Emeritus	Honorary category		

Note: Adapted from ONCTI (2009). *Sobre el Programa de promocion al investigador*. Retrieved May 16, 2009, from http://oncti.gob.ve/

Participants in the study are recruited by convenience sampling (Corbin & Strauss, 2007) and snowball sampling (Lindlof & Taylor, 2002) techniques. The researcher had in prior years (before 2002) worked with the scientific community during his tenure at the Science and Technology Ministry of Venezuela. While there, he had met a large number of scientists that had the professional standing required for participation in the study. Five scientists were contacted by email in May of 2009. The emails explained the objectives of the study and advanced the idea of being part of the research. Of those five individuals initially contacted, only one agreed to participate, while the other four declined. Almost unanimously, the reason given for declining participation in the study was "not being active in research anymore". The majority of those initially contacted provided the researcher with the contact information for potential participants, and actively contacted and recruited several participants. In June 2009, twenty interviews were already scheduled for the following month. Out of those twenty, seven participants either did not fit the academic precondition for participating in the study or declined to be interviewed later in the process of data collection.

The Research Incentive Program (PPI) lists thirteen domains or subject areas: agriculture, environment, biology, health sciences, physics, chemistry, mathematics, social science, humanities, education, engineering, technology and earth science (ONCTI, 2009). The participants in this study are researchers from the disciplines of physics, chemistry, and biology. They are faculty members and scientists from the Central Venezuelan University (UCV) and the Venezuelan Institute of Scientific Research (IVIC). Both institutions are at the forefront of scientific research in Venezuela, and are

the top two institutions in terms of most published research indexed in WOS (Thomson, 2010). Among Venezuelan institutions, they house the largest concentration of researchers affiliated with the Research Incentive Program (PPI). In the last days of June 2009, the researcher traveled to Venezuela. The scheduled interview appointments were confirmed by email and telephone conversations. Thirteen active Level 3 or higher researchers were interviewed. The interviews were conducted in July 2009. Data analysis was performed on the text of the interviews of thirteen Level 3 or higher researchers. Table 3-2 shows the participants' distribution according to academic rank, discipline, and institution.

Table 3-2
Participants

Academic rank	Research Level 3 = 10	Research Level 4 = 3	
Discipline	Biology = 5	Chemistry = 4	Physics = 4
Institution	IVIC = 6	UCV = 7	

Qualitative research methodology does not specify a standard number of participants from which to collect data (Corbin & Strauss, 2007; Glazer & Strauss, 1967; McCraken, 1988). The appropriate number of participants is defined by the development of the categories of interest from the analysis of the data. Interviews then continue until the level of saturation is reached, which is when additional interviews do not produce new insights. In this study, saturation was reached at the ninth interview. Later interviews did not provide new or unique information; however, they are important for corroborating and checking the information that was provided in the earlier ones.

3.2.2. Interviews

The long interview technique was used to collect data. McCraken (1988) points out that any social science research is improved if one can understand the experiences of the participants. He advocates the long interview technique as a potent tool to discover and understand how the individual sees the world and makes sense out of it. For this study, interviews were conducted in Spanish. At the beginning of each interview, the researcher explained the objectives and breadth of the study. In addition, the risks and benefits of participation were discussed, permission to be audio-recorded was obtained, and a Spanish language copy of the IRB informed consent statement was presented to the participant to be read and signed. (Appendix A has the form in Spanish; for an English version, see Appendix B.)

It is estimated that interviews should typically last an hour (Morrison, Haley, Sheenan & Taylor, 2002). However, the time range for this study's interviews varied from forty minutes to three hours and forty minutes. Interview duration was determined

in situ by the quality of the data being gathered and the willingness, motivation, and time restrictions of the participants. In total, 302 megabytes of Mp3 sound were recorded, generating 260 letter-size, single spaced pages of transcription.

Morrison et al. (2002) points out that "context is very important determining meaning" (p. 46). All of the interviews took place in the participants' natural settings. The researcher was able to observe and ask questions about work conditions and locations of computers, journals, telephones and other devices relevant to the study. Questions such as: "How do you organize your information?", "Do you read printed or electronic journals?", or "Do you keep a core collection of relevant literature?", are motivated and inspired by one participant with a large collection of photocopied articles in PDF format neatly organized by a homegrown classification system.

3.2.3. The Interview Guide

An interview guide (see Tables 3-3, 3-4, 3-5, and 3-6) was developed based on the researcher's professional experience in the field, prior assumptions and beliefs about information seeking behavior and information dissemination in Venezuela, and from the literature review presented in Chapter Two of this study. However, the interview guide has limited usefulness in the field where the interviews take place. The interview guide is included in this report because most of the issues were discussed with the participants as they appeared spontaneously and naturally in the dialogue. They also serve to inform the reader on the methodological design of the study.

Private, confidential, personal, and demographic information are not included in the analysis, in order to safeguard the identities of the participants. For example, data on

areas of research, research agendas, institutions of affiliation (see Table 3-3), scientific community affiliations, ideas for research, journal affiliations, and chemical compounds (see Table 3-6) were collected but are not reported in this study.

The interviews are carried out as conversations. All of the interviews are started with the same general questions: "How do you research?", "How do you search for information?", "Where do you publish?", and from then on, topics and themes are discussed as they are introduced by the participants and by the researcher. Probes and other questions are used to clarify behaviors, concepts, topics and themes (Krueger & Casey, 200). For example, participants were asked, "Are you subscribed to any journal?", "How many?", "Which ones?", and "Is it a personal subscription?"

As the collection of data and information progressed, the researcher introduced prior themes to further develop them until the point of saturation. By the same token, unanticipated topics were also explored as they appeared in consecutive interviews to enhance understanding (McCraken, 1988). Corbin and Strauss (2007) point out that interview guides lose relevance, and their content changes during the study. They write that:

> *If a researcher enters the field with a structured questionnaire, persons will answer only that which is asked, and often without elaboration. Respondents might have other information to offer, but if the researcher doesn't ask, then they are reluctant to volunteer, fearing that they might disturb the research process*…(p. 153).

The rigid use of an interview guide would have defeated the purpose and the assumptions of the study that consider the participants to be the experts on information seeking behavior and information dissemination in Venezuela. Therefore, an unstructured approach to the interview was favored instead of a structured interview that rigidly followed the question guide, an approach that would have limited the scope and depth of the data and information collected.

Table 3-3
General questions

#	**Question guide**
1	What is the name of the institution you work for?
2	In what school are you in?
3	What is your research area?
4	What is your research agenda?
5	What is your PPI level?
6	How many years have you been a scientist?
7	Where did you study?

Table 3-4
Information seeking behavior

#	**Question guide**	**Probe examples**
1	How do you find out what is being published in your research field?	
2	Where do you get scientific information?	
3	What sources of information do you use?	
4	What formats do you favor?	Why?
5	What information technologies do you have in your workplace?	
6	How do you use those technologies to keep current with scientific information?	
7	Do you use the Internet to search for scientific information?	
8	Do you use any academic database or index?	Which one? How often?
9	Do you use SciELO or LATINDEX?	
10	Do you use Google Scholar?	
11	How do keep current with scientific information?	Can you explain further?
12	What journals do you read?	
13	Do you visit the library?	How often? What do you look for? Can you give me some titles? Do you find it useful?
14	Does anybody help you to find information?	Grad student? Colleagues?
15	How do you start your search for scientific information?	
16	Do you keep your own collection of journals?	What are they? How many? How do you get them?
17	How do you keep current with scientific information?	

Table 3-5
Difficulties in accessing scientific information

#	**Question guide**	**Probe examples**
1	Are you able to search for information from your office?	How?
2	Do you find scientific information in Spanish?	How? Where?
3	How difficult is it to find scientific information?	Explain further?
4	Does the library provide a good collection of resources?	
5	Does the library provide services for the researchers?	Reference services? Onsite? Online? Computers? Photocopy machines?
6	Is the library accessible?	How far from your office?
7	Does the library provide electronic access?	
8	Do you have remote access to the library collections?	
9	Does the library have subject librarians?	
10	Does the library provide special accommodations to researchers?	Special rooms? Desks?
11	What difficulties and/or barriers do you find when trying to search and access scientific information?	

Table 3-6
Dissemination of information

#	**Question guide**	**Probe examples**
1	Do you get any journals by mail?	How many? How often?
2	Do you have a journal subscription?	Are they paid? National? International?
3	Do you attend conferences?	How many times a year? International? National?
4	Who funds conference attendance?	
5	How do you communicate with your peers?	Have regular meetings? By phone? By mail? By email? Using social media? Are they national or international scientists?
6	In what journals do you publish?	How do you choose where to publish? How many articles do you plan in publishing a year?
7	How do you tell your colleagues about your research?	
8	How do you share your publications?	
9	How do your colleagues share their research with you?	
10	Are there indexes or databases of Venezuelan journals?	What are they? Do you use them? Are they electronic or printed? Do you have access to them?
11	How do you get journal issues?	
12	What journals do you review for?	
13	Are you a member of an online community?	Which one? Is it national or international?
14	Where do you get ideas for research?	
15	How is scientific information is disseminated in Venezuela?	

3.2.4. Analysis of the Interviews

Coding is the process of developing concepts from data. Haley (1996) defines analytic induction as a process that "consists of scanning…line by line for themes and categories*"* (p. 26). Thomas (2006) points out that "the outcome of an inductive analysis is the development of categories into a model or framework that summarizes the raw data and conveys key themes and processes" (p. 240). Important features of categories, according to Thomas (2006), are category labels; category descriptions; coded text that illustrates meanings and behaviors; links to other categories; and model or theoretical construct that is the end point of the inductive approach.

In order to complete the research and to fulfill the terms of Thomas' (2006) inductive analysis proposition, the researcher has taken the following steps (these steps are based on Thomas (2006) with some modifications to fit the specific study):

1. The raw data is read. Non-relevant and confidential discussions are taken out.
2. The raw data is formatted, each line is numbered, and it is printed out on letter size pages. Each interview is named sequentially: P1, P2, P3 and so on.
3. The text is read again in order to gain a general understanding and to get familiar with the data.
4. A careful line-by-line reading is performed to discover initial categories (Appendix C). Categories are labeled with emic descriptors (when possible); text segments are selected and description, analysis, ideas, and interpretations are attached.
5. Additional parts of the text are added to the initial categories when and where they fit.
6. Relationships between categories are explored.
7. Redundant and repetitive categories are revised and combined.

8. Higher categories are developed that included lower levels of induction.

9. A model that explains scholarly communication with limited access to international sources and outlets in a context of dependency emerged from the incorporation of the major categories.

10. The model has been tested by deductive reasoning against lower categories of analysis.

11. Category labels, descriptions, explanations, interpretations, relations, models and selected text have been translated from Spanish to English.

3.3. Limitations of the Study

The study has achieved the objectives set out in the research proposal: a model that explains scholarly communication in a context of dependency has been constructed, information seeking behavior of Venezuelan scientists is identified, the barriers experienced by them in accessing scientific information are established, and their dissemination of scientific information is explored.

However, the study might be critiqued regarding potential issues with validity, reliability, and objectivity. At least two types of validity are reported in the literature: internal and external. Internal validity refers to how accurate and appropriate the methods and findings are in addressing the objectives of the study, while external validity refers to what degree the generalization of its findings is justified. Reliability is defined as how precise, replicable, and stable the measurements and findings are. Objectivity refers to the degree to which the measurements and analysis are value-free or independent from the influence of the researcher's own perspectives or influence. (Lincoln & Guba, 1985).

To address these concerns, qualitative research rests on the concepts of credibility and transferability (Hoepfl, 1997).

In regards to credibility, accuracy, integrity and trustworthiness, extensive interviews were performed. Data presented in the study are extensive, in-depth, and rich. Emic descriptors were used whenever possible. Phrases and words from the transcripts are chosen to label and describe some categories because they more accurately explained the meanings, thoughts, expressions, and actions of the participants; they also help the reader to understand the participants' perspectives (Taylor, Hoy & Haley, 1996). However, it is important to point out that many colloquial terms were lost in the translation from Spanish to English. As noted above in step 11, translation from Spanish to English was performed. Therefore, quotes and segments reported here are in English. Translations were very carefully done to safeguard as much as possible the original meaning of the Spanish language (Taylor, Hoy & Haley, 1996).

After saturation was reached (with the ninth interview), data and information were checked and corroborated in the subsequent interviews. For example, several participants told the researcher about the limited role of Venezuelan periodicals and regional databases as publication outlets and sources of information. Those findings are corroborated almost unanimously by later interviews. Transcriptions have been sent to the participants in order to clarify ideas and concepts; information deemed confidential or inaccurate then has been deleted or corrected. The model of scholarly communication in a context of dependency was tested with deductive reasoning against lower categories of analysis.

With regard to transferability, comprehensive background data was provided on Venezuela's scientific output, publications, and research institutions. A respected and time-tested theoretical perspective was presented as a plausible explanation of economic development in Venezuela. These elements offer enough information to consider the transferability of the findings to other scholarly communication studies situated in developing countries that are facing comparable realities.

Other potential limitations of the study are as follows:

1. Participants are similar in terms of discipline, age, career path, and institutional affiliation. A more diverse sample might have allowed the emergence of other themes and categories.
2. The study is missing the international scientific community's perspective on scholarly communication with developing countries.

3.4. IRB Approval

The study was granted approval (IRB#7739B) under expedited review by the Institutional Review Board of the University of Tennessee in October 23, 2008. The IRB approval was renewed in October 22, 2009. The approval expires on October 23, 2010.

3.5. Summary

In this chapter, the purpose of the research, research questions, theoretical framework, and the method are discussed. The general inductive approach is explained and compared to other qualitative methods and approaches, such as phenomenology, grounded theory and theory elaboration.

The method section is divided into four subsections: participants, interviews, the interview guide and the analysis. In this section, the participants' profile and preconditions required for participation in the study are defined as scientists with at least a "research" rank of Level 3 or higher, and who are affiliated with the Research Incentive Program (PPI). The process of participant selection and enrollment in the study is described as convenience sampling and snowball sampling techniques. The interview protocol is described in subsection 3.2.2. The long interview is the selected method for creating data. The interviews are described as non-structured and conversation-like. The interview guide is de-emphasized as a research tool because it limits the scope, the quality and the richness of the data gathered in this type of research. However, the content of the interview guide is included in Tables 3-3, 3-4, 3-5, 3-6 because most of the issues addressed by the interview guide's questions were actually discussed in the field and they serve as a guide to the reader. A detailed account on transforming data into findings is enunciated in eleven steps: from raw data to theoretical tools. The procedures to ensure the quality and trustworthiness of the research are described as: triangulation of data, participants' transcription checks, and the use of emic descriptors in the study. Finally, information on IRB approval is referenced in section 3.3.

In the next chapter, the findings of the study will be presented and discussed. Main categories, themes, and a model will illustrate scholarly communication, information seeking behavior and information dissemination in Venezuela.

CHAPTER FOUR: FINDINGS AND DISCUSSION

4.1. Introduction

This chapter presents the study's findings: a model that explains scholarly communication in a context of dependency; the identification of Venezuelan scientists' information seeking behavior; the discovery of the barriers experienced by them in accessing scientific information and the exploration of scientific information dissemination in Venezuela.

The model of scholarly communication is defined as a set of interrelated strategies of interpersonal communication, information dissemination and information seeking behavior with the purpose of overcoming difficulties and barriers experimented by Venezuelan scientists with limited access to international information sources and publication outlets in a context of dependency. The major themes from where the model surfaces are: persisting interpersonal communication with the international scientific community; publication in international journals; prestige and name recognition; and contacting the authors to access full-text journal articles.

The chapter includes a presentation of the data used to establish these themes as well as other important elements that substantiate, describe and illustrate information seeking behavior and dissemination of scholarly information in Venezuela, such as initiating search, browsing, database search, internet search, reading abstracts, buying papers online, national and regional journals, library services, information management and conferencing.

4.2. Interpersonal Communication

In the subsections below, the participants of this study describe how communication takes place in their scientific community. The participants mention the importance of information technologies for their communication with the international scientific community. Several devices, technologies, and patterns of communication are described. An emphasis is also placed on the necessity to have face-to-face contact in order to build collaborative relationships that contribute to the advancement and development of the national scientific community. These relationships also promote improved access to scientific information otherwise unavailable to the Venezuelan scientific community.

4.2.1. "We Could Not Survive Without That Daily Contact"

The participants describe the importance of using information and communication technologies (ICTs) and how they have changed communication patterns, searching and finding information. Conversations by traditional telephones, Voice Over Internet Protocol (VOIP), electronic chat and email are mentioned as some of the alternatives used to communicate with each other. Participant 9, for example, pointed out that the

telephone is the preferred method of communication with scientists based in Venezuela, while electronic mail is used to communicate with international scientists; though, as it is illustrated below, traditional telephone communication is also used to communicate with national and international scientists:

> *P9: Most researchers use computers regularly to search for information and to check electronic mail. The scientific community communicates by email. We still use landlines and cell phones to communicate with scientists in Venezuela but internationally we communicate by email…*

Participant P7 reported, on the other hand, *"We talk to international scientists by phone or by chat"*. Yet another distinction is made by Participant P6 in terms of communicating with international scientists. Participant P8 also described the tools and the frequency of those communications as happening almost daily.

> *P6: The French like to use the telephone; we also have a lot of meetings using Skype. We meet every month; lately we have met every fifteen days. Every day, there are phone calls and chats; it's a daily thing.*
>
> *P8: We may use regular telephone lines, Skype, email, chats or more sophisticated tools but the main thing is that we communicate, it is a daily occurrence…*

Finally Participant P7 sees the role of the ICTs going beyond communication, stating that, *"information technologies are integrating us to the international scientific*

community. There is daily communication in the scientific community. We could not survive without that daily contact."

Participant 7 also mentions the frequency of the interaction as "daily communication", and underscores its importance by using the terms "integrated" and "survive". Both terms denote what it is essential and vital to the Venezuelan scientific community. Frequent, even daily, direct communication and integration with the international community is essential for the survival of science in Venezuela.

On the one hand, it could be argued that the relationship between the Venezuelan scientific community and the international community is not one between equal partners and peers. Venezuelan scientists feel the need to be integrated into the international community because they cannot survive and develop in their own terms. Though this study cannot fully substantiate this argument, it advances the notion expressed by the participants that scientists in Venezuela depend on the international scientific community to achieve progress and to advance; at least in terms of access to information sources and outlets of publication.

On the other hand, communication among scientists is paramount for scientific research. According to Garvey & Griffith (1972), the informal interaction of scientists is what initiates new ideas, approaches and problems to be researched. Small groups of scientists need constant communication to be inspired and encouraged to do scientific research. In this initial stage, feedback from other scientists is the key for successful research. Information technologies play a crucial role in communications within the national and with the international communities. As it is pointed out, above, landlines and

cell phones are used to communicate with national scientists while VOIP such as Skype, email, and chat are the preferred information technologies for communicating with international scientists. Cost may account for this difference in technology use. If the infrastructure is available, Internet-based communication is less expensive than communication based on phone calls.

4.2.2. Nothing Can Replace Face-to-face Contact

Another crucial aspect of interpersonal communication with "international scientists" is to know them personally or to at least be able to identify who they are. Participant 7 affirmed how important is to travel abroad, socialize, and experience their working conditions, *"Even though, we may use email to connect with other scientists, nothing can substitute for face-to-face contact. We need to travel. We need to see other scientists. We need to see how they work…"*

According to participants 7, 12 and 9, face-to-face conference participation is another great opportunity to know who the "big names" are in the discipline. Participant 7 mentioned meeting and accessing important scientists in the field:

> *P7: Yes, my field is very specialized. Even though it has grown a lot in the last few years, we know who the big names are. When we go to international conferences, there is a great opportunity to meet and access those big names.*

Participant 12 also expressed the concepts of networking and collaboration, as when "building bridges of collaboration" is stated in the quote below. Moreover, according to this participant, the "international scientists", and the "big names" are also

interested in collaborating with the Venezuelan scientific community. In addition, participant 12 communicated something that was common to all participants: that even though ICTs facilitate communication and help with the integration of Venezuelan scientists into the international community, face-to-face contact is still crucial and fundamental to building those relationships:

> *P12: I try to go to international conferences to find out what is happening in the field. I like to meet other scientists in the field in person. I am interested in building those bridges of collaboration. They also are interested in collaborating with me. Nothing can replace face-to-face contact…*

Participant 9 asserted the more traditional role of the conference as one of the preferred outlets for the dissemination of research. It is pointed out that being known and knowing the important actors brings a lot of opportunities for the national scientist's career:

> *P9: If you want to build your career, you have to go to the main conferences. It is important for the community to know who you are. It is important for you to become acquainted with them. It opens a whole new world of opportunities to further develop your research agenda.*

For the Venezuelan scientific community the international conference becomes a place to network, meet other scientists and make personal contacts and relations that can

open new opportunities of research collaboration, funding, and access to scientific information. Few participants mentioned conference participation as a setting to formally disseminate scientific information and to have their research validated by a larger audience of peers as it is pointed out in the Garvey & Griffith (1972) study. Instead, the main theme on international conference participation centers on the idea of "building bridges of collaboration" as one participant indicated above. Venezuelan scientists have very few opportunities to mingle, socialize, and share personal and professional concerns and issues with the international community. Attendance of international conferences is one of the few chances available to them to meet face-to-face with scientists from other countries.

4.3. "I Want To Be Known Internationally"

Participants in the study described their publication patterns. Research publication in scholarly journals is the primary communication and information dissemination conduit found in the study. A differentiation in terms of goals and objectives is made between national, regional, and international journals and publication patterns. The second common theme of the theoretical construct emerged from the data below. Venezuelan scientists gained recognition and reputation by publishing in journals with high impact factors, a common bond with scientists elsewhere. Recognition facilitates interpersonal communication, which in turn facilitates access to sources of information.

4.3.1. Wasting a paper

Participants discussed the roles of the national, regional and international journals in the dissemination of their work. A distinction is made between these three outlets of

publication, in terms of scope, visibility, document type, indexing, and language. In terms of scope, the national journal is their preferred outlet for publishing national conference proceedings and articles on educational and scientific policy. The regional journal is found to be the outlet of choice for publishing regional conference proceedings and research of regional relevancy, while the international journal is the chosen outlet for publishing high quality research. In terms of visibility, the participants expressed the understanding that the national journal has low visibility, the regional journal medium visibility and the international journal high visibility and impact. In terms of document type, the national journal is reported to be a good outlet for publishing editorials, letters, opinions and news, while the regional journal is a good outlet for publishing research papers and items about regional matters. The international journal is the most desired outlet for research papers. No data was collected about their use of national databases and/or indexes for publication, because they are unknown to the participants. Regional databases and indexes (SciELO, Periodica, Latindex and LILACS) are known but considered irrelevant to the participants' research interests and agendas. Web of Science, Medline, Pubmed and Google Scholar were indexes, search engines and databases considered relevant by the participants. In terms of language, the national journals are published in Spanish, while regional journals are published in Spanish, Portuguese and English, and the international journals is published in English. For a summary of these findings, see Table 4-1.

Table 4-1
Journals

	Scope	Visibility/Impact	Document type	Databases/Indexes (examples)	Language
National	Educational Training National conference proceedings Scientific policy	Low	Editorial Letter Opinion News		Spanish
Regional	Regional conference proceedings Research	Medium	Research paper Conference proceedings Regional issues	SciELO Periodica Latindex LILACS	Spanish English Portuguese
International	Research	High	Research Paper	Web of Science Medline Pubmed Google Scholar	English

Wanting to be published in high impact journals is a common ambition within the scientific community. Scientists want the manuscripts to be published in the most prestigious journals. They are looking for the largest audience possible in the scientific

community. If the manuscript is rejected at that level of publication, then it is sent to be reviewed in journals with lower visibility (Garvey and Griffith, 1972) until its publication is accomplished. In the case of the participants of this study, the preferred outlet for research publication is also the high impact international journal. Meneghini, Packer & Nassi-Calo (2008) point out that scientists from developing countries in Latin America try to get research published in high impact international journals in order to enhance their ability to obtain funding for research. This phenomenon will become evident in the next section: publishing in high impact journals increases the prestige and status of the scientists in the scientific community, opening the door for new opportunities and resources.

Participant 13 clearly makes the point and the relative valuation of journals when he says: "O*ne is not going to waste a good research paper with good results in national journals*". By the same token, Participant 9 noted that national journals have a small audience; for this participant, the objective is to reach a larger audience by publishing in international journals. This participant also mentions the lack of indexing of national journals: *"The problem with our journals is that they are not indexed anywhere. My objective is not to publish in national journals. My objective is to publish where my research can get to the largest audience."*

Participant 7 advanced the idea that national publications should serve as training grounds for graduate students and perhaps for junior researchers where they can publish research: *"I believe that national journals are the place where graduate students get their*

feet wet. They should publish in national journals. In my case, I prefer international journals."

Participant 3 also mentioned another publication goal for national and regional journals: *"...[O]ne can publish in national and regional journals, but it is mostly for reviews and comments. Rather than research, we publish educational and didactic pieces…"* Two participants added that national and regional journals are good channels to disseminate information produced at conferences. Participant 8 observed, *"Conference proceedings are published in regional journals" and "...the national journals are good for congress proceedings…",* while Participant 4 pointed out that, "…[W]e publish some themes locally, for example, editorials on scientific policy…"

Participant 8 later added that: "*There are few good Latin American journals in my field. There is one high impact journal in Mexico. We sometimes submit research there. It is published in English…"* One of the "*few good Latin American journals*" mentioned by the same participant is *Interciencia*, which is published in Venezuela. It is indexed in Web of Science (WOS). It has more visibility than journals not indexed by WOS. Its articles are published in Spanish, Portuguese, and English. Participant 8 said the following about Interciencia:

> *P8: "The only national journal I might consider for publication is Interciencia…It is indexed in Web of Science. It is multidisciplinary and has good visibility. Interciencia is even read in Japan. A Japanese scientist contacted me about an article that I published in Interciencia. There are*

> *other good national journals; however, they are not indexed and thus they don't have any international visibility…"*

4.3.2. Recognition By Peers

A shared opinion among the participants in this study revolves around the idea of gaining recognition and prestige by publishing in high impact journals. It is a common view that publication and dissemination means publishing research in international journals. As shown in the last section, national journals are perceived as informative, educational, and didactical outlets rather than being important scholarly journals that communicate new knowledge. New knowledge and research is published in high impact international journals. The quotes below are selected because they show what the motivations are for publishing in high impact journals.

Participant 5 points out that recognition from the scientific community results from publishing research in international journals:

> *P5: "…The scientific community revolves around visibility and prestige. It doesn't matter what the salary or the monetary rewards are; what matters is being recognized by your peers…The only way to obtain that recognition is by publishing in journals with international visibility and impact."*

By the same token, for Participants 2 and 4, one of the motivations for publishing is to be known internationally by the scientific community.

> *P2: "[W]e always want to submit our research to well known journals with high impact factors…normally I just submit to indexed and international journals; that is my philosophy. I want to be known internationally by the scientific community…"*
>
> *P4: … "My objectives are to develop my research and to publish in international journals. I want my work to be known…I always look for international journals…"*

Other scientific information dissemination practices and activities are also identified (i.e. conferences, online networks) in the study and will be explored in the following sections. However, it is clear that high visibility international journals are these scientists' preferred outlets for research dissemination. One reason for this is that publishing in high visibility journals increases their prestige. Prestige enhances their standing with their peers, which facilitates their interaction and interpersonal communication with international figures in their fields. Participants in the study state that they "*… want to be known internationally by the scientific community"*, which in turn, "*opens a whole world of new opportunities to further develop your research"*.

In most contexts (national and international), interaction between scientists facilitates research in many ways, such as improving funding, technology, equipment, computing, and lab facilities, and encouraging traveling, data sharing, and access to expert counsel. These positive outcomes are the components of personal and academic collaboration. In this context, it also facilitates the Venezuelan researchers' access to

information sources that cannot be accessed by formal channels. Data presented in the next section show that the most effective practice for accessing and acquiring information is to have contact with "international scientists".

4.4. Finding Full-text Sources

When the literature on the information seeking behavior of scientists is examined, one finds that the preferred information sources are usually journals, databases, conference proceedings, and books (Grefsheim & Rankin, 2007; Hemminger, Lu, Vaughan, & Adams, 2007; and Tenopir, King, & Bush, 2004). Among these sources, the journal article is paramount for scientific research because, as the literature points out, it has become established knowledge on which new research is built. In the case of the Venezuelan scientific community, accessing journal articles is crucial because publishing research is the focus of this community's information dissemination practices.

It is also vital to have access to published research in order to build scientific capacity in developing nations. Scientific development is obstructed if the national scientific community does not have access to a current core collection of journals. Chan, Kirsop & Arunachalam (2005) point out that scientist outside the USA, Europe and some parts of Asia have little or no access to published information sources, because of the high cost of maintaining journal collections.

Participants in this study reported that, with the resources available to them, it is possible to initiate searches and find relevant references. In some cases, they are also able to read and browse abstracts. However, finding full-text articles and journals is the main difficulty experienced by the participants. Four strategies for coping with this

problem are found in this study, which have made it possible for participants to access full-text articles and journals. The first is to use full-text and journal locating services from libraries (interlibrary loan and document delivery). The second is to acquire the paper by buying it online. The third strategy is for the lab to have subscriptions to the most relevant publications. The fourth one, contacting the author directly for a copy of the article, is the strategy preferred by these scientists to solve the problem of limited access to full-text sources.

4.4.1. Library Services

The Instituto Venezolano de Investigaciones Científicas (IVIC) and the Universidad Central de Venezuela (UCV) each has a main academic and research library, offering a number of services to their communities. The most important services that the libraries provide, according to the participants, are: providing access to full-text papers (via interlibrary loan and document delivery services) and offering access to selected academic and scientific databases.

Most of the information seeking takes place in the researcher's office. However, some participants reported going to the library to search and eventually find information. For example, Participant 6 said: *"Sometimes I go to the library, either with a notebook or index cards to take some notes…little by little, I do my literature reviews…"* While going to the library to search for information is not a common behavior among the participants, library users visit the library to request full-text finding services (interlibrary loan and document delivery services). Participant 7 explained in detail the procedure to find full-text journal articles:

> *P7: …[F]or example, one of the services the library provides is to search for full-text journal articles. I give the library a list of references that interest me. The library tries to locate those resources in the country and outside the country, too, for example, at the British library in England or at libraries in the USA. If the resources are found, they are emailed to us in PDF format. Many times they are unable to locate full-text files. They help us locate information that we cannot find ourselves…no, they don't do searches, we do the search ourselves, and as I told you before, if we cannot locate the full-text, the library tries to get it for us…*

Participant 5 shares a similar experience in terms of the library's obtaining research papers and publications. It is also mentioned that it may take some time before the user actually receives a copy of the full-text. :

> *P5:…I ask the library to get me a full-text journal article. Usually the library contacts other libraries to see if they have the publication. Sometimes I may get a fax or a photocopy…of course the information takes very long to get to me…*

Another service offered by these two libraries is access to academic databases and indexes. It is interesting to note that, according to the participants, these two libraries do not offer workshops or user training on the use of electronic databases.

> *P4: …Yes, the library offers academic and scientific databases; however, it doesn't offer any training about searching strategies. We confront searching with our experience. We get better with time and are able to access more information. We learn by doing it. We are self-taught searchers…*

By the same token, the access to information sources is limited by time and in many cases, there are no links available to the full-text publications. One participant said: "I*f the library doesn't have a subscription; then I have no access to that information*".

Participant 8 stated that the library offers insufficient electronic access to back issues of journals. If the researcher wants an older issue, then he must go to the library to browse the printed collection:

> *P8: …The library offers a limited number of academic databases. Online access is available to resources published after the year 2000. We must go to the library to search serials published before the year 2000 …*

These limitations on library services mentioned by the participants --few links to full-text, access to back-issues, and no user education -- are similar to the ones found by

Majid, Anwar & Eisenschitz in the 2000 study on scientists in Malaysia. The participants in that study reported that libraries have deficient collections and services.

Schwartz (1995), on the other hand, reported that librarians were perceived to be ill trained by physicians and biomedical students of the All India Institute of Medical Science in New Delhi and the Tama Memorial Cancer Centre in Bombay. In the case of this dissertation study, no data on scientists' perception of librarians' training and performance was collected. The Venezuelan libraries help the users by contacting other national and international libraries in order to respond to the user information needs. Interlibrary loans and document delivery services are implemented and are found to be useful by the researchers of both institutions.

4.4.2. Buying Papers Online

Another strategy used by the participants to obtain electronic full-text papers is to buy them online directly from the publisher. This option is seldom used and it is chosen when every other approach has failed, *P10: "When I don't have access to full-text through the Institution website; I have the chance to buy the article online; however, they are very expensive. An article may cost $30"…*

4.4.3. Journal Subscription

Another strategy is that labs and other units purchase their own subscriptions to relevant journals according to their domain and area of expertise. This strategy appears to be very common. In the data collection stage of this study, the researcher was able to visit several labs at IVIC and UCV and was able to observe their collections. These collections of printed journals are stacked in an orderly fashion, so the researcher was able to detect

that several issues and complete volumes were missing. Lab members were probably consulting the absent issues, as the collection was open to them. Participant 6 explained that the members of the unit make use of the issues in this local collection by following a pecking order:

> *P6: We have our own journal subscriptions at the lab. When a new issue arrives, lab members share it. The lab director is the first one to read it, then the researchers. Grad students are the last group to get the publications. The issue is passed from one member to the other according to their status in the lab…*

Participant 11 mentioned that this practice of maintaining an internal collection of key journals by the lab having journal subscriptions has decreased lately for economic reasons, as has the strategy of buying papers online. For some, journal subscription is not a viable practice anymore, *P11: … "In the past, it was very popular to have our own subscriptions. We can't anymore; it has become too expensive..."*

A fairly good organization of resources is observed in the open stacks. As pointed out above, there are few issues and volumes missing. The collections are not current anymore because it has become too expensive to maintain them. It is also worth noting that these holdings are in print rather than electronic format. In this context, is easier to examine, read, and photocopy the printed journals than to buy access to electronic versions of the publications.

Personal subscriptions of print and/or electronic journals seem to be a common practice of scientists. For example, Tenopir, King and Bush (2004) reported that doctors at the University of Tennessee Health Science Center (UTHSC) average 6.3 subscriptions per person, while faculty members at the University of Tennessee average 3.8 subscriptions per person. This study found that scientists in Venezuela very seldom keep personal subscriptions. Several participants mentioned that it was a common practice of the past, but that currently, it is impossible to keep subscriptions any more because of the high subscription prices and the scarcity of hard currency in Venezuela.

4.4.4. Contacting the Main Author

The most important strategy found to gain access to full-text is to contact authors of the papers directly, especially the main or principal author. It was unanimous, in that all participants mentioned that contacting the author is the best way for them to acquire full-text electronic journal articles. It is the strategy they preferred over the other three mentioned above. The full-text resources are acquired on a timely basis, and the response from the authors, in most cases, has been positive. The participants try to access the full-text online either through the library website or the open Internet; however, if the publication does not have a link to the library website (electronic subscription) or the journal is not part of the library's holdings, they feel it is more efficient to contact the main author directly, than to ask their library to search for the resource in other libraries:

> *P1: If it is not in the library, I write the author and ask politely for a copy of the paper.*

> *P2: When the information is not at the library, there are two ways or possibilities to access it. First, you contact the author,; and second, the library tries to get you the publication through a partner library. I have done both…*

Participant 10 asserted that using the library's service takes too much time; while contacting the author is almost instantaneous:

> *P10: Yes it is very frustrating going to the library. Sometimes we have to wait up to six months to read a publication. There is always a delay. If we don't have access through the library, we must find the publications ourselves. The best way is to contact the author.*

The search is performed either using Google Scholar or the academic databases available to the participants. Relevant references are selected, then abstracts are read, and the participants take note of the author's name and email address. An email is sent to them requesting a PDF copy of the journal article. According to Participant 7, there is a substantial advantage in having the paper returned by email rather than postal mail:

> *P7: Once the main author is identified, an email is sent requesting a copy of the article. If the publication is sent by regular mail, it takes a long time to get here. You know how bad our postal system is. On the other hand, if it is sent by electronic mail, then it gets here immediately.*

P3: There is one specialized database that is my favorite. The database is in the USA. I have set up filters to get the most current information. I print the references…and if I find something that interests me, I have the names of the authors. Then I proceed to contact them…

Participant 5 mentioned two factors that play a part in getting the full-text: one is luck and the second one, is being known by the author. Participant 3 re-asserted that the status gained from being recognized as a scientist that publishes in the same journals facilitates communication with the author. Participant 3 expressed in the quote below that the international scientists would email back with the full-text because he/she is also known:

P5: I write an email to the main author. I ask for a PDF of the publication. In general, it only takes minutes before a positive response comes back by email. I have always been lucky. Most of the authors that I have contacted are very happy to share publications. They know who we are. We publish in the same journals and we are known…

P3: I remember the name of the journal "XXXXXX". Then I search the references and find the authors. I look for emails. I ask them for full-text copies. The authors always reply with the information because they know me. I am known as a researcher through my publications.

Four strategies to access full-text journal articles are identified in this research. The first three (library services, buying papers online and personal journal subscriptions) consist of establishing formal institutional agreements (interlibrary loan) and market transactions (purchasing and subscription) with libraries, publishers, and retailers to acquire access to the information source. These three strategies are reported to be deficient by the participants in the study.

In the case of going through the institutional channel and having the library acquire the full-text, this solution is deemed "frustrating" because of the long time-lapse that occurs from the moment the service is requested to the moment the scientist is able to read the paper. One of participants quoted above mentioned that it may take up to six months to get the publication this way.

The other two strategies (purchasing the paper online or buying journal subscriptions) offer a reliable system of full-text access, in either the electronic or printed format, when compared to the first strategy. These two strategies are limited by the lack of purchasing power of the Venezuelan scientific community, a common problem among scientific communities developing countries (Chan, Kirsop & Arunachalam, 2005). One of the participants expressed that getting a paper online was very expensive. The same monetary limitation applies to keeping private subscriptions either by the lab or by the individual scientists, making these solutions almost untenable. The price of access to information sources has become prohibitive for most nations in the World.

The fourth approach discovered in the study, involved personal contacts with author(s) of the paper or papers needed. The participants singled out this communication

strategy of contacting the author(s) by email, as the most efficient and effective way to obtain articles published in international journals. The effectiveness of this practice was enhanced by the prestige of the Venezuelan scientists interviewed in this research. Participants 5 and 3 mentioned that they are well known in the community by the fact of having published research in the same international high impact journals as the international scientists from whom they requested papers.

4.5. Model of Scholarly Communication in a Context of Dependency

The model of scholarly communication that emerged is defined as a set of interrelated strategies of interpersonal communication, information dissemination and information seeking behavior with the purpose of overcoming difficulties and barriers experimented by Venezuelan scientists with limited access to international information sources and publication outlets in a context of dependency (see Figure 4-1). The major themes from where the model surfaces are: persisting interpersonal communication with the international scientific community; publication in international journals; prestige and name recognition; and contacting the authors to access full-text journal articles.

In regards to interpersonal communication and information seeking behavior the study found that the best approach to gain access to full-text journal articles is to ask authors for a copy of their work. This approach is facilitated by the prestige and recognition of the national scientific community gained by publishing in international journals. The international scientific community acts as the facilitator or gatekeeper of international information sources because access to full-text article journals depends on

the scientific community's willingness to comply with the national scientific community's request.

In regards to scientific dissemination the study found that the preferred publication outlet for research is the international journal. National and regional journals are discarded as possible outlets for publication unless they are indexed in international databases and have become internationalized. Publishing in international journals increases visibility, prestige and name recognition of the national scientific community. This increased recognition enhances interpersonal communication of national and international scientists.

Figure 4-1 represents the model of scholarly communication in a context of dependency. There are three elements: the national scientific community, the international scientific community and the international journals. The model's process is illustrated next. The national scientist reserves the best research for publication in international journals. By publishing in high impact journals, the scientist gains prestige and recognition in the international community. The acquired prestige and recognition enhances and facilitates interpersonal communication with international scientists. Enhanced interpersonal communication unlocks access to information resources that flow from the international journals across the international scientific community to the national scientific community.

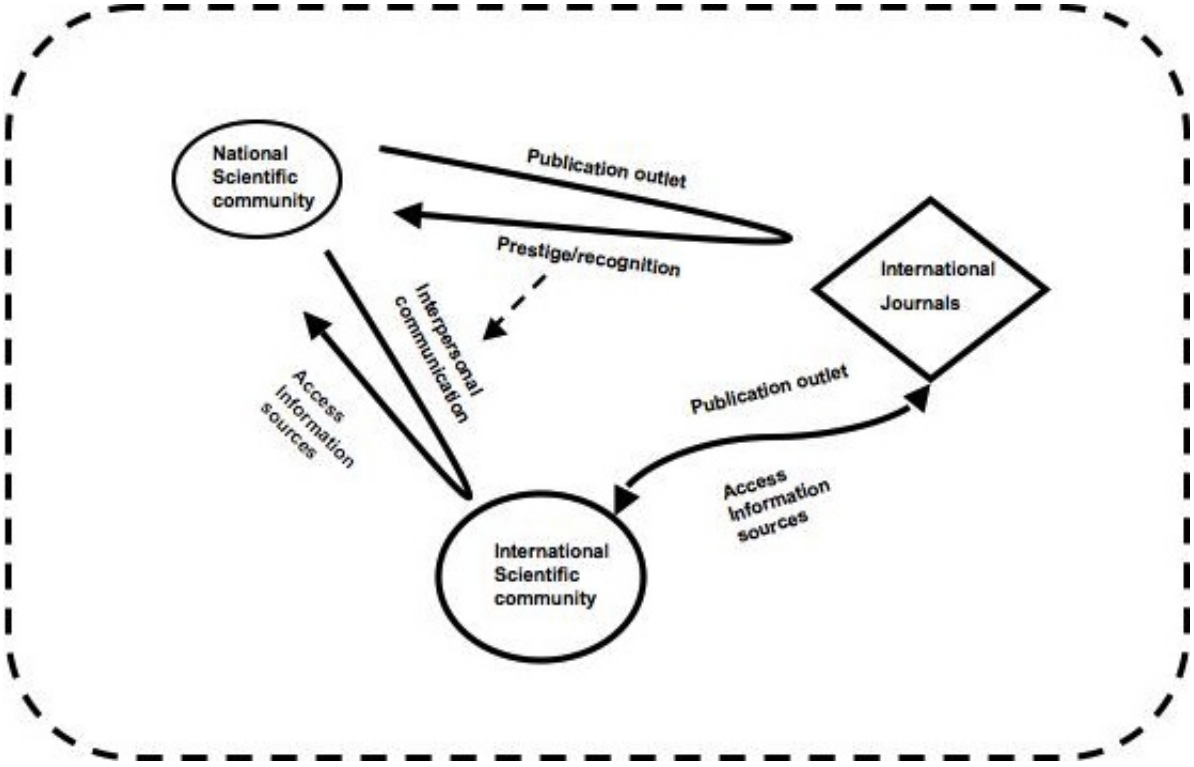

Figure 4-1
Scholarly Communication in a Context of Dependency

In the following sections, other elements of information seeking behavior and information dissemination in Venezuela are explored. Those elements are also important findings of the study; however, the model presented in this section is the major finding of the study that explains scholarly communication in a context of dependency.

4.6. The Language of Science

An important aspect of scientific communication that is explored in the first chapter of this dissertation was the language in which science is communicated. There is little language diversity in international journals. The dominant language of scientific literature is English (Vickery, 2000).

The participants expressed that English is the language of science. One of the participants said that: "*...Everything that is important in science is written in English…"* Several participants pointed out that English is the "universal language" and that its universality is measured by how widespread the language is: *"...The universal language is defined by how widely is used; if you speak English, you will be able to communicate your ideas in any part of the world…"*

Participants expressed that Venezuelan journals should be published in English because it would increase visibility. Participant 1 pointed out that, at the least, abstracts should be written in English:

> *P1: We have to accept, even if we don't like it, that the universal language is English. The language of science is English. Latin was the main language in the past. Later, it may have been Spanish or French. Today it is English. Scientific communication is done in English formally and informally, written and spoken. Nobody is asking us to write like Shakespeare, but we have to communicate in English. It is the only way to interact internationally. Our journals should be in English. At least they should have an English abstract.*

Participants 5 and 7 give examples of other non-English speaking countries that are publishing journals in English as a way to increase visibility and impact:

> *P5: …The best Brazilian journals are published in English with a Portuguese abstract. Those journals have more impact than ours; why? Because they are in English. We should be doing the same with our journals. Everything should be done in English.*
>
> *P7: …Even the most traditional and conservative French journals are being published in English; only the abstract is written in French.*

Participant 3 asserted that there is always a dominant language, just as Participant 1 mentioned Latin as the dominant language of the past. This same participant also expressed that the English language is a limitation for non-native speakers, but it is a reality that must be faced and very little can be done to change it:

> *P3: It would be the same if the dominant language were Chinese. All of us would speak and write Chinese. The universal language is English. That may change in the future, but not in my lifetime. It is a limitation that we have to face and accept.*

Participants 2 and 8 also considered the limitations of having to communicate in English:

> *P2: It is a barrier, an obstacle for those of us who don't speak it or write it well. It is very difficult as a scientist to succeed if you cannot communicate in English. Imagine*

yourself presenting a conference paper in English and not being able to answer questions and defend your research.

Participant 8 talks about the difficulties of doing post-doc work in USA. In the opinion of this researcher, Participant 8's comments are very interesting, regarding the experience of this participant about journal submission. The participant noted that editors help make suggestions and recommendations to improve the quality of the paper regarding language.

P8: My English is not very good. My first experience with the English language was when I was doing post-doc work in the USA. I had done my degree in Venezuela. It is not the same to do some courses in English in Venezuela and to live in an English-speaking country…In terms of article submission, one can have the grammar, but these journals require a very technical English. One has to adapt to that type of situation. At the beginning it was very difficult for me to show my work internationally. I am not going to say that it has become easier; I still have some problems with my writing skills; but I have been getting better. We get a lot of suggestions and recommendations from journals editors with phrases and sentences that improve our submissions.

One participant's strategy to overcome the language barrier is to use the Internet to search for terms and phrases, in order to find out how to properly use them. Especially in regards to technical and scientific methodology:

> *P7: ...I sometimes search using phrases, especially in English. Sometimes I am not sure about the correct terminology. I Google phrases to see what returns I get and then I choose the correct phrase…*

The quotes from the participants left little doubt that communicating in a foreign language is a barrier. Language is one limitation faced by the Venezuelan scientific community when submitting research for publication, consulting, and reading information sources and using the Internet.

They also expressed the idea that this barrier is unavoidable because there is always going to be a dominant language in the world of science. Another concern expressed by Participant 8 is that studying English is substantially different from actually living in an English-speaking country.

National journals suffer limitations in terms of impact and visibility if they are published in a language other than English. Several participants mentioned the idea of having at least the abstract published in English, while others argued that national journals should be published entirely in English and maybe the abstract should be published in Spanish.

4.7. Information Seeking Behavior

Sections 4.7 and 4.8 will describe other information seeking behaviors and information dissemination practices of the Venezuelan scientific community not discussed above. These practices illustrate how scientists in Venezuela search, access, manage, and communicate information.

Ellis' (1989) information seeking behavior model initially identified six activities: starting, chaining, browsing, differentiating, monitoring and extracting. A later study on engineers and scientists in industry discovered eight activities: surveying, chaining, monitoring, browsing, distinguishing, filtering, extracting and ending (Ellis & Haugan, 1997). Elements of the Ellis model on information seeking behavior are supported by the data collected in this study. The patterns are not as clear-cut as in the original model although no effort was made to fit the data into the patterns identified by Ellis. However, some comments on the Ellis model and the data collected are warranted.

The starting stage of search found in the study is mostly electronic searching, though searching printed sources is also identified, using the Internet (specifically Google Scholar, and international academic databases). These searches are focused by author, journal title, topics, and keywords. Searching by author and journal is found to be the most frequent searching pattern for Venezuela's scientists. Meneghini, Packer & Nassi-Calo (2008) point out that Brazilian scientists cite well-known international scientists and high impact journals while avoiding citing other Brazilian scientists in an effort to increase the weight of their work. This finding might also explain the searching patterns of Venezuelan scientists. As it has been pointed out before, the goal of information dissemination of the Venezuelan scientific community is to achieve publication in

international journals; therefore, it might be perceived that citing reknown scientists and high impact journals increases the chances of getting published in those same journals.

Browsing is also mainly an electronically mediated activity. It is performed in the sources during in the starting stage. Public access journal articles, references, and abstracts are the main types of documents reviewed in this stage. If preprints and conference proceedings are found at this stage, they are also browsed. However, Venezuela's scientists' information seeking is focused on finding established scientific knowledge. Therefore, preprints are less essential information sources for the Venezuelan scientific community.

Chaining references is only reported in the study when a national publication and author is cited by an international source, at which point the cited reference is traced and followed. (See the above comment on the Meneghini, Packer, & Nassi-Calo, 2008 study). The participants in the study also report differentiating. One participant reported filtering results by year, source, authors and methodology. Participants also reported monitoring and extracting using the international databases available to them. Information management is reported and observed in two participants' offices; this finding coincides with the Meho & Tibbo (2003) study on social science faculty, which added four more categories to the Ellis model: accessing, networking, verifying, and information managing.

4.7.1. Initiating Search

Most of the searches done by the participants are electronic, either in the "open Internet" or in public or paid search engines and indexes, such as Google Scholar,

Science Finder and Web of Science, which are linked through the library's website. This finding corresponds to other findings in the literature. Grefsheim & Rankin (2007) reported that 84% of the 500 scientists surveyed from the National Institute of Health prefer electronic searching. Hemminger, Lu, Vaughan, and Adams (2007) reported similar preferences among University of North Carolina scientists. All of the participants in the study had desktop computers at their offices and they were connected to the Internet. Few complained about the speed of the connection being extremely slow. Several participants mentioned that the changes brought about by the information and communication technologies (ICTs) are comparable to the invention of the printing press. They further established their innovative character by calling the Internet "revolutionary":

> *P1: ...I felt in love with information technologies. I believe that something similar might have happened when Gutenberg invented the printing press. Being able to access the net is a revolution…I still remember when I used the computer for the first time. I used the keyword and I thought that I had done something wrong and the computer was going to blow up…*

However, participants still go to libraries to search and browse printed journals, as mentioned in subsection 4.4.1 on library services. It was also described in subsection 4.4.3, that individual labs have printed journals subscriptions for browsing and searching. However, for the most part, the action of initiating a search is an individual process that

takes place in the researcher's office. Many times, the search is initiated at the researcher's office but browsing full-text articles is done in the libraries if the publication is only available in print. Another non-electronic search-initiating practice was to go to the library to browse the serial collection in search of important information:

> *P8: …With the use of information technologies, it is easier to find information. Academic databases make it very easy to search for scientific information. When we don't have remote access to electronic sources, we go to the library and look journal by journal for the relevant topics.*

For the most part, participants initiated searches using the author's name. They were aware of who the leading scientists in the field are; therefore, initiating a search by an author's name is the preferred strategy. Search seems to depend heavily on their perceptions of who the big names are, as participant 7 pointed out in subsection 4.2.2. Themes, topics, keywords and phrases were also identified as search fields.

> Participants 6 preferred author search: … *"In most e cases, I am interested in searching for authors."*

Participant 11 mentioned that information could be located in other ways; however, the participant also favored author search because it would retrieve recent and up-to-date research:

> *P11: You can locate information by phrases, authors and journals. You can also draw chemical compound structures. Sometimes I look for themes, but what interests*

> *me the most are authors. I know the researchers who work in my area or are close to it. Then, I just do a simple search by name and browse to the most recent works. In that manner, I can see the state of research in my area or discipline.*

Participants 7 and 4 initiated searches by theme and topic, while Participant 4 explained that keywords were used to initiate a search:

> *P7: I look for themes, in my case pathogen organisms…then I am able to retrieve the references for the most recent work…*
>
> *P4: When I search Web of Science, I search by topics…*
>
> *P3: In most cases, I use keywords for searching; limiting the search to recent years…Yes, I combine keywords to retrieve what is relevant to me…*

4.7.2. Browsing

Browsing is the second activity or behavior to be identified. Browsing was mainly an electronic activity that took place at the researchers' offices. Browsing of printed journals also occurred at the library and at the labs. Google Scholar was found to be the most popular open database for the participants. Other generic search engines were also used. For example, Google and Yahoo were used to search for relevant information sources. National and regional databases were reported to be irrelevant and of little use.

4.7.2.1. Internet

Searching and browsing the Internet was a common practice among the participants, as one participant put it "…*the Internet is a place to search and browse...*" After the search was performed, the retrieved information was browsed in order to find relevant sources. One of the participants defines browsing as: "*looking over*" or "*light reading*", while another terms it as "*window shopping.*" The type of informational items reported to be found on the Internet were: references, abstracts, open access journals, and links to the libraries' electronic journal collection.

> *P3: I do search by keywords in the Internet, and then print the references…Most of the time, I use Google Search. I also use Yahoo.*
>
> *P6: ...I like to browse the Internet. I find references that are important for me. If I am lucky, I will be able to find the full text either on the Internet or in the library…*
>
> *P9: I first search for abstracts on the Internet. I read the titles. I then read the abstracts. If the publication is in the library, there will be a link to the full text…*
>
> *P7: I surf the Internet and search by title, journal, and author. Sometimes I can download the full text because I hit an open access full text journal. You don't need to be subscribed to those journals.*
>
> *P8: The first thing I do is to read the abstract to find out if the publication is in my interest…*

P13…I like to go to the Internet to see what I find…

4.7.2.2. Google Scholar

Google Scholar is the preferred tool for searching information sources on the Internet. It is an open access search engine of patent and scientific information managed by Google. Many participants initiated the search in Google Scholar instead of the subscription databases available to them through the library website. It was mentioned that citations or references are the only information items that can be retrieved from this database. Participants 4 and 5 stated:

> *P4: I always start each search in Google Scholar. It is being used around here a lot. It only cites the source. If our library has the publication then we are safe; if not, the process of getting the information is stopped and we don't have access.*
>
> *P5: …Google Scholar is great! However, it doesn't give you access to full-text…which is very frustrating..*

Participant 3 stated that a search is initiated at the library first and then in Google Scholar.

> *P3: Now we have Google Scholar. It is a very good tool. When I don't find the information in the library, I use Google Scholar.*

4.7.2.3. Regional Databases

There has been a sustained effort in the region to consolidate scientific, social science, and humanities information sources. This effort has materialized in several public access databases. There are, for example, Clase, Periodica, Latindex, LILACS and SciELO that index documents and offered, in some cases, access to full-text scientific articles. These databases were designed for the purpose of facilitating access to academic information for the regional and international scientific community. By the same token, these databases were intended to enhance visibility and impact of research in the region.

Participants were asked about how these regional databases were being used as sources of scientific information. It was discovered that the participants in the study either did not know of their existence, or found them to be irrelevant. They were only used if they were referenced in international publications. National publications and regional databases are not thought of as viable publication outlets (for information dissemination) or as information sources by the participants in this study. According to the participants, Venezuelan journals should be the training ground for aspiring scientists (graduate students) or just for publishing editorial and opinion pieces (see subsection 4.3.1). In addition, regional databases were perceived as not indexing relevant research that could be used as references sources.

Participant 10 stated the following about national journals and regional databases: "…F*ew national publications are relevant…if they are cited internationally I may take a look at it*…" Another participant said:

> *P3: ...I would only read and reference national publications if I find them cited in international journals.*

There is SciELO…I don't remember it well…with things from Latin America. I just use it when it is cited internationally.

Other participants stated:

P2: …[O]n full text or source references?...No, I don't know of any.

P6: I know of SciELO but I have never used it. I am not interested in reading or referencing regional publications.

P7: …Yes I know SciELO and LILACS. I am doing a review from the year 2000 to the present. I searched them, I could not find anything relevant…

P2: …SciELO is not important for me…

4.7.2.4. International Databases

The advantages mentioned by the participants regarding electronic database search were the following: fast searching, easy browsing, not having to visit the library, and extensive record and information retrieval. Participants 4 and 7 stated:

P4: Database searching is easier and faster that manually searching for information at the library. Searching and browsing printed journals takes more time. In the past, it was easier to miss some publications and research; today, when we search electronically, we recover more information and little published research is lost.

P7: It is very easy if we can search electronically for new molecular building methodologies in a database and not have to go to the library and browse journal by journal.

The following quotes from Participants 1, 4, and 5 mentioned the use of international databases:

P1: We use one that comes from the U.S.; it is part of the U.S. National Library of Medicine. It has millions of records and hundreds of publications on biomedical information. When I want to see something on research, it is where I go. I limit the search to the last ten years. For example: "keyword"; there you go, there are 562 papers in the last ten years.

P4: I search in a NASA database. It is on astrophysics and physics.

P5: ...We are fortunate to have Science Finder…wish we had more databases available with links to full-text journal articles.

Finally, Participant 12 made a distinction between access to scientific information in Venezuela and in the USA. Participant 12 stated:

P12: ...In the USA, they have more advanced and complete databases. There you can search information in detail. There, they are one or two steps ahead of us…libraries and

professors have direct access to better collections, they have direct access from their computers…

4.7.3. Reading Behavior and Information Management

Another behavior that was observed and discussed with the participants is how they read, organize and manage scientific information (references, abstracts, and papers). It was found that some participants read papers from the computer screen while others need to print them in order to use them. In one case, it was found that a participant had a very organized collection of scientific papers in print, that was classified using index cards and in another case reference management software. Other participants showed some degree of engaging information management activity.

4.7.3.1. Reading Abstracts

Reading abstracts was found to be a common practice among the participants of this research. This practice is used to go beyond the title and to get more information on the research published. It is also, in a context of limited access to full-text, a replacement for reading the full-text article. One participant mentioned that "A*bstract reading substitutes for article reading*", while another one stated that *"…We read more abstracts than anything. It is easier to find the abstract than to find the complete full-text…"*

Abstracts were also read to be informed and stay current in one's discipline. The participants said:

P3: I read the abstracts, and if I think they are important then, I will try to get the publication.

P10: I also read abstracts to find out in more detail about published research.

P11: I read the abstracts to keep me informed of what is happening in my area…

As noted above, reading abstract online replaces reading papers in the Venezuelan context, because abstracts are available online most of the time, while full-text papers have to be obtained following the strategies explained in section 4.4., unless they are part of the libraries' journal collection.

4.7.3.2. Reading Electronic Articles

Participants were found to start reading papers online or from a downloaded PDF file. However, once the paper caught the participants' interest, it was printed. Printing was limited by economic concerns, especially regarding the cost of ink. Participants 1 and 5 stated:

P1: It all depends. There are papers that I start reading in the computer because it is very expensive to print everything. I first read the abstract and if I am interested then I search for the full text. If I find it, I save it in the computer. In any case, I like to have it in PDF. Most of the time, I end up printing it because the information is vital for me.

P5: I see it and then I save it. Later, I will convert it to PDF to read it.

P12: I use the computer because I can copy and paste, zoom or minimize.

4.7.3.3. Printing

Once the paper catches the attention of the participant, the common practice is to print the PDF. The participants observe that printed paper is easy to read and highlight and mark. The participants stated:

P10: I don't like to read from the computer. It is easier for me to read a print. I can read it from the computer screen; however, it is more fluid to read a printed copy.

P12: I still like to read from a printed copy, so I can highlight and cross out words and sentences with lines.

P3: It may be an age issue; the younger generation does everything on the computer, but not me, I have to print everything.

P7: Yes, I download and print a lot of things; the full text is read on printed paper.

P9: I download, print and then read.

P4: In my case, I print. I like to make marks on the paper.

4.7.3.4. Managing information

As mentioned at the beginning of this section, activities related to organization of information were observed and discussed with the participants. Most of the time, there was not a visible pattern of information organization and management. There were papers

all over the researchers' desk and in the offices' bookshelves. However, there were two participants who had a very impressive collection of printed papers in PDF format in their offices. One of the participants managed the paper collection using index cards. The index cards had the following elements: the full reference, notes, and a topically-coded homegrown classification system. Participant 3 stated:

> *P3: ...I have many boxes full of index cards. I like to keep track of what I read. I was fortunate to start managing and saving information from the beginning of my career. I also collected information on my specialized field ...*

Participant 2 also has a very organized collection of papers on the office's shelf. In this case, however, management of the collection was made using the desktop computer, running reference management software. In the quote, the participant explains how the collection is managed:

> *P2: I print all the PDFs. I have a personal library where I keep all the papers. I also save them in the computer. I use a program called Endnote, it runs under Windows. I do reference work after lunch. I have a whole stack of papers. I enter the information of two papers everyday. Then I put them in my personal library. I archived them there. I use my own classification scheme. To me is very important to find them later. To me, Endnote helps me to find them faster.*

4.8. Information Dissemination

Other than what has already been explored in terms of interpersonal communication with national and international scientists, very little data were collected regarding informal channels of scientific communication. Literature on the dissemination of information points out that there are within the scientific community highly specialized groups in constant communication, discussing new ideas and research. Once research has been initiated, information is disseminated to the scientific community in the form of preprints and conference presentations until the manuscript is submitted for review and publishing (Garvey & Griffith, 1972; Price, 1963). The participants did not report data on the existence of those closely-knit groups in Venezuela known as the "invisible college" (Price, 1963; Wagner, 2008; Zuccala, 2005) or on disseminating research by preprints.

What the study found is that conference attendance is an important practice for disseminating scientific information. As one participant put it, "T*he role of the scientist is to create and disseminate knowledge…conferences and congresses are a part of that…*"

Participants describe going to conferences to disseminate scientific information. These conferences take place at the national, regional, and international level. Conference attendance objectives are differentiated according to the conference's context (national, regional, or international). National conferences are attended to meet with old friends and to present research on local issues. One participant said, "*I may go to national conferences to see friends and former students, however, my work is disseminated at international conferences.*" Regional conferences are attended to find out what other scientists in the region are doing in terms of research. Participant 6 stated, "*I go to the*

Latin-American conferences. There I met with people who faced the same realities. For example, I like to know what the Mexicans and Brazilians are doing." International conferences are attended to present research and to meet the international scientific elite. For example, Participant 4 stated, "*When we assist with international conferences, we have a great opportunity to meet and access those big names."* Participant 3 stated, *"I have been invited to several international conferences to talk about my research."* It was also found that online and electronic conferences are becoming popular, because they minimize traveling expenses and allow for the participation of international scientists. Participants 9 and 7 offered:

> *P9: …Yes, we have organized online conferences…we have had online discussions, just like in regular conferences. It is very expensive to travel abroad to participate in conferences. We are trying to schedule one every two or three years…*
>
> *P7: …We did one here. It lasted 15 days. There were paper presentations and online papers. It was an interactive experience…the presentations were done with voice, and other interactions were by chat…At the beginning it didn't work well. Now we are getting better. The information technology infrastructure is not the best. There were delays that made interaction difficult at times…There were international guests: Americans, Europeans…*

4.9. Summary

This chapter presented the major elements that illustrate and describe information seeking behavior of and information dissemination by scientists in Venezuela. A model that explains scholarly communication in a context of dependency was presented and discussed. The major themes from where the model surfaces are: persisting interpersonal communication with the international scientific community; publication in international journals; prestige and name recognition; and contacting the authors to access full-text journal articles.

Other significant findings presented in the chapter were: the effect of English as the dominant language of science, the initiation of a search, browsing behavior, database searching, Internet searching, the role of abstracts, buying papers online, perceptions of national and regional journals, reliance on library services, information management, and conferencing. Chapter Five will present the conclusions, and future ideas for research.

CHAPTER FIVE: CONCLUSION

5.1. Scholarly Communication in a Context on Dependency

The objectives of the study were to build a model that explains scholarly communication with limited access to international information sources and outlets in a context of dependency, to identify Venezuelan scientists' information seeking behavior, to discover the barriers experienced by them in accessing scientific information, and to explore scientific information dissemination in Venezuela. In order to achieve these goals, the study followed the general inductive approach, which calls for condensing data collected in the interviews, establishing clear relationships between the research objectives and the data presented, and developing a model that arises from the main themes in the text (Thomas, 2006).

A model that explains scholarly communication in a context of dependency has emerged from the analysis of the data collected from thirteen Venezuelan scientists interviewed in July 2009. The model is defined as a set of interrelated strategies of interpersonal communication, information dissemination, and information seeking

behavior, with the purpose of overcoming difficulties and barriers experienced by Venezuelan scientists with limited access to international information sources and publication outlets. The major themes from which the model surfaces are: ongoing interpersonal communication with the international scientific community, publication in international journals, prestige and name recognition, and contacting the authors to access full-text journal articles. The national scientist reserves the best research for publication in international journals. By publishing in high impact journals, the scientist gains prestige and recognition in the international community. The acquired prestige and recognition enhances and facilitates interpersonal communication with international scientists. Enhanced interpersonal communication unlocks access to resources (e.g., information sources, grant funding, collaboration, and traveling opportunities). Those newly opened resources enable the national scientist to advance his research and publications.

Scientific research and scholarly communication are primarily centered in developed countries; for example, 90% of all research in 2004 was done by 15 developed countries (Wagner, 2008). Ninety percent of relevant information is concentrated in 10% of all journals, and the Science Citation Index (SCI) covers less than 2% of all of the journals published in developing countries (Marusic & Marusic, 1999). Knowledge and information have become international commodities (Lyotard, 1984). These commodities are controlled and owned by multinational corporations at the core regions. Most countries do not have enough hard currency to acquire information, patents and technologies in the international market; therefore, developing nations have limited

opportunities to input science and technology to the production system which in turns means that value cannot be added to raw materials and agricultural products nor the production system can become more efficient in the production of goods to compete in the marketplace. This phenomenon has given origin to new forms of information and technological dependency (Kirsop, Arunachalam & Chan, 2007; Shie & Meer, 2010).

Dependency theory provides a framework to understand the development of science in Venezuela and the relationship with the core. Economic and industrial development in the periphery is tailored to tend to the needs of the core economies (Cardoso, 1972; Dos Santos, 1970; Valenzuela & Valenzuela, 1978). Venezuela's productive forces developed as an export-oriented economy. Industry is not established to feed the internal market but to export oil and other materials to the industrialized World. Science might have developed in the same fashion. The data collected in this study seems to provide enough evidence to speculate that research and science in Venezuela is dependent on international actors, and is developing as an export-oriented science, at least in regards to information sources and publication outlets.

The model of scholarly communication in a context of dependency that emerged from the study is expressed by the consumption and production patterns of the Venezuelan scientific community. The national scientific community consumes information from international sources and produces scientific research relevant to international publication outlets. In other words, national scientists' information needs are satisfied with international scientific sources, and publication requirements are fulfill by publishing in international journals. Rather than reducing dependency, the information

seeking behavior and information dissemination practices of the national community seem to lead to more dependency on international information sources and publishing outlets because they are focused on consuming and producing information and research for core publications rather than consuming and producing for local, national and regional information sources and publication outlets.

The national scientific elites' (Díaz, 1980) strategies and practices are directed toward overcoming local difficulties to access international information sources and publication outlets. As effective as these strategies of interpersonal communication, information dissemination, and information seeking behavior are, it seems unfair that national scientific communities are dependent on the willingness of the international community to share information sources. Alternatives, such as open access digital libraries, should be encouraged in the developed world. Cockerill and Tracz (2006) enumerate some of the advantages of the open access publication model: free access makes research more efficient, it eases and encourages multidisciplinary work, it aids research in smaller institutions, and helps developing countries. If access to information sources were opened to all, developing countries could increase the rate of scientific progress and decrease dependency (Kirsop, Arunachalam & Chan, 2007); and national scholarly journals could become more attractive as publication outlets, which in turn, would make them relevant as sources of scientific information.

5.2. Information Seeking Behavior

The information seeking behavior of Venezuelan scientists is influenced by their need to find established scientific literature for the purpose of publishing research in

international journals. The search strategy is focused on finding journal articles authored by well-known experts, and published in high impact journals. National and regional authors and journals are bypassed as irrelevant. The journal article is the document type preferred over others, such as preprints and conference proceedings. Meneghini, Packer & Nassi-Calò (2008) point out that Brazilian scientists "tend to produce reference lists containing a majority of prominent authors and prestigious journals, and avoid citations of their compatriots, as if this would give more weight to their publications" (p. 4). Though data collected in this study is not conclusive, it seems to indicate, as in the case of the Brazilian scientists, that the participants in the study perceive that having highly-cited references in their manuscripts increases the likelihood of getting published in international journals.

Some of the salient elements that identify information-seeking behavior of scientists in Venezuela were examined in light of the Ellis (1989) model. Ellis' (1989) model of information seeking behavior is derived from data collected at the University of Sheffield with the intent of aiding the design of information retrieval systems. The context and purpose of Ellis' study suggest a situation where information resources are readily available, while this dissertation study took place in a context where information sources are scarce. Nonetheless, Ellis' patterns of activity are identifiable in these data:

1. "Starting" is mostly an electronic activity occurring on the Internet (using Google Scholar and academic databases, for example), though library visits are also reported. The fields commonly used for electronic searching are author and source. As

pointed out above, this searching strategy reflects the perceived necessity to find key authors who are the "big names" in their fields, and high impact international journals.

2. Browsing of abstracts, references, and journal articles are activities mainly done using electronic formats. Printed collections of journals held by libraries or individual labs are also browsed occasionally. References and citations are browsed with the intention of finding full-text journal articles. Participants report that abstracts and citations are more readily available than full-text articles; in the information resources open to them (e.g., Google Scholar and academic databases without links to full-text).

3. Chaining of citations is performed when a national source (author and/or journal) is cited by an international source. Participants reported that few national and regional publications are relevant information sources for their work unless they are cited in high visibility journals.

4. Filtering electronic searches according to publication year, source, author, and methodology, as well as monitoring journals and indexes for pertinent new research are activities reported by several participants, particularly those familiar with the use of information technologies.

5. Extracting information occurs if the resource is accessible from an open-access, full-text electronic database and/or a library collection (either electronic or print). If the resource is not available in this way, finding a full-text version becomes a challenge. Four coping strategies are reported: seeking library-based provisional services (interlibrary loan and document delivery), purchasing the article online, purchasing a subscription to the publication, and contacting the first author for a courtesy copy. Contacting the author

is the preferred extracting strategy, and it is also one of the main themes from which the model of scholarly communication in Venezuela emerges.

6. Information management is also identified in two participants' explanations. They each kept a well-organized personal collection of full-text scholarly articles in PDF format, obtained from both electronic and printed original sources.

5.3. Information Dissemination

According to Garvey & Griffith (1972) information dissemination in science is a constant activity in which information flows from informal channels of communication to established scientific literature; from small groups to large audiences. Dissemination takes several forms and formats in which information is shared and communicated among members of the scientific community; for example, scientific information is passed from one member to another by interpersonal communication, email, preprints, posters, conference papers, textbooks and digital content. (Brown, 1999; Garvey & Griffith, 1972; Price, 1963; Tenopir, King, Edward & Wu, 2009).

One of the major findings of the study is that scientists in Venezuela are in constant communication with international scientists. They deem this communication indispensable for their survival as scientists in Venezuela. Interpersonal communication for both communities (national and international) is channeled by telephone, VOIP and email. Face-to-face communication occurs when members of the national scientific community participate in international conferences.

There are other mechanisms available to the scientific community to interact with each other; one of those mechanisms is the invisible college. Price (1963) defines the

invisible college as a *"closed group, a small number of hundreds in membership strength, selected from a population…They effectively solve a communication crisis by reducing a large group to a small select one of the maximum size that can be handled by interpersonal relationships" (p. 85).* The invisible college provides the means by which communication flows freely and informally to and from each one of its members. This kind of non-official mobile institution exists in every discipline to address the information needs of the scientific community.

Though no data was collected regarding the invisible college, it could be argued that the daily communication reported by the participants in the dissertation study with international scientists recreates in part the mechanism of the invisible college, where information and ideas on research flow freely and informally between its members. As pointed out before, communication between the national and the international scientific community is facilitated by the ICTs.

Participants reveal very little information regarding their use of preprints of articles, or of posters and paper presentations, either as disseminators or recipients of scientific information. Participants' attention is focused on publishing their papers in international journals rather than on disseminating their research by other means. Paper publication increases recognition and prestige, qualities that then facilitates their interpersonal communication with international scientists.

Participants reported attending national, regional, international, and online conferences. National conferences are reported to be good venues to meet old friends and disseminate research on local and national issues. Regional conferences are attended, for

the most part, in order to receive scientific information from other colleagues in Latin America. International conferences are attended for the purpose of disseminating research and to reinforce interpersonal communication opportunities with the international scientific community. Online conferencing is viewed as a less expensive alternative to face-to-face international conferences.

The study found that these scientists perceive that English is the dominant language for communicating about science. Participants reported having difficulties in searching, disseminating their research, and publishing in English. It is recognized, however, that in order to succeed as scientists, English has to be mastered.

It is reported that national journals have low visibility and impact because they are published in Spanish and not in English. The scientific literature establishes that there are many factors that account for the visibility and impact of a given article. Language is one of them. Other factors mentioned in the literature are: citation patterns, document type, quality and type of research, author prestige, institutional affiliation, and national origin. Journals from developing countries suffer from low visibility and impact.

The 2009 Journal Citation Report (JCR) indexes seven Venezuelan journals, each from one of an array of separate disciplines. Based on impact factor, the JCR ranks each one of them in the fourth quartile of their respective disciplines. Out of the seven journals, one is published in English; three are published in Spanish; and three are reported to be multilingual (Thomson, 2010). The sample of seven journals is too small to reach any significant conclusion; however, it is reasonable to think that language is not

the only factor impeding visibility. There are other factors, such as the mentioned in the above paragraph, that also affect journal visibility and impact.

5.4. Suggestions for Future Research

This study provides the groundwork for scholarly communication studies in Venezuela and other developing countries. There are issues pertaining to national and regional publications, research output, dependency, and scientific policy that require further exploration. Future studies might include:

1. Studies on national and regional journals to measure visibility and impact,
2. Studies on scholarly communication of scientists, who produce, consume, and disseminate national-level scientific information,
3. Studies on research output and its relevance to local, national and regional communities.
4. Longitudinal studies on the process that informs scientific research to measure scientific progress in Venezuela and other developing countries,
5. Studies to identify relevant research areas that interest national and international scientists, to foster more opportunities for collaboration.
6. Studies to test the model of scholarly communication in a context of dependency in other countries of the region.
7. Studies to identify invisible colleges, collaboration, research fronts and clusters in which national and international scientists participate.

5.5. Suggestions for Improving Scientific Performance

There is some knowledge that is to be derived from the scientists' accounts, and the observations and findings of the study. It has to do with the perseverance and tenacity shown by the participants to access scientific information sources and publication outlets. Information and communication technologies are inadequate and obsolete. Funding to purchase access to information sources is scarce. Electronic and online network systems (e.g., web conferencing, online learning environments, web-based content management systems) that facilitate communication, dissemination, education, and collaboration are seldom available. Funding to travel nationally and internationally to meet other scientists and disseminate information is difficult to obtain. Despite these hardships, Venezuela's scientific community produces and publishes scientific research.

The following suggestions might alleviate some of the adversity faced by national scientists, and thereby increase scientific output and communication in Venezuela:

1. Information sources should be readily available for searching, browsing and extracting, especially those providing full-text access to published scientific literature.
2. Funding from national and international agencies should be available to update the obsolete information and communication technologies.
3. Participation in national, regional, and international conferences should be encouraged and fully funded by the Venezuelan state.
4. International scientists should be invited to visit Venezuela for extended periods of time to promote interpersonal communication and research collaboration.

5. National and regional journal editors should devise a publication policy with the purpose of consolidating and strengthening national and regional publications. Moreover, well-known international scientists should be invited to publish in national and regional journals as a strategy to increase visibility and impact.

6. Academic libraries should offer instructional services to improve the searching and information management capabilities of the Venezuelan scientists.

5.6. Summary

The study presents a model that explains scholarly communication in a context of dependency. The model is defined as a set of interrelated strategies of interpersonal communication, information dissemination, and information seeking behavior with the purpose of overcoming difficulties and barriers experienced by Venezuelan scientists in a context of limited access to international information sources and publication outlets. The major themes from which the model surfaces are: ongoing interpersonal communication with the international scientific community, publication in international journals, prestige and name recognition, and contacting the authors directly to obtain copies of full-text journal articles. Insights on the information seeking behaviors and information dissemination practices of Venezuelan scientists are presented.

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APPENDICES

APPENDIX A: Consent statement (Spanish version)

Autorización para entrevista de investigación

Uso de información científica

Usted esta invitado a participar en un estudio de investigación, que tiene como propósito entender como los investigadores Venezolanos usan información científica. Yo estoy muy interesado en conocer como Ud., busca, encuentra y usa información.

La sesión consiste en una entrevista semi-estructurada de aproximadamente una hora. Las preguntas exploran como Ud., se entera de investigaciones actuales, como Ud., busca información, como maneja esa información, al igual que otras actividades relacionadas con el proceso de investigación. Con su permiso, esta entrevista será grabada. Las grabaciones serán transcritas inmediatamente y luego serán borradas. Todas las notas y transcripciones serán anónimas y confidenciales, ya que se les asignara un numero de identificación, el cual no revela su identidad.

No hay ningún riesgo para Ud., si participa en esta investigación. Toda la información obtenida en el estudio será confidencial. Ni su nombre, ni ninguna otra información personal podrá ser conectada a la data. Todos los registros, notas, transcripciones y grabaciones estarán bajo llave en la oficina del investigador. Cuando el estudio haya concluido todo la data será destruida. Ninguna referencia oral o escrita podrá ligarlo a Ud., con el estudio.

Los resultados de este estudio, podrían mejorar potencialmente el acceso y uso a recursos de información , lo que podría resultar en una proceso investigativo mas eficiente y conveniente para Ud.

> Si Ud., tiene alguna pregunta sobre el estudio durante o después, hágamelo saber. De igual manera si Ud., experimenta algún efecto adverso como resultado de haber participado en el mismo, me podra contactar: Simon Aristeguieta-Trillos, at Email: saristeg@utk.edu; Office 100, First Floor, 1345 Circle, Park Drive, Knoxville, TN 37996-0341, Telephone: 865-974-8200.

Si Ud., quiere averiguar cuales son sus derechos como participante, por favor contacte al Oficial en la Oficina de Investigación de la Universidad de Tennessee en el teléfono (865)974-3466.

Su participación en este estudio es voluntaria. Ud puede declinar participar sin ningún consecuencia. Si decide participar, Ud., puede declinar su participación en cualquier momento sin ninguna consecuencia negativa. Si Ud., decide no participar toda su data será devuelta o destruida.

Yo he leído toda la información arriba descrita. Tengo una copia de esta autorización. Estoy de acuerdo y conforme con participar.

Firma del participante_____ Fecha _____

Firma del investigador _____ Fecha _____

APPENDIX B: Consent statement (English version)

INFORMED CONSENT FORM

How to be a successful scientist with limited access to information sources

You are invited to participate in a research study, conducted for the purpose of understanding how researchers in Venezuela use scientific information. I am interested in how you search, find and use information.

This session will consist of a semi-structured interview lasting approximately 1 hour. Questions will explore how do you know about current research, how do you look for information, how do you use information, how that information is managed; and various research activities engaged in during the research process. With your permission, this interview will be audio-recorded. Recordings will be transcribed and then immediately erased. All notes and transcriptions will be assigned an anonymous identification number to maintain your confidentiality.

There are no risks posed to you with your involvement in this project. All information obtained in this study will be kept confidential. Neither your name, nor any other personal identification will be linked to the data. All records, notes, transcripts, and recordings will be locked securely in the office of the researcher and will be made available only to the researcher. At the conclusion of the study, all data will be destroyed. No reference will be made in oral or written reports that might link you to this study.

Results from this study have the potential to greatly inform and improve informational resources in terms of accessibility and efficiency, while making research more convenient and effective

If you have questions at any time about the study or the procedures, (or you experience adverse effects as a result of participating in this study,) you may contact the researcher, Simon Aristeguieta-Trillos, at Email: saristeg@utk.edu; Office 100, First Floor, 1345 Circle, Park Drive, Knoxville, TN 37996-0341, Telephone: 865-974-8200.

If you have questions about your rights as a participant, contact the UT Office of Research Compliance Officer at (865) 974-3466.

Your participation in this study is voluntary; you may decline to participate without penalty. If you decide to participate, you may withdraw from the study at anytime without penalty and without loss of benefits to which you are otherwise entitled. If you withdraw from the study before data collection is completed you data will be returned to you or destroyed.

I have read the above information. I have received a copy of this form. I agree to participate in this study.

Participant's signature _____ Date _____

Investigator's signature _____ Date _____

APPENDIX C: Initial category list

Abstract browsing- Ojeando resúmenes; P1; P3; P10; P11

Abstract in English – Resúmenes en Ingles; P1; P5

Abstract in French – Resúmenes en Francés; P7

Abstract in Portuguese – Resúmenes en Portugués; P5

Abstract reading - Leyendo resúmenes; P1; P3; P10; P11

Academic database fields – Campos en bases de datos; P6

Academic database in English – Bases de datos en Ingles; P1; P4; P5; P7; P8; P12

Academic database in Spanish – Bases de datos en Español; P12

Academic database search – Búsqueda en bases de datos académicas; P1; P4; P5; P7; P8; P12

Academic databases - Bases de datos especializadas; P1; P4; P5; P7; P12

Ask the author - Pedirle al autor; P1; P2; P3; P5; P6; P7; P10; P11; P13

Beginning a research – Comenzando una investigación; P10

Beginning search – Iniciando la búsqueda; P1; P3; P4; P6; P7; P8; P11

Beginning the career - Empezando la carrera; P3, P9; P10

Browse journal by journal – Ojeando revista por revista P6; P8; P11

Browsing in the Internet - Ojeando el Internet; P2; P3; P6; P7; P8; P9 ;P13

Build your career - Construir tu carrera; P9; P4

Burned a paper - Quemar un articulo; P13

Buying a computer – Comprar una computadora; P1; P5; P12

Buying a journal subscription – Comprar una suscripción; P6; P11

Buying papers online - Comprar artículos en línea; P10

Collaboration with Europe - Colaboración con Europa; P1; P7

Collaboration with international experts -Colaboración con expertos internacionales; P9; P12

Collaboration with large laboratories - Colaboración con grandes laboratorios internacionales; P1

Collaboration with very specialized people - Colaboración con gente muy especializada; P1

Communicating with international scientists – Comunicación con científicos extranjeros; P1; P2; P3; P7; P9; P12

Communicating with my peers – Comunicación con mis compañeros; P1; P3; P4; P6

Communicating with national scientists – Comunicación con mis colegas nacionales; P1; P3; P4; P6

Communicating with the French –Comunicación con los Franceses; P6, P8, P9

Communicating with the international scientific community – Comunicación con la comunidad internacional; P1; P2; P3; P7; P9; P12

Communicating with the national scientific community – Comunicación con la comunidad nacional

Contacting authors – Escribir a los autores; P1; P2; P3; P5; P6; P7; P10; P11; P13

Contacting other labs – Escribir a otros laboratorios; P1; P3

Contacting other libraries – Escribir a otras bibliotecas; P4; P5; P7

Contacting our department – Escribir a nuestro departamento; P1; P2; P3

Contacting our library – Contactar nuestra biblioteca; P4; P5; P6; P7; P8

Contacting the editors – Escribir a los editores; P8

Contacting the principal author - Escribir al autor principal; P1; P2; P3; P5; P6; P7; P10; P11; P13

Deficient mail - Correo deficiente; P1

Document delivery service – Servicio de envío de documentos; P5; P6; P7

Electronic access – Acceso electrónico; P8; P12; P13

Electronic journals – Revistas electrónicas; P7; P9

Electronic mail - Correo electrónico; P9; P1; P2

Face-to-face contact - Contacto cara a cara; P7

Filtering information – Filtrar información; P3

Get your degree - Obtener su titulo; P8

Getting prestige – Ganando prestigio; P2; P3; P4; P5; P7; P13

Getting published in Latin American journals – Publicar en revistas Latinoamericanas; P8

Getting published in national journals – Publicar en revistas nacionales; P3; P7; P13

Getting published internationally - Publicando internacionalmente; P1; P2; P4;P5; P7; P13

Getting recognition – Ganando reconocimiento; P2; P4; P5

Going to conferences – Cunado voy a las conferencias; P7; P9; P12

Going to do a post-doc – Cuando me fui hacer el post-doctorado; P1; P11

Going to Europe – Cuando voy a Europa; P1

Going to study – Cuando voy estudiar ; P1; P2; P3

Going to the Internet - Cuando voy al Internet; P2; P3; P6; P7; P8; P9 ;P13

Going to the USA – Cuando voy a los Estados Unidos

Grad studies in Europe - Postgrado en Europa; P1

Grad studies in Venezuela - Postgrados en Venezuela; P2

High impact journals – Revistas de alto impacto; P2; P8; P10

I am known internationally – Yo conocido mundialmente ; P1; P2; P3; P4; P5; P7; P9

I called them by phone – Yo los llamo por teléfono; P7; P7; P8; P9

I cannot be an expert in all - Yo no puedo ser experto en todo; P1

I cannot read in the computer – Yo no puedo leer en la computadora; P3; P4; P7; P10; P12

I classify information – Yo clasifico la información; P3; P3

I collaborate with international scientists – Yo colaboro con científicos internacionales; P1; P6; P7; P8; P9; P12

I collaborate with national scientists – Yo colaboro con colegas nacionales; P1; P2; P3; P9

I communicate daily – Yo me comunico diariamente; P6; P8

I disseminate information in conferences – Yo disemino información en conferencias; P3, P7, P9; P12

I disseminate my work – Yo disemino mi trabajo; P1; P3

I disseminate other's people work – Yo disemino el trabajo de otras personas; P1; P6; P7; P9

I don't find anything relevant in national journals – No encuentro nada relevante en las revistas nacionales; P1; P2; P3; P6; P7; P10

I don't like to publish in national journals – No me gusta publicar en revistas nacionales; P1; P3; P7; P8; P13

I don't read national journals – Yo no leo revistas nacionales; P1; P2; P3; P6; P7

I don't visit the library – Yo no visito la biblioteca; P7

I emailed them – Yo les escribo correos electrónicos; P6; P7; P8

I have a name – Yo tengo un nombre reconocido; P3; P7; P8

I know how to use the computer – Yo se como manejar la computadora; P1; P2; P3

I known them personally – Yo los conozco personalmente; P7; P9; P12

I learned myself – Yo aprendi solo; P4

I like multidisciplinary research - Yo me inclino a al investigación multidisciplinaria; P1

I manage a network – Yo manejo una red; P1; P7; P9

I manage my information – Yo manejo mi información; P2; P3

I meet them in conferences – Yo los encuentro en conferencias; P1; P3; P4; P6; P7; P9; P10

I only published editorials in national journals – Yo solo publico editoriales en revistas nacionales; P3; P4; P8

I only published in international journals – Yo solo publico en revistas internacionales; P4

I print everything – Yo imprimo todo; P3

I rather print - Lo prefiero impreso; P3; P4; P7; P10; P12

I read in the computer – Yo leo en la computadora; P1; P5; P12

I read the abstracts – Yo leo los resúmenes; P1; P3; P10 ; P11

I read the references – Yo leo las referencias; P3; P4; P5; P6; P7

I receive recommendations from editors – Yo recibo recomendaciones de editores; P8

I save everything – Yo salvo todo; P3

I search academic databases – Yo busco en bases de datos académicas; P1; P4; P5; P7; P8; P12

I search by author – Yo busco por autor; P6; P7; P8 ;P11

I search by compound – Yo busco por compuesto; P11

I search by journal title – Yo busco por el titulo de la revista; P8

I search by keyword – Yo busco por palabras claves; P3; P4

I search by theme – Yo busco por tema; P3; P7

I search by topic – Yo busco por topico; P3; P4; P7

I search for my own information – Yo busco mi propia información; P4

I search Google Scholar – Yo busco en Google Scholar; P3; P4; P5; P7

I search in the Internet – Yo busco en el Internet; P2; P3; P6; P7; P8; P9 ;P13

I search in the library – Yo busco en la biblioteca; P6

I sometimes published in national journals – A veces publico en revistas nacionales; P3; P4; P8

I sometimes read national journals – A veces leo revistas nacionales; P1

I studied in Europe – Yo estudie en Europa; P1; P3; P4; P7

I studied in the USA – Yo estudie en Estados Unidos; P2; P8

I studied in Venezuela – Yo estudie en Venezuela; P9

I think database search is easier – Buscar en las bases de datos es mas fácil; P8

I travel to Europe – Yo viajo a Europa; P1

I travel to other countries – Yo viajo a otros países; P1; P7; P9

I visit the library – Yo visito la biblioteca; P7

I want to known - Yo quiero ser famoso; P2; P4

I work at the library – Yo trabajo en la biblioteca; P6

If interested I saved - Si me interesa lo guardo; P2

Impact of research – Impacto de la investigación; P3; P5; P7; P10

Information on conferences - Información sobre congresos; P7; P9

Information technology changed science – Las tecnologías de información cambiaron la ciencia; P1; P7; P8; P9

Interested in authors - Me interesa autores; P6; P7; P11

Interested in themes - Me interesa el tema; P4; P7

International conferences - Conferencias internacionales; P3; P4

International networks - Redes internacionales; P12

Is like window shopping - Es ir de vidrieras; P4; P5; P6

It took me sometime to learn computers – Me tomo un tiempo aprender sobre computadoras; P1

Journal subscription – Subscripciones a revistas; P6; P11

Knowing the big names - Conocer a los grandes nombres; P4; P7

Latin American journals - Revistas latinoamericanas; P1; P8; P11

LatinAmerica databases - Bases de datos Latinoamericanas; P2; P3; P6; P7; P10; P12

LatinAmerican collaboration - Colaboración Latinoamericana; P1; P2; P4; P6; P8

LatinAmerican conferences – Conferencias Latinoamericanas; P1; P6

LatinAmerican scientific community- La comunidad científica de Latinoamérica; P4; P6; P8

Library collections –Las colecciones de la biblioteca; P4; P8

Library infrastructure – La infraestructura de la biblioteca; P4; P5; P7; P8

Library services - Servicios de biblioteca; P4; P5; P7

Local research – Investigación local; P4

Local scientific community – La comunidad científica local; P4

Local things - Cosas locales; P4

Lost research – La investigación perdida; P4; P7

Low impact journals – Revistas de bajo impacto; P9; P13

Managing information - Manejando información; P2; P3

More visibility - Mayor visibilidad; P5; P7; P8; P9

My English is not very good – Mi ingles no es muy bueno; P2; P8

Not every one can publish in Nature - No todos podemos publicar en Nature; P1

Nothing that is relevant - Nada relevante; P2; P3; P6; P7; P10

Online conferences - Congresos virtuales; P7; P9

Online journals – Revistas en línea; P7; P10

Only when they are cited - solo cuando son citados; P10

Open access journals – Revistas de acceso libre; P3; P4; P5; P7

Printed journals – Revistas impresas; P6; P11

Published to be -Si no publicas no existes; P1; P2; P4 ; P5

Reding abstracts – Leyendo resúmenes; P3; P10; P11

Scientific collaboration in Latin America - Colaboración científica en Latinoamérica; P1

Searching by phrases - Busqueda por frases; P7

Searching electronically – Busqueda electronica; P1; P2; P3 P4; P5; P6 ;P7; P8; P9; P10; P11; P12; P13

Searching for information in the library - Buscando información en la biblioteca; P6

The World of computers – El mundo de la computadora; P1

The electronic world - El mundo electrónico; P1

The labs had subscriptions - Los laboratorios podían tener subscripciones; P1; P6; P11

The lenguage of science - El lenguaje de la ciencia; P1; P2; P3; P5; P7; P8

The net is too slow - La red es lenta; P4

They are not indexed - no están indizados; P9

They are one or two steps ahead of us - Están uno o dos pasos mas avanzados; P12

Too many references - Muchas referencias: P4

Use of telephone - Uso del teléfono; P9; P1; P3; P4

Using Skype - Usando Skype; P6

We are being integated - Estamos siendo integrados; P7

We communicate daily - Nos comunicamos diariamente; P7

We couldn't survive - No podríamos sobrevivir. P7

We need to travel - Necesitamos viajar; P7; P9; P12

VITA

Simón was born in Caracas, Venezuela. He went to school at Colegio Santiago de León de Caracas; where he completed his high school education in 1980. Right after high School graduation he traveled to the United States to study Sociology at the University of California, Berkeley. He went back to Caracas to work at the Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICIT) where he developed an agenda on enhancing the quality of the national scientific journals. In 2002, he helped to establish the Scientific Electronic Library Online (SciELO), the Sistema Regional de Información en Línea para Revistas Científicas de América Latina, el Caribe, España y Portugal (Latindex) and the Curriculum Vitae en Ciencia y Tecnología (CVLAC). In 2003, he traveled to San Juan, Puerto Rico where he studied information science at the University of Puerto Rico. There he focused his attention on citation analysis and bibliometric research. In 2006, he began doctoral studies at the University of Tennessee, Knoxville with an emphasis on scholarly communication and social networking.