

**The Common, the Contradictory and the Idiosyncratic: Signposts from a
Qualitative Exploration into the Structural Factors Influencing
Scientific Work in Tsukuba, Japan [1997 – 2002]**

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Abstract

From the socio-economic turmoil of the 20th century, Japan has repeatedly revealed its resilience. During these trying times, scientific work has been an important element in Japan's economic development. However, the 1990s revealed weaknesses in this "economic miracle." During this period, several socio-structural factors have contributed to this social landscape. Future successes in Japanese socio-economic spheres will partially depend on scientific work. In this study, it is suggested that identifying structural factors in the Japanese "system" that contribute to its scientific organizations is key to ascertaining a more coherent assessment of scientific work in Japan. This assessment can lead to more in depth analyses of the interconnections between science and society. The focus of this study is on scientific institutes and their organizational structure. The social networks that interconnect these institutes and couple their scientific work with other elements of Japanese culture are essential in the analysis of Japan's scientific enterprise.

In the present study, a qualitative case study methodology is used to explore socio-structural networks within the *cultural field* of scientific work in Tsukuba, Japan. The structure of scientific work in Japan is composed of several cultural and material elements which have been distilled into two themes for evaluative purposes. These themes include cultural factors and scientific production/economic affairs. Through a reflexive-thematic lens an analysis of scientific work is conducted. Central to the method used in this study is a series of structured and un-structured in-person interviews using a format of open-ended questions. Most informants in this study were chosen by administrators of the institutes involved. Although, I did participate in assuring diversity in the sample, there is possible bias inherent in management's choices of particular informants. These interviews were held during the month of October 2002 in five separate university and non-university institutes in Tsukuba, Japan.

The findings in this study reveal common, contradictory and idiosyncratic aspects that have important cultural and scientific/economic effects across organizational types.

Common attributes include the observation of universal “top-down” organizational hierarchies with networks of labor being accumulated through elite scientists. Generally, informants perceived little to no effect from the national economy on their particular institute’s funding of science. Scientists spent an extraordinary amount of time at work and conducted highly specialized work tasks. The publishing activity concentrated among elite scientists while utilization of foreign scientists and contingent workers were segregated. Also, the use of tacit knowledge as a principal training tool was universally observed across institutes.

Contradictory attributes include scientists’ attitudes toward their work versus the city they live in, government policy versus actual laboratory work, and publishing versus conference presentations. The idiosyncratic attributes focus on levels of organizational formality across organizations. The organizational formality is related to the individual scientists’ perceptions of what they enjoyed most about their work. Thus, scientists that enjoyed the “processes” of their work tended to be located in more formal organizations whereas those scientists who enjoyed “discovery” were situated in less formal organizations. It is likely that the different levels of organizational formality observed in this study are associated with other elements of laboratory culture. Also, the composition of foreigners and women varied remarkably across institutes. Yet, their use in laboratories is relatively similar.

Dedication

This dissertation is dedicated to Jack and Jan Wilkins, my Mother and Father, who introduced me to Japan and continue to amaze me with their caring participation in our global community.

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Chapter 1: INTRODUCTION

Upon leaving Tokyo Station headed toward Tsukuba Science City, the bus quickly exited the plethora of neon lights and chaotic dispositions of a fast-paced city alive with an exuberant ambiance. The tall seats of the bus act as a buffer for my tired body as the bus passes tall buildings, pachinko parlors and scurrying pedestrians before climbing a tall bridge overlooking the city of Tokyo toward the Joban freeway. As most of my fellow passengers slept or conversed with their neighbors from across aisles, out the bus windows groups of homeless people can be seen milling about their blue tarp homes along the Sumida-gawa (Sumida river) – a drastic contradiction in the middle of one of the most prosperous cities in the world. Tollbooths mark the beginning of a unique excursion away from Tokyo. On this cool October evening, the approximate 40-minute bus ride from Tokyo to Tsukuba City is unusually quiet and dark. In many ways I felt as if I was leaving something special behind me, going somewhere foreign. As the distant lights from Tokyo dissipate and passengers settle into comfort zones, an automated travel message spoken aloud with a female Japanese voice is broadcast over the bus speakers. The voice describes destination information in both Japanese and English.

After entering the Joban Expressway, a lonely, quiet and uneventful ride begins. About forty minutes later, after exiting the “Joban” and officially entering Tsukuba city, much had changed. On Ushiku-Gakuen Dori (a large highway-street connecting the Joban Expressway to Tsukuba Center), Western restaurants (Denny’s, Taco-Bell, a Mexican franchise) and car dealerships line the roadside. The large open spaces and tall advertising signs are indeed striking – a world away from Tokyo. The exit to Tsukuba city resembles any other exit off a U.S. interstate highway. There is little doubt that I had arrived in an odd Japanese town.

Situated deep in the planned and very organized streets of Tsukuba is Tsukuba University, located near the center of the city. This large open campus is outlined with cropped lawns of grass and large parking lots (unheard of in other parts of Japan). The campus is dotted with varying sized buildings, pedestrian bridges and artistic sculptures that provide a comfortable atmosphere for the nearly 10,000 faculty, staff, students and administrators that live and work in and around this university complex. Foreign visitors are said to feel at home in Tsukuba because of its uniquely Western atmosphere. The campus teems with student and faculty life. Classrooms, cafes, institutes, laboratories and administrative offices are all carefully “clustered” around landscaped open spaces with contemplative ponds and soothing sculptures.

The following narrative about Japanese science begins and ends with culture. Although popular culture is an extremely important aspect of Japanese society (*manga* and *anime*, “Hello Kitty” and “Hamutaro,” films and theatre, Japanese sporting events), my particular project relies more heavily on the culture of scientific organizations. Having said this, it is important to note that popular culture in Japan often merges with the work environment in interesting ways. For instance, a popular manga called “Division Chief: Kosaku shima” (Hirokane, 2002) is a distraction for young businessmen that takes them

away from their exhausting work schedules. This particular manga is filled with the exploits of Japanese businessmen and their social interactions with co-workers, the opposite sex and their work.

Popular culture is one element in a field of cultural production that adds important understanding to Japanese organizations of work. However, details of the historical context of contemporary Japanese culture are also important. These details are documented extensively in several interdisciplinary works (Bellah, 1985; Traweek, 1988; Ketelaar, 1990; Hess, 1995; Hudson, 1999). Bellah observed vertical hierarchical structures in the organization of Japan's religious spheres. Others have documented this vertical structure in different realms (Nakane, 1974; Hamabata, 1990). Some have even gone as far as documenting "networks" (keiretsu) in the Japanese economy (Lincoln, et al. 1992) or focusing solely on educational reform in universities such as Tsukuba University (Halpin, 1978). Yet, explicit analysis of Tsukuba's scientific work and organization in a cultural context are more thinly documented. One exception is the work of James W. Dearing (1995). Thus, one of the problems in this study is to address the relatively meager array of materials on contemporary scientific fields and social networks localized in Tsukuba, Japan.

The ambiance of smells, tastes, scenery and the people of Japan themselves make for a unique backdrop in studying "science in Japan." Even though "real" science is being conducted in Tsukuba at a feverish pace, the science itself is integrally related to the socio-structural, cultural, and economic networks inherent in this city. The Japanese "system," as many experts from different fields have called it, its culture, population, land, educational system, labor force and organization of work interact in interesting patterns to produce social ways of conducting science.

In the present study, these "social ways" of conducting science are revealed in the testimony of exceptionally bright and promising young scientists who truly believe their work is having an important positive impact on society. Within this context of youthful exuberance, the Japanese economic situation has deteriorated in recent years. The government is looking toward science as an important tool to help fix the economic problems revealed during the 1990s. I argue that the social networks in the cultural fields of science in Japan are important foci for understanding the organization of science. In turn, these networks are built by the efforts of real people, real scientists and real organizations. Whether or not science is transforming into different assemblages in Japan is an interesting question. *However, a more urgent question in this dissertation is to understand how science functions and is structured in Tsukuba. The social networks should reveal these functions and structures and help elucidate meaning drawn from the testimony of scientists.*

Networks of socio-structural elements in Japanese society are fundamental components in the description of culture and scientific production. These social entities tend to produce cogent organizational structures within the field of scientific work. In the context of a qualitative case study such as this, informants' attitudes, values and beliefs play an important role in the development of evaluative criteria used. Cultural

significance/meaning, reflexive interpretation, explanation (generalization), and the importance of making connections act as criteria for the evaluation of scientific organization in a particular culture. These criteria are necessarily linked to my own cultural biases and methodological instruments. Thus, in effect, I have become a participant observer in Tsukuba's field of science.

In recent years, much has been written on the Japanese "system." Some works have focused on the negative aspects of the entire system (van Wolferen, 1990) and others have focused solely on particular institutions (Cutts, 1997; Schwartz, 1998; McVeigh, 2002). There have been some investigations that have focused solely on Tsukuba (Traweek, 1988; Dearing, 1995). However, much of what has been written on Tsukuba's scientific enterprise is descriptive in that special attention is paid to government documents, institute pamphlets and foreign "white-papers."

The intent of this dissertation is to conduct a qualitative case study through the distillation of formal governmental and institutional documents within the context of scientist interviews and my own personal observations during research in Tsukuba. I have sought to make this project balanced so that it can serve as a basis for a fundamental assessment of transformations taking place in the scientific work and organization of an important Japanese city.

Since this is a qualitative case study, I utilize several sources of data. However, the principal data source is in-person interviews. I have developed evaluative criteria to be used in analyzing the content and quality of interviews. This iterative process of evaluating the content of interviews in a reflexive manner leads to the construction of a narrative about Japanese science in Tsukuba. As such, I run the risk of projecting my cultural dispositions on the culture I am studying. However, the reflexive approach used in this study will help minimize the masking of these biases in order to create a more balanced assessment of the subject material.

Japan is an "aging" and increasingly urbanized society. Its educational system focuses on intense standardization, memorization and specialization. Although these institutional characteristics are seen across the globe as models to emulate, many suggest that these institutional characteristics are inherently detrimental to Japanese society. Even though Japan's pre-high school and high school drop out rates are among the lowest in the world, internal and external critiques have been levied against this educational system which is integrally related to the Japanese labor force (van Wolferen, 1990; Cutts, 1997; McVeigh, 2002).

These socio-structural patterns tend to affect the cultural practice of work in Japan and more specifically, the culture of science in Tsukuba. However, Tsukuba is a very unique place. Most observers would agree that there is no other place in Japan quite like Tsukuba. Some see this "uniqueness" in negative terms. Others are more positive about this planned community. This study aims at understanding the commonalities, contradictions and idiosyncrasies that encompass the field of science in Tsukuba.

The data analysis of interviews in this study led to the development of a dichotomy: culture versus scientific production/economic affairs. These two methodological constructions were derived from interviews. As such, I interact with the informants in a “dance” that produces a unique glimpse into the character and structure of science in Tsukuba. The framework developed emanates out of this interplay between interviewer and interviewee in hopes of better understanding local culture and knowledge. My personal experiences in a private laboratory setting in Virginia, working off the coast of Alaska on Japanese fishing vessels and living in Japan for two years during the 1970s locate my situated view on “Japanese science” within an interesting context. These cultural experiences merge with my graduate education in the sociology of science to precipitate unique ways of viewing the subject materials. The outcome inherently links to my experience and the interaction of this researcher with the networks and interests of struggle observed in a myriad of social relations.

Interviews in this study were conducted in 5 institutes/organizations. Four of these institutes (Institutes 1, 2, 3 and 5) were on Tsukuba University’s campus. A fifth institute (Institute 4) is a larger internationally recognized institute in the city of Tsukuba. Although this latter institute has ties with Tsukuba University, it is independent of the university and in fact, competes in many ways with one of the other four institutes studied (Institute 1). The institutes and their research foci in my sample reveal a wide variety of scientific disciplines and research agendas (see Table 1.1).

TABLE 1.1: Research Institutes and Organizations in Study

Organizations / Institutions	Number of Interviews	Institute/Organization Focus
Institute 1	13	Medical Sciences, New Materials, Information Technology and Scientific Collaborations with corporations
Institute 2	7	New Materials Research (encompasses physics and chemistry)
Institute 3	4	Agricultural Economics, Biology
Other (Institutes 4 and 5)	10	Policy Planning & Economics, Promotion of Science

As the “brain-child” of a Nobel Laureate in the mid-1990s, Institute 1 is located at the extreme northern end of Tsukuba University campus. It is administratively an appendage of the university. However, its networks of science are far more extensive. Institute 1 is focused on three major research areas (medical sciences, chemistry and new materials and information technology). The laboratories of this institute are located on one square block of terrain at the northern end of campus. Two, office-park-like

buildings make up the entirety of its physical space. These dual attached buildings are three floors in height and are organized around an administrative “A-wing” where top administrators, senior professors and a patent-group faculty maintain offices. The second building (“B-Wing”) is attached to A-wing. B-wing consists of laboratory space and laboratory administrative cubicles where most of Institute 1 informants worked.

The laboratory space in “B” wing is located throughout the three floors. However, the architecture and organization are such that lab space is flexible. The lab spaces have inherent flexibility via temporary lab walls for accommodating the shifting requirements in equipment, space, personnel and research types. The ongoing reorganization of this institute (initiated in 2002) has diminished its size from a peak of 7 laboratory “aspects” (research discipline groups) in the mid-1990s to 4 “aspects” in 2002 (inform_15 and inform_17). Each “aspect” or laboratory group is responsible for approximately three projects that are all under the responsibility of the laboratory leaders. One of the three projects is strictly run, operated and staffed by the institute. However, the other two projects under each group are competitively bid upon by “outside” interests (scientists and other public and private laboratory facilities) who attempt to have their proposals approved by institute 1 management and as such will have access to laboratory space, funding, equipment and personnel at this institute. Each of these latter two projects must enlist an industry expert, a university expert and be associated with a government funded research institute.

In the autumn of every year, institute 1’s administrators and scientists select the following year’s proposal-applicant winners and these projects are announced to the recipients. According to a leader in this institute (inform_15), an important element in the selection process is whether or not the proposed project balances the utilization of university faculty, industry experts and governmental institutes. Thus, structurally, collaboration appears to be an inherent part of the organization of science in institute 1. Interestingly, the interdisciplinary and collaborative structure of this institute is somewhat stifled by the segmentation and specialized-expertise it incorporates into its research aspects. The very nature of separate disciplinary groups in the context of an ever-increasing competitive funding system has put enormous pressures on the leaders and group managers to fund their projects. The national politics of funding science and technology seems to have constructed barriers that the policies themselves were meant to destroy. The increased proportion of government funded competitive grants for specific research agendas has created winners and losers in a ritualistic game of survival. This game of acquiring limited funds for research appears to have increased the focus of research on applied sectors. On the other hand, institute 2 seems to have flourished in this competitive environment.

As was the case with institute 1, the formation of Institute 2 originated out of the work of a Nobel Laureate. However, institute 2’s social landscape differs remarkably from institute 1. It is situated in a heavily traversed area of campus located in the engineering cluster in one of the university’s tallest buildings. This institute has been internationally recognized for its discovery of chemical compounds that have led to lucrative applied products in the international electronics industry (innovative LED

displays, personal computers and computer chip technologies). Its scientific research is focused upon novel materials and their mechanisms and structures.

Most striking in this institute is its relative informal structure and operation as compared with institute 1. Although, the Director of the institute is bogged down with administrative duties, he routinely participates in laboratory practices. This is not a common activity for Directors of institutes in Tsukuba. He is a gentle man with a calm demeanor and obvious intellect. He has an excellent command of the English language and displays an extremely modest disposition. He is responsible for two “thematic” research labs that make up the “heart” of this institute. His laboratories are accessed by taking an elevator from the entrance of the cluster up several floors into a sterile hallway with no clutter whatsoever. The administrative offices are organized around two wings forming an “H.” Each length of the two long arms of the “H” is filled with two rows of scientists’ offices which house junior and senior faculty. The middle arm of the “H” houses the administrative office of the institute and the associated departments. The laboratories associated with this institute are located on a floor below the administrative offices and in another wing of the building. The “life-blood” of this institute flourishes in its laboratories.

Approaching the laboratory wing is analogous to traveling into the dark surroundings of a “black hole.” The halls are dimly lit or completely dark, filled with used and outdated equipment and the walls are full of scuffed marks. A descriptive poster that graphically displays the laboratory research process in simplified form hangs near the double doors of the lab subsequently leading into complete and utter scientific chaos – at least to an untrained eye. My initial reflection of Institute 2’s laboratory was the amazement of seeing a compressed quantity of glass tubing and laboratory equipment packed onto three large stands (10 feet in length) running back toward a large window at the back of the lab. The glass tubing and other equipment on the laboratory desktops are the principle tools used to synthesize conjugates and restructure the molecules of interest. In short, this chaotic environment did not deter its inhabitants from being associated with a Nobel Prize winning discovery.

Graduate students and post-doctoral fellows (and sometimes their junior faculty supervisors) mill about moving from laptop computers to glass tubing in chaotic but effortless patterns. The loud sounds of machinery elevate the background noise of these labs while researchers greet visitors with smiles since speech cannot be heard over the background chatter of machines. Institute 2 is divided into two research themes both of which are organizationally separate but theoretically linked. The Director and junior faculty insist upon the strict separation of laboratory space and supervision. This was an interesting point in that; the informalities of this laboratory did not cross over to the formal organizational plan of the institute. Each of the two research groups in this institute had their own laboratories. Computers and desktop space were shared except for the junior faculty who had specific areas of lab bench top as well as offices on the floor above. Interestingly, this institute does collaborate on one particular project with institute 1.

Institute 3 is situated toward the northern end of Tsukuba University campus. It is literally across the block from the more isolated institute 1. Institute 3 is located within a large cluster of buildings that are designated as biological and agricultural studies. This institute resides in a tall pre-fabricated concrete building that has an annexed building of similar size. Interestingly, the graduate students in this institute resided in brand new offices in the newer annex and the Professors' offices were located in the older building. This organizational "attitude" that has situated graduate students in the new annexed building with spacious offices and new equipment while relegating the Professorate to the older wing with smaller office space and more outdated equipment, is quite remarkable in this culture.

The hallways of this large institute were clear of debris but dingy, dark and unappealing in character. The walls were painted dark orange. Scuffmarks and dirt marks covered the walls, ceilings and elevators and the linoleum floors provided a sterile ambiance throughout the halls of this institute. The ambiance of this institute's spaces was similar to that of Institute 2. However, the people in all institutes were large in character and niceties. Their hospitality included my use of an administrative office as a home away from home. The secretarial staff (referred to as *office flowers* or *office ladies* by some, Ogasawara, 1998) routinely served me morning coffee in a porcelain cup with saucer and cookies on the side. The informal and hospitable nature on the surface of Institute 3's cultural practices masked some of the worker's frantic pace.

The three main institutes of interest (institutes 1, 2 and 3) share some common organizational attributes. However, they differ remarkably with regard to structure, mission, scientific specialties, ambiance and character. The scientists working in these environments have unique stories that reveal further commonalities, contradictions and idiosyncrasies. In order to analyze the contemporary scientific culture in Tsukuba through these institutes it is necessary to review the literature, describe socio-structural demographics of the Japanese and Tsukuba cultures, characterize my methodological approach, and synthesize the narratives into a cohesive evaluative framework. The interplay of these parameters cannot be final in that, culture is continually evolving and thus, science is not static. Instead science is in transformation within an overall field of cultural production.

Chapter 2: REVIEW OF THE LITERATURE

In “creating” a story grounded in an ethnographic form, I run the risk of oversimplifying a complex system of relations that has emerged over time. In an attempt to curtail this error, I choose to analyze “Japanese science” through a reflexive and comparative lens. Japan’s socio-structural components are woven together with historical and contemporary actors engaged in particular struggles of interest, lifestyles and control. The practice and culture of science is in some ways an extension of the cultural history and can be understood through the social networks embedded in socio-structural relations as well as with comparisons to the United States. The socio-structural demography of Japan is crucial for describing cultural practice. This “practice” of culture is observed in the family, work, politics, population, education, and science. The process of describing organizations of scientific work in Japan must involve the sociology of scientific knowledge (SSK) along with other comparisons in order to help elucidate the meaning of the cultural practices of science in Japan.

Historical Context and Organization of Work

Japan’s pre-war past has had an impact on its contemporary cultural development. The Meiji Restoration (1868) carries with it particular importance for this project. Through innovative laws, the Meiji government induced educational reforms that transformed Japan’s society in many ways.

The Meiji Period was an important “turning point” in the internationalization of Japan. Prior to this Era, Japan’s government was predominantly isolationist in nature. Mass production of goods in factories (silk being one such good) acted as a mode of operation in this turn toward internationalization. There were several institutional factors that helped transform Japanese society during the Meiji era. Work and the family were two of these important institutions.

Factory workers during the Meiji Period were essential agents of societal transformation (Gordon, 1988; Tsurumi, 1990). Depending on the type of factory many were women. These women were also integrally involved in the constitution of the family. Toward the end of the Meiji era, the government and the factory owners realized that their workforce was not producing the profit they had expected. Gordon demonstrates that many of the industrial laborers of the Meiji Period were “working poor” (Gordon, 1988 p.26). Managers in the silk factories tried to alleviate the condition of these workers. For instance, they made a special effort to increase morale. Several researchers have noted the “company songs,” lectures, and education sessions that connected silk reeling with the nation of Japan (Tsurumi, 1990). Thus, a loyalty to the company was illustrated as a means of bettering the nation. This loyalty was integrated iteratively with the family.

However, Tsurumi (1990) argues that overall, the women silk workers never bought this “marketing” scheme from their employers. It does appear that in the 1870s, many

women did meet this call for patriotism. However, when the 1880s began, and the factories quickly deteriorated along with Japan's economy, women silk workers were focused on helping their families. This was partly due to the embedded cultural expectations of the *ie* system of household organization. Hamabata (1990) and Hess (1995) detail the importance of the *ie*'s organizational effects on social structure. It was also due in part to larger structural transformations in society. Women and the lower and middle-class Japanese made up the majority of Meiji era factory workers. Thus, class and gender relations along with cultural artifacts (*ie*) intersect in interesting ways. This important historical anecdote provides an introduction into contemporary class and gender struggles that are being negotiated in the workplaces of Japanese society today. The internationalization of a country being carried by the lower classes through factory work is not new (Braverman, 1998). However, it is important to note the legacy of this "system" in contemporary Japan. Generally, Japanese families today still operate within the structural constraints of the *ie* system. Hamabata (1990) details the typology of "positional succession" in this patriarchal family structure.

Some investigators have noted that the *ie* system flows over into the economic and political spheres of social life in Japan (Hamabata, 1990). Hamabata recognizes that "The internal activities of the family are intimately related to the position of the family within the economy and the polity, and the way those two realms are organized is intimately related to the internal activities of the family..." (Hamabata, 1990 p.31). Contemporary American systems of control and power in the workplace were also being negotiated during the Meiji Era – on the other side of the Pacific. This American "system" had already influenced Japan by the beginning of the Meiji Era, specifically in 1853, with the arrival of Commodore Matthew Perry's "Black Ships" (van Wolferen, 1990). Some would argue that the Korean Peninsula and China had played important roles in Japanese culture dating back to the Yayoi Period (300 B.C. – 300 A.D.; Hudson, 1999) Thus, "outside" cultural influences appear to have been an integral element in this history of Japan's societal transformations.

Work, Control and Power in the United States

In the United States, several researchers have characterized the relationships between work, labor and capital as a conflict-oriented struggle (Fischer and Sirianni, 1994; Braverman, 1998; Domhoff, 1998). Within this framework, the assumption of an "elite" class controlling society is often made. These investigators also construct an underlying web of relationships that exist in society and their inherent attempts at control of interests. This conception of interested social relations links "interest" to "culture" and can be conceived as a "cultural field of production" (Bourdieu and Wacquant, 1992).

In the early part of the 20th century, Frederick Winslow Taylor's "scientific management" offered capitalists a tool for productive capacities (Taylor, 1911). Taylor's research transformed the culture of work and put in motion a trajectory of control of labor interests by capitalists. The cultural significance of these investigations is seen in the

meanings of the practices that emanate out of institutional change. Thus, the prediction of continued loss of control by many U.S. workers gives important cultural significance to these writings. In this context, Japan's scientific culture and practice can be seen as arising in the swell of internationalization and "scientific management" which was already firmly ingrained on the American organizational landscape.

Edwards notes that "new systems" of control (specifically, technical and bureaucratic control) were structurally transformed by capitalists to gain leverage over social conditions of uncertainty and labor (Fischer & Sirianni, Eds. 1994). The cultural significance is seen in the emergence of new forms of social relations between actors. Yet, both Braverman and Edwards' conceptions of "transformation" seem to have inflexible boundaries that limit their analyses. For instance, Braverman suggests that high wage industries are the most stagnant, growing the least. However, in contemporary U.S. society we have seen (especially, in the 1980s and early 1990s) high growth industries emerging with high wage structures (the computer programming occupations). Thus, the transformation of social relations over time appears to affect particular sectors of work in unique and meaningful ways.

C. Wright Mills (1956) and more recently, G. William Domhoff (1998) characterize power as "(T)he capacity of some persons to produce intended and foreseen effects on others" (Domhoff, 1998 p.18). In fact, Max Weber reminded us that power is the ability of one to impose his/her will on another despite resistance. He notes "*In general, we understand by 'power' the chance of a man or of a number of men to realize their own will in a communal action even against the resistance of others who are participating in the action*" (translated in Gerth and Mills, 1946 p. 180). More importantly, Weber saw power as a struggle to get others to accept the authority imposed on them – a form of "legitimate power."

Within a power-elite framework, Domhoff argues that the corporations, social clubs, and discussion groups construct important policy issues and agendas. These organizations pass these issues and agendas to a network of individuals and institutions (think-tanks, foundations, policy discussion groups) that refine and choose alternatives. In this sense, Domhoff points out that the elite define policy questions in advance of the contributions ascertained from the "people." Each of these organizations (think tanks, foundations and policy discussion groups) is linked with the corporate community through interlocking directorates and funding. Applying this logic to Japan is more complicated than might be expected. Although the interlocking directorates, corporations and bureaucrats in the government associate with DIET (Japan's National Congress) members in the policymaking processes, several factors in Japan's system are distinct. Several policy investigations shed light on these complications in contexts outside of Japan (Dunn, 1994; Kingdon, 1995; Yanow, 1996; Stone, 1997; Schneider and Ingram, 1997). Since Japan has often used other countries as models for the organization of their institutions, analyses of the United States are pertinent for initiating a discourse on organizations of work in Japan.

Japan's system of authority in the pre-war years was directly linked to the *ie* system (a cultural system of household structure and organization) and the Emperor himself. These traditional control systems allowed for several political and economic transitions to take place in what has been characterized as an orderly fashion (Nakane, 1974; Hall and Hall, 1987; Hamabata, 1990). However, to assume that order has been the "rule" and not the exception in Japan is to miss many of the cultural attributes that define Japanese society. For in fact, informants revealed to me that a sense of disorder and chaos is essential in this country¹. The traditional spaces of the imperial palace and Yasukuni Jinja themselves are situated within a context of high rise office complexes, tourists and raised highways² - a sense of chaos and contradiction surrounds these spaces.

Theoretically, there are similarities between the United States and Japan regarding these conceptions of control and power. For instance, Hamabata (1990) clearly shows the significance of the *doozoku gaisha* (the family business classes in Japan) in the economics and politics of Japanese society. However, in some sectors the theoretical water is more turbid than opaque. For instance, Mary C. Brinton (2000) suggests that the work system in Japan relies heavily on the talents of junior high school and high school teachers to equip the nation with employee talent. Her research into the Japanese youth labor market is predicated on two "forces." These forces; the national legal framework and norms that dictate to schools that the schools must have a responsibility for student placement appear to characterize Japan as having inadvertently relied on secondary education as the filter for youth labor.

Results from this research suggest another angle to this "unforeseen consequence" (Sztompka, Ed. 1996) proposition. Brinton's theory provides a notion that the responsibility of teachers, and high schools in general, is to supply labor to the labor markets in Japan and that this result is a policy "*by-product*," not a direct policy outcome. Brinton's theory is grounded on the assumption that Japan's system of labor is necessarily different than the United States' system across the labor market. However, in my research I found that Ph.D. level employees seem to rely much more on private social capital than institutional social capital in obtaining employment. This statement in no way diminishes the importance of institutional capital. Instead, it merely reflects the importance of private social capital within the framework of institutional capital. Although, Brinton did not study higher education, it is important to realize that her characterization of the institutional social capital directly imbedded in the institutions of education and private enterprises is an important contribution in that, prestige of the institution becomes a mediating factor. Todai (the University of Tokyo), Kyoto University and other institutes of high-prestige are examples in which institutional social capital plays a large role. However, in my study at the University of Tsukuba, institutional social capital seemed to play a lesser role than private social capital for academics specifically after scientists are firmly entrenched in an occupational role.

Cultural significance/meaning

The literature on Japanese culture and science is extensive. Cultural significance is an essential evaluative criterion for understanding the culture and practice of science. In assuming a “system” or “network” of relations as an inherent property in the culture of science, I situate myself and my own culture in an “objective” position viewing the Japanese culture as “exotic.” Since scientific cultures have their own boundaries and cross over into regional, national and international cultures, this study provides an analysis of evidence from a particular point of view. Therefore, before beginning to understand the cultural factors that influence Japanese science, I must address my own culture to understand the ontological framework that my critique is situated in. I suggest that this subjective reference will help “de-exoticize” my analysis of Japanese culture and science. This task begins with the academic texts that have been a large part of my own education about Japanese science.

If one assumes that science is inside the social boundaries of culture, one would have to explain the meaning of these boundaries and thus, the relationships between science and culture. Several investigators have undertaken this exhausting research (Kuhn, 1996; Storer, Ed., 1973; Smelser, Ed. 1988; Traweek, 1988; Latour, 1986; 1987; 1988; van Wolferen, 1990; Bloor, 1991; Pickering, Ed. 1992; 1995; Shapin, 1994; Sztompka, Ed.1996; Greenberg, 2001). These works reveal important differences in the cultural patterns of science. By utilizing cultural significance/meaning as an evaluative criterion, a “story of culture” can be merged with a “story of science.”

Culture and history play large roles in the practice of science. Historical context is an important element in understanding the cultural relations between society and science. One of the primary “problematics” of Sociology of Scientific Knowledge (SSK) centers on science-as-knowledge versus science as social. To Pickering (1995), social aspects are involved in all of a scientist’s resources within their practice. Since one of the main foci in SSK is knowledge, a move to characterize the technical culture of science as a single network is a logical step. By pulling in Kuhn (1996), the production of knowledge involves seeing new situations within a paradigm. Pickering argues that this is problematic. “Why doesn’t scientific culture continually disintegrate as scientific actors develop it in the myriad different ways that are conceivable in principle?” (Pickering, Ed., 1992 p.4) To Pickering, the answer lies in the “sociology.” SSK emphasizes the scientific actors. Actors also have interests. Thus, the concept of “interest” appears to help solve some of the questions of scientific culture. Pickering sees actors as extending culture for their own interests. In this sense, networks of interest overlay cultural *fields* of production.

In relation to science and technology policy, observing *laboratory life* (1986) initiates an understanding of what scientists do and the importance of their actions in the knowledge they produce. It also allows for the illumination of sites of interest and struggle. David Gooding (Pickering, Ed., 1992) argues that nature is constrained by human activity. Thus, to Gooding, conceptual objects and their manipulation are not separated from the manipulation of material objects. Gooding constructed

“experimental maps” that he suggests indicate the changing relations between experimental practice and argumentation. In this context, Gooding is realizing that tacit knowledge is not necessarily included in the output of experimental science. Thus, understanding the output requires understanding the tacit knowledge. In other words, a lot of the work in laboratories is included in the output, but only in a covert manner. As such, analyses of texts will not uncover this latter form of work. Interestingly, studies in Japanese communication suggest that Japanese society is set in a “high context” framework which relies less on verbal communication and more on contextual setting (Hall and Hall, 1987). Gooding’s position puts an interesting spin on the analysis of laboratory science and its influence internally, and externally. It appears that a “map” of networks is an important step in uncovering the relationships involved in the *fields* of science and culture.

A Latourian lens can be helpful in extending Gooding’s arguments. For instance, the agency and interests of actors can affect alliances that are forged. These interests can also affect the actual science in laboratories through a “dance of agency” (Pickering, 1995). In this context, the micro-aspects of laboratory practice can be extended to the macro-relations of the cultural field of science. The cultural significance of these investigations is located in their inherent connections drawn between culture and scientific practice. Thus, the participation of actors in science is “connected” to the outer culture of society. Others (Kuhn, 1996) have taken structuralist stances.

In *The Structure of Scientific Revolutions* (Kuhn, 1996), Kuhn articulates the historical character and practice of science. He argues, “...(C)risis loosens the rules of normal puzzle-solving in ways that ultimately permit a new paradigm to emerge (Kuhn, 1996 p.80). Instead of a “falsification” or “confirmation,” Kuhn sees normal science as a puzzle-solving game. In this context, the paradigm’s validity is assumed. It is the research based on past achievements that a particular discipline sees as a foundation for further work. Paradigms to Kuhn are the entities of knowledge that suggest what experiments are worth performing (Kuhn, 1996 p.18). In Japan, the ministries appear to choose which sorts of science are deemed “needed” (LRSJ1996-30053, 1996) by society through various political mechanisms (shingikai being one of these mechanisms). Informants in one Tsukuba institute (Institute 2) vehemently exclaimed their desire for obtaining “that one molecule” or “one result” through painstaking experimentations. This sort of “puzzle-solving” as a goal in and of itself is culturally significant in that the puzzle is linked to paradigms being contested outside of the laboratory.

For Kuhn, normal science leads to anomalies and crises (Kuhn, 1996 p.122). One of his most intriguing insights is the attribution of “invisibility” to revolutions. The invisibility, according to Kuhn, is caused by these revolutions being seen as additions to scientific knowledge, not revolutions or, paradigm shifts. The invisibility issue helps tie together the three entities that Kuhn wants to illuminate as components of the glue that hold scientific communities together: textbooks, popularization, and philosophical works. The textbooks, as a “source of authority,” act as a template for the developing student of science. The popularization connects the outside world as well as the inside world in a

language that everyone understands. Kuhn explains that each of these entities focuses on the problems, data, and theory of the existing paradigms. Textbooks are a necessary element in science.

In Japan, the pre-college textbooks are either owned by or approved by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). This pedagogical “leverage” by MEXT is coupled to the *ie* system’s inherent respect for authority. The cultural significance of “texts” in the practice of science is their pedagogical script that embeds the paradigms and desirable values and meanings into the practice and daily life of both the public and the scientists. Latour (1986; 1987; 1988) and others (Shapin, 1994) provide more in-depth analyses that suggest links between the laboratory, society, and the production of “facts.” These facts are often embedded in society as taken for granted “truths.”

The work of institutional veracity and authority are best epitomized in one of Steven Shapin’s investigations (Shapin, 1994). Shapin’s work and that of other investigations (Bijker, Eds., 1997; Pickering, Ed., 1992) can be coupled with a Latourian stance. For instance, Bijker suggests the concept of “technological frame” (Bijker, Eds. 1997 p.168). This concept deals with the techniques that a community uses for its problem solving. Technological style is limited to social groups of engineers. However, technological frame is applicable to non-engineers as well. In essence, the “frame” applies to the interaction of actors. Nakane (1974) also suggests that “*frames*” or “*Ba*” (roughly translated to English as “field” in the discipline of physics) are appropriate for the study of Japanese culture. Thus, frames are located between actors. This conception fits in well with both Latour’s and Bourdieu’s theoretical stances. There are various degrees of “inclusion” within technological frames. The inclusion of actors is specified by the goals of those actors. However, it also considers their problem-solving strategies, experimental skills and theoretical training (Bijker, Eds. 1997 p.168). Latour (1988) suggests that we must try to study science with tools and words that are independent of the science we are studying. This is a difficult task. However, the key seems to be, to avoid any a priori assumptions and to let the actors be “themselves.” If this is possible, one should be able to follow the transformations of the actors. Latour terms these transformations, translations (Latour & Woolgar, 1986). Along the lines of a *sociology of translation*, Callon articulates the many facets involved in this process (Latour & Woolgar, 1986; Law, Ed. 1986).

The relational “network map” (see Figure 2.1) illustrates the complex actor-network field of production in “Japanese science” which surrounds the particular institutes in this study. The cultural significance of an actor-network model is its ability to uncover relationships between actors and the cultural meanings of these relationships. This network map reveals the context of institutes and organizations studied. It also sets the stage for uncovering the cultural meanings of these relationships that are derived from informant testimony.

Latour’s “Science in Action” (1987) provides many suggestions for researching networks in science. For Latour, acting at a distance and accumulating through mobility, stability,

and combinability of the objects reflects the occurrence of networks. He posits that scientists and engineers gather resources only when they are not doing basic research. These areas along with the accumulation cycle are foci of interest for me. Who are the players in the associations or networks? To begin with, according to Sigurdson (1995), research and development in Japan is produced in five general institutions. These institutions are (1) the university system (state and local government and private institutions); (2) government research institutes (at both national and local levels); (3) public corporations; (4) non-profit foundations; and (5) company research and development laboratories (includes research activity in divisions/companies, central research labs and basic research labs. These institutions appear to be the “centers” of research and development. However, a closer scrutiny of the policy process in Japan puts these initial “centers” into the context of a diffuse array of institutional actors and processes.

The accusations made from “inside” the science networks against the “outside” have created what Latour terms the “Great Divide.” This “Them vs. Us” mentality is a problem that has to be broken down. Thus, the concept of “sociologic” has an extended meaning beyond the strength of association. Sociologic can now be interpreted as a bridge across the “Great Divide.” Again, my “network map” can provide a starting point for a conversation on science policy in Japan.

Reflexive interpretation and explanation (generalization)

In accordance with a reflexivity along the lines of Bourdieu (1989; Bourdieu and Wacquant, 1992), Japanese society can be visualized as a “field” which allows for “doing sociology” in a way that avoids the pitfalls of arranging social structures a priori. Instead, the structures, constructions, social interactions, attitudes and values, agents and agencies are deconstructed into relational conceptions of emergent spheres of influence. The socio-structural components contribute to the *field* of science through individuals’ *habitus* and their objective structural constraints. Some investigations reveal a utility for this sort of theorizing. For instance, van Wolferen’s notion of “Japanese power being so diffuse that it eludes confrontation” (van Wolferen, 1990 p.52) suggests the need for an indirect and relational synthesis of thought.

Bourdieu’s habitus allows for individual agency to interact with social structure in its own “dance” (Pickering, 1995) to help elucidate social trajectories and emergent institutional forms. By including the individual and the structure as interactive participants in social formation, meaning can be inferred from the voices of several different sources of information. Thus, my research approach benefits from the theoretical frame of combining both structural networks and individual testimonies.

Bourdieu’s schema differs greatly from the notion of a society merely composed of dominators and dominated. This is highly attractive since some investigations into Japanese science emphasize the allusive nature of power in that country. For instance, van Wolferen (1990) contends that there is no accountability or responsibility in the

governmental structure of Japan. This abstract, diffuse system of command and control in the Japanese government appears receptive to a Bourdieuan analysis. Bourdieu states "(I)n each field, hierarchy is continually contested and the very principles that under gird the structure of the field can be challenged and revoked (Bourdieu and Wacquant, 1992 p.52). Thus, relative democracy is not excluded from a dominated society and "... (A)s the field of power becomes more differentiated, as the division of the work of domination becomes more complex, involving more agents, each with their specific interests, as the universal is invoked in more of the sub fields that make up the space of play of the dominant class, opportunities for pushing reason forward increase" (Bourdieu and Wacquant, 1992 p.52).

A Domhoffian (1998) critique of Japan's "system" runs the risk of encountering analytical problems rooted in the evasiveness of fundamental social relations. Bourdieu (Bourdieu, 1989; Bourdieu and Wacquant, 1992) offers more indirect relational analyses that may uncover the hidden linkages in a "system" of mythologized homogeneity and equality. Instead of focusing only upon the objective structures or individual constructivist readings of testimony, Bourdieu suggests a novel coupling of the two theoretical frameworks via a reexamination of the researcher and objects of the research in a context of cultural production.

Some may interpret this sort of analysis as a reconstruction in the context of a "one-culture Japan." Actually, this is not my intent. For instance, Cutts notes there are no one-cultures. Instead, there are only cultural systems (Cutts, 1997 p.89). In accordance with this logic of a cultural system, science can be visualized as merely one field of cultural production within a cultural system of multiple fields and *habitus*. For in fact, countries and governments are not "natural" forms of organization. They vary by culture and as such are social constructions. These social constructions are fully functioning entities that effect policy within a particular cultural setting. They are also systems which are influenced by other nations and regions. Yet, the people on the "receiving" end of policy are not innocuous or inactive agents. The analysis of causes, selection of policy and their eventual implementation of policy choices, affect the lives of real people, societal institutions and the organizations of work.

Making "connections"

There have been several academic investigations connecting Japanese institutional forms with embedded cultural attributes (Kingston, 2001; Pempel, 1998; Coleman, 1999; Dearing, 1995; Reid and Traweek, Eds. 2000; Traweek, 1988). However, many of these researches have either been strictly concerned with the "structure of society" (Kingston, 2001; Pempel, 1998) or the particulars of subcultures (Coleman, 1999; Dearing, 1995; Reid and Traweek, Eds. 2000; Traweek, 1988). This in no way presumes that these works are insignificant. To the contrary, they all offer an interesting and informative glimpse into varying aspects of Japanese society.

An evaluation of these investigations in the context of understanding their “connectivity” is important for understanding the embedded cultural artifacts in contemporary Japan. Kingston takes a historical-political angle in trying to uncover Japan’s societal *honno* from its *tatema*e (Kingston, 2001). He notes that the current economy of Japan was set in the context of the United States decision (in 1971) to drop out of the 1944 Bretton-Woods system of fixed exchange rates (Pempel, 1998 p. 11; Kingston, 2001 p.44). According to Kingston, after 1971 there had been a continual rise in the value of the yen. This economic event set the stage for later developments internal to and external to Japan’s economy. He correctly “connects” the economic system with the history and political trajectory of Japanese society. However, Kingston leaves particular policy explanations unconnected. Others focus more on unified social institutions such as the political system (Pempel, 1998).

Pempel views the structure of society in Japan within a context of socio-political regime shifts. Although, this helps explain many of the political dynamics of shifting policies it leaves unanswered many of the connections that individual actors negotiate in their daily lives. To Pempel’s credit, his 1970s analysis of deliberation councils (*shingikai*) is an interesting case study that draws upon the macro and microstructures of policy making in Japan (Pempel, 1974). His more recent work (Pempel, 1998) reveals the mid-to-late 1990s as a critical juncture for political change in Japan. However, during this time period, the country was “totally without policy or socioeconomic logic” (Pempel, 1998 p.1). This notion of disarray is consistent with other investigations (van Wolferen, 1990; Cutts, 1997) but it avoids the *habitus* that individuals contribute to a social situation.

To Pempel, the political and economic avenues are essential to understanding Japan’s current system of government. According to some of his earlier writings (Pempel, 1974), Pempel suggests that minute aspects of the Japanese policy system have had a large impact on public policy. For example, one such aspect involved the orchestrated attempt by Japan’s government in 1965 to create “Planning Divisions” within Ministries that were essentially the precursors to *shingikai*. *Shingikai* have become important avenues for legitimating policy. The people on these committees tend to be ex-bureaucrats and university educators. In fact, over 50 percent were university presidents (Pempel, 1974 p.662). This sort of constituency on the advisory committees inherently affects policy decisions. The bureaucrats have close ties with the ex-bureaucrats and current bureaucrat policy is favored on these committees through social networks. These relationships are important since, as Pempel argues the trajectory of influence is unidirectional, in the direction of bureaucrat to committee (Pempel, 1974). These committees have increasingly played a role in the post-WW II decline of DIET sponsored legislation over the increases in Ministerial/Bureaucratic-sponsored legislation. The importance here is the bureaucracy’s unaccountability to the public. Thus, bureaucrats have increased strength in both their associations with policymaking and the lack of accountability they possess to the public.

Politically, the conservative Liberal Democratic Party (LDP) controlled the government for about 40 years (1948-1993). It wasn’t until 1989 (interestingly, when the economic

bubble was starting to burst) that the LDP started losing some its control. Pempel reminds us that from the 1970s into the 1990s, most of Japan's new jobs were created in the private sector. Japanese "labor peace" was never brought to the forefront by unions. Instead, it came only after a decline of power in Japanese labor and the Japanese political left. The union rates declined from a high in 1950 around 50 percent to a mid-1990s low of 23 percent (Pempel, 1998 p. 10). Gordon suggests that from 1950 onward "union-busting" policies by companies broke inter-company union ties and created stronger intrafirm "allegiances" (Gordon, 1988 p.3).

At the economic level, Pempel (1998) suggests several key external economic shocks occurring in Japan that led to shifts in political power. Some of these factors include World War II; the rapid reduction of tariffs and quotas following several GATT negotiations; the U.S. pulling out of Bretton-Woods in 1971; the oil shocks of early 1973 and 1979-1980; the doubling of the value of the Japanese Yen in the early 1970s; and the formation of the European Union and NAFTA with their anti-Asian trade focus, all of which played roles in the insulation of Japan's economy. According to Pempel, a break of the old way of doing things is not complete but a shift in the political economy has and is still occurring. From these historical analyses of the political economy of Japan, Kingston and Pempel are "connected" together by the significance of the Bretton-Woods meetings.

Briefly, Pempel argues that the Japanese political economy changed in significant ways between the 1960s and 1990s and that these changes constitute a "regime shift." Since this regime shift is still ongoing during the new millennium, one must ask where we are today and where we are going in the future. The scientific enterprise appears uniquely situated in Japanese culture for purposes of tapping into possible answers to these interesting questions. Since ministries, international communities, public and private corporations, the university system and many other spheres of influence operate in the field of science; Pempel's work becomes important for putting the political-economic connection in line with the practice and culture of science. Other investigations have contributed to an understanding of various aspects of science in Japan (Traweek, 1988; Dearing, 1995, Coleman, 1999; Lambert, 2000; Reid and Traweek, Eds. 2000). These investigations are the "other half" of the structural and constructivist coupling that Bourdieu (1998) suggests.

Coleman (1999) articulates one of the more thorough investigations of science in "Japanese Science: From the Inside." He notes that although Japanese scientists have contributed to professional international journals, at the same time their contributions to domestic journals have declined. I found a similar pattern through informant interviews. Informants' most prominent reason for the decline was that Japanese journals' lack international readership. Thus, the Japanese language, at least in the international institution of science is a major impediment for Japanese scientists. Although, most Japanese in Tsukuba speak English well, the writing of English is a more difficult matter. Coleman's research did not include Tsukuba. However, his analysis of laboratories connects a sector of research with structural aspects of Japanese society. This "connectivity" between the laboratory and "objective" structures outside the lab is an

essential element in the present study. Thus, the significance of Coleman's work lies in its connections between laboratory and culture.

Reid and Traweek's (2000) concept of "regional shift" in resource allocation helps link historical actors and expands the understanding of inside-outside laboratory connections. They argue that the insertion of new agents of control over the course of several decades has led to the denial of resources to some and promotion of resources for others. Their synopsis ties in well with Edwards and Braverman regarding systems of control in the workplace and helps illuminate networks of control in the present study. According to my informant interviews, these new agents have remained within systems of politics and economy in the national government and have continued effects on the funding of Japanese science, although in new and interesting ways. These actors of the status quo tend to bring perceptions of stability and "harmony" to network struggles. In one example, informants from one institute (Institute 4) described the intense competition between themselves and another institute in my study (Institute 1). However, when I asked the informants from this latter institute about this "competition," they acted surprised, as if no competition existed. Eventually, a leader of the latter institute confirmed the ongoing competition for intellectual resources. Both of these institutes are dedicated to the recruitment of academic scholars in their quest for joint corporate and university research and development. The connection between various actors and the scarce resources of intellectual specialties is an ongoing struggle for institutional actors in the *field* of science in Japan. This connection underscores the competition for resources and reminds one of van Wolferen's (1990) descriptions of the Japanese "system's" myths. It also alludes to the fact that Japan's "system" may be less harmonious than once believed.

Traweek documented a prevalent feeling of democracy among Japanese scientists (Traweek, 1988 p.146). Her work focused on physicists at KEK in Tsukuba. My data show different results than those of Traweek. For instance, I found that feelings of democracy among workers varied across organizations, organizational type, and discipline. She noted that physicists in her study community saw data and nature as one and the same, the machines being the texts that the scientists' read (Traweek, 1988 p.160). My data appear to confirm this latter observation. However, according to my informants, the outcomes (i.e. the new material or new gene) appear more important to the scientists than the text itself. I also experienced a deep concern in informants' views of atypical "Japanese" social life in Tsukuba. The Japanese I spoke with have a desire to be in a social environment that has degrees of chaos and disorganization. They often point to Tokyo as a model of "nice" or "good" social life.

Another investigator (Dearing, 1995) unraveled the particulars of Tsukuba city in a most interesting way. He suggests that the most notable successes in Tsukuba have been related to superconductivity, solid-state physics, extreme high-energy vacuums, genetic mapping and electron microscopy (Dearing, 1995 p. 2-3). However, the question of a social-connectivity between the scientists in Tsukuba and their society is left unanswered. Tsukuba residents are resigned to the feeling that Tsukuba is young and is transforming before their eyes. However, others suggest that the "experiment" is over

and Tsukuba is a failure. My informants' views appear to connect more with Japanese societal patience than the negative accounts of failure. Japanese "system" actors have shown resilience (the LDP and the World War II rebuilding) and patience and most agree that the Tsukuba "experiment" is still unfolding.

External Factors Influencing Japanese Science

Scientific networks of Interest: a preliminary discourse

A network of actor relations presupposes an interpretation of how Japan's "system" of scientific policy and decision-making is constructed. There are several "objective institutions" which function in concert with both informal and formal actors in diffuse attempts to promote and implement the practice of science and technology in Japan (see Figure 2.1). This schema maps the basic boundaries observed in the field of science studied during this project. The network map illustrates the complexity of interconnections between organizations.

Recently, the work and organizational structures in Japan have had both political and economic setbacks in several areas. However, stabilizing cultural attributes of this country have lingered and merged with new forms of organization. The *ie* system of household organization has slowly been transformed into an embedded cultural artifact of modern work environments. For instance, Cutts suggests that Japanese use education as a "...defining landscape of society itself" (Cutts, 1997 p.3). The source of the emphasis put on education is related to the home and derived from the *ie* system of household organization. Interestingly, this organizational type has remnants in contemporary Japanese organizations of work.

"Japanese Science": a network of social relations - The Prime Minister

The Prime Minister's role in science and technology policy is in relation to the Cabinet Office for policy and general coordination³. Japan's governmental hierarchy was reorganized in 2001. The new Cabinet reports directly to the Prime Minister and directs several important "councils" (economy and fiscal policy; science and technology policy; disaster management; and gender equality) one of which is science and technology policy.

The Council for Science and Technology Policy (located within the Cabinet Office) has distinct social relations with the Director-General of the Bureau of Science and Technology Policy (Cabinet Office, 2001; National Councils, 2002). This Director-General reports directly to the offices of the Minister of State for Science and Technology Policy. Thus, the concerns of science and technology policy are visible at the highest levels of government in Japan. In fact, the ministries themselves are officially responsible to the Prime Minister through the Cabinet Office. Although the educational system is accountable to a different set of actors, the ministerial actors

associated with different institutions (education and science) are interlocked in substantive ways.

Educational system

Several informants suggested that the educational system in Japan is in disarray. Cutts (1997) believes that two, unanswered questions are essential to understanding why the Japanese educational system is in such a crisis. First, whether learning should be a tool to produce resources for the state? And secondly, what did the American “democratic” constitution imposed on Japan in the 1940s mean?

Cutts claims that the Meiji Restoration, the beginning of Japan’s modern educational system, was the impetus and primary historical factor that reorganized Japan’s educational system into one that began to atomize the individual. In this process of atomization, Cutts believes that Japan rerouted a nation of tight kinship values into a modern non-democratic, elite society. To Cutts the Meiji era educational system did not churn out automatons. Instead, it produced malleable individuals “...capable of adapting to the ethos, customs, and usages of whatever group he or she attaches to” (Cutts, 1997 p.47). In Japanese universities

“...the ‘knowledge’ dispensed is not open to a process of intellectual investigation by students. It is a store of information resources, to be absorbed in the largest volumes possible by the individual for regurgitation in the examinations”
(Cutts, 1997 p.48).

Cutts acknowledges that this system was used and still is, by the ruling elite in Japan. This suggests a proposition that the educational system in Japan is no more than a tool used by the elite to produce willing followers into the political, social and structural framework of Japanese society. Hamabata (1990) further exploits this contention of a ruling elite by suggesting that the *doozoku gaisha* are key actors in a Japanese elite helping embed many of the cultural legacies and norms of society.

Interestingly, Japan’s educational system has remained remarkably unchanged since the US occupation. However, the 1960’s student protests did manage to catch the attention of the national government. Some investigators suggest that these protests merely gave the government an excuse to further compartmentalize and control dissent (Cutts, 1997). One extension of this governmental control was to set up alternative educational structures such as those found at Tsukuba University. Many have suggested that the educational system is not unlike other institutions in Japan. In other words, Japan is characterized with institutions of “harmony,” “accommodation,” and “consensus.” Cutt’s goes further by suggesting a more in-depth analysis of “harmony,” as it is understood from the Japanese point of view. He posits that generally, the Japanese see “harmony” as “...competing without showing it” (Cutts, 1997 p.15). Competition appears to be imbedded in many of the socio-structural aspects of Japanese society. To Cutts, the root of the problem is in the home. He tells us that

Japanese mothers uniquely create a dependent child that relearns this dependency in subsequent institutions once s/he leaves the home. The *ie* system is an embedded structural “frame” in Japanese society that contributes to particular societal arrangements of exchange and power. Thus, through an embedded dependency structure learned in the beginning stages of life, Japanese find it “normal” to be dependent (i.e. not strongly independent) throughout school and work-life. The difference between these two latter institutional types is located in different peer groups and hierarchies. But the focus of this unique structure is the teaching of dependence in small work groups. At the junction between scientific work places and the educational system lie individual’s ongoing negotiations of institutional boundaries.

Science can be framed in a non-static manner by visualizing the scientific enterprise as an evolving apparatus dependent on a larger system. As science moves on a trajectory that is destined to eclipse the public (evidence of this occurring as seen through the increasing difficulty of science and increasing misunderstanding lack of understanding of science by the public), one quickly realizes that this eclipse is only one aspect or event in a complicated life course that leads to institutional transformations.

Ministries and Corporations / Consortia

Between 1972 and 1992, scientists in Japanese companies had sharply increased in numbers from 250,000(1972) to over 500,000(1992), while technicians and assistants remained near 100,000 in number throughout this same period. Researchers in companies were being enrolled in the company R&D effort in increasing numbers. During this period the government ministries escalated efforts to increase scientific collaboration between themselves, universities and corporations.

The 1980s and 1990s consortia point to several actors (institutional and individuals) that contributed to negotiations of transforming relations in Japan’s science and technology field. These consortia were a series of organizations set up by the government of Japan to house collaborative research between corporations, ministries and the universities. The impetus behind the development of these consortia was essentially economic in origin.

A policy relevant case (the “Fifth Generation Consortium” in the 1980s) provides a sub-story about trials of strength, association and struggle within one sphere of the *field* of science in Japan. These struggles are often put into particularistic accounts that leave culture aside and focus on science as an independent objective structure. A reflexivity project that accounts for the various fields of operation and understands science in the context of culture is better suited for deconstructing this case.

The “Fifth Generation Consortium” was a product of “collaboration” conceived during the “bubble” and boom years of early 1980s Japan. Japan’s rapid and extensive deployment of consortia during this period can be deconstructed through an analysis of the intricacies of actor-network agency in the process of maturity of this particular

consortium. The Ministry of International Trade and Industry (MITI - now METI) through its laboratory arm, the Agency of Industrial Science and Technology and the Ministry of Education (Monbusho - now MEXT) are essential co-actors in coordination of laboratory R&D in Japan. Scott Callon (1995) argues that cooperation rarely existed between industry and MITI. Instead, *tatema*e and *hon*ne played a large part in constructing the public face (*tatema*e) of cooperation, and hiding the “inner reality” (*hon*ne).

Callon (1995) provides three major aspects of Japan’s situation that have contributed to the degrading of their science and technology policy since the 1970s. First, as Japan moved from the “catch up” phase in the 1970s to the leading edge of technology production in the 1980s, following the United States was not a favored option any longer. Also, the Japanese companies that were dependent on MITI in the 1970s for protection against international competition were gaining strength by the 1980s. Finally, the US trade deficit with Japan rose sharply in the early 1980s. This triggered US pressure on MITI. These three aspects of the Japanese industrial science and technology apparatus are crucial to understanding the complex networks and actors involved in the making of science and technology in Japan. According to Callon (1995), the new policy created since the 1970s, lacks cooperation and is not successful. Looking more closely at the networks and actors to uncover their trials of strength and weakness, the consortia must be seen in the context of a field (Bourdieu and Wacquant, 1992) of cultural production of science.

It would be incorrect to assume that the ministries and their affiliate organizations directed a “top-down” management of Japanese science policy. At the time of the creation of “Fifth Generation,” Monbusho was a separate entity from the Science and Technology Agency (STA). Thus, there were more ministerial actors with a wider variety of interests than later. Recent governmental reorganization created a coupling of Monbusho and STA into one ministry, The Ministry of Education, Culture, Sports, Science and Technology (MEXT).

METI and MEXT are only two actors within a field containing a myriad of actors (see Figure 2.1). Understanding the main actors in Japanese science and technology policy and understanding their relationships are two separate questions. It is a totally different question to understand the transformations that these actors are involved in. These questions necessitate a need to look at specific scientific projects that have been undertaken in the past. In this regard, history may lead to a better understanding of current and future situations. Regardless of project success or failure (*symmetry*), these instances of scientific research will allow me to gauge the particular actors involved, and thus, gain a better understanding of Japanese science policy.

Callon (1995) argues that consensus and coherence have disintegrated in Japanese science and technology policy. In other words, he is arguing that ministry policies and Japan’s economic success, have had very little to do with each other, especially, since the early 1980s. Others contend that this disintegration is more extensive (van Wolferen, 1990; Cutts, 1997). One of the more controversial investigations of Japan’s “system” and the power arrangements in Japan is that of Karel van Wolferen (1990).

This latter researcher is clear about the way in which Japan operates. He rejects the “difference” and “uniqueness” stereotypes that are often given to the Japanese system. He goes a step further in denouncing the common assumptions that Japan is a democracy or has a free-market. His argument is grounded in a power-elite theory. However, for Japan this necessarily means that the “elite” are operating within the context of a “homogenous” society. Since van Wolferen refutes the “homogeneity” myth, he is able to shape his argument in terms of an elite conglomeration of bureaucrat-business partnerships that rig the “system.”

Unlike Domhoff (1998), van Wolferen sees a myriad of elite candidates, but within a diffuse power system where very few actors take responsibility and nobody really challenges the status quo with new ideas or argumentative stances. Instead, the bureaucrats work with industry to dictate policy that is “rubber-stamped” by the Diet. Other investigations put forward similar claims (Pempel, 1974; Tanaka, 1995; Tanaka and Hirasawa, 1996; Schwartz, 1998). To van Wolferen, the economy has prospered so well because of the “...stimulation of fiscal policies favoring investment” (p.7) in particular sectors of the economy. This “investment” in particular sectors was attempted in the early 1980s with the “Fifth Generation Consortium” (FGC).

The “Fifth Generation Consortium” (1982-1992) is an interesting example of the inherent conflicts in the agenda of national “collaboration-building” still undertaken today. The Fifth Generation consortium illustrates the fierce competition between MITI and MOE (Ministry of Education). MOE wanted to contribute to this consortium only on its own terms. This project contained highly speculative research. Thus, the sector and type of research is a crucial element in which stakeholders are involved in particular struggles of interest. Even though the FGC was considered applicable to university research, MOE would not participate. ICOT (the “Institute for New Generation Computer Technology” the Fifth Generation research institute) ended up relying upon company researchers to accomplish its goals. However, the companies could not extend their full participation due to other research obligations and needs.

Both the Fifth Generation and the Supercomputer consortia were government led organizations. MITI was the driving force, continually trying to attain company participation. The intent of this consortium was to complete the degradation of IBM’s hold on the Japanese computer industry. Thus, international competition became an important impetus in the formation of this consortium. The consortium had a much larger budget than that of the Supercomputer project. Also, many other actors were involved. There were nine company representatives on the Board of Directors for this consortium. MITI was enrolling more actors. Besides the companies represented on the Supercomputer consortium, Matsushita, Sharp, and NTT were added. It is important to note that NTT was a public company at the time of Fifth Generation’s creation. Upon privatization of NTT in the mid-1980s, JKTC (Japan Key Technology Corporation) was developed with the released government monies from this privatization. JKTC was seen as the most flexible policy tool for investments in development companies (for both loans and arrangements of joint research). Thus, the transition of a public company led to the creation of a private effort focused on

Japanese R&D, through a private NTT, and the creation of a policy tool (JKTC), to be used in initiating private research.

A significant difference between this consortium and the previous ones is that besides the nine central companies, several other private firms contributed. MITI set up the Institute for New Generation Computer Technology (ICOT) to run the Fifth Generation consortium. The goals for this consortium revolved around the idea of creating a computer that could process knowledge and compute concepts. This idea is close to that of artificial intelligence (AI). In the end, MITI provided 100 percent of the funding for this consortium even though the project was termed “collaborative.” MITI did initiate a joint laboratory for this consortium. However, only about 20 percent of the total consortium funding was spent in this joint lab. The rest of the funding went to contract work in separate company laboratories. This reflects a government-led consortium that essentially funneled investment monies and basic research for future applied products to private corporate actors.

MITI and MOE were main actors in a trial of strength within this consortium. The main battleground was over the participation of universities in the Fifth Generation research. This consortium seemed to be a good fit for university R&D. Even though the Ministry of Education would not participate in this project, it is evident through papers presented at the Fifth Generation conferences that university professors did participate. Regardless, officially, ICOT had to rely on company researchers. At the same time, the companies were not well equipped to perform “futuristic” research and development. In this context, the companies involved with this project participated in a very passive manner. They only provided minimal staff and did not provide their elite scientists. In the end, only about 10 researchers were located at ICOT, in any stable manner, throughout the project’s life.

Kazuhiro Fuchi headed the Fifth Generation effort. He was a “gikan” (researcher / technician). For Fuchi, this project was about technology improvement. However, the “jimukan” (bureaucrats) saw this project as a competition between MITI and IBM. The multiplicity of interests complicates this process of “collaboration.” Frictions between Fuchi and the “jimukan” at MITI became a trial of strength that Fuchi would lose. The intensified competition with IBM would slowly become unimportant for the companies as their market share of the computer industry sharply rose. However, the “jimukan” at MITI lost sight of the changing computer market. Transformations and translations of strength were occurring throughout Japan’s science and technology networks. Besides the trouble of getting company participation, Fuchi was having communication problems with the MITI “jimukan.” This project was originally developed to include the universities. Since MOE shut MITI’s Fifth Generation out of the university system, MITI had to get company cooperation. Callon notes that four years before the start of this consortium, a Hitachi executive “laughed” at the suggestion of this project (Callon, 1995 p.67). Fuchi was an ETL (“Electro-technical Laboratory run by MITI in Tsukuba) scientist who headed one of the committees that was analyzing the feasibility of the Fifth Generation project. These “deliberation councils” are important actors in their own right (Krauss, 1992). ICOT and Fuchi made a couple of huge mistakes in developing

their Fifth Generation system. One mistake was when Sun Microsystems developed their unix-based workstations, ICOT decided to focus on their localized “prolog” language system. Fuchi’s insistence on staying with prolog, instead of merging into a unix-based system upset the company participants.

The Fifth Generation consortium lost its trial of strength. The networks were in place between MITI, the US and Japanese companies, and now individuals like Fuchi. However, at the same time, the nonhuman supercomputer architecture and faster CPUs were also driving the trajectory of science and technology policy in Japan. These trials of strength and weakness can best be observed through the linkage of MITI and the Japanese companies. MITI was showing (*tatemaē*) its strength, even though its strength was in question. By the late 1980s, the Japanese companies were leading the world in the computer industry. The strength had shifted from MITI to the Japanese companies. At the same time, the US companies were also losing strength to Japan’s computer companies. Thus, an accumulation of strength was unfolding in favor of the Japanese corporations.

Kazuhiro Fuchi and ICOT were actors that lacked the ability to enroll anyone in their effort. The companies could not be enrolled in an effort to chase a *technology dream*. In fact, I argue that MITI itself was unable to be enrolled. This argument is based on the trials of strength between the “*jimukan*” and “*gikan*” within MITI itself. The circumstances illustrated through a consortium are important to “making connections” in the science *field’s* spheres of influence. However, accumulations of strength or weakness are not necessarily final. The policy trajectory of associations involved in policy making is continually negotiated. The Fifth Generation project reveals this negotiation and transformation of MITI strength to corporate strength and back to a transformed Ministry of Education within a diffuse array of actors and institutions. By the time the Fifth Generation Consortium had run its course, a coalition government replaced the LDP and the Japanese “bubble” economy had burst.

Organizations of scientific work in the strategic research site - the *field* encompassing the research site

The *field* of education and research in Tsukuba is built around the University of Tsukuba. My particular research site is composed of five objective institutional structures (Institutes 1 - 5) within the setting of Tsukuba University, a large actor in its own right (see Figure 2.1). As a national university, it separates research and education. Professors of this university belong to both research projects and the classroom. The University of Tsukuba has kept a Tokyo campus that serves as an educational setting for evening graduate programs. Undergraduate students are a majority of the population. However, research and development at this university is extensive and reaches out to government and private laboratories throughout Japan.

Professors at this university belong to one of the twenty-two research institutes. These institutes range in discipline from philosophy to disability sciences to chemistry and

geology. The university is also home to about twenty-eight “Common Use Facilities” or “Centers.” One of these centers (Institute 1) was included in my study. However, there are other unofficial “centers” that operate as research institutes situated as appendages within the boundaries of Tsukuba University’s organizational structure. One of the departments (which is also an “Institute”); Institute 3 functioned almost purely in an academic manner. This institute focused on undergraduate and graduate teaching and research. The focus of much of their research was agricultural economics case studies in several countries including Japan.

The University of Tsukuba also promotes “promising young scholars” and “joint research on common subjects.” Both of these types of research are provided funds by the university. In fact “special research grants” (S-type) were initiated in 1989 to foster internationally significant research. S-type funding allows for additional funds to be granted to promising “concentrated research” and additional support for faculty.

Network of relations in the *field*

Tsukuba University is the centerpiece of a planned scientific community - Tsukuba Science City. It is termed by government officials and institute management as the nexus of collaborative work between industry, university and government researchers. My strategic research site included portions of five institutes four of which were located directly within the boundaries of Tsukuba University. The fifth institute (Institute 4) is one of the largest research institutes in Japan and is headquartered in Tsukuba City outside the University campus. The network map (Figure 2.1) is used as a template for understanding the “view” that most “generalists” observe when studying Tsukuba. My project is more concerned with the day to day life of scientists in particular institutes within Tsukuba University and thus, a more particularistic observation will reflect the struggles of interest and the boundaries in the communities of science in and around Tsukuba University.

The above evaluation of the literature coupled to the substantive description of network relationships give thick description in the context of reflexive reasoning. Through cultural significance/meaning, reflexive interpretation and explanation and the importance of making “connections,” the literature has suggested several important relationships in “Japanese science.” This increased understanding in the framework of evaluative criteria has led to the construction of actor-network maps of interest. Several actors in the field of science and the field of Tsukuba University’s research and development are constructed within a theoretical frame of structuralist and constructivist intentions. However, the *habitus* of the individual scientists has remained elusive. In subsequent chapters, I will develop descriptions of the pertinent social landscapes and the themes constructed out of informant interviews.

Chapter 3: METHODS

Study Type and Methodological Approach

This research was conducted as a qualitative case study using field research as a primary observation and data collection technique. I proceeded in the tradition of an ethnographic study that is, attempting to understand local social structures and knowledge in a field of Japanese cultural production (Bourdieu, 1992). The methodology used was highly attractive, in that the method of choice allowed for flexible and adaptive research responses by me and my informants.

One of the most inviting elements of my field research was the allowance for letting the informants, the documents, the culture and the social situations “talk.” The methodological approach for this project can be viewed in a chronology of research questions leading to questionnaire development and construction, on-site research, theme construction and data analysis. The cognizant framing of my research design began at the finishing stages of my questionnaire development and construction. Subsequently, on-site research and construction of themes tie the data analysis to interpretative techniques (see Figure 3.1).

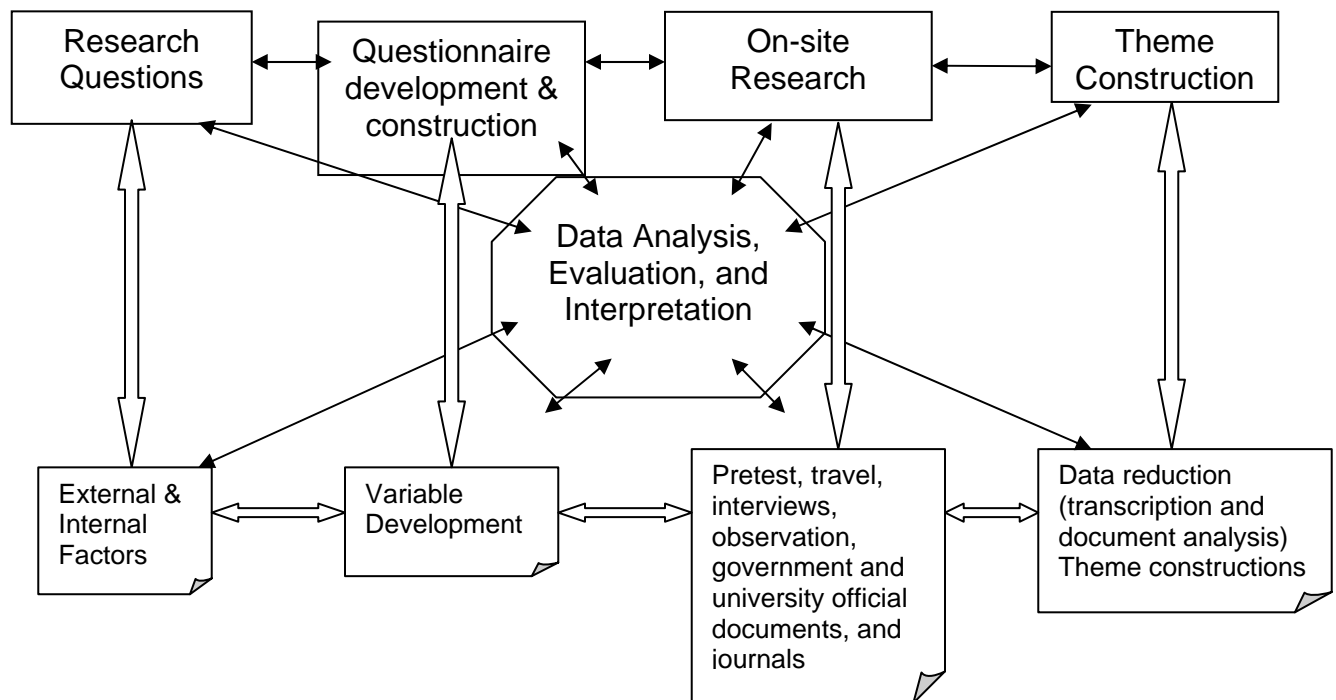


FIGURE 3.1: Research Flow Chart

Tools Used in Study

I utilized several important “tools” throughout my research. The tools proved invaluable during the course of field research in Japan. These aids helped in data collection and the data analysis phases (see Table 3.1). But, they also were instrumental in giving me a “peace of mind” during the intense traveling and data collection phases through their dependability and accuracy.

TABLE 3.1: Tools Used in Research

Tool	Use	Source/Manufacturer
DS-320 digital recorder	Interview collection	Olympus
DSC-P51 Cyber-shot digital camera	Data collection	Sony
All-weather student journal	Field journal	J.L. Darling Corp., Tacoma WA.
Laptop computer	All phases of research	Dell Inspiron 4000
Software	Analysis	SPSS v.10.0
Data set	Analysis	ICPSR #da2790

The main instrument for collection of in-person interviews was a digital recorder that allowed me to digitally record each interview for subsequent transcription onto a laptop computer. The recorder date and time stamped all recordings for convenient access to length of interviews and retrieval and coding of interviews. Along with the recorder, I used an “all-weather” pocket sized journal for taking notes during interviews and travel. I also recorded many architectural and structural features of Tsukuba, Kamakura, and Tokyo with a digital camera. The camera was important for instantaneous and reliable archiving of cultural, architectural, structural and aesthetic aspects during the field research phase. Most of the photographic data was used in this study as confirmation of other data collections. It was never used in a “stand-alone” manner. I expect that the photos taken during this project will be used as comparative tools for subsequent research.

Reflexive Issues

Cultural field of objects

In coordinating a sustained, iterative logic for the analysis of this research project I utilized several theoretical and practical tools. Two sociological world-views of special interest, the “structuralist” and the “constructivist” stances are points of reference for this project. However, an over-arching focus for this project is the understanding of social relations or networks that connect both the individual and the objective social structures. These relations or networks are important on several levels (Latour, 1987; 1988; 1989; Bourdieu, 1992; Shapin, 1994; Callon, 1995).

I choose a starting point as the “social praxeology” of Bourdieu (Bourdieu, 1989; Bourdieu and Wacquant, 1992) which focuses on the “interpenetration” of theory and

practice leaving both active in a “field” of social life that must be deconstructed and maintained simultaneously for the purpose of understanding the relations embedded in the structures and mechanisms that sustain the viability of a system of relations. For this reflexive method, I truly need to “out” myself (Finlay, 2002) through a procedure that goes beyond structural descriptors and mechanisms. Instead, I will focus attention on the more taken-for-granted emergent forms of social relations that are often hidden below the surface of informant details and the many objective societal structures permeating a field of culture. In this sense, I follow a Bourdieuan framework for my reflexive project. As Bourdieu himself suggests, I hope to “objectivize *my* objectivizing point of view” (Bourdieu, 1992 p.69). My position located in academics and from a western-situated academic researcher in Japan become important aspects in the reflexivity of this study.

This multi-constituted form of reflexivity, where my point of view and its social location is as important as the point of view of the objects I am objectivizing assumes the equal importance of both the researcher and the researched. Finlay (2002) successfully points out the confusion that arises in academic work between reflection and reflexivity. She describes reflection as a distanced “thinking about something else,” and reflexivity as opposite to reflection in that, reflexivity is “an immediate and intimate subjective self-awareness” (Finlay, 2002 p.532-533). This focus on the researcher and those researched demands a need for evaluative criteria. These criteria (see “Evaluative Criteria” section) presuppose a particular theoretical lens from which this researcher has viewed objects of study. Thus, the application of reflexive ways of analysis in this project allow for the simultaneous “viewing” of relationships that mediate social objects in society and the objects themselves as both are active objects within social space. In taking a reflexive disposition toward this research I hope to more fully incorporate the relationships in Japanese science into an understanding of the cultural field they are elements of. The research instruments and tools (questionnaires, field research methodologies, interpretive methodologies, etc) used in this study are rooted in a tacit disciplinary ontology that propels this researcher into particular directions of understanding. I hope to mediate this a priori production of knowledge by better understanding these tools in the context of my own predetermined dispositions. Evaluative criteria offer an avenue for both “outing” and laying a concrete theoretical foundation in the process of developing a substantive analysis of the culture and practice of science in Japan from “the inside out.”

Evaluative criteria

One tool in my quest for understanding the relations and mechanisms of actors and institutions in this study is evaluative criteria. Cultural significance/meaning, reflexive interpretation and explanation (generalization), and the importance of making connections are evaluative devices used in this project.

Evaluation of “data” in a research project such as this is complex and rigorous. The evaluative measures used are intended to first decipher and then simplify the value,

meaning, validity and reliability in this study. As a methodological tool, these criteria provide an “outing” of research bias and set boundary limits of the study objects. In this sense, the chosen evaluative criteria interpenetrate this researchers practice and theory and should elucidate the significance of structural relationships between actors.

Procedures

A key element in this research was the development of the questionnaire. I focused on the daily life of informants and was concerned with their lifestyles. This focus on “lifestyle” is suggested in Bourdieu’s “field of power” (1989 p.16) conception. The locations created through objectivizing the structures in cultural fields can lead to hiding these very positions. Thus, a descriptive account of informant lifestyles gives me a more objective view of the operational spheres that these informants are conducting daily life within. This framework falls in line with the idea that the information gleaned from interviews will be emergent in the sense that it will locate informants within a non-static trajectory and allow me to more fully understand the “field” as a whole.

According to Bourdieu, spatial distances coincide with social distance. “(T)he truth of any interaction is never entirely to be found within the interaction as it avails itself for observation” (Bourdieu, 1989 p.16). This distancing of social space was reflected during my interviews with institute scientists and can be utilized as indicators of difference, social distance and formation of spheres within the larger cultural field.

Questionnaire Development

The questionnaire developed for this project was conceived over the course of several months prior to the field research. This instrument was used as a tool to help elucidate meaning from informant interviews and construct an understanding of the varied lifestyles and structural arrangements in Tsukuba, Japan. The findings from interview results were put in the context of a larger structural apparatus and critiqued within a reflexive framework so as to increase the integrity of this project.

Research questions were developed with an informed attitude toward the literature on Tsukuba, Tsukuba University and Japan in general. I assume that Individual perceptions are as important as objective structures in the larger society. Thus, I gave importance to questions that help reveal attitudes and values of informants fully realizing that objective structures will remain in place for some time and can be revealed throughout the research process.

The purpose of the questionnaire was to gather data reflecting the relationships between structures and individuals to better understand the networks of social action within the context of Japan’s scientific enterprise in Tsukuba. The particular language used by Japanese informants in the research interviews is of particular importance. The language used helps organize the differences between and within their social groups

and provides a mechanism by which I can sort out different spheres of social life within the larger societal field.

The questionnaire for this study evolved over the course of approximately 6 months in conjunction with the proposal for this project. The questionnaire consisted of seven pages of open-ended questions that directly linked to the research questions. Demographics, work duties, training, succession, work & educational networks, politics in the workplace, gender, time & rules, lifestyles, and cultural aspects of Tsukuba and Japan were foci of interest in the questionnaire. After finishing the pretest, several modifications were edited into the document. However, two unforeseen implications of the pretest proved to be important aspects of the final interview schedule. These modifications brought more intense focus to the “work time” and “free time” questions, as well as an impetus to better understand and use key Japanese words and phrases on the questionnaire. At the time of the pretest, the questionnaire was written in English. By the time I conducted field research in Japan, I had inserted relevant Japanese words and phrases throughout the questionnaire.

Pretest

The pretest was conducted at a restaurant near the National Institutes of Health campus in Bethesda, Maryland during late summer, 2002 approximately one month prior to beginning the research in Japan. Two informants were interviewed for the pretest. Both were young Japanese scientists that graduated with their Ph.D.s from Tsukuba University and were Visiting Research Fellows at the NIH. I conducted an interview with both informants simultaneously for approximately 2 hours. Their insights into the culture of Tsukuba, work time, and free time in organizations in Tsukuba were invaluable. Some of the findings in the pretest ended up being essential for the development of this dissertation. The pretest informants were very helpful in suggesting changes to my questionnaire, namely the implementation of certain Japanese words and phrases to be used in the actual interviews along with a focus on work time and free time.

During the pretest phase I conducted the open-ended question survey in conjunction with a close-ended survey. However, I found that the close-ended survey was difficult for the informants to understand and did not seem to elicit reliable information. Gender-related questions on the close-ended instrument were of particular concern during the pretest. I noticed that both respondents had difficulty answering the gender questions. In fact, toward the end of the interview, when I asked both of them whether or not “a woman finds her happiness in Marriage” (very true to very untrue), one informant looked astonished and asked me “What does this question have to do with science?” This comment was enough for me to edit the question and eventually discard the close-ended survey all together.

Informant Interviews

All interviews were conducted in private offices or personal laboratory space considered optimal for intimate conversation. “Private” in Japan can be interpreted as a misnomer. Generally, the Japanese have been characterized as “high context” and “polychromic” in communication style (Hall and Hall, 1987; Hess, 1990). However, the scientific community in Tsukuba does vary with respect to institutional attributes. As such, there tends to be a mixture of low context, monochromic, high context and polychromic attributes exhibited in different social situations across differing institutional types.

One interview was conducted with multiple people (inform_1_2_3). All other interviews were conducted with the individual respondent and the researcher alone in a private setting. This latter factor along with lengthy interviews helped diminish “politically contrived” testimony and observer bias. Questions focused on external effects posed on the lifestyles of scientists and their scientific work in Tsukuba, Japan. Since the methodology of my project is an inductive one, it was obvious that “internal factors” would play a substantial role in understanding the external factors posed upon science in general. The interviews revealed several “themes.” These themes, free-time, work-time, attitudes toward Tsukuba, socio-structural location of informants, work tasks and professional activities (publishing, etc.) can contribute to the present research in their statuses as indicators of difference. The trajectories of difference can point to interesting structural differences in the spheres of influence located throughout relations in the “field” (Bourdieu, 1992).

Since in-person interviews were a fundamental part of this project, it is important to describe the characteristics of a typical interview. After a brief introduction of myself, the study, and the purpose of the interview and research, I reiterated the confidentiality of each interview. All respondents agreed to interviews. However, two declined to be tape-recorded. Both of these respondents were in the same group. Interview time lengths (see Table 3.2) show the average interview length across my sample as 1.42 hours. Within groups, the average interview length ranged from 55 minutes to over 2 hours. It is important to note that the interview time lengths listed in Table 3.2 consist of “formal” interview time periods. Many of the interviews in this study continued past the “taped period.” On average, these unrecorded times ranged from 15 to 45 minutes.

The on-site research focused on intensive in-person formal and informal interviews but included collection of official documents and informal conversations with many Japanese citizens and Western ex-patriots. These peripheral data supplemented the interviews. The sources of data for this study consisted of in-person interviews, informal conversations, official documents, data sets, journals, popular press articles and texts (see Table 3.4). Informant interviews were the cornerstone of my field research. These interviews ranged from 18 minutes to 4 hours in length (see Table 3.2). The former interview (18 minutes) was conducted during a tour of one of the laboratory facilities. However, in both the Institute 3 and Institute 4 and 5 groups some of the informants have not been included in Table 3.2 due to conversations being conducted with informants over the course of several days and even weeks in some instances.

Therefore, only “formal” interviews are included in this table. One of the interviews in the “Other” category includes the multiple-person interview mentioned above.

TABLE 3.2: Formal Interview Lengths for Informant Groups

	Institute 1 [13]	Institute 2 [7]	Institute 3 [3]	Institute 4 and 5 [7]	Pretest
Average Length per Interview	54.52 minutes	88.11 minutes	123.07 minutes	75.95 minutes	116.41 minutes
Total Time of All Interviews	708.81 minutes	616.8 minutes	369.23 minutes	531.62 minutes	116.41 minutes

*Institute 3 informants included in this table are: inform_28, inform_29, inform_30

**“other” informants included in this table are: inform_1_2_3, inform_25, inform_26, inform_27, inform_35

[] indicates sample “n” included in table

Sample

Outline of the Research Sample

My sample was drawn from 5 institutes in and around Tsukuba, Japan. However, I also had substantial conversations with informants in Tokyo and Kamakura. Three institutes located on Tsukuba University’s campus were foci. I focused on these institutes for both interviews and other miscellaneous data collections¹. However, my sample also included a bank executive (a large multi-national bank with offices in London, New York and Tokyo) and a retired professor from a Japanese university located South East of Tokyo. Scientists and students from other departments in Tsukuba University and a public research institute (Institute 4) were represented in my sample.

In the mid-1990s, Institute 1 was created with funding support from Monbukagakusho or MEXT. MEXT is a critical link in the scientific infrastructure of Japan. Investigators have noticed that basic science research in Japan is under funded (Arima, 1992). The goals of Institute 1 set by MEXT were two-fold. It was to be a leader of basic science research focusing on interdisciplinary scientific developments and was to facilitate the application of this basic research to help society. In 1994, the organization was divided into 7 research laboratories or aspects. By the time I conducted research at Institute 1 in October 2002, this organization had recently (April 2002) reorganized into two major units (Section “A” and Section “B”) and the original 7 aspects were reduced to 4. The Science & Technology Basic Plan appears to have had a large impact on this organization both structurally and economically.

Institute 1’s Section “A” is to serve as a liaison between government, business and universities. Section “A” has the charge of developing Institute 1’s basic research results “...into a form applicable to society” (Institute 1, 2002). This reorganization effectively created two new organizations, one (Section “A”) more connected to private enterprises and joint-venture research, while the other, (Section “B”) refocused on scientific research and development. Although, I was unable to conduct interviews at

Institute 1's Section "A," I was fortunate enough to interview scientists in three of the four Section "B" laboratories.

Data for 27 informants were collected by way of structured, in-person interviews varying from 18 minutes to 4 hours in length. Data for the remaining 8 informants were gathered by unstructured in-person interviews and informal conversations occurring over the course of approximately 4 weeks during October 2002. One formal interview was conducted in the Physics department at Virginia Polytechnic Institute and State University.

The sample was composed of one undergraduate student, graduate students, postdocs, lecturers, foreign professors, tenured full professors, a bank executive and one retired professor most of which were working in one of five centers or institutes in Tsukuba city or at Tsukuba University in Tsukuba, Japan. The pool of informants has a distinct structural makeup. For instance, the majority of my interviewees were male (76.5%), Japanese (79.4%) with an average age in their mid-30s. My sample was composed mainly of Japanese scientists. The overall informant pool consisted of 27 from Japan, 3 from china, 3 from the USA, 1 from Ireland, and 1 from Hungary (see Table 3.3). The average number of years spent at informants' current jobs was 5.48 years (n=30).

TABLE 3.3: Nationalities of Research Informants for this Study (proportions)

Country of Origin	Institute 1	Institute 2	Institute 3	Others	Total Sample
Japan	12	5	3	7	27
China	0	2	1	0	3
United States	0	0	0	3	3
Ireland	1	0	0	0	1
Hungary	0	0	0	1	1
Totals	13	7	4	11	35
Proportions	37.14%	20.00%	11.43%	31.43%	100.0%

Japanese informants represent 79.4 percent of my sample while foreigners represent 20.6 percent (one informant that was interviewed at Virginia Tech is excluded from this latter proportion). Males made up 76.5 percent of my sample and females consisted of 23.5 percent. The majority of my informants were Japanese (79.4%), while China (8.8%), the United States (5.9%), Ireland (2.9%) and Hungary (2.9%) are all represented. Twenty-one percent of my sample contained foreign scientists. Generally, these foreigners expressed concern for the way in which their skills were utilized in their respective organizational environments (inform_8; inform_22; inform_26; and others). Publications in professional journals are a primary focus for most scientists in Tsukuba. However, foreigners tend to be relegated to editing and foreign communications due to their foreign writing and language skills.

This section has provided a preliminary analysis and discussion of the demographic structure of Japan, Ibaraki Prefecture, Tsukuba City, Japan and my research sample.

This grounding of demographic structures provides a template for discussing Informant Interviews. Generally, the demographic data suggest that Japan is an aging and increasingly urbanized society, with an exceptionally rigorous educational system focused on memorization and examinations at the lower levels of this system. Behind the scenery of a rigorous educational system, dynamic economic growth (specifically, in from World War II through the late 1980s), an aging and increasingly urban society, lies a trend of attitudinal change in the workplace aligned with diffuse governmentally-led structural changes. These transformations and reorganizations between a myriad of actors sets is arrayed throughout the contours of Japan's "field" of science.

Science and technology in Japan is rapidly changing in structure and practice. Many of the transformations in this sphere are precipitated by governmental reorganization plans. The effectiveness of these plans is arguable. However, as a government "constructed" city, Tsukuba lies in the middle of emergent policy and cultural change. It is an essential ingredient in a "soup" of international and national transformations. More specifically related to this study are the structural tendencies in Ibaraki Prefecture and Tsukuba city itself. For these locations, the society is younger, more transient and much more international in character. Interviews conducted for this study in Ibaraki prefecture and more specifically Tsukuba, indicate significant trends in population, land, the educational system, foreign participation and time that appear to build a context specific to this area of Japan but may have future implications for the entire country.

Limitations

The study findings can be generalized to a population of scientists, institutions and organizations in Tsukuba, Japan. Limitations in this study are concentrated in two main areas: the pretest and sample selection of the research sample.

The limitations of the pretest in this study focus specifically on sample number. During the pretest phase, I was unable (due to time constraints, budgeting factors and accessibility) to conduct a large group of interviews or more specifically, a pilot study. I believe that a pilot study and/or a larger group of interviews during the pretest phase may have bolstered or led to novel findings. A more comprehensive pretest, given time and funds, may have increased reliability and validity of this study through a more developed and tested questionnaire.

The method used in sample selection developed from an ideal random sample to an unintended dependency on the "strategic research site" (Merton, 1987). Thus, sample selection was inherently linked to study locations that is, the institutes and organizations in Tsukuba, Japan. I was limited in sample selection within the organizations studied, in that I had very little control of the particular respondents that would be chosen other than the following parameters:

- (1) diversity across occupational type
- (2) gender diversity
- (3) ethnic diversity

Therefore, limitations in sample selection may have caused bias in the sample. The bias is located in managers and/or administrators of the particular institutes directly choosing particular informants. Did managers/administrators choose particular informants that represented particular attitudes, values, or ideas? Are the informants chosen representative of their particular occupational level? The method of sample selection in this study may have impacted the answer to these and other important questions.

Besides the organizations of interest, the sample diversity was the only other “control” allowed for the researcher under the particular nuances of this study. Under a couple of circumstances, the snowball method was used. For instance, 5 of my interviews were snowballs, in that prearranged meetings in a particular institute led to the interviewing of previously unplanned interviews in another institute. Individual respondents were chosen during the course of meetings with mid-level directors of the institutes/organizations involved. I worked with these “directors” in coordinating the diversities mentioned above, so that demographics showed variance, i.e. occupational type, gender and ethnic diversity. Thus, a significant limitation in this study is that I was dependent upon mid-level management for the choosing of actual study respondents. Having said this, I attempted to mediate this effect by working with these leaders to get the “best possible” variation in the sample. Seven of the thirty-five interviews were with individuals that I had prior knowledge of in advance of the beginning of the fieldwork. The remaining 28 interviews were conducted with scientists that I had no a priori knowledge of.

Sources of data

As a qualitative case study, with field research as a primary data collection technique, I began with an interest in science cities. Several texts were instrumental in my education on Tsukuba, science cities and science in Japan. However, three texts stand out in particular, James W. Dearing’s *Growing a Japanese Science City* (1995), Paul R. Josephson’s *New Atlantis Revisted* (1997) and Samuel Coleman’s *Japanese Science: From the Inside* (1999). These writings were instrumental in motivating me over the course of my graduate student studies to investigate Tsukuba, Japan. Josephson’s text (1997) is a socio-political history of Akademgorodok in Russia, whereas, the other two texts are focused on Tsukuba, Japan (Dearing, 1995) and Japanese science (Coleman, 1999). However, all three are substantive analyses of the culture of science.

After establishing an interest in a “strategic research site” (Merton, 1987), I began the arduous task of preparing research questions within a very “fuzzy” research design. A variety of data sources were used during the course of this research (see Table 3.4).

TABLE 3.4: Data Sources

Data Type	Data Source
In-person interviews	Interviewees in Japan & U.S.
Informal conversations	Interviewees in Japan & U.S.
Official government documents	Japan, U.S. LOC, internet
Journals and diaries ²	Personal journals and diary
Newspapers and pop-culture magazines	Japan, U.S. and internet
Historical data	Libraries, Virginia Tech and Tsukuba University, various agencies in the Japanese government and internet
Internet sources	Internet
Data sets	World Values Survey
Tourism	Japan

With regard to “weight” of importance, in-person interviews, informal conversations, and official documents are very important in this study. However, all sources significantly contributed to this project. The particular institutes and organizations along with other sources of data not mentioned elsewhere will be discussed.

Other

Interviews and personal conversations were important in this study. However, official documents (government & university), historical data (Ministry statistics, Library of Congress documents), the popular press (newspapers, magazines, etc.), Internet sources, data sets (world values survey), and diaries and journals were also used. Since this study is essentially a qualitative and inductive one, I hoped to be led through the research by the informants themselves. I utilized their responses in interviews to guide the trajectory of the research. During this research process, new outcomes, ideas and goals were formed.

This methodological approach has led to construction of data analysis “themes.” These themes (culture, and scientific production and economic affairs) form a substantive core for the data analysis sections in this research.

Chapter 4: SOCIO-STRUCTURAL DEMOGRAPHICS

The long line of scholars studying the culture, policy, and science in Japan is an extended one (Kingston, 2001; Reid and Traweek, 2000; Coleman, 1999; Pempel, 1998; Schwartz, 1998; Callon, 1995; Dearing, 1995; Tanaka, 1995; Traweek, 1988; Benedict, 1946). It is clear from these researchers' work that the economy and politics of Japan intersect with other aspects of culture. This chapter focuses on the description of demographic characteristics and trends in Japan, Ibaraki Prefecture, Tsukuba Science City, Tsukuba University and my research sample. The landscape described provides a foundation for investigating the work and organization of science in a Japan. Structural relations that affect Japan's scientific "field" (Bourdieu, 1989; Bourdieu and Wacquant, 1992) are sustained within an array of socio-institutional positions. Some observers of Japan see these arrays as disparate centers of policy formation (van Wolferen, 1990; Cutts, 1997). Other investigations visualize these nodes of power as centers of immense command and control (Pempel, 1998; Schwartz, 1998; Callon, 1995). Regardless of the theoretical stance one takes on these structural elements or institutional nodes of operation one can begin to understand the objective layout of the scientific enterprise in Japan through the actor networks between the organizations and the agents residing within them.

Within the field of science in Japan, important structural factors include the people and politics, population and land trends, the educational system, foreigners, and labor participation through which actors and their organizational hierarchies interpenetrate scientific work. Through a descriptive analysis of these socio-structural spheres and my research sample demographics, a clearer picture of the present research will be illuminated. Subsequently, I will summarize important aspects of my sample that provide substance to more in-depth data analysis sections on informant "themes" arising out of research interviews.

The Japanese "System": People and Politics

In 1992, Japan's total population was about 124 million. The population today is over 127 million (Statistics Bureau & Statistics Center, 2002). This is less than half the United States' population and about 55 percent of reunited Germany (Sigurdson, 1995 p.23). Sixty percent of the total population lives in 4 huge urban areas (Tokyo, Osaka, Nagoya, and Kyushu). Another 20 percent of the population lives in other urban areas. Thus, about 50 percent of Japan's population lives in the corridor that stretches from Tokyo - Yokohama to Osaka - Kobe.

Japan has a bicameral (2-house) parliamentary system. At the center are the Diet (Japan's legislature) and various Ministries. The Diet consists of a Lower House of Representatives (511, 4-year term Representatives) and an Upper House of Councilors (252, 6-year term Councilors). All Japanese 20 years of age or older can vote. One key element is that the Lower House is a more powerful institution in that; it can veto anything that the Upper House passes. It has been stated that together these two

macro-actors function to create science and technology policy in Japan (Sigurdson, 1995). However, to give privilege to the political system or to equate the political “system” to these two elements would be an erroneous reduction. The Diet and various ministry appendages are woven throughout society and perform both cohesive (through consensus building) and contradictory (through conflict) behaviors. They also appear to have as much trouble working together as they do working alone.

The Liberal Democratic Party (LDP) has controlled the DIET in the post-World War II era. It has been in power from 1948 through the early 1990s. In 1988, the LDP had about 2.6 million members. These members were mostly made up of farmers (27.1 percent) and small business people (28.4 percent). Due to redistricting, the LDP has been able to maintain a very powerful rural and semi-urban constituency. It was not until 1993 that a coalition ousted the LDP from power. This transformation in political power occurred during great economic and political upheaval. However, by the end of the 1990s, the LDP was back in power. After losing some of their grip on power between the 1950s and 1970s, LDP officials countered by making stronger ties with traditional support groups (the Farmers and small business). This entailed unprecedented low interest business and farm loans. The Diet, under LDP leadership, pushed through a 6-fold increase in public expenditures between 1970 and 1985 on agriculture, medical professions, small business and war veterans. However, there is an irony. According to Okimoto, the dependence of the LDP on farmers and small-business permitted MITI to implement policies which stimulated industrial growth, which in turn, led to the contraction of the farming and small-business sectors (Okimoto, 1989 p.189-190). During this time period, science and technology in Japan was increasingly funded.

The Diet and ministries are essentially interlocking mechanisms for policy formulation and implementation. They are important actors in Japan’s organized effort to promote and implement science and technology in Japan. One of the most important mechanisms by which government has attempted to reorganize science in the 1990s is the *Science & Technology Basic Plan*. This tool affects science and technology initially from a “top-down” fashion. But, it is formulated and implemented in an abstract and diffuse manner. This “typical Japanese” way of accommodating consensus and “deliberation” is an important cultural aspect characterized in the structure of science and technology policy in Japan.

The Science & Technology Basic Plan

The First Science & Technology Basic Plan (1995) explicitly articulates public discontent with an aging Japanese population in the context of a stagnant scientific enterprise dependent upon globalization effects, national economic and political atmospheres, and environmental linkages. The relationships between science and society are explained in the Science & Technology Basic Plan:

(W)ith more Japanese people concerned about their spiritual affluence, it is increasingly necessary to build a pleasant community where people live with peace of mind” (Science & Technology Basic Plan, 1996).

This simple but very important phrasing in an official document provides evidence of the government of Japan’s perceived need of science to aid society and in fact, change society in meaningful ways. This document implies a needed change in the scientific apparatus due mostly to an investment decline in both the public and private sectors during the early 1990s. Besides total numbers of research support personnel being very low relative to researchers (as compared to other developed nations), the Basic Plan suggests that Japan’s research and development has been “hallowing out.” The “hallowing” effect is noticed in the relationship between scientific advances (and their inherent increases in public understanding of science) and the public’s avoidance of science via declining youth enrollment in the ranks of national research. Thus, priorities in this Plan focus on (1) basic research at university and public research institutes and (2) government roles in promoting research and development along social and economic needs, especially those researches that are avoided by the private sector. The Science & Technology Basic Plan was initiated after Japan’s Cabinet passed a Basic Policy for Science & Technology in 1992 and the legislature approved the Science & Technology Basic Law in 1995. The goal of these initiatives was to reorganize science and technology so that creativity and collaboration would be increased and lead to a more globally competitive scientific field. This Plan’s goals are structured around several international and national areas of focus. A couple of these foci are essential to the present study.

In one of these areas of interest, the Science & Technology Basic Plan calls for the government to ensure that both natural and cultural sciences develop “harmoniously” and that

(F)or the advancement of science and technology their interactions are important

In reality, I saw none of this “interaction” while researching in Tsukuba. Instead, the “outside” interaction was mostly with the private sector. “Internally,” the social and natural sciences rarely collaborate within the university. This focus on collaboration is purportedly subject to routine evaluation by Law.

The Prime Minister issued a “Guidelines” paper (LRS97-30251) Prime Minister of Japan, 1997) in 1997 for evaluating science and technology along the lines of the science and technology basic plan. His report states that

This guideline applies to evaluations of both R&D themes and R&D institutions, and aims to implement such R&D evaluations more effectively by requiring that ‘external evaluations’ be introduced, evaluation results be made public, and that they be made use of for the allocation of R&D resources such as research funds” (LRS97-30251, 1997 p.2).

Two key elements are inherent in the “Guidelines” and the “Plan.” These elements focus on novel research systems (as in Institutes 1 & 2) and the expansion of various types of funding. My informants revealed some of the effects of these new funding mechanisms. For instance, many informants described funding from the government as “no problem.” However, more senior informants focused on the increase in institute independence regarding funding. According to these latter informants more private funding sources are necessary since the government has less available monies. Thus, the impact of the 1995 Science & Technology Basic Plan on my research informants reveals mixed results. The “increased funding” has essentially meant more “competitive funding” and more funding to specific sectors of science that are “socially and economically needed.” These “needed” projects are most often decided upon in Ministerial and deliberation council settings, not in the laboratory.

Since nearly eighty-percent of research and development in Japan (S&T Basic Plan; Sigurdson, 1995) is funded by the private sector, the Plan calls for more collaboration between the government and corporations. Several mechanisms are used to entice businesses to get involved with government-led R&D collaborations. These include tax incentives, subsidies and infrastructure (LAN’s and building space) support. Since the Plan is focused on specific sectors of science, not all scientists “feel” its policy implications. However, those institutes and organizations that have depended heavily on government funding are greatly impacted by the codification of new rules and procedures. In a recent United Nations survey (UNESCO, 2002), several important indicators of international science and technology were used to gauge different aspects of science around the globe. Japan was one of several Asian countries included in this survey. More than 3 out of every 4 respondents considered “resources” as being “extremely important.” The “impact on society” (53%) and “dissemination of knowledge and technology” (53%) were close seconds. In this survey, less than 50 percent of the respondents considered “science and technology output” and “institutional mechanisms” as “extremely important.” Thus, scientists around the world tend to see “resources” as more important than “scientific output.” These attitudinal responses tend to be uniform across global regions. Interestingly, African and American (Canada, USA, Mexico, and South & Central America) respondents tended to give higher importance to “resource” issues than respondents from Asia and Europe.

Japan and Ibaraki Prefecture

Population Trends, Population Dynamics

The population of Japan in recent years has been a popular topic of discussion among demographers (Statistics Bureau & Statistics Center, 2002; National Institute of Population and Social Security Research, 2002). Its population has been changing in composition since the beginning of the Meiji Restoration. Between 1873 and 1940, Japan’s population rose from 32.5 million to 73.1 million (Ellings & Friedberg, Eds. 2001 p.21). Today, Japan’s population is aging and highly concentrated in several large metropolitan areas. In fact, one of the officially stated reasons for the creation of

Tsukuba (Dearing, 1995) was to alleviate population stressors from cities such as Tokyo. Both increases in population and Japan's population concentrations in metro-areas are well documented in ministry population data (see Figures 4.1 & 4.2).

Currently, the population of Japan is 127.4 million (Statistics Bureau & Statistics Center, 2002). Males represent about 51 percent of this population and females 49 percent. Japanese Ministry documents report that Japan's population is expected to peak in 2007 and that an "aged society" where about 33 percent of the people are over the age of 65 will occur around 2050. Others (van Wolferen, 1990; Cutts, 1997) suggest that about 25 percent of Japan's population will be 65 or older by 2020. By 2051, the total population of Japan is expected to be below 100 million (National Institute of Population and Social Security Research, 1997). The precursors of an "aging society" can be seen in the population dynamics of the 1980s and early-1990s (see Figure 4.2). The youngest cohort (0-14) is decreasing in numbers while both the middle-aged cohort (15-64) and the older cohort (65+) are slowly increasing. In fact, Japan's Statistics Bureau & Statistics Center (2002) reported in 2001 that there were 22.87 million citizens (18% of the total population) 65 or older. This agency predicts that by 2050, those aged 65 or older in Japan will comprise about 35 percent of the population.

Preliminary effects of Japan's aging society are noticed in increasing mean age at first marriage (28.8 more males and 27.0 for females) and the leading causes of death among Japanese (malignant neoplasmas and heart disease) (National Institute of Population and Social Security Research, 2002). With an increasing urban and aging population, Japan has undertaken several projects that both directly and indirectly have the effect of dispersing populated metropolitan areas. In fact, as of the late-1990s, government spokespersons are suggesting that the capital may be in the process of moving from Tokyo to a more rural setting. Tokyo has an estimated population of 12 million (Statistics Bureau & Statistics Center, 2002). Therefore, any movement of the capital would have a tremendous impact on the Kanto region. The Kanto region of Japan includes several densely populated areas. It is in the North-Kanto region where my research was conducted. Tokyo has a population that is four times the size of Ibaraki prefecture. This region includes Ibaraki Prefecture, the home prefecture of Tsukuba city. Ibaraki population growth rates in the 1960s (0.46) and late-1980s (0.71) were significant. Its population increased slightly between 1990 (2,845,382) and 1995 (2,955,512). Today, Ibaraki-ken has a population of 2,985,676 (Statistics Bureau & Statistics Center, 2002). Between 1985 and 1990, North-Kanto had the second highest population growth rate in Japan, second only to South Kanto, which includes Tokyo (see Figure 4.3).

Japan's aging society is more complicated than mere "aging," per se. Immigration and emigration are important factors in understanding the structural arrangements of society in Japan. It is important to note that data on migration in Japan are unique as compared to other developed nations. For instance, in Japan, immigration and emigration numbers are almost identical (see Figure 4.4). Approximately ninety-nine percent of Japan's population is ethnic-Japanese. Thus, at least statistically, Japan is a quite homogenous society with regard to ethnicity. This society has less than doubled

its population in the 60 or so years after 1940 with the older aged cohorts increasing in proportion relative to the younger cohorts. Thus, Japan can be correctly characterized as an aging, ethnic-Japanese society.

Proportions of the population by specific age cohorts across Japan, Ibaraki-ken and the United States indicate that Japan and Ibaraki-ken have significantly less youth (aged 0-14) than the United States (see Table 4.1). Ibaraki Prefecture has a population of about 3 million people ranking it as the 11th most populated prefecture in Japan. Ibarakians are concentrated (both male and female) in the 15-64-age cohort. For instance, 69.9 percent of males are aged 15-64. In addition, 65.9 percent of the females in this prefecture are aged 15-64. The age profile of Ibaraki reflects a youthful, working-aged population, which has steadily increased in concentration since 1920 (see Figure 4.5). In general, the population of Ibaraki Prefecture is significantly different from other nations and localities within Japan. In the city of Tsukuba, the four largest age cohorts (30-34, 25-29, 45-49 and 50-54) also represent a youthful and working-age population (from smallest to largest proportion).

TABLE 4.1: Populations in prominent age cohorts for Japan, Ibaraki Prefecture and the United States (2000)

Age Cohort	* Japan	** Ibaraki Prefecture	United States
Total Population (2000)	126,926,000	3 million	283 million
0-14	14.6%	15.4%	21.7%
15-64	68.1%	68.0%	66.0%
65 or older	17.4%	16.6%	12.3%

Source: adapted from Statistics Bureau & Statistics Center, Ministry of Public Management, Home Affairs, Posts & Telecommunications (with UN and Japan's Ministry of Health, Labour & Welfare (2002).

* National Institute of Population and Social Security Research, "Population Predictions for Japan: 2001-2050" and also verified through Japan Statistics Bureau (October 2000 data)

** source adapted Japan Statistics Bureau (October 2000 data)

Ibaraki Prefecture's demographic structures are directly linked to people's space and land usages. Without land, science and technology would be greatly diminished in size and scope. Available land for urban use is increasing in Japan but in the context of decreasing forests. It is also important to note that particular segments of society tend to own this land. Thus, an ever-increasing and aging population is competing for land ownership.

The nature of development in Japan since World War II has had an impact on society in several meaningful ways. Japan's population, land usage, educational system and life expectancy have all been transformed.

Life Expectancies

Life expectancy in Japan has been increasing dramatically for both sexes since the turn of the 20th century. This has had a dramatic effect on both overall population and the aging of this society. In particular, older Japanese have experienced increasing life expectancies. From 1960 to 1990, Japanese men and women have experienced a 10-year increase in life expectancy (see Table 4.12). These increases in life expectancy are significant when one considers the strides made prior to 1960. For instance, between 1921 and 1960, life expectancies were increased by about 25 years. These figures indicate rapidly changing population dynamics. The significance of this age effect has the inherent ability to affect both the politics and economics in Japanese society.

Land

Japan's natural resources can be classified into three major categories: Food, Forestry, and Energy and mineral resources. Seventy percent of Japan's total area is covered by forest. Yet, their forests account for only 1 percent of the world's total forested lands. This implies that Japan imports most of its forest products. Since the collapse of the Soviet Union in 1991, Japan became the largest producer of steel in the world. However, the Japanese steel industry is almost completely dependent upon foreign supplies. Production of rice has been regarded as a basic component of life in Japan. This "ideology of rice" partly explains Japan's resistance to importing cheaper rice from abroad. The steel industry, forest products, and food seem to typify Japanese natural resources. However, since the 1970s, Japan has had an increased focus on science and technology. Catching up with the West and regional development were primary goals in Japanese science and technology policy decisions through the late 1970s. By the early 1980s, Japanese high technology was leading the world.

The importance of land to the people and policy makers in Japan is an essential element in the development of this country. In fact, construction is a major enterprise and has led to some critics of this industry calling Japan's development as the "concretization" of Japan (AAS meeting, 2002). Japan can be correctly characterized as a country in which people are concentrated in a few large metropolitan areas. Forests and agriculture abound throughout the country. Two-thirds of land in Japan (25.16 million hectares) is classified as forestry and forty percent of this land is "planted" forests (LRS96-12799). However, recent trends suggest an increasing amount of forested land being urbanized. Most of this "new" land is developed and owned by private interests. Close to 80 percent of the land developed in 1994 was developed by the private sector (8,600 ha).

For instance, in 1994 the total area of Japan contained nearly 38 million hectares (ha). Agricultural and Forested areas make up most of this area (80%). Non-forested land since 1993 has increased by 10,000 hectares largely through state-sponsored development (LRS96-12799). In 1994, 42,000 hectares were converted to alternative

forms of land. This acreage included agricultural and forestry lands being converted to urban land. Development has not been isolated to the conversions of forested lands. In 1995, cultivated agricultural land in Japan amounted to 5.038 million ha (14% of the total area). 2.75 million hectares were cultivated paddy fields. The quantity of cultivated land in Japan peaked in 1961 at 6.09 million hectares but has been declining ever since (LRS96-12799). The assessment of land status reveals a picture of increasing private urbanization. However, there are significant differences in the ownership status of Japan's land.

"Freehold" is the only type of property ownership in Japan. This equates to land and buildings being legally defined as separate assets. Between 1970 and 1995 the number of individual land owners in Japan increased from 20.5 million to 33.93 million people (a 65% increase). During this period the population increased 20 percent and the number of households increased 52 percent. Thus, landowners both as a proportion of the number of households and a proportion of the population are increasing (see Figure 4.6; LRS96-12799). As of 1994 commercial and residentially developed lands amounted to 10,800 hectares. This was a decrease compared to the peak year of 1972 (23,400 ha). Of the 10,800 ha, 2,200 was developed by the public sector and the remaining 8,600 ha was developed by the private sector (LRS96-12799).

From the fall 1993 "Basic Land Survey," several important findings can be deduced (see Table 4.13). In this large-scale survey (700,000 corporations were mailed questionnaires and 600,000 households were interviewed in-person), 18.2 percent of insurance companies held land, 20 percent of food and beverage companies held land and 27.8 percent of other wholesale and retail companies held land. Land ownership also differs between types of companies. For instance, 99.5 percent of listed companies own land, 41.1 percent of non-listed companies own land, 85.6 percent of educational organizations own land and 85.9 percent of religious organizations own land (LRS96-12799). In 1993, there were 40.53 million households in Japan. A majority (57.4%) of these households owned land. Further, most of this majority (53.8 percent) owned the land on which they resided (see Table 4.13).

As of 1950 there was a consistent decline in Ibaraki Prefecture's available land area. It wasn't until the late 1960s or early-1970s that development of Ibaraki's land took hold. This is directly related to the development of Tsukuba Science City in the 1960s (see Figure 4.7; Henini, 1999), which was initiated by the development of the research and education district in Tsukuba. Thus, the development of this study's research site began with the purposeful development of research and educational facilities that had an intended purpose of population relief in an expanding society.

The situation in Ibaraki Prefecture is quite different from that of neighboring Tokyo. For instance, in Ibaraki-ken land prices are relatively lower and the space available for development is much larger than in Tokyo. Also, Ibaraki-ken has experienced much larger price declines in commercial land. Recently, commercial land prices in Ibaraki-ken declined an annual average of 9.1 percent (see Table 4.2). The Ministry of Land, Infrastructure and Transport reports land prices in the centers of metropolitan areas are

either increasing or leveling off. However, by observing the key prefecture and city land prices for this study, it is obvious that mean declines in land prices run across prefecture borders. The most remarkable recent change is that of commercial land prices in Ibaraki-ken. Residential land prices in Tsukuba city continue to decline at a higher rate than both Tokyo and Ibaraki-ken as a whole.

TABLE 4.2: Average Land Price-Change Comparisons in Japan

Land Area	Residential 2000 – 2001	Commercial 2000-2001
Japan “total”	-4.2%	-7.8%
Tokyo Prefecture	-5.5%	-7.2%
Ibaraki Prefecture	-4.8%	-9.1%
Tsukuba City	-5.6%	-6.3%

Source adapted from Ministry of Land, Infrastructure & Transport, 2002

Decreasing land prices in non-metropolitan areas of Japan have been useful to the educational system. Eighty-six percent of educational organizations in Japan own land. Land ownership offers unique opportunities to exhibit leverage in funding struggles. This is helpful leverage for an educational district. However, not all university systems are poised to “win” in these conflicts of interest.

Educational System, Educational Structure

Education in Japan is an important institution not only as a direct link to its culture of credentials (van Wolferen, 1990; Cutts, 1997) but also its effects upon scientific labor hierarchies. Therefore, this institution is particularly important in the analysis of the field of science. Total Japanese school attendance percentages in the beginning of the 20th century were about 90 percent. During the early part of the 20th century, the schools separated children by gender and the government followed a European model of education by using a system that was divided into academic and technical tracks. After World War II, the Postwar Educational Reform of 1947 transitioned into a single-track system. The 1947 reform for Japan’s educational system was based on a system used in the United States at the time. Education is compulsory for children aged 6 to 15 and those in junior high school. However, high school is not compulsory in Japan (National Center for Educational Statistics, 1996). The end of World War II marked the beginning of an educational system modeled after the United States.

Today, the Japanese educational system is termed a “6-3-3” system. More than 90 percent of pre-schoolers (under the age of 6 years) are enrolled in kindergartens (yochien) or day care centers (hoikuen or hoikusho). Students spend 6 years in elementary school, 3 years in junior high school (chugakko) and 3-years in high school (kotogakko). Additionally, many students participate for 4 years at the university level (daigaku) or 2 years in junior college (tanki daigaku) programs. Recently, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) initiated educational reforms that have concentrated on “academic ability” and “moral education” (MEXT(a), 2003) in the classroom. Textbooks for classes are controlled by MEXT. Books in use

must be approved by the Minister of MEXT or be copyrighted and owned by MEXT. The moral element of education is outlined in booklets that are distributed at elementary and lower-secondary schools. These booklets, titled *KK oro no Note* explain the morals to be acquired by students (MEXT(a), 2003). The ministerial-issued doctrines of academic and moral education are guidelines that include the development of individual character. As of April 1999, these conflicting notions of strict control over the educational process and development of individuality are being incorporated into “unified” lower and upper-secondary schools. MEXT is involved with opening one “unified” secondary school in every upper-secondary school district in Japan. This “unification” may have a consequence of further embedding both the moral and academic intensity of education of Japanese youth with a more consolidated message emanating out of MEXT. This “hidden curriculum” does not end with moral and academic indoctrination. The curriculum itself serves as a life-course trajectory that focuses the attention of students on certain life-choices and patterns of work.

School Curriculum

Pre-university educational time requirements are efficiently scheduled in Japan. Elementary education in Japan is structured into a 35-week schedule each year, with 34 weeks or more for first grade students. First through third grade students have 850, 910, and 980 school hours, respectively, each year. Fourth, fifth and sixth graders are required to incorporate 1,015 hours of school each year (see Table 4.14) and Junior high school students are required to attend 1,050 hours of school each year (see Table 4.15). Students in elementary or junior high school can attend public or private school anywhere in Japan. In fact, 80 percent of college students end up entering private universities and colleges (Cutts, 1997). MEXT (Monbusho was renamed MEXT in 2001) requires a minimum of 210 days of instruction, including a half-day on Saturdays which is counted as a full day for all elementary and secondary students” (National Center for Educational Statistics, 1996). Yet, many local school boards advocate 240 days per year. This educational time requirement in the lower years of education is roughly equivalent to other OECD countries (see Table 4.3).

TABLE 4.3: Comparisons of Intended Instruction Time in public institutions between OECD Countries and Japan across particular student ages (in hours for year 2000)

Age Cohort	Japan	Mean for OECD countries
9 year olds	761	829
10 year olds	761	835
11 year olds	761	855
12 year olds	875	916
13 year olds	875	944
14 year olds	875	944

Source adapted from OECD, 2001.

Raw time spent does not necessarily translate into similar educational agendas across cultures. It is thus important to understand what types of curricula are required in different educational systems. By looking at the curricula across other developed societies for one of these age groups one notices some interesting variations (see Table 4.4).

TABLE 4.4: Comparisons of Curriculum Focus Between OECD Countries and Japan across the 9-11 Age Cohort (percentages)

Time (%) per subject	Japan	Mean for OECD Countries
Reading, Writing, Literature	23	24
Mathematics	17	16
Science	10	8
Social Studies	10	9
Foreign Languages	N	6
Technology	5	2
Arts	14	11
Physical Ed	10	8
Religion	N	4
Practical & Vocational Skills	N	2
Other	10	3
Non-compulsory	0	7

Source adapted from OECD document <http://www.oecd.org>

Japan's curriculum focus for 9-11 year olds emphasizes science, technology, the arts and physical education. This emphasis is above OECD averages and it is documented in both U.S. Department of Education (Stevenson, et al. 1996) and OECD reports (OECD, 2001). On the other hand, the educational structure in the early stages of learning in Japan for literature, reading/writing and math tend to follow OECD averages. The demands of pre-university education in Japan are extremely rigorous. However, many students have opted out of the "system." Some reasons for the dropouts include *ijime* (bullying), difficulty levels and various other external influences (Stevenson, et al. 1996).

Participation, Dropouts and Truancy

Another consideration for better understanding Japan's educational system is an awareness of those students who are not participating or are only participating up to certain educational levels. An understanding of participation, dropout rates and truancy should enhance the structural description of education, which is a determinate of the structure of labor. Japan's dropout rates are among the lowest in the world. They have remained at or below 2.6 percent through the 1990s (see Table 4.5). However, the data show that the dropout rate has not declined in recent years. It has remained at a peak rate since 1996-97 of approximately 2.6 percent.

TABLE 4.5: Japan's High School Dropout Rates (1990-2000)

Year	High School Population (persons)	High School Dropouts (persons)	High School Drop out Rate (%)
1990	5,623,336	123,529	2.2
1991	5,454,929	112,933	2.1
1992	5,218,497	101,194	1.9
1993	5,010,472	94,065	1.9
1994	4,862,725	96,401	2.0
1995	4,724,945	98,179	2.1
1996	4,547,497	112,150	2.5
1997	4,371,360	111,491	2.6
1998	4,258,385	111,372	2.6
1999	4,211,826	106,578	2.5
2000	4,165,434	109,146	2.6

Source adapted from Japan Information Network (a) and (b) (2003) Note: The dropout numbers are not included in the population numbers

An educational appendage of the United Nations (UNESCO) estimates that sub-Saharan Africa and southern Asia account for 78 million (of the total 88 million) primary-out-of-school children around the globe today (WER, 2000). Dropout rates in both eastern and southern Asia are projected to decline in the coming decade (WER, 2000). However, very little declines in sub-Saharan Africa are expected. These primary school participation data affect the participation rates in lower- and upper secondary schools. Thus, there are inherent factors in participation rates across global regions. A main consideration is whether or not education at certain levels is "compulsory."

Recently, levels of truancy in Japanese schools have been increasing (see Figure 4.8). However, since the lower levels of Japanese education are compulsory and most Japanese participate in school (see Table 4.16), high school is a good location for comparison of dropout rates. In Table 4.34, the ramifications of dropout rates are expressed in their relationship to unemployment. The increasing high school dropout rates in Japan appear to be related to the increasing unemployment rate. This positive relationship also holds for the United States where the decreasing dropout rates are related to decreasing unemployment rates. However, Japan's high school dropout rate is significantly lower than the dropout rate in the United States (see Table 4.6).

TABLE 4.6: Upper-Secondary (High School) Dropout Rates (DOR) and Unemployment Rates (UER) in Japan and the United States (1995-2000)

Year	Japan		United States	
	DOR	UER	DOR	UER
1995	2.1	3.1	12.0	5.6
1996	2.5	3.3	11.1	5.4
1997	2.6	3.4	11.0	5.0
1998	2.6	4.1	11.8	4.5
1999	2.5	4.7	11.2	4.2
2000	2.6	4.7	10.9	4.0

Source: USDOE, (2002) National Center for Education Statistics, "The Condition of Education, 2002"
Source for unemployment rates adapted from UNESCO(b), 2002.

According to one report; "junior high students exhibit more problem behaviors than any other segment of the school population" (Stevenson, Lee and Nerison-Low, 1996). This report suggests that their maturity level may make them more vulnerable to the cultural stresses of education within the context of a credentialist society (gakureki shakai). Thus, recent decreases in entrance rates of children going into kindergarten (see Table 4.17) may be a prelude to larger decreases in dropout rates among junior high and high school students.

In 1992 (Domoto, 2003), 94,000 children missed school for a consecutive period of no less than 30 days with the main reason being given as "disliking school." 19,000 of these children were elementary school students and the other 75,000 were in junior high school. In 1996, those elementary and junior high students missing 50 days or more of school numbered 15,000 and 62,000 respectively for a total of 78,000. Some problem behaviors may be more related to the micro-level interaction between peers. Bullying (Ijime) is an important factor for a large portion of "refusals" in recent years. In 1996 there were 51,544 incidents of Ijime in 13,693 public elementary and junior high schools.

In 1994, there were 57,000 cases of Ijime reported in Japan's public schools. In response to this problem, the Ministry of Education formed the "Cooperative Committee to Conduct Surveys and Studies on Problematic Behaviors of School Children." This committee was composed of several representatives from various fields of research. During December 1994 and January 1995, it conducted a national survey of 19,397 school children, parents and teachers. The committee concluded that 22 percent of elementary school children, 13 percent of junior high students and 4 percent of high school students were bullied. In the study, parents suggested (63.4%) that "lack of sense of justice and of rule consciousness among children" was the main reason why certain children are bullies. Teachers suggested (68.7%) the problem was "lack of education at home" (Domoto, 2003). Internationally, there are differences among developed nations in the percentages of youth participating in school across educational levels (see Table 4.16).

Today, nearly 78 percent of all students and 94 percent of students in Junior Colleges are in private schools (Domoto, 2003). This trend toward private education began in the 1960s as Japan experienced increasing economic growth and prosperity. However, since World War II, averages of young Japanese entering college have remained relatively stable (see Table 4.17) and "...sweeping changes..." (Kakuchi, 1999) are being made to Japan's educational system. It is interesting to note that some investigators are predicting the demise of private universities in Japan. Recent popular press reports have already revealed the beginnings of this trend. The Seishin Gakuen Women's Junior College in Ibaraki-ken stopped accepting new students in 2002 (Asahi News Service, 2003). The problem is so severe that some universities have set up "deliberation councils" to address the issue in hopes of creating university mergers to alleviate the closing of schools.

The intense focus on exams and the rigorous curriculum (revealed to me through interviews) in the educational system are important artifacts of Japanese culture. These artifacts extend into many avenues of Japanese society.

"Examination Culture"

Few (throughout my informant interviews) doubt that Japan focuses attention on exams in school. Two informants (in two separate departments at the University of Tsukuba) during informal interviews referred to Japan as an "examination culture" (inform_26; inform_27). This quote speaks volumes about the perception of Japan's educational system as a memorization and standardization oriented culture. The national government and private corporations promote intensive study and a ferocious work ethic, especially in the pre-college educational setting. However, according to my informants and several investigations (inform_1_2_3; van Wolferen, 1990; McVeigh, 2002) this intensive form of education has not necessarily worked for many Japanese youth and in fact, the rigor of this learning model may be unintentionally producing different types of students (see Table 4.18). Some localities in the United States are now trying to emulate Japan's educational system which may have consequences on not only future participation rates in school but production of different types of students in the United States.

Examination networks are woven throughout the Japanese educational system. These exams begin in the elementary years and become more intensified at the Junior and High School levels. The two major tests that are given outside of school are the high school entrance exams (koko nyugaku shiken) and the university entrance exams (senta shiken and daigaku nyugaku shiken). Juku or Yobiko ("cram schools") are forms of supplementary education in Japan that are routinely utilized for preparing students for exams (Stevenson, et al. 1996). Juku are geared for elementary and junior high and high school students, while Yobiko are aimed at students specifically preparing for college examinations. Cram schools usually operate after normal school hours and are run privately and independently from the regular school system. Cram school businesses operating "exam schools" are quite profitable (see Table 4.7).

TABLE 4.7: National Average Cost for Supplementary Education for Students Attending Japanese Public Schools in 1990 (in U.S. dollars)

Educational Level	Cost
Elementary School	\$401
Junior High School	\$954
High School	\$496

Source: Stevenson, et al. , 1996; [MEXT, 1993 or Monbusho, 1993 Statistical Abstract of Education, Science and Culture, Tokyo: Printing Bureau, Ministry of Finance]

Most agree that examination results of prospective students are an essential ingredient in University selections. Yet, others contend that this examination culture has inherent political flaws. For instance, one informant (inform_26) told me that he had been told (instructed by his supervisor – the department head) to “...change a couple of entrance exam scores...” for prospective students. According to this faculty member, this process allows for some of the better students (“better” as in ones that failed or had scores lower than the required exam scores but, had very good interviews with the department committee) to be moved up in the “entrance distribution” and the students that may have been marginally successful on the exam but did not perform well on the personal interviews with department committee members to be below accepted exam scores. In other words, this informant declared that he had “fudged” entrance exam scores to improve the scores of some while demoting the scores (relatively) of others – thus, not admitting these latter students and admitting the former students (which would not have been admitted otherwise). This was valuable insight into the politics of university admissions. It also resonates loudly as to the importance of “entrance exams” in Japan’s educational culture. My question to him after he finished with his declaration was “How prevalent is this sort of practice?” His reply was:

(T)his practice occurs all over campus in about every department – it is the norm (inform_26).

In conclusion, his explanation for the prevalence of this political device is that the distribution of desired students becomes “more competitive” against other departments for a department using this practice. However, this “mechanism” may have negative consequences leading to declining disciplinary diversity and devaluation of creative research and development - both of which are important reorganization goals of MEXT.

Degree Trends & Credentials

The curriculum, dropout rates and rigor of examinations in Japan’s system of education are elements that culminate in personal credentials. One form of credentials in Japan is a university degree. These degrees illuminate the disciplinary diversity and creativity in education. In fields of science, numbers of personnel involved with research and development are highest in Japan followed by Germany, France and the United Kingdom (LRSJ1999-30412, 1998). It is well known that the industrial structure of a country can affect degree trends in that country. This also implies that Laws can influence the structure of labor in a country. In fact, some investigations have revealed

a migration of high-skilled workers from several OECD countries to Japan (Fuess, 2001a; NSF, S&E Indicators, 2002). The trends in production of graduate science degrees in Japan reveal a concentration in specific disciplines (see Table 4.8).

TABLE 4.8: “Natural” Science Graduate Degrees Awarded in Japan and to Japanese from United States universities (1996)

Subject of Degree	Numbers of Graduate Degrees in Japan
Total Graduate Degrees	50,713
Medical sciences, Dentistry, Pharmacy and Health	1,941
Agricultural Sciences	3,289
Engineering	23,620
Physical Sciences	5,302
Humanities	3,691
Social Sciences	5,751
Education	4,095

Source adapted from MEXT(b)

According to a MEXT “white paper” (LRSJ1999-30412, 1999), the number of degrees awarded (both masters and doctorate) experienced increases in the 1990s. Between 1989 and 1994, Japan-issued 58.6% more masters degrees and about 27% more doctorates. In 1996, 50,713 graduate degrees were awarded (LRSJ1999-30412, 1999). The overwhelming concentration of degrees awarded to graduate students is in the engineering sciences (see Table 4.8). United States’ universities awarded 81 natural science (30) and engineering (51) doctorates to Japanese graduates in 1995 (NSB, 1998). Doctorates awarded to Japanese by U.S. universities between 1986 and 1995 number 1,276 (NSB, 1998). These data appear relatively low as compared to the production of graduate students in Japan.

It is important to note that the “cumulative science and technology expenditures” since FY1996 have drastically increased (from 3 trillion yen in FY96 to 13.3 trillion yen in FY99). According to the government (LRSJ1999-30412, 1999), these monies are generally allocated toward development (61.5%), applied (24.4%), and basic research (14.1). Natural science researchers in Japan are concentrated in corporations (66%) and universities and colleges (27.1% or 197,000 researchers). The university and college researchers are concentrated in 4 major fields of operation: health (54.7%), engineering (22.8%), physical sciences (12.5%), and 6.4% for agricultural sciences (LRSJ1999-30412, 1998).

Foreigners in Japan

The foreign population in Japan is small. However, this is not to say this population is insignificant. Koreans and Chinese make up the largest proportions of foreigners living in Japan (see Figures 4.9, 4.10, 4.11). Yet, for foreigners numbering more than 1,000,

immigrants, Bolivians, Iranians and Peruvians showed the largest rate of population growth between the years 1990 and 1995 (Statistics Bureau & Statistics Center, 2002).

There are an estimated 39,779 foreign residents living in Ibaraki Prefecture (Ibaraki, 2002). Approximately 3,000 foreign students and researchers live in Tsukuba, the highest proportion of foreign residents of any Japanese city (Dearing, 1995). Yet, more specific to the present research is the effects foreigners may have on Japan's labor force. Fuess (2001a) examined 12 occupation visa categories in Japan. In 1999, 240,936 workers entered Japan in "high-skill" visa categories. This was a 75 percent increase since 1992. This equates to 40 percent of the number of Japanese university graduates entering the labor force in Japan each year and twice the number of entries to the United States (Fuess, 2001a; NSB, 2002). Thus, the global educational nexus in relation to Japan is not "one-way." American and other OECD nations are sending thousands of scientists to Japan with "temporary" visas for "indefinite" time periods.

Labor Force

Gordon (1988) argues that Japanese labor relations resembled the West more at its outset than today. This argument is a critique of those who might posit that Japan's labor relations are moving toward a Western model.

Sigurdson (1995) categorizes four classes of workers in Japan. These are: the top 10 percent who own and control the nation's wealth; the "labor aristocracy" (workers in large companies with consistent wages and benefits); the small-business workers; and the casual workers. However, it is important to note that about 90 percent of the Japanese public considers themselves' middle-class. The labor force in Japan is made up of several different sectors. Employment and labor force trends in Japan suggest stability in employment in the 1980s and slight decreases in employment growth in the 1990s (see Table 4.9) (OECD, 2003).

**TABLE 4.9: Japan's Employment and Labor Force Growth
(annual percentage change)**

	1988-1998	1999	2000
Employment	0.8	-0.8	-0.2
Labor force	1.0	-0.2	-0.2

Source adapted from OECD, 2003.

Standardized unemployment trends suggest a steady increase in unemployment in the Japanese labor force since 1990 (see Table 4.10).

TABLE 4.10: Standardized Unemployment rates in Japan (% of total labor force, 1990-2000)

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2.1	2.1	2.2	2.5	2.9	3.1	3.4	3.4	4.1	4.7	4.7

Source adapted from OECD, 2003.

The lack of growth in labor force employment and the increases in unemployment are indicative of a slowing economy. In fact, in the introduction to the 1995 "Science and Technology Basic Plan" the Japanese government states that "*People are deeply concerned that Japan is heading towards a crisis where the hollowing-out of industry, lack of society's vitality, and a worsening living standard are highly evident*" (LRSJ1996-30053, p. 1 1996). In many developed societies unions play important roles in mediating economic downturns. Japan's union "system" is interesting in that, it tends to operate through accommodation and consensus with opposing stakeholders. Regardless, many workers in Japan are not a part of unions due to their involvement in contingent work (Sato, 2001; Weathers, 2001).

Recent investigations into the structure of Japan's labor force (Sato, 2001; Weathers, 2001) have shed light on non-standard work in Japan. Sato (2001) investigated "part-timers" and "dispatch personnel" in Japan. He compared these types of employees with "regular" types. Although there is a view that suggests non-standard employees have been negatively impacted and excluded from the regular work force, Sato concludes that "...this view can only be correctly applied to a minority of workers in non-standard employment" (Sato, 2001 p.179).

According to Sato, compared with regular employees, part-timers and female dispatch personnel attach greater importance to lifestyle than to their jobs. Thus, female dispatch workers, married female part-timers, young part-timers and elderly part-timers are working in their respective categories of work because they chose this style of work. Interestingly, Sato shows evidence that "atypical" workers are generally more satisfied with their work lives than "regular" workers. However, some of the assumptions that Sato carries may prevent him from correctly analyzing his data.

Weathers (2001) reported that 90 percent of all Japanese temporary workers are female. This suggests that Sato's analysis may have inherent flaws in it. For instance, Sato's comparisons must be mostly women if 90 percent of the temporary work force is female. According to Weathers, in the late 1990s there was a large increase in temporary work production. However, there were only slight increases in pay to temporary workers and little to no increase in temporary work status on the job. These discrepancies in production and pay may be addressed by unions in some countries. Although unions are present in Japan, participation rates have been decreasing over the last couple of decades.

Unions in Japan tend to be centralized in corporate and public sectors. This tends to leave small businesses (a large proportion of businesses) un-unionized. There has also been a decline in overall growth of unions since the Occupation years. Union membership has declined from about 35 percent (stable from the Occupation to 1975) to 24.1 percent in 1994 (Schwartz, 1998 p.36). Also, membership in many of the Japanese unions, specifically, in the private sector, is exclusionary in that, to be a member one must be a permanent and full-time employee. Thus, temporary workers are excluded from much of the union activity in Japan (Schwartz, 1998). Adding to this lack of "coverage" by unions is the growing temporary workforce that is primarily

occupied by women. The relative impact of unions on Japan's labor relations is complex. Some argue that labor's declining membership along with its solubility into bureaucratic and political circles has neutralized much of the union's goals. Recent developments (1989) substantiate this "solubility" with the development of the National Confederation of Private-Sector Trade Unions (Rengo). Rengo consolidates private interests from both the public and private union federations and has emerged as the third largest union federation in the world. However, its impact and effects on labor issues has been arguably minimal (Schwartz, 1998).

One of the most revealing elements of the work force in Japan is the recent trend in work and life dissatisfaction among workers. Recently, employee dissatisfaction with work, attitudes of both genders about the difficulties for women to find work, and variations on other attitude measures relating to work satisfaction have been assessed by Japanese ministries. Comparisons between FY1989 and FY1995 surveys indicate several negative trends in work related attitudes. Furthermore, some investigations (Cutts, 1997) indicate that women are exceedingly "privileged" in Japanese society due to their control of household monies and budgets and the lesser household duties since children per household have been decreasing in the post-war years. At the same time, the entrance into this "leisure class" (Cutts, 1997) is one-way – through male dominated institutions. Men's preoccupation with work leaves them virtually out of the community. However, women's "gateway to the leisure class" can only be attained through inheritance or marriage - both dominated by men (Cutts, 1997). It is this latter aspect of Japanese culture that permeates society – women are not expected to be involved with questions of politics and policy. This may be why so many young women in Japan spend a large amount of free time shopping or conducting other leisure activities.

A summary of employment since World War II reveals some interesting gender related aspects to work and employment in Japan during the bubble years. The two most notable of these trends are the consistently low unemployment rates across gender and the "gender effect" on those not in the labor force (see Figures 4.12, 4.13, 4.14). However, it would be deceiving to consider only this factor, since type of work often indicates differences in the quality of work. For instance, full time employment often comes with benefits such as medical and future savings awards, whereas part-time and seasonal types of work usually lack full benefits and regular hours. Women tend to be located outside of the traditional labor force (see Figure 4.14). The unemployment data indicate that both men and women show extremely low unemployment rates. Thus, women who are "not in the work force" are most likely located in alternative labor, e.g. housework, seasonal work, and other temporary workers. To understand the labor force in Japan, one must look at the attitudes of the workers. In other words, are women and men happy with their social positions in life? How easy is it for women and men to get jobs in Japan? What are the obstacles, if any, to advancing and/or promoting oneself in the work force? The attitudes of Japanese to these questions should add to the substance of the structure of work in Japan. However, worker attitudes should be coupled to time in order to more fully understand worker dispositions.

Cutts (1997) notes that in 1992, the average Japanese male worked about 2,500 hours and that one in six men worked over 3,100 hours. This latter figure equates to 388-eight hour days. Japan's national trend for average annual work hours reveals a significant decline since 1979 (see Table 4.11).

TABLE 4.11: Average Annual Hours Actually Worked per Person in Employment in Japan

1979	1983	1990	1996	1997	1998	1999
2126	2095	2031	1892	1864	1842	1840

Source adapted from OECD, 2003.

In my sample, informant work hours varied widely. Thus, actual work conditions must be described to context to the structural field of scientific work. This sort of description necessarily requires an analysis of scientific work in Japan.

Chapter 5: SCIENCE AND SCIENTIFIC WORK IN JAPAN

Japan has more researchers (per 10,000 population and per 10,000 in the labor force) than any other developed nation. In the natural sciences, Japan's researchers are predominantly located in the corporate sector (66%) and the university/college sector (27.1%). Within the university and college sector, researchers in national universities tend to hold the position of faculty (50%) and doctoral student (33.5%). The personnel engaged in natural science research and development (864,321) is involved with 0.42 non-researchers for every researcher (see Table 5.1).

TABLE 5.1: International Comparisons of Scientific Researchers

Country	Total Number of Personnel engaged in R&D	Non-researchers	Researchers per 10,000		Non-researcher per researcher
			Population	Labor-Force	
Japan (1997)	970,041	274,418	55.1	102.2	0.39
Japan, natural sciences only (1997)	864,321	257,537	48.1	89.2	0.42
United Kingdom (1993)	270,000	135,000	25.3	52.1	1.00
Germany (1993)	475,016	245,176	28.3	58.1	1.07
France (1995)	318,384	167,135	26.0	59.6	1.11

Source: adapted from LRSJ1999-30412, "Part 2" (pp.123 & 132)

Researcher data provide an interesting comparison across countries. Japan has a large network of researchers relative to other nations. More interesting is that the proportion of non-researchers tied to researchers in Japan is far less than in other countries. Informants in this study confirmed the notion of increased needs for support workers.

Attitudes toward science

In 1995, about 81 percent of Japanese youth agreed with the opinion "Scientific research is essential even if it is not immediately useful, because it brings about new knowledge," while 73 percent agreed with the opinion that "Japan needs to have advanced science and technology in order to boost its international competitiveness," and 52 percent agreed that "Our lives can become healthier and more comfortable if science and technology is advanced." However, 31 percent of the respondents in this survey did not agree with this latter opinion. Obviously, there is a disagreement over what impact science and technology have on society (LRSJ1999-30412, 1998). To further understand this "split" of opinion on the value of science and technology in Japanese society, I undertook an analysis of the World Values Survey¹ (Inglehart, et al. 2000). The results provide the basis for understanding some of the complexities of Japanese attitudes toward education, gender, foreigners and work and occupations in Japan. These data also suggest that the Japanese public has specific attitudes toward

science and technology. Regardless of attitudes, scientific production in Japan is widely characterized as extensive. Journal citation reports offer access to article productivity and impact.

Scientific Citations: Productivity and Impact

The Institute of Scientific Information releases several data on global citations. Some of the most used data in their *Journal Citation Reports*² are Impact Factors (IFs), self-citation and self-cited rates. “Impact Factors are ratios obtained by dividing citations received in 1 year by articles published in the two previous years. Self-citation rates relate a journal’s self-citations to the total references it makes and self-cited rates relate a journal’s self-citations to the number of times it is cited by all journals including itself” (Haiqi and Yamazaki, 1998 p. 377). According to Haiqi and Yamazaki (1998), Japanese scientists tend not to submit their best articles, especially concerning basic research. They go on to conclude that citation indicators reflect that Japan does not compare favorably, except in one instance (e.g., the journal *International Immunology*), to the international scientific community.

From 1981-1991, University of Tokyo researchers published 10,982 articles in physical science journals, compared with 8,853 for the University of Kyoto, 7,549 for the University of Osaka, 6,037 for the Tokyo Institute of Technology and 2,784 for the University of Tsukuba. As a measure of importance, or impact, articles by the University of Tokyo researchers were subsequently cited by others an average of 8.22 times compared with (Dearing, 1995):

- 7.05 times for the University of Kyoto
- 6.54 times for the University of Osaka
- 6.49 times for the Tokyo Institute of Technology
- 6.09 times for the University of Tsukuba

One informant provided me with his assessment of the global impact of Japanese scientists on international science production by stating

Between 1980 and 1998 Japanese scientists with at least twelve high-impact papers numbered 30 in the whole country (inform_27).

To this informant, Japanese science is not living up to international standards of production. In fact, according to this informant between 1980 and 1998,

Tsukuba only had one citation laureate (inform_27).

This poses the question of where Japanese science ranks with regard to scientific production. A study on citation indicators for Japanese journals appears to address the question of Japan’s global rankings (Haiqi and Yamazaki, 1998). These investigators looked at 128 Japanese journals indexed in the 1994 Journal Citation Reports (JCR) and found that Japanese scientists are publishing “a huge number of articles in

Japanese and in English ... however, these articles had not shown profound influence on the global scientific community” (Haiqi and Yamazaki, 1998).

Data from Haiqi and Yamazaki (1998) support the claim that both the self-citing and self-cited rates in Japanese journals are high. This leads to a tentative conclusion that Japanese journals predominately cited themselves more frequently than others (see Table 5.2).

TABLE 5.2: Top 15 Japanese Journals - Citation Analysis (Haiqi and Yamazaki, 1998)

	Impact Factor	Self-Citing Rates	Self-Cited Rates
Rankings of Top 15 Japanese Journals	1 journal >3.0 3 journals > 2.0 & < 3.0 12 journals < 2.0	1 journal > 20% 2 journals >14% & < 20% 2 journals at 10%-13% 10 journals < 9%	0 journals > 20% 7 journals > 14% & < 20 8 journals < 10%

Source: adapted from Haiqi and Yamazaki (1998)

Even though the numbers may indicate a lagging behind by the Japanese scientific community and a tendency for Japanese journals to cite themselves, one must also consider the fact that Tsukuba University is a relatively young institution that is still growing within the confines of a relatively new city. Thus, citation rates and their meanings may differ between Tsukuba and other research sites in Japan. The trajectory of scientific production in Tsukuba may not parallel that of the larger Japanese scientific community. Thus, the testimony given to me by actors that live and work in Tsukuba is essential for understanding the importance of publishing within the context of work and organizations in this city. Also, Tsukuba University may be influenced and/or influence the citation data in a different manner than other academic institutions in Japan.

Several researchers have studied the productivity and impact of scientific literature (Arunachalam and Doss, 2000). International collaboration on scientific articles has been increasing in most advanced countries. However, as seen in Table 4.21, the collaboration levels in Asia vary markedly. For instance, great strides in the internationalization of science have occurred particularly in China and South Korea. Between 1986-1988 and 1995-1997, Japan’s international collaboration on articles extended from 80 countries to 127.

Table 5.3 reflects the growing importance of China and South Korea in the production of collaborative articles. These two countries are also making progress on the impact of their articles (IFs). These data substantiate the large production of papers that Japanese scientists produce in the context of low levels of international collaboration.

TABLE 5.3: Proportions of research collaboration for Japan, China and South Korea (1998)

Measure	Japan	China	South Korea
Number of papers	60,721	13,878	8,234
% internationally collaborated papers	16.48	28.5	24.57
Average "Impact Factor" for all papers	1.986	1.243	1.430

Source: Arunachalam and M. Jinandra Doss, (2000).

The Organization of Research & Development in Japan

Japan, its culture, and its bicameral political system situate science and technology policy in a unique location. Trials of strength within and between the networks of the science and technology field are revealed between various nodes of the network. These trials of strength (and weakness) are critical to the present analysis. As Latour alludes, trials of strength and weakness are the only reality. It is widely acknowledged that three important periods in Japan's recent past have had enormous implications for the present state of Japan's economy, politics and scientific development. The "post-war," "bubble years," and "post-bubble years" help structure the science and technology policy trajectories in Japan along economic and political spheres of influence.

The "post-war" period can be correctly characterized as a transition phase of development and build-up after the tragedies of World War II. However, the "bubble economy" was awakened out of rubble of a war and ministerial domination. The evolution of MITI-led consortia from a dominant and strong MITI, to a weakened MITI, began in the 1970s and was diminished by the early 1980s. By the 1980s, new, and increasingly strengthened consortia were developed. The intent of these consortia focused on an increased basic research effort. As evidenced by the 1995 Science & Technology Basic Plan, this "collaboration-building" has been reinvigorated in the mid-1990s. The consortia have been translated into obligatory passage points that drive the enrollment of actors. Yet, the center of the enrollment process has also been transformed from MITI to the Japanese companies involved in these consortia. At the same time, corporations tend to be isolates within the field of science, preferring to hibernate within their own research spheres. This is evidenced in the relatively low proportions of corporate actors involved in the policymaking bodies (e.g. shingikai). The next trials of strength and weakness have been between Japanese companies themselves. The main consequence of this process of translation may have been the deterioration of government control of science and technology in Japan ultimately leading to corporate leadership in the investment of Japanese research and development. Japan's Diet and ministries, as well as Japanese and US companies cannot attain their desired interests without the help of the other actors.

Callon's *problematization* (Law, Ed. 1986) is a system of networks between actors. In essence, Japanese science policy can be characterized in this problematization scheme. For instance, if science and technology are to thrive and multiply, the actors involved must necessarily be intertwined to attain this goal. To Callon, one actor gains the interests of another by "...cutting or weakening all the links..."(Law, Ed. 1986,

p.208) the latter actor keeps with others. In this process the identity of this now interested actor is transformed. Therefore, to Callon, this transformation of one actor's interests into the interests of another is "...a 'result' of the association..." (Law, Ed. 1986 p.208). The transformations of association have become clearer since the "bubble" economy.

Funding in the post-War and "bubble" economy years

According to Jon Sigurdson (1995), four-fifths of all government research and development costs in Japan are financed by private companies. The private companies themselves are also involved with a similar amount of research and development. Some have contended, "...budgets are a fair estimate of the amount of interest scientists have been able to secure for their work" (Latour, 1987 p. 168). Thus, the budgets associated with science in any manner will become an important tool for me in assessing networks and associations. However, budgets also have the important purpose of illuminating the accumulation cycle.

In Japan, a triad of circumstances "handcuffed" the Japanese government. This caused a curtailing of government advances in research and development. For instance, Sigurdson (1995) points out that the government created a ceiling on expenditures and resisted tax increases. Also, the corporations, until recently, have been very profitable and have expanded their research and development. Finally, many of the companies have diversified their product development. This move by corporations required large expenditures in research and development. Thus, corporations increased spending on research and development while the government stifled its own spending.

In the 1970s, Japan's economy was nearing the end of its "catch-up" phase in technology development. After completing this successful transition, the government of Japan began to strengthen national science and technology with a new approach. They initiated new collaborative efforts (e.g., Future Generation Basic Technologies program, the Fifth Generation Computer project, the Exploratory Research on Advanced Technologies program (ERATO), more recently initiation of projects like the Real World Computing program, and the Angstrom Technology Partnership have been initiated). The 1970s were active trial-collaboration years for Japanese science.

In the 1980s, the formation of new organizations and financing methods in Japan science policy were created. These systems coupled ministries and agencies, which helped increase the mobility of researchers. At this point, many government research laboratories were reorganized to expend their efforts at basic research rather than applied research. Thus, the 1980s were a decade of reorganization in Japanese science. It is also interesting to note that Japan was roughly equivalent to the U.K., and Germany in research and development expenditures during the 1960s. However, from the 1970s through the 1980s, Japan expanded the differential enormously between themselves, and the U.K and West Germany in R&D spending, in actual dollars, and as a percentage of GNP (NSB, 1989). Increasing collaborations between the public and

private sectors marked by large amounts of funding in research and development would reach a crescendo in the late-1980s as the economic “bubble” burst.

Funding in the post-“Bubble” economy years

Private interests in the 1990s financed nearly 80 percent of Japanese national research and development (NSB, 1998). Most of this 80 percent of expenditures is located within Japan. The government is providing the rest of research and development (R&D) funds (about 20 percent coming mostly from the Ministry of International Trade and Industry -- MITI). In the 1990s, Japanese companies along with Japanese ministries controlled 10% of global expenditures in science and technology activities. The private sector did most of this spending. One reason for this disparity in spending is the Japanese government imposed “ceiling” on spending starting in the 1980s. A consequence has been the curtailing of government sponsored R&D activity. From the 1980s forward, the Japanese corporations have been very profitable and have been able to fill the void of government spending on R&D with their own monies. Thus, private industry’s need of government help has slowly dwindled. However, the government does play a role in Japan’s science and technology policy.

In 1995, the private sector alone allocated approximately 80 percent of the Japanese national monies spent on R&D in Japan. Government contributed the remaining funds. For research and development (R&D) expenditures globally, Japan is second to the United States. However, growth rate in research and development gives one a better understanding of science expenditure trajectories. For instance, Japan saw the highest growth rates among all countries in the early 1990s. But, in FY1993 and FY1994, it experienced consecutive growth rate decreases. However, in FY1995 and FY1996, growth rate increases were experienced again (LRSJ1999-30412, p.101-103). These trends suggest a post-economic-bubble invigoration of government investment in Japanese science and technology.

Research investment is usually reflected in research and development as a percentage of gross domestic production (GDP). For these figures, the early 1990s showed successive declines of government expenditure on Japanese science. However, in FY1995 and FY1996, Japan invested much more funds and these increases remain the highest among major developed nations (LRSJ1999-30412, p.103-105).

By looking at particular investments in different sectors of research and development since FY1975, the university, government and private research institutes in Japan showed slight or no increases in investment. But R&D by the industrial sector is currently running high. Industry remains a large influence in Japanese science and technology. Companies are credited with much of this increase. Between FY1976 and FY1990, R&D spending in industry increased, but the growth rate decreased in FY1991. R&D expenditures decreased for three consecutive years from FY1992, but recovered and began to increase in FY1995 (LRSJ1999-30412, p.106-109). The notion of increasing funds for science in Japan was a routine response during informant

interviews. However, it was never implied by informants that Japan could afford these expenditures.

In FY1996, 15,000 companies conducted R&D activities in Japan. 84.7% of these were manufacturing, 10.8% were in construction. The largest manufacturing companies were evenly divided among general machinery industry (14.2%), electrical machinery industry (13.4%), and the chemical industry (11.7%). Manufacturing accounted for the largest research and development expenditures, followed by transportation, communications, and public utilities industries. Within the manufacturing sector, the majority of the spending was in the electrical machinery, chemicals, and transport equipment industries totaling 70% of the manufacturing sector's expenditures (LRSJ1999-30412, p.112).

In a January 2000 summary of funding (Saegusa, Nature p.4), Asako Saegusa points out that the budget approved at the end of 1999 for April 1, 2000 was the largest ever in Japan. The Japanese government had \$11.8 billion to spend on research. However, out of a ¥84.9 Trillion budget, public-works projects are still the most funded. It is important to note, as Saegusa (2000) suggests, that the Japanese FY2000 budget depended heavily on government bonds, i.e., deficit spending. With the national debt possibly reaching ¥645 Trillion (1.3 times Japan's GDP), the increases in spending on science and technology are seen from within Japan as a future investment in society. However, various surveys (Inglehart, et al. 2000, and others) suggest that Japanese public attitudes are divided on whether or not science is a panacea for many of Japan's societal challenges.

Although the total increase in the FY2000 budget is modest compared to past increases (+0.8% increase from 1999), there are very large increases in particular sectors of science and technology while other sectors are being reduced in budgetary size. I read this as a government priority assessment. For instance, space development and nuclear energy research are being cut, while genome research is obtaining a 50 percent increase (see Table 5.4).

With regard to the arguably the two most powerful ministries in Japan, MEXT and MITI, it is obvious that MEXT has put an enormous amount of budgetary muscle behind collaborative research (see Table 5.5) and MITI has focused funding attention toward biotechnology and information technology, while maintaining hefty allotments to collaboration and nuclear safety (see Table 5.6). Many of my interviews substantiated these developments. However, the interviews also suggest a more laissez-faire attitude by MEXT in that, more independent responsibility for fund raising has been given to the scientists and institutes they are associated with. This type of funding has taken a competitive form that reflects the Science & Technology Basic Plan. This is a double-edged sword. On the one hand, this independence somewhat frees institutes from the demands of MEXT. On the other it ties institutes with corporations and necessarily their research goals.

TABLE 5.4: Japan's Science and Technology Budget (FY2000 \$1 = ¥103)

	Budget (in billion ¥)	Change from 1999
Total Budget	780.3	+0.8%
Genome Research	17.6	+47.9%
Brain Research	20.1	+9.8%
Space Development	170.6	-8.9%
Nuclear Energy (including nuclear safety)	257.4	-3.9%

Adapted from Saegusa, 2000 (Nature, p. 4)

TABLE 5.5: Japan's Ministry of Education Budget (FY2000 \$1 = ¥103)

Funding Type	Budget (in billion ¥)	Change from 1999
Grants-in-Aid for Scientific Research	141.9	+8.0%
Joint Research with Industry	120.9	+2.7%
Postdoctoral Fellowships	17.9	+1.9%
Promotion of Biological Sciences	42.9	+56.5%
Center of Excellence Program	70.2	-0.5%

Adapted from Saegusa, 2000 (Nature, p. 4)

TABLE 5.6: Japan's Ministry of International Trade and Industry Budget (FY2000 \$1 = ¥103)

	Budget (in billion ¥)	Change from 1999
Total R&D Budget	528.3	+4.4%
Biotechnology	10.3	New
Information Technology	10.4	New
Industry/University Collaboration	16.9	+100%
Nuclear Safety	127.8	+22.9

Adapted from Saegusa, 2000

Although funding is an essential element for developing a national science and technology apparatus, policy formation networks that make this funding available to certain groups or disciplines appear to be concentrated around shingikai (deliberation councils).

Shingikai and Standards Boards

Interest groups in Japan are ubiquitous. Government policy in Japan is routinely a task assigned to government "generalists." However, Tanaka (1995) suggests that one of the most important factors in science policy is "Advisory Councils" (shingikai) and that these councils in fact, are full of "specialists." The importance of these advisory council specialists is arguable, since many of them serve limited terms and Ministries are in charge of managing the councils themselves. However, Tanaka sheds light on internal aspects of these councils and provides the notion of dual post-holding as a central feature of control and management of policy in Japanese science and technology.

The importance of Tanaka's summary of the inner-workings of small specialty-oriented groups brought together by the Japanese government to inform ministry generalists in policy decisions is essential to understanding the wider breadth of science and technology culture in Japan. The focus of many Japan scholars has been on bureaucrats, corporations and/or politicians. This "Iron Triangle" seems reasonable if compared in the context of other analyses of political systems (Domhoff, 1998; Pempel, 1998). However, this type of analysis hides the relations between these actors and institutions in favor of a purely structural analysis of elites.

Other investigators (Schwartz, 1998) provide more particularistic models that illustrate the nature of relations in Japanese policymaking spheres. Schwartz posits that shingikai are prominent structural devices in Japan's political policy nodes. As a type of interest group, shingikai offer an avenue for understanding the array of actors participating in policymaking. Several political models (statist, triad, corporatist and various forms of pluralism) do not adequately address the current form of interest group participation in Japan's political system. Schwartz (1998) argues that the shingikai play a singular role in a network of actors that configure the Japanese system of policy. However, he is careful to note that the shingikai work within a fragmented policy system which is made up of both sectionalisms and factions. Thus, shingikai appear to be one avenue of policy formation available to a fractionalized bureaucracy and political domain. For this project, the shingikai merely address a need for a better understanding of the complex actors, agency, roles and institutions that operate in interest group spheres.

Japanese policy networks have also been conceived in terms of the national political system (van Wolferen, 1990; Pempel 1998) but seem to give scant descriptions of the inner-workings of deliberation committees. Even in the hardened writings of physics there are fundamental assertions that the specifics of the microcosms of behavior have to be "...seen jointly..." with the more macroscopic "...surrounding space..." (Genz, 1999 p.187). Thus, observing the outcomes of committees and inserting results of these observations into a macroscopic theory of behavior without understanding how and why these committees are formed and what constitutes their substance has the flaw of misinterpreting or missing altogether the way in which science policy is conducted.

Schwartz (1998) argues that business interests in Japan have become politically more sector-specific. The system of policy making in Japan is diffuse and often reveals opposing interest groups involved in struggles. Thus, the notion that bureaucrats, corporations or politicians are controlling policy in Japan is too simplistic for the present research. Shingikai offer a glimpse into a more complex array of social relations that more likely than not elucidate the mechanisms and relations involved in sector-specific policy decision making. The role of bureaucrats is not novel. Pempel (1974) showed the increasing control of policy by bureaucrats through an increasing role they possessed in legislation. This has led many critics to see the Japanese "system" as a bureaucratically controlled one. However, a more in-depth analysis of shingikai may elucidate a more comprehensive set of meanings.

The importance of shingikai in policymaking can be over emphasized. However, there are direct and indirect links to and from these councils that deserve attention. For instance, the membership of these councils constitutes five major sectors of society: members of parliament, bureaucrats and “old boys” (OBs), interest groups, business and scholars. Regardless of the constituent members, shingikai are “managed” by its own ministerial administration. Membership in shingikai does not appear to be a financially lucrative “career.” Thus, incentives for being a member on shingikai are more abstract. Membership tenure is often short and financial gain does not appear to be an important incentive. In fact, Schwartz discovered that in 1995 most shingikai councilors were paid between \$220 and \$440 per meeting and most shingikai do not appear to meet that often (see Table 5.7).

TABLE 5.7: Shingikai Meeting Prevalence (1985)

“Inactive” no meetings	Less than 5 meetings	5 – 19 meetings	20 or more meetings	100 or more meetings
4.2%	29.4%	41.1%	25.2%	5.5%

Source adapted from Schwartz, 1998 (p.83)

there were 11 councils with 100 or more meetings in 1985 – the proportion is assuming 200 total councils in 1985, since there were 212 in 1992.

Although some investigations (Schwartz, 1998) have found shingikai to be more administratively democratic than one would expect. Others (Pempel, 1974) see inherent conflicts of interest and bureaucratic power in the relationships between shingikai and policy formation. Shingikai may also be understood as another aspect of Japan’s systemic activities in diffusing or incorporating conflicting interests into unified policy. In fact, this may fall in line with some critics of the Japanese “system” (van Wolferen, 1990) in that, negotiation and accommodation have the effect of quelling accountability and responsibility of government. For the present study, the shingikai take on more importance in policymaking when the technical difficulty of the policy being deliberated increases (Schwartz, 1998). This is especially true on scientific issues. When dealing with scientific issues, the ministries, bureaucrats and chairs related to a shingikai must recruit experts in the necessary scientific disciplines. The importance of these experts on shingikai is arguable. For example, policy directions and foundational data are still provided by the ministries in charge. Thus, policy making appears to be hindered by ministerial encroachment on policy deliberations. The relationships between shingikai and their “parent agency” (the ministry in charge of the shingikai) is argued to be communicative and accommodating not dominating (Schwartz, 1998). However, opportunities for domination of the shingikai by bureaucrats, private interests and the ministries are available.

Tsukuba as a “special” case: Tsukuba’s Social Situation

Tsukuba’s population is estimated at 165,968 (National Census, 2001). From 1955 to 1970, the population of Tsukuba had been decreasing but a dramatic increase in population occurred in 1975 due to the construction of the Tsukuba research and education district. Ibaraki prefecture tended to mirror the Tsukuba growth rates. For

instance, Ibaraki's population remained somewhat steady from 1950 to 1960. However, between the 1970s and 1980s, the young and middle aged cohorts showed significant increases in population (see Figure 4.5). This similarity between Ibaraki Prefecture and Tsukuba is a function of Tsukuba being at the center of Ibaraki's population growth.

Between 1975 and 1985, Tsukuba realized a 57 percent increase in population. The rate of growth slowed in the 1990s, but has risen recently and still continues to rise at about 12 percent per year. While there has been growth in the total population, recently Tsukuba household numbers have declined relative to increases in population (see Figure 4.6). This is indicative of a growing population with less numbers in individual households. In 1975 there were 4.4 people per household versus 1999 where there were 2.7 people per household. Available space, cost of living and the nature of work may be contributing to this change in household composition.

Indeed, Tsukuba is a "special place." The fact that the government conceived, initiated, and constructed a scientific city out of farmland and then built an infrastructure around it is a testament to the attention paid to science and technology by Japan's government. Most would agree that Tsukuba is not a nightlife Mecca, nor a place of social extravaganza. Instead, it is primarily a place to work. Informants continually confided to me that Tsukuba has very little of this "social life." This alludes to a major distinction between the "other" Japan and Tsukuba namely, the culture and social situation of Tsukuba is far different than any other city in Japan. Regardless, the University of Tsukuba is a central node of research collaboration in this city and plays a role on the national science and technology stage.

The *ie* System of Family Hierarchy and Occupational organization

In some cases, investigators have suggested that particular aspects of Japanese contemporary culture are not simply vestiges of the past (Gordon, 1988). However, Hess (1995) does argue that the family structural system ("ie") in Japan has been transformed into the contemporary work environment. Hamabata (1990) and Nakane (1974) reveal the important "positional" context or socio-structural aspects of the family in Japan versus the more "attribute" oriented context that other countries like the United States tends to show. From a "positional", socio-structural context, the Japanese "ie" see the position and the organization (whether it's the household or the workplace) as a more important aspect of identification than their mere rank or category as a sibling/boss.

Hall and Hall (1987) extend the interconnections between the *ie* family structure and workplace communication by conceiving an important difference between Japanese and Western communication styles. They suggest that the Japanese culture generally is a "high context" culture where verbal communication is not central. Instead, a large proportion of information is embedded in the context of communications. Hess (1995) interprets the appearance, setting, and social relationship as key contextual frames for the Japanese communication style. Since communication is such an integral part of

any culture (Hall and Hall, 1987), it is important to understand the cultural style of a society so that one's interpretations of the content are not misguided. In the process of studying science some investigators (Genz, 1999) either miss or slight the essential foundational elements of culture that may contribute to the organization and behavior of scientists. Scientists operate within the constraints of a culture. Communication style coupled to a historical context helps in the interpretation of organizational settings.

An important aspect of Japanese culture that affects the organization of science is the historical legacy carried by contemporary culture of the *ie* system of household organization. This system of social relations can be experienced in a relatively arcane manner by observing the system of relations at the dinner table in a typical Japanese house. The middle-aged to elderly woman conducts the creation and delivery of meals for all those at the table and happily sees joy in the contentment of others consumption of her servitude. This servitude is perceived in the context of shifting power relations between genders and age cohorts as "ie" continues to be an integrated cultural artifact affecting most modes of interaction in Japan.

The *ie* system coupled with changes in government, global events, and economic changes has been informally transformed into contemporary Japanese society. The relative stability of the Japanese family, work hierarchy, and gender and family relations appear to be linked to the *ie* system. *ie* was a pre-Meiji practice of household relations. However, in the Meiji Restoration the rulers of Japan changed its informal nature by enacting it into Law. Simply put, the post-Meiji *ie* system was a system of control that connected the individual household to a system of family relations linked to government. Cutts argues that the *ie* system made the household a unit of government and transposed marriage into a type of economic and political alliance" (Cutts, 1997 p. 133). This perspective illuminates the cultural bindings between government and individuals in Japanese society. The male heads of households were owed an allegiance in both social and economic forms. This household system rooted in samurai culture was eventually "eliminated" by Occupation forces. However, its appendages are prevalent throughout Japan today.

Because the *ie* system does not consist of individuals per se, but rather positions in a social structure, it is significantly different than a nuclear family (Hamabata, 1990). Hess argues that one of the most important functions of this "positional" structure is that it is "highly resistant to the unpredictability of individual characteristics and behavior" (Hamabata, 1990 p. 40).

The elimination of the *ie* system after World War II was coupled with a mass urbanization of families. Some investigators (Cutts, 1997) have argued that the *ie* system was transformed into a more applicable form after the war since urbanization caused a dislocation of the family. Males went to work and the women stayed home. Over time, a transformation of women into the head of household turned the "ie" system on its head so to speak. This is only one transformation of the *ie* structure. The change in power status of women within the post-world war II household is arguable. Regardless, marriage is still today rooted in the *ie* system's culture of control. Today, in

contrast to the *ie* system of control, Japan's government is purported to be democratic. The notion of democracy appears to run contradictory to the *ie* system of social relations in Japan.

Tsukuba University

Tsukuba science city, a government planned scientific community located 60km Northeast of Tokyo in Ibaraki Prefecture is home to a myriad of scientific institutes, research organizations, a large university (and smaller college campuses) and corporations. It has a population greater than 160,000 and has plans for increasing this population to 220,000 in the near future (Tsukuba University, 2001 p.58). This city's land area, which incorporates five towns and one village, encompasses 70,543 acres (Dearing, 1995 p.7). The land area of the Tsukuba research and education district measures 6,669 acres (Dearing, 1995 p.7; Tsukuba University, 2001 p.58). The University of Tsukuba is a centerpiece of the research and education district. This university and the surrounding research institutes and businesses along with low average land prices help attract people to this vibrant city.

Tsukuba University was established in 1973 as a result of the relocation of the Tokyo University of Education (Tsukuba University, 2001) in the context of a protesting student population. According to official documents, the management system of Tsukuba University "...is specialized and centralized to reflect the opinions of each faculty" (Tsukuba University, 2001 p.16). The three founding characteristics of this university are: (1) New Systems for Education and Research, (2) New University Government and (3) an Open University. It is a university modeled after the University of California at San Diego (Dearing, 1995). With an American model as a guideline, Tsukuba University has followed an organizational type more similar to that of a German academic setting (inform_15). This university's mission is unique relative to other Japanese universities. The mission is stated explicitly in its bi-annual information bulletin. Tsukuba University is aiming

to establish free exchange and close relationships in both basic and applied sciences with educational and research organizations and academic communities in Japan and overseas. While developing these relationships, we intend to pursue education and research to cultivate men and women with creative intelligence and rich human qualities (Tsukuba University, 2001 p.12).

The official charter goes on to point out that

...Formerly, Japanese universities tended to remain cloistered in their own narrow, specialized fields, creating polarization, stagnation in education and research, and alienation from their communities (Tsukuba University, 2001 p.12).

In conclusion,

The University of Tsukuba has decided to function as a university that is open to all within and outside of Japan. Toward this end, the university has made it its goal to develop an organization better suiting the functions and administration with a new concept of education and research highly international in character, rich in diversity and flexibility, and capable of dealing sensitively with the changes occurring in contemporary society. To realize this, it has vested in its staff and administrative authorities the powers necessary to carry out these responsibilities (Tsukuba University, 2001 p.12).

This “Concept” or what I would rather call “Mission” of Tsukuba University is an important aspect for understanding the University and the culture it resides in. Interestingly, in a similar document published 2 years earlier and even located on the same page number (Tsukuba University, 1999 p.12), the administration evokes the same message, almost verbatim. Yet, “missions” or “concepts” do not necessarily translate into behavioral outcomes. Japan’s University Council (Tsukuba University, 1999) admitted that the selection system to graduate school in Japan has not been revised substantively since 1974. Thus, Tsukuba University should get credit for attempting to put together an innovative system of education. However, whether or not Tsukuba University has succeeded in its reorganization of education is a much more difficult question. In fact, some researchers indicate that the government is essentially in charge and that universities in Japan have little to no power in their own determinations (van Wolferen, 1990; Cutts, 1997). Has their message of diversity, creativity and organizational change been implemented? Is this message reflected in the behavior of students, faculty and staff? These are questions I hope to explore in subsequent chapters.

As a prelude to addressing these questions, an institute Professor I interviewed who leads a biotechnology group in Tsukuba conveyed his idea of the mission and university responsibilities in the following manner:

... (A)bout a quarter of a century ago, the Japanese government decided to establish a science city in the Tsukuba area with big government funded research institutes and these big research institutes are at University Tsukuba ... (A)lso private company research institutes moved here, and more than 100 research institutes are accumulated in this city ... (W)e are the only comprehensive university in this area so expectations for us are to make an academic environment in this science city, so we decided to establish a good relationship between private companies and big government funded research institutes ... (O)ur institute’s main goal is to make a liaison between these government funded research institutes, private companies and Tsukuba University (inform_15).

Regardless of missions, charters, concepts and administrative plans, in many of the world’s educational institutions of higher learning, the students, staff, and faculty of a university are the frontline in implementing, applying and incorporating policy and administrative ideas into their daily lives. The students and faculty I observed in Tsukuba are intensively immersed in their work, have only small amounts of time for

extracurricular activities but generally, seem to be enjoying their lives at Tsukuba University and within Tsukuba city.

Students, Faculty, and Foreigners

According to a recent university publication, the total student population at Tsukuba University is 3,748 of which 1011 are foreign students within a total campus population estimated to be 8,000 to 10,000 students, faculty and staff (Tsukuba University, 2001; inform_26; inform_27). Official numbers place the university's total population around 7,596 proportioned in the following manner:

- 3,848 staff and faculty (including all types of staff) (50.66%)
- 3,748 students (undergraduate and graduate) (49.34%)

These official numbers clarify my informants' reporting of about 8,000 to 10,000 people working on the campus of Tsukuba University (inform_26; inform_27). "Present Staff Members" at TU number about 3,848. Forty-five percent are "Administrative Staff" (1,712 people). The remaining fifty-five percent are the President (1), Vice-Presidents (5), Professors (534), Associate Professors (456), Assistant Professors (485), Research Associates (155), and "Others" (500).

There are 2002 undergraduate students and 1746 graduate students. The foreign student population is much more evenly divided by gender than the total undergraduate or graduate student populations (see Table 5.8). Chinese are the most highly represented foreign students at Tsukuba University with 357 students of which 164 are female or 46% (Tsukuba University, 2001 p.44). Thus, the largest group of minority students represents 9.5 percent of the total student population at Tsukuba University.

TABLE 5.8: Tsukuba University: Foreign, Undergraduate, and Graduate Student Populations (2001)

Status	Total	Males	Females
Foreign Students	1011	547 (54.1%)	464 (45.9%)
Undergraduate Students	2002	1228 (61.3%)	774 (38.7%)
Graduate Students	1746	1206 (69.1%)	540 (30.9%)

Source: University of Tsukuba, 2001 p.50

This university is also home to 78 foreign faculty/professor members (University of Tsukuba, 2001 p.45). The numbers of foreign faculty working at Tsukuba University are low. Officially, there are 47 foreign "faculty members," and 31 foreign Professors (Tsukuba University, 2001 p. 45). China has the most faculty members in one category at nine "Associate Professors." The United States is second to China with seven "Professors" (Tsukuba University, 2001 p. 45). Relatively, the student population shows a higher proportion of foreigners than that of the faculty. Thus, foreigners at TU are concentrated in the student body (see Table 5.10).

For instance, of the 1011 (or 27%) foreign students at TU, China (357), Korea (211) and Thailand (45 students) are the most represented countries of origin. Numbers of

Americans and Canadian students (22 and 5 students respectively) are far behind the foreign Asian populations (Tsukuba University, 2001 p. 44). In contrast to Tsukuba University, at a comparable United States university, Virginia Polytechnic Institute and State University (Virginia Tech), students from India, China and Korea were ranked among the highest proportions of foreign students (Cranwell International Student Center, Table 5.9).

***TABLE 5.9: Numbers of Foreign Students by Level of Education and Full-Time Foreign Faculty at Virginia Polytechnic Institute and State University (2002)**

Classification of Foreigner	Totals	Proportion by Country (%)							
		India	China	Korea	Turkey	France	Thailand	Japan	**Others
*Foreign Faculty	202	11.4	20.8	5.9	1.9	3.0	0	1.9	55.0
**Undergraduate Students	581	17.4	3.8	9.0	7.2	4.1	1.4	2.4	54.7
Graduate Students	1342	28.8	24.5	7.9	2.9	1.7	2.8	0.7	30.6
Totals	2125	24.0	18.5	8.0	4.0	2.5	2.1	1.3	39.5

*source: adapted from data provided by Virginia Tech's Institutional Research data from Census file 9/30/02

**source: adapted from data provided by Virginia Polytechnic Institute and State University's (Virginia Tech) Cranwell International Student Center, 2003

Note-1: "Others" refers to "the remaining foreign students who represent 116 different foreign countries in varying numbers at Virginia Tech

Note-2: Data of students provided by an administrator in the undergraduate offices at Virginia Tech, Cranwell International Student Center and Virginia Tech's Institutional Research department differ slightly from each other. However, the deviations are not significant and do not change the ordering of the highest proportion foreign students at Virginia Tech.

The overall foreign, graduate student proportion for these two schools (Tsukuba and Virginia Tech) runs parallel to each other. For instance at Tsukuba University, the 644 graduate students represent 63.7% of the foreign student population whereas, foreign graduate students at Virginia Tech number 1342 or, 69.8% of the total foreign, student population. The data for undergraduate students are more complicated because Tsukuba University divides the undergraduate population into two categories, "undergraduate" and "other." However, by looking at the similarity between these two school's foreign graduate students, it appears that proportions at both educational levels (undergraduate and graduate) are similar across both campuses. Yet, there are some underlying points of interest with respect to the specific foreign countries that are most highly represented at these universities.

Virginia Tech has a total of 1923 foreign students. Data show that the total number of foreign countries represented at this university, are more than twice the number represented in Tsukuba University's student population (753) and the number of countries represented at Virginia Tech (116 countries represented) is substantially higher than those countries at Tsukuba University (77 countries represented).

Interestingly, China and Korea are in the top 3 at both institutions with regard to highest proportions of foreign students. This may say as much about the growing internationalization agendas of these two countries as it does about the two respective universities.

Chapter 6: DATA ANALYSIS 1: CULTURE

Introduction

A central focus for this study is culture. Hall and Hall (1987) define culture as “primarily a system for creating, sending, storing, and processing information” (Hall and Hall, 1987 p.3). However, other investigators have characterized “culture” in more encompassing ways. For instance, Eitzen and Zinn (2003) define culture as “...the knowledge that the members of a social organization ... share” (p.97). These “Shared ideas, values, beliefs, and understandings shape the behaviors, perceptions, and interpretations of the members of society” (p.97). Regarding the culture of science, Pickering takes culture to mean the ‘made things’ of skills, social relations, machines and instruments, as well as scientific facts and theories” (Pickering, 1995 p.3). These definitions of culture meet in interesting ways on the campus of Tsukuba University.

Tsukuba University is a focal point in the present study. The institutes studied are all located in and around this campus. During the interviews and informal conversations conducted during this project, informants’ stories came “alive.” I have organized these stories into two substantive themes. In the data analysis chapters, I focus attention on these themes hoping to bring to life the stories of informants in a “dance” with other sources of data. Although informant testimonies have been constructed into discrete categories (culture, scientific production and economic affairs), these “themes” are merely devices with “fuzzy” conceptual boundaries. In fact, they have several points of intersection and overlap.

The cultural findings that make up the contents of this chapter include informant characteristics, the culture of scientific work and organization, intra-department communications, and informant attitudes on Tsukuba. These cultural elements are synthesized into common, contradictory and idiosyncratic testimony.

Informant Characteristics

Nakane (1974) recognized that “attributes” blend with “frame” to construct social structure. His conception of an “attribute” is analogous to an informant’s characteristics in this research. Thus, attributes are one element located within a larger contextual frame of social relations.

Informants in this study have unique personal and professional life histories. The mean age of these 27 informants is 35.4 years. Their most representative home cities are Sendai City and Toride City. However, individual scientists in the interview pool originated from most of the districts throughout Japan including Kyushu (southern Japan), Hokkaido (northern Japan) and many locations in central Japan (see Figure 6.1). The regional variation in the sample constituted fourteen Japanese Prefectures and 4 countries (China, Ireland, Japan and United States).

Informants' occupational status included a technician (1), an undergraduate student (1), masters-level and doctoral level graduate students (9), post-doctoral fellows and junior faculty (11), Professors (4), and one multiple-individual interview (1). The ages of the technician (25) and the undergraduate student (22) are similar. The mean age of the graduate students is 26.1 years. The mean age of the post-doctoral fellows and junior faculty is 37.1 years. Professors averaged 55.0 years of age and the mean age of the individuals involved in the multiple-individual interview is 46.0 years. This latter group contained a young Ph.D. scientist, a middle-aged Ph.D. scientist and a public relations officer.

The informants represented five different institutes and several departments connected to Tsukuba University (institutes 1 – 5). One informant was associated with the University of Library and Information Science. This latter university recently merged with Tsukuba University adding hundreds of students, staff, faculty and administrators to "TU." Thus, his organization is not included as an "institute" in this study. Also, another institute (institute 6) was mentioned by one informant during an interview and was not included in the study.

Unstructured, informal interviews were conducted with several individuals having various occupational statuses. The content of these informal conversations are woven into the text of the data analysis chapters. However, the focus of the data analysis sections is more heavily weighted on formal interviews. The interviews provide a unique window into Tsukuba's organizations of scientific work. The culture of work in Tsukuba varies by particular institutes studied. However, there are meaningful commonalities, contradictions, and idiosyncrasies that reveal a particular culture of work and organization in Tsukuba's scientific community.

Structures & Hierarchies in the Culture of Scientific Work

Most informants in this study worked on the campus of Tsukuba University. Although, the research agendas in all institutes were organized around particular types of science, the structural organization of these institutes varied remarkably. For example, two institutes (institutes 1 and 4) focus primarily on collaborative research that includes scientists working on specialized research programs, funded from a variety of sources. These particular institutes' research projects vary by each of their respective sizes.

The much smaller organization (in size and scope of research) focuses attention on the research and development of basic and applied medical research, chemistry and new materials. However, the latter institute (institute 4) being one of the largest public research institutes in Japan has the resources to construct a complex network of scientific collaboration throughout Japan. In fact, the research and development projects in institute 4 have communication networks through two other smaller institutes involved in the present study (institutes 1 and 2). Three of the five institutes in this study are focused primarily on applied science (institutes 1, 3, and 4). However, one institute in this study (institute 2) concentrates most of its energy on basic research. In

many ways, the operating structures and types of science (basic vs. applied) practiced appear to have influenced their organizational culture. The institutional types in this study are important access points for understanding the culture of work in Tsukuba.

Generally, the organizational structures of the institutes are quite similar (with one exception, institute 4). They all revolve around specific laboratory group leaders that reported to internationally recognized Professors. Directors lead each of the institutes' several laboratories and are recognized as administrative figureheads. The lab managers (predominantly post-docs or junior faculty) in each department (research themes) are in charge of daily operations. However, major research decisions are usually made with the consultative support of the principle professors. These latter personnel design the research for their units and lead teams of junior faculty, post-doctoral fellows, graduate students and technicians. The "ideal" type of all organizations in this study was a "flat" hierarchy with collaboration as a central means for conducting research. In reality, a top-down hierarchal structure was universally observed across institutes.

Although the prominent organizational structure observed in this study is that of a "top-down" hierarchy, organizational missions and operations differed considerably. The perceived mission of institute 1 in particular, was truly innovative in that, its goals encompassed being defined by the scientific community as an internationally and nationally collaborative institute. This goal was being conceived in the midst of organizational change. The changes were purportedly initiated to facilitate and incorporate applied research. One of the key organizational elements in this institute is the availability of laboratory space that is flexible enough to allow changes in the physical space of each laboratory. The spaces are then outsourced to collaborative project teams that can adjust the laboratory space to fit their research needs. Thus, the organization, architecture and culture of this particular institute appeared coupled to its institutional mission.

Institute 1 informants reflected in myriad ways about the collaborative science being conducted in their buildings. However, the "science" appears to be constrained by the implementation of specific research agendas or "aspects." Thus, the goal of interdisciplinary research appears to have inherent structural strains in institute 1.

Institute 2 operated in a completely different environment. As a small and informal university institute, it garnered support (both funding and personnel) through the reputations of its eminent leaders (one of which is a Nobel Laureate, the other a well-published veteran in his specialty). Collaboration in this latter institute was self-imposed and not solicited to as in the former institute. This latter type of institute was the "ideal type" in university department/institutes. These types of department-institutes tend to take on more informal organization than other institutes in Tsukuba.

One informant compared a Tsukuba University physics facility to a well-known laboratory in the United States as follows:

I didn't get very high in the administration, but it seems to me that since this occurred before September 11th, if I compare it to what I see in the United States when I go to Brookhaven (Brookhaven National Laboratory in the United States), it's much more informal in Japan, I could have come on site without anybody checking any identity and go into the dorms and late at night usually, there is nobody from the dormitory administration around, they've left your key in a box and on the honor system you take your key and go to your room and at Brookhaven the security is very tight you can't get on site without notifying them before hand that your coming, showing them identity when you do come, and they swipe your guest badge before they let you on to the site (inform_35).

This testimony about the informal codes of behavior at a Japanese University by a Western scientist speaks to the context of the university-style of Japanese physics laboratories – similar to institute 2 in the present research.

The highly planned scientific policy emanating out of the national government (specifically, the Science and Technology Basic Plan) reinforces the organizational behavior by specifying the funding of specific research areas. Thus, top-down policy implementation processes from the government of Japan meld with Tsukuba's unique scientific culture to create ordered but colorful organizational landscapes.

Descriptive landscape of the study sites

About 50 percent of the total budget of Japan's scientific institutes is situated in Tsukuba (Hall, 1997 p. 307). Through grand government economic facilitations, this city has at the very least attracted a lot of capital. This notion of large sums of money being invested in particular research areas within Tsukuba was verified in several interviews (institutes 1; 2 and inform_26). Its inhabitants rarely discuss the cost of building Tsukuba city. But, Hall estimates that it took about \$1.067 billion to build. This leads to the question of quality, worth, and substance for this enormous amount of funding. Hall also points out that the Japanese culture works on a longer time scale than that of Western nations. To the Japanese, a project of this sort is not expected to show dividends for several decades (Hall, 1997 p., 407). Although the quantity of funding provided by a national government to one of its jurisdiction's cities cannot provide a substantive description of the city's culture by itself, it does indicate the relative commitment of investment (funding and other resources) to an area (such as Tsukuba).

Tsukuba, Japan is a uniquely western-Japanese social collage and the varied perceptions of this city by all that enter it are complicated. One influential informant from a progressive institute told me

A quarter of a century ago, the Japanese government decided to establish a science city in the Tsukuba area with government funded research institutes, big research institutes, and these are at the University Tsukuba, and also private company research institutes moved here, and more than 100 research institutes are accumulated in this city ... (W)e are the only comprehensive university in Tsukuba so the responsibility expected from us is to make an academic environment in this science city. (S)o we decided to establish good relationships between the private companies or the big government funded research laboratories, research institutes and the university ... (S)o this institutes main goal is to

make a liaison between these government funded research institutes, private companies and this university ... (T)his is our goal and to make collaborations with various activities in this research institute (inform_15).

Tsukuba resembles a town like no other town in Japan. Its eclectic nature is uniquely its own and the people residing in it have strong beliefs about its structure, its culture and its ambiance. Whether I was enjoying coffee delivered by an “office lady,” or strolling through Matsumi Park near the university, the peacefulness of the people and social environment of Tsukuba, Japan consumed me. However, this peacefulness and calm is situated within a context of vibrant and stressful working conditions. This latter element of Tsukuba is quite common throughout Japan. Yet, even Japanese living and working in Tokyo conveyed to me that Tsukuba is “...a place to work” (inform_33) and conversations with other informants corroborated this:

There is very little social life in Tsukuba” (inform_35).

This uniquely constructed town with odd structural characteristics became “my city” for 4 weeks during October 2002. Two of the several institutes (institutes 1 and 2), comprising 20 informants are main foci in the present chapter. However, all institutes studied are included in varying degrees throughout these chapters. The culture of the city, the institutes, the individual laboratories, their scientific production and informants reflections on the economy play a central role in Tsukuba’s science in the making.

The social landscape of Tsukuba city is concentrated around the work of science. According to informants across all institutes, the Japanese government (specifically, through MEXT and METI) and corporations are the principle providers of funds that keep this enterprise moving. As a national university, Tsukuba also contributes its own funds. However, most of these monies and related resources emanate out of the Monbukagakusho (MEXT). There are special cases where at least one of the informants was completely funded by another organization, specifically a highly recognized national public corporation (JSPS). Thus, the complexities involved in the social landscape of informants’ lives at work and at home are reflected in their cultural, occupational and educational diversities.

Control of the scientific enterprise in Japan has traditionally been in the hands of the national government through the Ministry of Education, Sports, Culture, Science & Technology (MEXT). However, this trend appears to be changing as ministries vie for power while funding structures are nationally reorganized toward more competitive practices. Although, two of the institutes in this study (institutes 1 and 4) appear to be on the leading edge of Japan’s scientific reorganization, the successful implementation of their particular reorganization schemes is not at all certain. Instead, a majority of informants have experienced very little change in the amount of funding and organizational structures. But, some expressed to me that they have experienced personal effects from the economic troubles of the 1990s. Only a couple of informants had experienced negative effects from the economy on their scientific work. The cultural landscape of the institutes in this study does not end with funding and increased

competitive governmental policies. Instead, this landscape is initiated with the locus of Tsukuba's research efforts, situated in Tsukuba University.

The institutes located on Tsukuba University's campus are positioned in "clusters" of departments that follow along disciplinary boundaries (the Engineering cluster, the Biological Science, Forestry and Agriculture cluster, the Policy Sciences cluster, etc.). Each cluster consists of a central administrative/departmental building with adjacent classrooms and laboratories situated in a multitude of additional facilities that are centered within building complexes. Two western informants (inform_26 and inform_27) revealed to me their amazement at the quantity of construction projects going on at the university while the economy is in such dire condition. I not only observed these many projects on campus but throughout the city of Tsukuba and Tokyo. Construction in Japan is characterized by some as a prolific instrument in the "concretization" of Japan.

This study's 3 main research institutes (institutes 1, 2, 3) are all heavily regulated by MEXT. All institutes are currently experiencing some sort of reorganization. Some institutes were in the middle of substantive and expansive reorganizations (institutes 1 and 4) while others appeared to be reorganizing solely because of the mandates brought upon them by university officials (institutes 2 and 3). A central organizational theme across all of the institutes was the decreasing amount of "free" funding from MEXT. However, none of the informants saw any effect on the types of equipment they purchase, the science they conduct, or the funding they are receiving.

In order to understand the commonalities, contradictions and idiosyncrasies revealed by my pool of informants it is necessary to describe the cultural foundations of institutional organization in the context of informant stories about life and work in Tsukuba.

Institute 2 is in the midst of a 5-year project located in the facilities of institute 1. After "winning" an autumn proposal, Institute 2 was given laboratory space and resources by institute 1. This connection brings the two institutes together as "collaborators." However, according to the Director of institute 2, the collaboration is small and insignificant compared to their other work. The actual quality of the relationship between institute 1 and other institutes at Tsukuba University is characterized by both institute Directors in the following manner:

According to the Director of Institute 1

One of the reasons why the support from the university is not enough is that the President (of the university) is not very understanding due in part because he is not a scientist (inform_17).

According to the Director of Institute 2

I have one space at (institute 1) and there is one research associate for my work located there. Institute 4 has a large budget to promote research activity in Tsukuba. Institutes 4 and 6 have 10 times the normal budget size of a regular institute and therefore high-tech equipment is easily purchased. These institutes are (aligned) with METI. However,

institute 1 is aligned with Tsukuba University which is associated with MEXT. MEXT wants the University of Tsukuba to be the leader in Tsukuba. However, METI wants institute 4 or institute 6 to be the leader. I think METI will win (inform_24).

Thus, the weight of institute 2's collaborative effort exerted with institute 1 appears to be superficial in substance. Institute 2 informants suggest that their collaborative work with corporations is more important than their work with institute 1.

They are routinely involved with corporate science projects. The Director of institute 2 revealed that

I work with three companies who ask me to synthesize materials for them. We follow their requests and send these materials to the companies (inform_24).

Thus, the corporate collaborations for institute 2 appear to be uni-directional for corporate research interests only. However, a junior faculty in institute 2 suggested that corporate and government money flowing into his lab has diminished in recent years.

Last year was a very miserable time for funding. Funds decreased tremendously. Every proposal was denied except for one or two Professors in this institute, one or two famous Professors. Compared to other ministries, Monbusho (MEXT) doesn't have a lot of money but our proposals are mainly to Monbusho. And before 1990, many persons, so called recruiters (from companies) would visit us in the lab almost every day and they would bring us souvenirs (laugh) from some place and cookies (laugh), almost every day. And sometimes they brought our students to the restaurants after their cookies. But, they really wanted our students. And then suddenly in 1994, this stopped. It is probably 1994 that is the point of decline of the Japanese economy (inform_20).

The organizational landscapes of institute 1 and institute 2 are poised for collaborative research. However, informant views vary on the quantity and quality of these collaborative efforts. Unlike these institutes, institute 3 has a much different social landscape.

The hospitality of the scientists and staff in all Institutes was impeccably gracious and helpful. However, a stark contrast is noticed when one looks at the different environments that these scientists work in. Institute 1 appeared by any measure as a clean, well-equipped, carpeted and visually appealing scientific enterprise with an atmosphere of sophistication. Institute 2 is extremely informal and projected a relaxed often purposefully disorganized nature. Institute 3 revealed an organizational structure that is as informal as institute 2. However, the work conducted at institute 3 is more aligned with the social sciences and as such, lacks the laboratory facilities seen in other institutes.

Institute 3 is organized more like institute 2. This makes sense in that both of these institutes are officially departmental units of the university. The informal nature of both institutes made visits to these laboratories very comfortable. However, the hierarchies in both still remained concretized in a top-down structure. Foreign lecturers and other foreign Ph.D. holders were usually relegated to their own research and, away from the typical teaching and administrative functions of "regular" Japanese professors.

There was one prominent foreign tenured Professor who was noticeably distraught by his relegated daily duties of researching in his office and occasionally coming out to socialize with the “office flowers.” After having dinner with this professor one evening, he conveyed to me in a condescending tone that

They don't let me teach here, you know, I only have 30 years of teaching experience (laugh) in my home country (inform_34).¹

Institute 3 is composed of four major disciplines, one of which was included in my project. All disciplines were associated with the fields of biology and agriculture. The focus of their research was much different than the other institutes. Its main research tool was a form of case study. Funding remained much lower in this institute than in the natural sciences laboratories. The observed organizational differences are partly related to the socio-structural locations of informants.

Socio-structural location of informants

Networks of Labor

Informant regional histories and educational trajectories play important roles in reconstructing the scientific work environments in Tsukuba. The scientists in my interview pool grew up mostly in “traditional” areas of Japan. Only four spent their early years in Ibaraki Prefecture. Five originated from the larger Kanto district of which Ibaraki is one prefecture. Three informants grew up in the Kyushu district (southern Japan), one in Shikoku (southeastern Japan) and one in Hokkaido (northern Japan). Five informants originated from the Chugoku district (western Japan) and another one was from the Chubu district. Finally, 6 were originally from foreign countries (2 from New York, USA, 3 from China and 1 from Ireland). As diverse as the origins appear, informant educational trajectories are very closely connected in “scientific-familial” relationships. The networks in Japan’s educational system extend to the labor force and bind Tsukuba scientists into familial lineages. The testimony from several informants reveals the networks of institutional accumulated labor.

In reference to the question, “how did you come to your (institute)?” a technician who was working at institute 1 replied

When I was a third year student in college I needed a job, inform_15 gave me a chance ... my professor in college was a collaborator with inform_15 (inform_9).

Informants’ labor trajectories were networked with prestigious Professors in two of the three major institutes studied (institute 1 and institute 2). Three Professors were essentially nodes of accumulated personnel resources. However, the nature of the networks was heavily dependent upon occupational status of the workers. In this research, 75 percent of graduate students in this study came to Tsukuba University by either discovering this university on the Internet or magazines/journals. Family members or academic advisors introduced the other 25 percent of graduate students to

leaders in their current jobs. All female post-doctoral fellows were introduced to their current supervisors by a past graduate school advisor. One male post-doctoral fellow worked in his institute Director's supervisor's laboratory prior to his current position and another post-doc read an academic article produced by his supervisor and decided to apply for a position. The upper-level scientists were all directly connected to past laboratories of their current supervisor.

These professional labor networks coalesce at one important point in each of the two institutes (institutes 1 and 2). The Professor (informant_15) leading the bio-medical group at institute 1 was directly linked to the acquisition of 64 percent of the informants interviewed in this institute. This is quite remarkable in that, this network of labor essentially "breaks" the formal pattern of examination-application-interview processes so prevalent in Japan. Instead, the 64 percent of institute 1 informants were recruited by inform_15 through advisors he had collaborated with internationally and domestically over the past several years.

Regarding labor networks, Institute 2 revealed a similar pattern as institute 1. For instance, 66 percent of the workers in this institute were working in a laboratory associated with the Director prior to taking their current position. Only one upper-level informant (inform_22), a foreign scientist, found his current position through his own soliciting of the Director. The graduate students in Institute 2 followed the general pattern in institute 1 of finding Tsukuba University through conventional searching.

These networks of labor accumulation were not seen in Institute 3. One explanation is that data were only collected on three graduate students during this study. All graduate students followed the general trend of finding the university through friends, family or other sources of information (internet, journals and magazines).

Scientific Training

These labor networks are deeply rooted in educational culture and appear associated with scientific production in Tsukuba. The importance of this is in the level of training that newly hired scientists (all levels) have acquired prior to arrival at their current jobs. Most scientists revealed very small amounts of *formal* on-the-job training. Instead, their scientific training derived mostly from the formal educational system and the large quantities of *informal* on-the-job training. They also experienced a lot of mentoring during their work histories. This form of tacit-knowledge-exchange was prevalent throughout the study.

In reference to a question relating to "on the job training," a 25-year-old technician from Niigata replied that she has had

(H)alf year of training for transgenic mice and three months training for maintenance of mice (inform_9).

This formal “training” appeared to be restricted to technicians. Graduate students and post-doctoral fellows did not reveal any such training. Thus, educational histories and training received were an important part of informants’ scientific work.

A large proportion (38.5%) of the informants received their bachelor’s degrees from Tsukuba University. However, several informants received their bachelor’s degrees from foreign universities (23.1%). The remaining informants received these degrees from 7 other Japanese universities outside of Tsukuba (38.5%). 76.9 percent of Informants had earned masters degrees. Of these informants, 50 percent earned their degrees at Tsukuba University and another 20 percent had earned their degrees at other Japanese public and private universities. The remaining 30 percent of informants earned masters degrees at universities outside of Japan.

The interview pool contained 20 scientists who had earned (or were close to finishing) their Ph.D. in one of several disciplines. Included in this pool of doctoral degree holders are two scientists who also earned M.D. degrees. Both of these scientists earned their M.D. degrees from the same institution where they earned their doctorates. Forty-five percent earned their doctorate degrees at Tsukuba University and 30 percent earned these degrees at other Japanese public or private universities. Twenty-five percent of the informants that had earned Ph.D.s earned these degrees at foreign institutions.

Thirty percent of informants from the 20 doctorate-level scientists were either in post-doctoral fellowships in Tsukuba or had previously held post-doctoral positions. Only one post-doctoral fellow had held this position in another university. Thus, 83 percent of the post-doctoral fellows held this position in Tsukuba during the time of this study.

One of the Professors in Tsukuba described the unique structure of his institute in comparison to other Japanese facilities

(W)e have 7 professors ... and we don’t state which division or department they belong to, instead we call them 7 aspects ... the reason why we call these work teams aspects is we are assuming the traditional name of the research area is outdated ... (S)o here is one scientific group and here is like physics ... in between these guys we need to establish this area, the border area is important to us ... so we emphasize the margins of the traditional research area ... and also we request guidance from the professor, the Director of the aspect ... so anyway we have 7 professors, 7 aspects (inform_15).

Another respondent went on to describe the educational system’s occupational demands

(A) faculty job is very, very difficult to get because of the Japanese economic situation ... (A)lso a faculty job is very difficult to get because many persons want to have this faculty job because faculty in the national university is a public track, you know ... (A) public track is a stable job ... (A)nd in private companies the track is not very stable recently ... (S)o the people after they finish their doctoral courses want to become a faculty member in Japan (inform_20).

Some informants suggested that the Japanese system of education is in need of drastic change. In one interview, an informant alludes to a solution to one of Japan's systemic problems in higher learning:

...(T)hey need real business schools, they need more engineers who learn their engineering in college and graduate school rather than on the job and in class ... but that's what you find is that mostly you know, even our graduate students learn very little in their courses ... where they learn anything if they learn anything at all is in the seminar with their advisor ... and they have to have an advisor from day one (inform_26).

In reference to the stereotype of Japanese students having a relatively easy time in college, one informant (inform_26) suggested

That's true. (W)ell that's traditional here ... anybody who tells you about it, even the Japanese will tell you that college is not a place for working at least not on academics (inform_26).

Idiosyncratic Aspects

Creativity

Creativity and dedication are important elements in Tsukuba's cultures of work and science. Although most Japanese are well known for high production and long work hours, several critics of Japanese society (van Wolferen, 1990; McVeigh, 2002) and some of this study's informants (inform_26, inform_27) questioned the level of many Japanese scientists' creative abilities.

Many informants (8) expressed to me that scientists had a high degree of creativity in their respective institutes. Five expressed degrees of lack of creativity for the scientists at their institutes. Informants who perceived high degrees of creativity in their institutes conveyed to me their colleagues' creativity and dedication with a passionate dialogue.

One foreign informant in institute 2 noted that

Creativity is very important here. Everyday we think of new ideas, every scientist (here) is creative (inform_22).

In reference to scientists' dedication in his institute and lab, he stated,

They always want to do scientific work (inform_22).

One institute Director suggested that

(T)he researchers here (at this institute) are probably the top-rung in their research fields (inform_17).

Three of the five who expressed varying degrees of lack of creativity were working in institute 1, one was at institute 2 and one was working in another institute. They consisted of 1 junior faculty, 3 post-doctoral fellows and 1 graduate student (from institute 1).

One of the post-doctoral fellows suggested a more complex answer to the question of creativity:

...(T)he project leaders are very creative, I think the students would be more, follow what they say (inform_8).

In the same institute (institute 1), an informant (inform_5) claimed the following in reference to placing her institute's creativity on a scale of 0 to 10 (10 being excellent and 0 being very poor creativity):

... I rate it a 5 (laugh).

Those informants that suggested their scientist-colleagues were very creative also revealed that dedication to their work and dedication to their institute was very high. However, for those informants that suggested a lack of creativity in their institute, testimony on both creativity and dedication were quite interesting.

A graduate student (institute 1) who had suggested creativity was localized in the post-docs and Professors noted that

Graduate students have no dedication (inform_12).

When I reminded this student that he was a graduate student himself and asked him if he was dedicated to his work and/or the institute he noted that he was

(N)ot dedicated to the (institute), but more dedicated to just working (inform_12).

Inform_18 declared,

...(C)ompared to United States' Universities, I think that there are not as many seminars here. But, I hope that we have more and invite the other university scientists to give talks, this is very important for communication, to meet scientists, so (we) can improve ... yes, of course there is some scientists (that are) very creative, but I think we can do more creative things, but the environment is not (conducive for creativity).

One informant (inform_26) spoke to the lack of creativity in the educational system and described it as a precursor to lack of creativity in other aspects of Tsukuba daily life. For instance,

...(T)here are maybe 5,000 to 8,000 students here and at least 9,000 of them play guitar ... they have their student festivals and stuff like that so they practice up for the festivals, and then they practice all the time, you know like if I'm here late in the evening I can hear the reverberations from the guitars down the hall where they are practicing in the classrooms ... but, they do not go out, there are no live houses, no bars where you can play and where

people can go in and pay to hear good local vibe music the way there would be at any university this size in the United States (T)his (copying) seems to be very much embedded in the culture that until you are really in the top ranks you don't do anything different from what the masters do (inform_26).

He (inform_26) went on to describe that lack of creativity in research as being related to emphasis on specialization in Japan, in that the capacity for creativity is embedded in a lack of trust for one's own judgment.

...(T)here is not a lot of premium on doing things creatively, there's not a lot of weight placed on people's individual judgment ... for example, we have a very strict requirement that our students, our Ph.D. students publish at least 2 papers out of their dissertation or we don't give them the degree ... the papers are always crap ... because ... you know there written by mediocre students, in a mediocre institution by international standards ... so, they end up in 3rd rank journals of last resort ...now their research, they're real research in most cases, but nobody is ever going to read them, nobody is ever going to want to read them, they'll never get any citations ... and so what's going on here is that the faculty are basically saying that they don't trust each other to make the judgment on the student's work of whether it's worthy of a Ph.D. or not ... and you see this over and over again (inform_26).

The answers from several informants across institutes to the "question of creativity" underscores a system that may not rely on its "lower" lab workers to think creatively, at least not until the workers have "climbed the ladder." This follow-the-leader mentality may constrain innovation in cities like Tsukuba. More importantly, the follow-the-leader ideology at the lower ranks in organizations couples with increased government focus on specific research agendas that reinforces the "specialization-mentality" in science. This coupling may have negative consequences for the future of science in Tsukuba. According to my interview data, some sectors of the scientific community in Tsukuba may be experiencing the preliminary stages of being "left behind."

Left Behind (Foreigners and Women)?

Informant testimony reveals additional cultural complications for certain types of scientific workers in Tsukuba. Foreign and women scientists appear to have certain stressors that their counterparts do not experience. At the same time, it is important to note that these groups of scientists have contributed to their own situations in meaningful ways. For instance, many foreigners refuse to learn the Japanese language, which isolates them from many aspects of Japanese culture. Also, it has been well documented that "resistance" by some sectors of workers, specifically women, is more common than originally conceived (Ogasawara, 1998). Thus, conceiving all Japanese women in administrative positions as "office flowers" may be erroneous.

Some informants suggested that there is a great deal of pressure on women to be successful workers and successful homemakers (inform_5 and others). Christine Williams (1995) and Arlie Hochschild (1989) have documented this sort of social behavior in the form of the "second shift" and "glass escalator." In reference to a

question about the social behavior of men and women in Tsukuba, one informant (inform_8) told me that

(T)hey do mix of course but, compared to the U.K., not as much as the U.K.

If women are not fully immersed in the politics of the workplace, due to the “second shift” and “glass escalator,” negative consequences may arise personally for women and structurally for science in Japan. Since by most accounts, Japan’s society is “aging,” the need for all types of workers will become essential in the future. In one interview an informant put the difference between women and men in the work place in perspective

To get grant money women have to be more productive, it may be that women feel they have to work harder (inform_27).

In 1997, 62 percent of Japanese women were employed on a full-time basis (Kingston, 2001 p. 71). Kingston suggests that the Japanese tax system is discriminatory toward women in that, it pushes them toward “arubaito” (part-time work). For instance, “if a man’s wife earns over a certain amount, both are taxed at higher rates” (Kingston, 2001 p. 71). In fact, this is the case in Tsukuba according to one informant (inform_7). When I asked this respondent for an ideal number of support staff in his laboratory, his response was illustrative.

Inform_7 - If there is one secretary and one technician, these technicians are not real technicians; this is a very interesting point for you to know. In Japan, a lot of part-time workers are married and have children. They want to work but not for much.

Jw - I see so temporary?

Inform_7 - Yes, temporary workers. It is difficult to get temporary workers in Japan now. They are good (for us) because they are cheap.

Jw - why is this?

Inform_7 - Because there is a tax problem. If they work less, if they earn more than about \$7 per hour or maybe \$8 per hour they have to pay taxes and many of these workers are educated women.

Inform_7 - If you wanted to hire 6 people that are temporary, then (you) only (have to pay) 6 million yen to hire 6 people ... Most Japanese large labs have a lot of temporary workers.

These sorts of structural constraints on women have not necessarily led to social revolt in places of work. However, they do seem to have created new structural forms. Part-time and temporary work showed the greatest growth in new jobs during the 1990s. The labor-force participation scheme remains an “M-shaped” one. Thus, most women workers in Japan leave the workforce for child rearing and then return when their “motherly” duties have subsided. Kingston notes in 1998, only 28 percent of women with children under the age of three were working (Kingston, 2001 p. 73). Other investigators have corroborated Kingston’s arguments (Ogasawara, 1998).

In the institutes I studied, women's labor force participation varied by occupation. For instance, there were zero women in physics and chemistry laboratories. However, in biology, specifically a molecular genetics lab, women outnumbered men and represented 70 percent of the laboratory work force. Japanese men did not seem interested in conversing about the "plight of women" in Japan. In part, this may be due to other prejudices that they see in their society.

In one interview, a young junior faculty informant described a system of ageism and alluded to a limitation that Japan faces in utilizing all of its scientific talent.

... (I)f a student gets a Ph.D. (he) is over 27, 28 years old, because to get a Ph.D. takes a very, very, long time. So 27 or 28 year olds have a very difficult time getting jobs. The limitation is age, Japanese society is limited by age ... (S)o students don't want to go to graduate school in Japan. I think the United States is a very good system because if one person has a very good ability ... he has a promising future in the United States but in Japan if people have a really good ability it is not always promising (laugh) in the future ... (S)o that is very, very complicated (inform_20).

A Western scientist (inform_35) described the occupational diversity he noticed in a large Tsukuba physics facility:

I was doing an experiment at KEK, it was part of a large collaboration, the collaboration was headed by a senior physicist at KEK but, there were Russians in the collaboration, there were Americans, there were Canadians, there were Koreans and we would go there and we would take shifts when the data were taken and we would take part in analyzing the data together (inform_35).

However, another foreign informant (inform_22) in this study experienced working in his institute in a quite different manner. He summed up one of the cultural barriers² in dealing with the formalities of supervisors in laboratories at Tsukuba University by telling me that he

... (D)oesn't follow them. (A)lso, I have no chance, so I cannot pay any attention to these customs ... Japan has many customs, so maybe sometimes I will make mistakes (in their customs), but I don't worry about it (laugh) ... (T)hey hate you in their heart, you'll see they don't laugh or smile (laugh) ... (inform_22).

He went on to tell me

I do not like the situation in Japan. (I)t's very difficult to talk with Japanese ... and very difficult to make friends with Japanese ... I do not like this situation, I like people to talk with each other and I like people to make good friends and in Japan it's very difficult (inform_22).

In another interview, a junior faculty described a system of discrimination that is hidden within the structure of science in Japan:

... (S)o, you know Japanese society is very, very, discriminating, a discriminating society ... (Y)ou know we are all Japanese persons here (homogenous society) (laugh) whereas, the United States is not. (S)o if some person is in the United States from Asia, that person

has a very, very, good chance to have a bright future but not in Japan ... (A)s for age, also there is discrimination by age and researchers found some type of biases so and the discrimination circumstances are something different from that of the United States in Japan, our situation is different from you, than the United States but, really discriminating (inform_20).

Work time and free time

During interviews, Informants put a large emphasis on the issue of time. Previous investigations have uncovered succinct attributes that characterize the Japanese culture in ideal typical form regarding time and space. For instance Hall and Hall (1987) suggest that the Japanese operate under a high-context and polychronic cultural context. This typology can be misleading since some cultural contexts in Japan operate under monochronic and low-context rules. In the strict “business” environment, I observed a formal code of low context, monochronic behavior. Thus, verbal communication and uni-task orientations were a main focus. However, the context of such observations seemed to operate in a polychronic (multi-tasks) and high-context (communication embedded in social relations) environment. Thus, understanding the context of one’s work within the context of one’s social relations in Japan is paramount.

The lower occupational level employees in the institutes I studied appeared to have incorporated more free time into their daily lives than the higher occupational level employees. This may have to do with the fact that most of the lower occupational level workers interviewed were predominantly younger workers that were not married and did not have children.

Most Tsukuba scientists spend a great deal of their weekly time at work. In a rather interesting analogy, one informant provided me with an idea of how work time is perceived in Japanese culture. Over a casual conversation at dinner, I addressed the issue of the exorbitant amount of work time that Japanese scientists’ participate in while living in Tsukuba. The reply I received was a religious analogy describing how

You (Americans) have a religious doctrine that tells you your life is divided in thirds. In this doctrine, you spend one-third of your life at work, working, one-third sleeping and the final third is up to you on how you want to spend your time. In Japan, we spend one-third working; one-third sleeping and we choose to work for the final third of our time (inform_31).

In the course of my research, my first impressions of Tokyo and then later Tsukuba were overwhelmed by Japanese constant use of mobile phones, their rapid walking paces and their diligent schedules for meetings. The sense one gets from a visit to Tokyo is that time is of critical importance for most people in Japan. The situation is heightened in Tsukuba. However, after conducting interviews in Tsukuba, my assessment can be refined to mention that time is used as a resource differently across various settings.

The typical worker in my study experiences 12 to 16 hour workdays (Monday through Friday) and works part-time on Saturdays (4-6 hours per day) and/or Sundays. However, several of my informants worked full 6 or 7-day weeks. I asked a single, 34 year old, Junior Faculty member, originally from Sendai, how much free time he has each week? He replied,

I work on Saturday daytime from 9(am) to 6(pm) and then I have free time on Saturday until midnight ... (A)nd Sunday also, I come here (Institute 1) for only a short time (inform_10).

I next asked this informant (inform_10), "Do you know how many hours on Sundays you work, average?" He replied

6 hours (inform_10).

Thus, this informant works 9 hour Saturdays and 6 hour Sundays. Tsukuba is a city where work is the main focus of daily events. Many expressed to me that they had very little, if any, free time during the week. In one interview, I asked the question "How much free time do you have away from work?" to an eminent postdoctoral fellow at a prestigious institute in Tsukuba University. His reply was indicative of the scope of work in Tsukuba.

...(M)y lifetime is almost (all) occupied by the research work (laugh), yes so when I stay in my home ... I read a book or watch a little T.V. for awhile ... just read some books or think, thinking about the work, what to do tomorrow (laugh) I have children so that is an obligation for me, I come to the library, I go read, I drive with my children and hold them (inform_20).

Several scientists I interviewed reported that they work 7 days per week with Saturday and/or Sunday being part time workdays. For instance, a graduate student (inform_6) in Institute 1 reflected on his average workday:

I get up at 8 o'clock in the morning ... and start work at 9 O'clock ... I finish work at 1 am (inform_6).

A junior faculty informant (inform_7) conveyed to me that,

Well, it depends on the day, but usually I wake up at 7:30 morning and come here (Institute 1) by 8 (am) and work here until, until, let's see ... I will have lunch at about 1pm for about 30 minutes ... and some people go outside but, I stay here and take lunch, a kind of delicacy, o'bento ... and, I have a family so I go back to my home to take dinner at about 7:30pm and come back to the lab at 9:30 (pm) ... and work until 12(am), anyway midnight (inform_7).

Further, a female postdoctoral fellow (inform_8) relayed to me that,

It varies from day to day. It varies from 8 o'clock to midnight, I usually try and when I go home I would get something to eat and usually read a book ... we have an hour (for lunch) but, it's optional ... most of the boys go out to restaurants somewhere and the women cook and eat their own food at the lunch table ... maybe guys don't like to cook (inform_8).

Another female post-doc (inform_5) declared that dedication is inferred by weekend work:

...(O)ne who works research on Saturday or Sunday, their dedication is 10 (for a rating scale of 0=no dedication and 10=perfect dedication), but some persons work only (less during regular work week hours) and report to their home at 7 or 8 (pm), they are not so dedicated (inform_5).

In Tsukuba, the amount of time spent at work is not only a required element for keeping a job it's an essential component for an individual's advancement and promotion within the organization.

Intra-department Communications: meetings

One informant (inform_26) conveyed to me the lack of research conversations at conferences and in social settings. According to his testimony, Japanese scientists tend not to discuss work while socializing. Unlike Western scientists who generally enjoy the discussion of their research at conferences and in social gatherings, the Japanese avoid these sorts of discussions. Instead, for Japanese, family and "fun" conversations are the foci of "out of work" discussions. Japanese scientists generally save their work conversations for work. My informant described this activity as a barrier to true collaborative networks. Thus, professional idiosyncrasies such as excluding research conversations during social activities may be embedded in Japanese culture. This could be a function of the larger Japanese communication style since some have reported that the Japanese tend to operate within a "high context" framework (Hall and Hall, 1987). Nonetheless, the Japanese work environment is consumed with meetings.

In this study, intra-organizational communication is best understood by informants' accounts of meetings, support staff available and availability of mentors or experts when questions arise during research. The activities, durations and frequency of meetings are important parameters. Data collected on the activities, duration and frequency of meetings suggest large differences in the organizations and intra-department communications between institutes. Additional data were collected on the need for laboratory support personnel and access to staff when research questions arise.

Lab workers in Institute 1 attended 3 meetings each week lasting 1 to 4 hours each in duration. The longer length meetings usually include presentations of research by graduate students, junior faculty and post-doctoral fellows. Institute 2 scientists (all occupational statuses) participated in one weekly meeting that lasted approximately 3 hours. In institute 3, graduate students did not have planned meetings unless they or their advisors requested them. However, the faculty and staff of this latter institute participated in varying numbers of meetings throughout each week. The obvious variation in quantity and length of meetings between the institutes appears associated with the level of formality in each institute. The more formal the institute, the more meetings were held and the longer their durations. Institute 1 spends the most time in meetings of all organizations in this study and happens to be the most formally operated

and organized. Institute 2's participation in meetings was much less than institute 1. However, scientists in this institute still participated in one lengthy meeting each week.

The meetings in all institutes followed a similar pattern with regard to activity. They all focused on research and research results. Most of the institutes devoted much of the meeting time to staff presentations of research results. The presentations were followed by critique and advice from senior faculty. This intense weekly focus on scientific research may be a contributing factor to the general lack of communications about research outside of the work environment.

One informant volunteered to me candidly that in Japan there is not a lot of up front communication. She mentioned that

actually, I find there is a lot of behind-the-scenes things, like administration is all in Japanese ... when I was getting my Ph.D. (outside of Japan) my advisor told me everything ... we would go for a coffee break ... and he would tell me ... yeh, it's different (here) (inform_8).

According to one informant (inform_26)

(T)he intra-departmental battles tend to be much more overt in Japan, everybody knows where the lines are drawn and they stay that way for a long time because the only way to make progress within the organization is to go with the group ... whereas, in American organizations, if you can get the ear of the guy at the top, you can make these decisions and suddenly things snap and go ... which ever way you think they should (go) or maybe whichever the way somebody else thinks they should and you don't like that very much ... but in Japan, there's this tendency of inertia and so the groups within tend to be very stable ... and that's one of the reasons I think that we see very little change (inform_26).

Weekly schedules for the presentation of research results are taxing on scientists who were obviously putting in large amounts of work time on actual lab research. Since most informants suggested some level of need for "support staff," a burden on the researcher's time and efficiency may be an important factor in research. By not meeting "support" needs, a deficient number of support staff may also have the consequence of burdening upper-level scientists with technical and administrative questions from the bench-level researchers. In fact, scientists' attitudes toward their work and their organization may be related to the lack of "support staff."

Attitudes about Tsukuba

Tsukuba science city is an intensely concentrated with scientific workers (Henini, 1999). It is a controversial locale among the national populace. A professor in a prestigious institute at Tsukuba University pointed informed me that

The university and the research institutes were funded in this area 25 years ago, so no restaurants, no culture, no organization ... just the university and research institutes ... but then we had a city built up and there were parks, or fun, or other places ... many faculty started coming by themselves and leaving their families in the traditional city areas

(of Japan) ... (I)n most cases, almost all of the faculty leave their families behind ... so, like in my case I came from Sendai to this city, from Tohoku University to this city here and I came with my family, and my family is living here, and I commute by car ... (M)y daughter goes to school in this area ... and so all of the scientists start living in this city and sometimes you know, the newspapers or the magazines make fun of us in Tsukuba ... (T)hey report that we scientists are usually committing suicide ... but that's not true, that happens everywhere ... also some of these reports about scientists in Tsukuba show that we are a problem in restaurants or must leave restaurants or that we have drinking problems but that's not true ... (I)n this city we have many Ph.D.s, more than twelve-hundred ... (O)ne thousand Ph.D.s probably several thousand Ph.D.s, in this city, and so the academic atmosphere created in this city is rather unique and no big business type people in this city ... here it's scientists ... we can see many big names, many big named scientists in this city (inform_15).

A Chinese informant (inform_18) working in a prestigious physics laboratory politely suggested that in Tsukuba it is easier than China or the United States to conduct research. He told me that,

...(T)sukuba is an exciting city so there is a lot of national institutes. Recently, I stayed at UCR (University of California at Riverside) for one year and I worked with a professor, but, I found at UCR that if we wanted to do an experiment and wanted to use the high power superconductor magnet, we couldn't because it is very expensive, but we can contact the national institute here and we can use this equipment.... (S)o, we can use it anytime, but of course we must make an appointment, so it is a very good environment here. If you have a creative idea, you can do very excellent ... but I found at UCR because it is a small city and there is so many researchers (I can't use the equipment). I also study novel compounds and want to investigate its properties and there is so many equipment so, I am very happy here (inform_18).

Also, the high concentration of scientists in Tsukuba may contribute to the specialization that is so prevalent in this culture. For instance, an informant (inform_26) conveyed to me that

...(T)his is a very strange, strange social environment (Tsukuba) ... at the school that my daughter will most likely go to, I am told that 90 percent of the children have at least one doctoral level degree in their family (inform_26).

A junior faculty member (inform_7) at a prestigious institute in Tsukuba described the city in this way

Japanese students, high school students, have to choose bunkei (business people) or rikei (scientists), and rikei is scientists, bunkei is lawyer and let's say economist or businessman or something ... and most of the Japanese cities are made up of businessmen, I mean bunkei people (business people) ... but, in the case of Tsukuba most of the people are rikei ... and this is quite unusual ... and so this means each family is all rikei family ... and their children are all rikei, so the education of Tsukuba city is very, very high. (O)ne problem in Japan, is the people in the rikei, scientist people earn less money than businessman, maybe it's the same case in United States ... there is one report that shows that almost half. I'm not sure, but one scientist can earn about 100 million yen per life (he draws the 100, 000, 000 million yen on the board) (for a life) ... for a life ... but this is scientist (he points to the 100 million yen, per life), businessmen earn twice ... these two (comparisons in the report) guys have almost the (same education) from the same university, so the same manner ... so, this result shows that most of the high school

students want to be businessmen, not scientists ... but, in Tsukuba, most of the people are here (he points to Rikei on board and income level of 100 million yen per life) this is quite interesting thing ... the atmosphere of the city is so different (inform_7).

When asked about whether or not this informant's (inform_7) child will get the same education here versus Tokyo or Kamakura or somewhere else, he replied

I think it is much better here ... that's why, that's why I built my house here ...for my child (inform_7).

In another interview, an informant (inform_1_2_3) described "Tsukuba problems" in terms of the Japanese youth. For instance, she maintained that

Tsukuba is a very beautiful place to live but, (Me and my family with 2 daughters and husband) had a difficult time adjusting at the start of moving here ... Children in Tsukuba have a very difficult time adjusting and this means that there will be many problems in the future regarding the children of Tsukuba (inform_1_2_3).

Tsukuba was created with the vision of bringing scientists together. However, the city is a pre-planned metropolis modeled after Western ideals of society and as such, its appearance is far more Western than any other city in Japan. This contradiction is not forgotten by the Japanese living here. Although, the project of building this city began in the 1960s, the testimony of informants suggests that this city is an oddity that is still in its infancy. Yet, the odd nature of this town (by Japanese standards) isn't quite Japanese and isn't quite Western.

There were informants who provided glowing accounts of this wonderful city and its hospitable environment and there were also informants who provided far more negative testimony from their experiences. However, most informants portrayed Tsukuba in an ambiguous light. The attitudes informants displayed about Tsukuba seem rooted in their perceptions of Japanese culture. The planned nature of Tsukuba takes any "chaos" out of the city and reveals a rather sterile environment for most Japanese.

Data from 26 informants were collected on attitudes toward life in Tsukuba. 46.2 percent (12) of the informants perceive the city of Tsukuba in ambiguous terms. These informants included 9 men, 2 women and a multi-individual interview. The content of their ambiguous responses varied. However, in most cases they began their replies with "Tsukuba is good for studying," "Tsukuba is good for research," or "I'm very happy with my job in Tsukuba." As the questioning continued, the "ambiguous informants" displayed more negative attitudes toward life in Tsukuba. Most of the criticisms of this city revolved around its "planned" nature and the lack of "amusements" available to the citizenry.

The 9 men in this "ambiguous group" consistently focused upon how much they enjoyed their research work but disliked living in Tsukuba. There were several important themes given to why they disliked life in Tsukuba:

1. no types of work available other than scientific work
2. no shops or trains
3. not enough collaboration in research
4. cultural mannerisms of the Japanese make life difficult in Tsukuba
5. few “amusements” (bars, restaurants and movie theaters)
6. other universities have more elite students

Thus, those who view the large concentration of scientists in Tsukuba in a positive light have colleagues who view this concentration in negative terms.

The 2 women in the “ambiguous group” gave far more general responses than the men in this group. One female scientist in this group rated her job satisfaction as “8 out of 10” and her daily life in Tsukuba as “5 out of 10” (the scale was referring to a scale I had drawn up for a different question). The other female in this group would only say “I am not so happy in Tsukuba.”

34.6 percent (9) of the informants revealed attitudes about Tsukuba that were very positive. Seven of these informants were men and the remaining two were women. The three most mentioned positive attributes provided by these informants were Tsukuba’s “natural environment,” “closeness to Tokyo,” and “...the many scientific institutes” available to researchers. The men in the “positive group” focused on the good quality of research in Tsukuba and the many institutes within close proximity of each other. The two women in this group were positive about Tsukuba because their friends were located there and “it’s less expensive than Tokyo.”

The “negative group” consisted of 3 men and 2 women (19.2%). The three men in the “negative group” provided three general classifications of dissatisfaction with life in Tsukuba. Their attention focused on “crowded living conditions and nothing to do,” “embedded top-down organizations that never change and a poor educational system,” and “professors like Tsukuba but there is not much humanity for students.” Interestingly, two of the men were foreign faculty (both from the United States) and one was the only undergraduate student in my sample.

The two women were both from institute 1. These women portrayed life in Tsukuba in the context of their family and work. One of these female scientists (a divorced mother of one child) felt that she was spending far too much time at the institute and not enough time with her family. The other female scientist observed problems with many of her male and female counterparts who had marriages that were displaced due to working spouses that live in Tsukuba during the week and travel home weekends. She noticed an inordinate amount stress put on these “commuter spouses.” However, data in this study indicate that commuting was not a significant issue. In some cases, spouses and other family members were living in different regions of Japan and even other countries. However, the majority of informants (50%) commuted to work by car averaging 22 minutes each way. The other 50 percent of informants walked or commuted by bicycle averaging 10-minute one way commutes. These commutes in such a vibrant city are not long by any standard.

Commonalities, Contradictions and Idiosyncrasies

By constructing a cultural theme out of informant testimonies, I have uncovered tentative connections that outline informant characteristics, institutional landscapes, the networks of labor, scientific work, and attitudes about Tsukuba. This conceptual apparatus leads to a description of the commonalities, contradictions and idiosyncrasies that contour the social field of scientific work in Tsukuba, Japan.

Commonalities

Most respondents in this study were male Japanese scientists. The foreign scientists involved tended to be focusing on their own research which is outside the boundaries of their respective organization's occupational hierarchy. Regardless of informants' origins, most perceived meetings, collaboration, and intra-departmental communication as key elements of their organizational structure. Most of the scientists in this study were intricately involved with research and development. Their daily work is a focus of daily life.

Many informants have portrayed the culture of work in Tsukuba as an intensive system of labor where "free time" is limited and lengthened work schedules are exhaustive. Work tasks tend to be driven by a predominantly "top-down" organizational structure where "real lab work" is cut off from the upper-level scientists. The main organizational tool used in the more formal institutes is the "meeting" which occupies a tremendous amount of scientists' time. Meetings are almost always centered on in-house presentations of research results. However, upper-level scientists also participate in several university administrative committees each month. Informal institutes in this study exhibit less meeting-behavior and more often use informal means of communicating. This latter organizational form appears to be conducive to creativity and institutional dedication.

Contradictions

Generally, scientists were passionate about their research and work environment. But, they disliked "life in Tsukuba." This evaluation can be assessed in the context of the larger Japanese culture. One informant conveyed to me that the Japanese people "...need a little chaos in their lives." By most accounts, Tokyo and other traditional cities in Japan provide this chaos whereas Tsukuba inherently lacks it. Tsukuba's planned infrastructure necessitates a sense of societal organization and the Japanese people have readily recognized this city as "odd" compared with more "chaotic" cities elsewhere in Japan. This planned city (Tsukuba) seems to foster well organized networks of labor. In some ways, this planned network of labor contradicts the open, collaborative research environment that literally written into Law by the Japanese government.

The largest cultural contradiction in Tsukuba appears related to the comparison between “living” versus “working” in this city. Most scientists interviewed in this study describe the “oddity” of Tsukuba in relation to its overemphasis on planning and organizing the city. A little chaos is accepted in Japan as “normal.” However, planned communities that explicitly attempt to eliminate this chaos are seen by most Japanese as void of culture and life. As such, most Japanese do not feel totally “at home” in Tsukuba. This notion of chaos helps explain the deep-seated contradiction between scientists loving their work in Tsukuba, but disliking living in Tsukuba.

Another important contradiction emanating out of the interviews is the formal dictates of Tsukuba City and the Japanese national government espousing the interdisciplinary nature of Tsukuba Science City (Henini, 1999). Unfortunately, I saw little evidence suggesting substantive interdisciplinary work. In fact, to the contrary, the raw interview data suggest that the personal networks of elite scientists in the institutes studied have attracted like-minded scientists domestically and from abroad which led to increased focus on even more specialized scientific research (see Figure 6.1).

One of the most important structural contradictions in this study lies in the labor networks. The governmental “plans” for Tsukuba and most of the institutes and scientists in this city conceive of Tsukuba as a “collaborative” or “interdisciplinary” city. However, my findings suggest that the institutes (specifically Institutes 1 and 2) have nodes of accumulated resources through particular eminent scientists. Most of this accumulation is created through personal contacts both domestically and abroad. These nodes of labor accumulation do not appear to contain the “interdisciplinary” or “collaborative” elements that officials from the national government and this city routinely espouse.

Idiosyncrasies

There are important idiosyncrasies that emanate out of this study. First, the institutes themselves have peculiarities that make them uniquely situated to conduct their particular scientific research. Most striking is the informal versus formal structures of the different institutes. The divide between the different types of organizational formality appear to be related to the university-government-industrial divide in larger Japan. Interestingly, this is the same division of labor in science that the national government is attempting to liquidate.

On the micro-level, there are idiosyncrasies specific to the cultures of each institute. For example, creativity, dedication and work time are perceived in particular ways by particular institutes. Although most scientists confer that their colleagues are creative on some level, certain groups of scientists (Institute 1) perceived lower levels of creativity than others (Institute 2). Scientists from the latter institute conceptualized their particular environment as engrained with creativity. It was also interesting to find that the Professor/Director of Institute 2 was immersed in laboratory work himself unlike any

other Director I met in Tsukuba. Although his actual time in the laboratory averages about 20 percent of his weekly work proportion, his participation alone is significant.

Each institute paid differing levels of attention to work time. Scientists in the more formal organization (Institute 1) tended to associate nominal work hours with occupational advancement in their institute. On the other hand, Institute 2 focused less on nominal hours of work and more on the “science” or the “discovery” of interesting phenomena. The significance here is that institute 2 appears to exhibit a more open and creative environment for “doing science” than other institutes in this study. However, evidence of “interdisciplinary science” is still lacking throughout the study. Also, both institute 1 and institute 2 contained foreign and women scientists in their labor hierarchies.

The various institutes in this study also revealed some interesting idiosyncratic characteristics. Institute 1 contained a large proportion of women scientists. However, no women scientists within any of the organizations studied held top-level positions in their labor hierarchies. Institute 2 contained a few women scientists but, none of these scientists were observed or interviewed. The most important idiosyncrasy observed was the distinct level of formality in particular institutes. Institute 1 is a highly formal organization with strict “chain of command,” explicit organizational charts and planned and routinized meeting schedules. In institute 2, a much more informal organization, there were no such formalities. In fact, the only formal character was revealed in the planned weekly meeting held for all staff. In institute 2 everyone was accountable to the Director and routinely spoke with him at varying times and days. At the lower levels, two junior faculty ran daily operations for the two separate themes of research. However, even graduate students were able to speak with the Director on a routine basis. This contrasts drastically with the formal organization in institute 1.

Foreigners and women appear to be lagging behind on the “occupational ladder.” Most foreigners were relegated to their own research outside the boundary of the “promotion ladder.” This may be due to their informal statuses as “contract workers” (foreigners) or “temporary workers” (women). For the former group, language may also play a part in the creation of barriers to occupational networks. Yet, some foreign informants describe to me that their skills were not being utilized sufficiently. For example, two junior faculty informants who had married Japanese spouses and had been living in Japan for more than a decade each described how they have remained in similar jobs, teach very little (something they would like to do more of) and struggle daily with the politics of their particular organizations. It is interesting to note that both of these foreigners are fluent in the Japanese and English languages. These two scientists were both American. In fact, there was more animosity toward the Japanese from non-Japanese Asian scientists. Their criticisms focused on the culture of organizations in Tsukuba and how they do not feel comfortable in their particular work environments.

Women were most concentrated in one of the institutes studied (Institute 1). In this institute they maintained a proportion of 70 percent to 30 percent men in their laboratory group. According to informants, Institute 2 had a “couple of women scientists.”

However, there were no women in the laboratory where I conducted interviews. Interestingly, Institute 3 had many women in their department. However, only 1 of 10 total scientists was a woman Ph.D. holder. Most of the women in this latter institute were graduate students.

The cultural evidence emanating from observations and interviews of the scientific work and organization in Tsukuba have led to some tentative conclusions that contain common, contradictory, and idiosyncratic interpretations.

Conclusions

Cultural commonalities, contradictions, and idiosyncrasies are revealed through informant interviews as complex sets of beliefs, values and attitudes making up networks of social organization. The informant dispositions reveal both uniquely Japanese and more global aspects of the culture of science in Tsukuba.

Interviews in this study reveal both common individual characteristics/behaviors and common structural aspects of the organizations studied. Generally, the informants were of Japanese ethnic backgrounds, male, and with a mean age in their mid-30s. These informants tended to be relatively new to their occupational positions (the mean time spent in informants' current positions was 5.5 years). The mean age for institute 1 informants is 35.2 years while informant mean age in Institute 2 is 34.7 years. There is essentially no difference in mean age across these two institutes.

The scientists in this study spend an extraordinary amount of time at work and exhibited low levels of free time away from work. Most of the scientists spent their free time at home. However, there was also a commonality across institutes, suggesting scientists higher in the occupational hierarchy tend to spend greater periods of time at work than those lower in the hierarchy. These same elite scientists were also leaders or Directors of their respective institutes.

Organizational structure was also important in this study. Informants' attitudes on meetings, collaboration, and communication played important structural roles in their particular settings. Structural commonalities included meetings, perceptions of collaboration and funding sources.

All institutes in this study had both informal and formal modes of meetings. Although the institutes varied in the number of meetings per week, the subject material for the "weekly meetings" was always in-house research results. These meetings contained members from different laboratories. However, institute 1 was the only organization that included scientists from multiple disciplines in these weekly meetings. Institute 2's meetings included its two separate "theme" laboratories, but not multiple disciplines.

The cultural factors that have led to a synthesis of contradictory results focus on scientist's perceptions of Tsukuba, collaboration and labor networks. Most scientists in

Tsukuba were passionate about their work. However, these same scientists, generally, do not like living in Tsukuba. This seemingly contradictory belief system can be explained by informants' testimony. It appears that "chaos" in the Japanese culture is somewhat enjoyed to a certain extent. A "planned community" lacks this chaos. The Japanese exhibit a dislike for this sort of community based on the perception that it isn't really "Japanese."

Institute 1 scientists perceived their organization to be highly collaborative in structure. This structure of "collaboration" was written into their mission and an integral part of their scientific work. Institute 2 chose their own collaborations and collaboration was not a central focus here. Both institutes collaborated with international and domestic scientists. These commonalities help illustrate the similarities that connect disparate scientific research units in Tsukuba. However, each of these institute's informants' suggest contradictory findings that are interspersed in this web of common characteristics.

National priorities of collaboration between universities, industry and the government appear to be contradictory to actual laboratory science in the institutes. These national priorities seem largely symbolic and not effectively integrated into the scientific institutes that they are purportedly transforming. This contradiction in national priorities and actual laboratory science may be related to another contradiction – the interdisciplinary focus which appears contradictory to the accumulation of personnel by elite scientists. In the two main institutes in this study (1 and 2), elite scientists had recruited most of the scientists in their group through past affiliations. Thus, an "application process" did not seem to be a part of the recruiting program in these institutes. The importance of these contradictions is that elite scientists are recruiting only from within their discipline and as such, the national priorities associated with collaborative and interdisciplinary research are being slighted. In a sense, this appears to be the institutes' mechanism for negotiating national policies. This analysis is further complicated when one examines the idiosyncrasies exhibited in the organizations under study.

At the organizational level, there are distinct idiosyncratic characteristics for each institute. At the macro-level, institute 1 is more formally organized than institute 2. One of the most interesting idiosyncratic characteristics of these institutes involves workers perceptions of creativity and dedication to their and their organization.

Many scientists in my study perceive a high degree of creativity in their respective institutes. However, some informants suggest that creativity is localized in the higher levels of the occupational hierarchy that is at the post-doctoral and professorate levels. Others are more critical. For instance, two informants (inform_26 and inform_27) posit that the problems of creativity are located in the structure of the educational system itself. A common thread that runs through the question of creativity in Japanese science appears to be the heavy reliance on specialization and lower expectations that more junior employees need not think creatively. Interestingly, the dedication that workers feel toward their organization appears related to their level in the occupational hierarchy. Thus, those in lower positions seem less dedicated to their organization.

However, many of these same individuals are fully committed to their “work.” Thus, Japanese laboratory workers and those in temporary positions may psychologically separate the organization from the work they do when providing perceptions of dedication.

Time at work may seem to be an appropriate measure of dedication. However, I found that informants in the two major institutes studied (1 & 2) revealed completely different views of how they incorporate hours of work into their perceptions of time at work. For instance, most informants in institute 1 visualized work hours as a nominal measure that is directly related to their positions. Thus, institute 1 workers see work time as related to dedication towards their work and their organization. However, institute 2 scientists generally see work time in a more abstract context. Institute 2 informant views on work time could be a mere anomaly or related to a sampling error. Yet, their views become more salient in that, they represent perceptions from a leading laboratory that has been named a Center of Excellence in Tsukuba. Women and foreigners tend not to be the main focus of science in Japan. I first understood this fact, when conducting my pretest at NIH with two Japanese scientists from Tsukuba. However, this in no way indicates that foreigners and women are not deeply involved in Tsukuba’s work force.

In this study, foreign scientists tended to be relegated to separate offices and/or separate forms of research. Although, their research was related to the main foci of their respective institutes, the foreign researchers tended to be on different occupational tracks that did not put them into the main occupational hierarchies. In fact, all of the foreign scientists in this study had identifying titles that concretized their statuses. For instance, one was a foreign post-doc working with an international public funding institute. Three others were “Foreign Lecturers” who saw little to no teaching responsibilities even though, two of them were fluent in Japanese, had married Japanese wives and had lived in Japan for more than 10 years each. Women in this study were concentrated in institute 1 and there were no women Directors observed in this study. One woman scientist did hold a high-level position as a Ph.D. laboratory leader reporting directly to a Director of their institute. However, I also observed that her tasks included many administrative duties for the Director – something I did not observe for the male scientists at a similar occupational level. Thus, the qualitative high-level of respect and positioning of this medical doctor was mediated via the administrative tasks she performed.

The scientific production and economic affairs of scientific work in Tsukuba have been somewhat circumvented up to this point. In the next chapter, I undertake an analysis of these factors.

Chapter 7: DATA ANALYSIS 2: SCIENTIFIC PRODUCTION AND ECONOMIC AFFAIRS

Introduction

The scientific production reflected from the testimony of informant interviews and observed in Tsukuba during the course of this study focused primarily on informant article and conference activities, work tasks, and economic affairs exhibited in each institute. In this chapter, particular attention is paid to Institutes 1 and 2 due to the concentration of informants in these institutes.

Tsukuba was described to me as a city where people work (inform_33; inform_34; inform_35). One informant (inform_32) described his life as a bank executive in Tokyo as full workdays during the week and drinking with colleagues on weekends. When I inquired how much time he spends with his wife and child, he exclaimed “...it is better now because I spend weekends at home, but I still enjoy drinking with colleagues during the week.” This contrasts with a much more strict code of behavior in Tsukuba¹. For instance, routine weekly work hours rarely leave time for social gatherings during the week. Informants described to me average workdays of 12 to 16-hour days that take lab workers and managers into late night and early morning hours. Sunday is universally a day of rest and relaxation in Tsukuba. Most of my informants did not work on Sundays. However, several conveyed to me that they occasionally work on this day. Generally, scientists in my study conduct research 6 days per week.

Scientific production in Tsukuba is integrally related to the culture of time at work. One informant described to me

(If one wants to get ahead in this organization one must work on the weekend (inform_08).

Scientific production in Tsukuba can be characterized through interviews and more formal indicators such as professional articles, professional conference presentations, work tasks and the economic affairs of the particular institutes involved. The former types of measures take great precedence with scientific communities in Tsukuba.

Scientific Production

Published Articles

The quantity of published articles produced by informants in this study varied widely across and within organizations. Data were collected for three of the five institutes studied (Institutes 1, 2, and 3). There were 891 professional articles published by 24 informants. However, most of these articles (847 or 95%) were produced in two of the three institutes (Institutes 1 and 2). Of the total articles produced, 741 (83.2%) were written in English for international journals and 150 (16.8%) were written in Japanese for Japanese journals.

Four scientists (2 in each institute) produced most of the published articles in this study. For example, at institute 1, two scientists published 408 articles (45.8% of total articles produced by sample) of which 340 (38.2% of total articles) were written in English for international journals. One of these scientists had published 228 articles (25.6% of total articles) and the other had produced 180 (20.2% of total articles). At Institute 2, one of the two most cited individuals had published 202 articles (22.7%) while the other scientist in this institute had published 55 articles (6.2%).

In this study, two institutions (Institutes 1 and 2) had produced most of the professional articles (approximately 46% and 29% respectively). Four scientists in these two organizations had published 75 percent of the total articles in this study. Also, only 75 (11.3%) of the 665 articles written by the 4 “elite” scientists were published in Japanese. These data suggest that a small number of highly published scientists are producing large numbers of articles and these articles are published mostly in English through international journals (Griffith, 1980).

Institutes 1 and 2 revealed similar patterns in their choice of language with respect to published articles. However, numbers of articles and their proportions differed (see Table 7.1).

TABLE 7.1: Professional Articles for Institutes 1 and 2 (percentages)

Journal Origin/Language	Institute 1	Institute 2
In Japanese Journals in the Japanese Language	18.7 (104)	7.6 (22)
In International Journals in the English Language	81.3 (453)	92.4 (268)

() = actual numbers of articles

Conference Presentations

Even though some have suggested that Japanese scientists do not send in their best articles for publication (Haiqi and Yamazaki, 1998), my informants' conference presentations were less prevalent than their production of articles. A total of 535 presentations were conducted across the three main organizations in this study. Again, the same two institutes (Institutes 1 and 2) that were high volume producers of articles were also leaders in production of presentations. However, the data show that across organizational types, the scientists in this study present at Japanese conferences (using the Japanese language) at far higher rates than they present in English at international conferences.

The two prominent institutes conducted 525 conference presentations. Institute 1 informants produced 183 (34.2% of total presentations) while Institute 2 scientists had conducted 342 presentations (63.9% of total presentations) in their careers. Of these professional conference presentations, Institute 1 informants conducted 123 presentations (67.2% of Institute 1's total presentations) in Japanese at conference sites in Japan. Institute 2 informants presented 258 times (75.4% of Institute 2's total presentations) in Japanese at conference sites in Japan. The scientists at these two institutes produced 381 presentations (72.6% of these two institute's total presentations) in Japanese at conference sites in Japan. Scientists at these institutes also presented papers at 60 (Institute 1) and 84 (Institute 2) international conferences over the scientists' careers using the English language (see Table 7.2).

TABLE 7.2: Conference Presentations for Institutes 1 and 2 (percentages)

Conference Location/Language	Institute 1	Institute 2
At Domestic (Japanese) Conferences in the Japanese Language	67.2 (123)	75.4 (258)
At International Conferences in the English Language	32.8 (60)	24.6 (84)

() = actual numbers of presentations

These data on conference presentations suggest that my study informants present mostly at Japanese conferences using the Japanese language. However, unlike this study's published article data, where production is concentrated in the hands of a few "elite" scientists, my informants' conference presentations were more evenly distributed throughout the occupational hierarchy. At the same time, it is interesting to note that two of the three institutes are producing the bulk of professional articles and conference presentations. One reason for this may be the third institute's focus on case studies. Also, 3 of the 4 respondents in this third institute were graduate students. These descriptors of the sample may allude to the relative lack of article and presentation production in Institute 3.

Laboratory Work

Work tasks in this study's sample varied widely in both type and intensity. Informants' occupations ranged from Directors of Institutes to technician. The general types of work among similar occupational statuses were comparable across institutes. For instance, technicians focus on maintenance of equipment, cleaning and data collection. Graduate students spend most of their time supporting the work of post-doctoral fellows

and junior faculty and junior faculty are largely responsible for implementing day-to-day operations in the lab. Professors in this study apply large amounts of time (70-100%) to administrative duties. Generally, workers across occupational types and institutes spent Mondays through Fridays in their place of work for 12-16 hour days. However, weekend work varied from no hours to 8-hour days on both Saturdays and Sundays.

Across institutes, daily starting times for work each day ranged between 7:30am and 10:00am. The ending time varied from 5pm to 2am (the following morning). Ending times and weekend work are directly connected to the occupational hierarchy. For example, the higher one's occupational status the more likely s/he will spend longer hours at work and the more likely this person will work weekends. I often wondered how many of my informants found the time to "enjoy" work. Their testimony provided insight into this question.

"Waku Waku Suru" in the Lab

Informants were asked to provide aspects of their work that make them most excited (*waku waku suru*). Generally, the technician and graduate students revealed that the various scientific practices they performed were most enjoyable. For example, a technician in Institute 1 described her favorite task with an analogy

I must inject DNA to fertilize the egg. (A)nd sometimes it's very interesting, it's like a shooting game (inform_9).

The post-doctoral fellows, junior faculty and professors overwhelmingly (100%) suggested that their most enjoyable aspects dealt with the discovery of new materials, phenomena or processes in their research. One post-doc revealed that she just liked to see "...*things work out*" (inform_08). However, the majority of these "upper-level" respondents conveyed to me their interests in "new discovery" and "discussion of results" with students and other researchers.

In one interview I asked an informant "What is the most enjoyable part of your job?" His reply was

(T)hat's a very difficult question ... (W)hen I'm doing the experiment, some days it is very, very, amazing for me, but sometimes I am very tired ... (Y)ou know, chemical experiments are very hard work for us ... (I)t takes a very long time, so we don't know what has happened in the experiments for some time and sometimes it goes slowly so it's not waku waku suru ... (S)o, I like the experiments because working with glassware is very attractive (laugh) ... (M)y most exciting work is sometimes when I succeed I am very delighted ... (Y)ou know, when I succeed at experiments it is at that moment I will be excited ... (B)ut when time passes I forget the experiments (laugh) ... (A)lso I am excited, I have a dream for the future ... (T)he dream is also very difficult to become a real one ... (F)or example the superconductor polymer is very exciting but one that is very difficult to do actually so mine is a very (laugh) confusing, exciting and trying time (laugh) (inform_20).

A prestigious Professor/Director of one of the institute provided his comments on his most enjoyable aspect of work as follows

My most interesting research is when I have several failures in the research plan but then find out a new phenomenon or result (inform_24).

During the course of interviewing and touring facilities, I observed the enormous pride and enjoyment that many scientists had toward their research. Their facial expressions and body language revealed an underlying passion for scientific research.

Work Tasks in Institute 1

The laboratories in all institutes studied varied in size and scope of research tasks according to their unique disciplines. Institute 1 reflected an atmosphere of efficiency and orderliness. This institute was impeccably clean. Arriving at institute one was an experience that melded some interesting aspects of both Western and Japanese culture. One of the first experiences I had while arriving at institute 1 included the traditional exchange of street shoes for slippers before entering the carpeted hallways of this institute. During a tour of this facility, some laboratories were so clean as to appear “not used.” On the other hand, institute 2 exhibited a stark contrast to institute 1. Upon walking into the laboratory of the former, it was difficult fitting down the bench top aisles without touching a maze of glass tubing, rubber hoses, Bunsen burners, laptop computers and Gerry-rigged contraptions spread as high as 5 feet off the top of the tables. This particular laboratory was the main working area for about 5 graduate students and 3 post-doctoral fellows. The entire laboratory space was about 20 feet wide and 15 feet deep. This is a sharp contrast to the multi-level wide open and flexible spaces observed in institute 1.

Institute 1 was not solely a clean place of business. It was home to four major collaborative laboratory teams. My interviews took place in the largest laboratory of these four units. This particular laboratory contained administrative and lab facilities on all three floors of the institute’s “B-wing.” Its equipment is “state of the art” which is also reflected in the layout and architecture of the buildings. Tasks in this laboratory were discretely separated by occupational status. There were three major types of workers (lab workers, lab managers and Managers/Directors). These three classes of workers produced the majority of scientific work in this particular institute. The manager/director of this particular laboratory had one female secretary that he paid for out of his personal income. The secretary was responsibly solely to the manager/Director.

The classification of “lab worker” includes 7 informants that were composed of technicians, graduate students and post-doctoral fellows. The four females and three males in this category have an average age of 29.3 years. The 3 lab managers (all Ph.D. junior faculty, 2 males and 1 female) have an average age of 35 years. These lab managers could be said to be the workers who made sure day-to-day operations were being organized and completed. Finally, there were 3 manager/Directors interviewed. These scientists are all Ph.D.s (and in two of the cases M.D.s as well). Their average age is 48 years and they seldom (if at all) conducted actual laboratory work. They are

mostly scientific administrators. One of these latter informants was the Director of the institute itself and the other two were Professors or Directors of specific “aspects.” The scientific labor in institute 1 revolved around conducting experiments with various animal models (zebra fish and mice). However, one of the labs in this institute geared its research toward chemical and new materials analysis without the use of animal models. I investigated both labs and interviewed informants in each of these labs. Structurally, most informants spoke to me about the interdisciplinary nature of their institute. However, I observed a more separated disciplinary matrix where several areas of research were essentially sub-projects of the larger “aspects,” and as such, sub-disciplinary research. All of the laboratory groups (aspects) in this research facility appeared self-sufficient and self-reliant. More importantly, they operated under separate specialties. All “aspects” had designated laboratory space separated from the other disciplinary “aspects” or research spheres. There was an unusually large amount of time spent by scientists in their laboratories. According to the informants themselves, they performed a myriad of tasks. However, there is some consistency in the pattern of tasks performed (see Table 7.3).

TABLE 7.3: Institute 1 Work Tasks

Occupational type	Main daily tasks	Longer term tasks
7 laboratory workers	Maintenance and cleaning of fish tanks and mice cages, “running experiments,” DNA cloning, maintenance of cell lines, sampling and genotyping	In-house meetings and presentations (form of report), conference proceedings
3 lab managers	Lead research team for specific projects, lectures at university, preparation for teaching, administration of laboratory workers, writing proposals for funding, research meetings	In-house meetings and presentations, troubleshooting laboratory problems, liaison between manager/Director and laboratory workers
3 manager/Directors	Writing proposals, writing research papers, administration of staff, research meetings	In-house meetings and presentations, international conference proceedings, proposal selections committee for new institute projects

Daily work time is consistent within occupational types and remains similar across the institutes studied. However, there was one exception to this rule. The seven laboratory workers reported significantly different hours. The technician in this institute reported working an 8-hour day during the regular workweek and no work on the weekends. The three graduate students averaged 14-hour days during the regular workweek and part-time work on the weekends. However, the three post-doctoral fellows in this category averaged 16-hour weekdays and part-time work on the weekends. Therefore, in the “lab worker” category, hours worked per week dramatically increased as occupational status increased.

The 3 lab managers averaged 14-hour workdays during the week with part-time work on the weekends (or, in one case no work on the weekends). The three manager/Directors worked hours that were similar to the lab managers in all respects. Thus, the lower

occupational levels committed less hours of work to the organization than upper-level scientists.

Work Tasks in Institute 2

Institute 2 is located off one of the central roads on the campus of Tsukuba University. It is situated in one of the tallest buildings on campus with administrative offices on one of its floors and two laboratories on a lower level annex. The administrative offices take up an entire wing of one floor and the laboratories are dispersed in three rooms one floor below. Each laboratory is in a separate small room and houses the projects for its particular research themes. The third room is shared for “measurement” equipment and lectures.

One of the most striking observations upon entering this institute is the pervasive informality of the scientists and their work. Formal clothes are not seen and in fact, the schedules and pace of work is much more informal than in institute 1. Two junior faculty members lead the research themes. These faculty members are responsible for the research and daily operations of their particular research themes.

The informalities of this institute seemed to permeate through all levels of the occupational hierarchy. This was most evident in responses from graduate students indicating their ability to seek advice directly from the Director and any other faculty in the institute. Institute 2 lab workers appeared much happier and relaxed than their counterparts in institute 1. I observed a very active group scurrying between different rooms and performing several tasks at once. All of institute 2 informants praised their Director. Although none of the lab workers or lab managers suggested any need for additional personnel support, the Director himself noted that additional 3 or 4 post-doctoral fellows would greatly aid their research.

The four lab workers were each assigned to one of the two research themes in this institute. However, all informants (including the lab managers and Director) suggested that their goal centered around one task – finding novel compounds. This was a stark contrast in comparison to informant views in institute 1. Institute 1 interviews revealed a consistent dialogue containing the focus on collaboration and interdisciplinary work – abstract conceptions of scientific work. However, in institute 2, the informants consistently revealed their connections to their specific scientific expertise and showed very little interest in the overall scope of the scientific enterprise (as in collaborative work or interdisciplinary thinking). Instead, “discovery” of new phenomena and novel materials are their *raison d'être* for institute 2.

The graduate students' days focused around two major tasks: measurements and synthesis of compounds. Post-doctoral fellows led their own research and the daily research tasks for their particular lab theme. The laboratory managers filled the role of mentor and advisor to the graduate students. However, the post-doctoral fellows appeared solitary doing their own research connected to the institute's themes. The common trends in the daily and longer-term tasks that workers in institute 2 performed parallel typical chemistry/new materials laboratories (see Table 7.4).

The nominal amount of time spent at work for scientists at institute 2 was far less than that of institute 1. However, the informal nature of the organization appeared much more conducive to creativity and basic research than institute 1's environment.

TABLE 7.4: Institute 2 Work Tasks

Occupational type	Main daily tasks	Longer-term tasks
4 laboratory workers	Measurement and synthesis of compounds, running experiments, chemical structure analysis and drawings, classes	Discovery of new compounds
2 laboratory managers	Reading scientific papers, preparing for lectures, proposal writing, email communication, administration of research theme (research and staff)	Discovery of new compounds, writing proposals for funding, conference proceedings
1 manager/Director	80 % administrative work, 20% laboratory work (only on weekends), administration of staff, preparing for lectures, reviewing papers, proposal writing, university committee meetings, email communication	Discovery of new compounds, writing proposals for new funding, conference proceedings

The four “lab workers” interviewed (graduate students and post-doctoral fellows) in institute 2 averaged 10.1 hours of work each day with no work time on the weekends. The two lab managers (both junior faculty) averaged 11 hours of work each day and occasionally worked on weekends. The one Professor (and Director of institute 2) worked 12-hour days during the regular weekdays and conceptualized the weekend as his “time to conduct laboratory work.” Therefore, a key difference in the work time and culture between institute 1 and institute 2 is the level of organizational formalities and the immersion of Professors (specifically junior faculty and the Director of the institute) into actual laboratory tasks.

The scientists at both institutes did not perceive the Japanese economy as greatly affecting their organizations. Regardless, the importance of the economy was detected from testimony on scientists’ personal lives and in texts and documents that describe the problems with the Japanese economy. Thus, economic affairs are an important aspect of the overall field of scientific culture and production and need to be brought in to the story.

Economic Affairs

Most facets of the Japanese economy have had extremely difficult times surviving since the early 1990s. In a recent newspaper article, the sacred game of Pachinko², taverns

and karaoke-bars are all struggling (Belson, 2003). The blame has been squarely put on the "...falling land values and growing risk-aversion of the struggling banks" (Belson, 2003). However, Belson does note that rising unemployment and falling wages have left consumers with less pocket money to pour into "games like pachinko. At the same time, the younger generation is shifting more toward video games and sports like skiing and surfing. Thus, pachinko at the turn of the millennium may end up being a cultural relic sooner than expected. But, before it is a relic, according to Belson, many of the parlors are now offering amenities to draw customers in.

Besides faltering entertainment businesses, Japan has also experienced banking fiascos. Although some have blamed the financial crises in Japan on "Japan Inc-like practices" (Schlesinger, 1998), there have been fundamental banking mishaps in other cases (The Weekly Post, 2002). In April 2002, the "mega-bank," Mizuho Bank (one of the largest banks in the world) was created by the merger of three major corporations (Daiichi Kangyo Bank, Fuji Bank, and Industrial Bank of Japan) was involved in concealing a "glitch" (Mainichi Interactive, 2002) that caused panic for both private depositors and corporate clients. Bank cards were not usable and corporate clients had major problems with banking accounts that caused a banking "crisis." More importantly for this project is that the government had known about the problem and evidently did nothing about it.

At a Financial Committee meeting of the governing Liberal Democratic Party (LDP) held on April 15, Hirobumi Gomi, Director of FSA Inspection Bureau, responded, 'Our agency had sent official notice to Mizuho and said to them, 'We have found serious problems in the computer system. You must solve the problem before the end of this year.' The notice was reflecting our inspection which we conducted in the last fall (The Weekly Post, 2002).

As the short story above depicts, the Japanese economy is integrally linked to the Japanese political system. Ministries and various bureaus in the Japanese government play an important role in doling out funds and constructing "Plans" of action outlining specific trajectories for different economic sectors. Since MEXT is a primary actor in the funding and planning of education and science in Japan, it is one of the most important ministries in this study. Perhaps more importantly, MEXT's focus on research types, funding specificity and personnel are the substance of its plans. Thus, a description of informants' testimony regarding the directions of science and technology in Japan as related to funding, personnel and research flows is needed. Informant views on these matters help elucidate both formal and informal scientific organization in Japan.

Scientific research networks in Japan appear to be related to the success of scientific institutes and their particularistic scientific agendas. The Japanese government has initiated "projects," especially since the end of the War and more importantly, since the 1960s, to enhance the cooperation of public and private research efforts (Callon, 1995; Hall, 1997). Two institutes in this study are important examples of the drive for a competitive scientific culture in Japan. Institute 1 and Institute 4 act as exemplars for the government-led drive toward increased collaboration and competitiveness in

Japanese science. These institutes show both commonalities and differences in their size, scientific operations and funding breadth.

One prestigious informant in this study (inform_24) described to me that only one of these organizations (Institute 4) would succeed due to their overlapping competition for resources (public and private funding resources and scientific personnel resources). The personnel makeup of the two institutes reveals striking differences. As of November 2001, Institute 4 had approximately 2,400 researchers spread across several research institutes in Japan. During this period, Institute 1 supported a fraction of this quantity of researchers on one campus at Tsukuba University. Another important factor in the differences between these two “novel” organizations is their age. Institute 4 emanated out of a historically famous laboratory about 100 years ago. Whereas, Institute 1 is a youthful institute that was created in 1994. To the Japanese government, these institutes (1 & 4) represent future models of scientific organization. Therefore, a comparison of these institutes is important for understanding external economic factors influencing science in Tsukuba.

According to Institute 4’s informants, expansive research agendas (6 major disciplinary sectors from life sciences, information technology, environment and energy, nano- and materials sciences, geological sciences, and standards and measurement technology) are the foundation of a “...flexible organization” (inform_1_2_3). This institute is one of the largest public research institutes in Japan. In fiscal year 2001, its annual budget was approximately \$690 million of which \$540 million was provided by Japan’s government.

In recent years, both Institute 1 and Institute 4 have focused much of their attention on new materials research and the life sciences. However, the internal focus of these organizations differs with regard to these two disciplinary research agendas. Institute 1 appears more focused on the life sciences while Institute 4 remains focused on new materials research. According to informants in both organizations, Institute 4 puts more emphasis on nanotechnology while Institute 1 structures its organization around medical-genetics research. This fact may partially explain Institute 2’s Director’s comments on Institute 4 “winning” the battle over institute 1. These trends are also reflected in the numbers of researchers working in these areas of research. For instance, Institute 1 houses about 50 researchers in its life sciences laboratories (plus a network of international and domestic experts) and a mere 4 scientists in its new materials laboratories. Institute 4 maintains 508 researchers (20% of Institute 4’s research labor force) in its nano-technology laboratories and 279 researchers (12% of Institute 4’s research labor force) in its life sciences labs. These data show a divergence in research focus among important but differing nodes that house collaborative science teams.

The networks of science emanating out of these two important organizations are seen in the “invitation” of leading researchers. Although both organizations have associates in foreign countries, most “leading researchers” connected to these organizations are from

Japanese universities. I inquired about this concentration of Japanese experts. They replied

Foreign researchers do not want to work here because there is more opportunity in their home countries (inform_1_2_3).

Another interesting contrast between these organizations is reflected in their internal and external evaluation systems. Institute 1 has an external review conducted by an “outside evaluation committee” every 6 to 7 years. They are also monitored by a university *shingikai* (deliberation council). However, Institute 4 has an extensive “Review Board System” that not only evaluates the organization but also ties individual scientists to the “review” system. The “reviews” at this institute are conducted in 3 and 4-year intervals which presumably coincide with individual scientists’ contracts with this organization. In a sense, this sort of “tenure” system is coupled to the organization’s review and evaluation.

The system of reviews at Institute 4 is integrally related to the personnel salary system. Informants told me that this innovative personnel system is the first of its kind in Japan and is still in its infancy with regard to evaluating its success. This system allows for “bonuses” and provides “short” and “long-term” evaluations for institute personnel. Institute 4’s review system appears to be a tool that is penetrating the scientific enterprise in hopes of stimulating competitive practices. However, initial findings suggest that these practices have not taken hold in Tsukuba. Therefore, it is too early to predict the successes or failures of this novel personnel/organizational review system.

The Economy’s influence on Science and Scientists

With the exception of 4 informants, scientists in this study did not perceive any effects of Japan’s larger economy on their institute’s scientific work. The four exceptions (three in institute 1 and one in institute 2) perceived some effects on their institutes’ budgets and revealed that government funding was more difficult to obtain. Three of the exceptions were laboratory workers (1 graduate student and 2 post-doctoral fellows). The other exception was the Director of institute 2.

The majority of scientists (16) saw no effect from the economy on their particular scientific operations. This group of informants was made up of 11 men (4 graduate students, 1 post-doctoral fellow, 5 junior faculty and 1 Director) and 5 women (1 technician, 2 graduate students and 2 post-doctoral fellows). Interestingly, all junior faculty members saw no effect from the economy on their particular institutes. However, 40 percent of the post-doctoral fellows experienced an effect and more informants perceived the economy as intruding on their personal lives.

Ten respondents expressed that the economy has affected them personally. Forty percent (4) suggested that the economy has affected their future job prospects (3 graduate students and 1 post-doctoral fellow). Twenty percent (2) suggested that they had experienced a downward change in salary or savings and 10 percent revealed that

they had recently had trouble paying their rent. The other 30 percent experienced negative effects but could not give specifics. One of these latter informants also mentioned that corporations have been the most affected in Japan's economic situation. This latter comment indicates that the "type" of science being conducted (basic vs. applied) in Tsukuba may be in transformation.

Basic versus Applied Research

Informants' perceptions of their own institute's proportions of basic versus applied research varied remarkably across occupational status. For instance, in institute 1 only one informant perceived his laboratory as performing 50 percent or less basic research. The remaining informants at this institute ranked their lab's basic research at 80 percent and thus, performing only 20 percent applied research. On the other hand, institute 2 informants perceive their lab's work consistently at 80-90 percent basic research. Only one informant at this latter institute viewed the institute's work as less than 80 percent basic research (he perceived the number to be 70 percent basic research).

The data collected on informants' perceptions of their lab's basic and applied research versus their overall institute's research type was consistent within each institute. However, there were notable exceptions. For instance, one junior faculty informant in institute 1 who perceived his own laboratory work as 85 percent basic research viewed the larger institute as conducting 40 percent basic research. One post-doctoral fellow in this institute perceived her laboratory work as 95 percent basic research but saw the larger institute as conducting 50 percent basic research. According to informants in all laboratories of institute 1, their work was geared toward medical research and as such assumes a large proportion of applied work. However, in institute 2, as mentioned previously, the focus of research was geared toward "discovery" of new materials and as such assumes a larger proportion of basic research. In institute 2 there were no deviations between scientists' perceptions of basic versus applied research between their own lab's work and the larger institution's research.

Interestingly, the proportions of basic or applied research in the institutes studied appear to be linked to the particular informants' perceptions of company-associated work at their institute. Institute 1 informants all reported that they conducted mostly university-related research with very few corporate ties. A junior faculty scientist in this institute gave a specific proportion of corporate work he conducts. He suggested that his lab has about 10 percent of its work that utilizes corporate collaborations. The ties to corporations in institute 2 were much more open and direct. The Director of institute 2 provided a detailed analysis to me regarding the proportions of government and corporate work in his lab. He noted that 80 percent of the funding and research is tied to MEXT, 10 percent is tied to the university and 10 percent is tied to industry. One of the junior faculty informants concurred with this analysis by suggesting "private companies provide us with extra money." This latter testimony indicates that industry is not the major provider of funding for science at Tsukuba University. Instead,

corporations appear to be providing supplementary funding to the institutes at this university.

An increased emphasis on applied science can affect the structure of organizations involved with scientific research. For this study, the importance of proportions of basic versus applied scientific research lies in the link between “type” of research and the governmental tools or mechanisms used by government to facilitate research in Japan. The most prominent government tools that I observed in Tsukuba were the TLO and the COE.

TLOs and COEs as Stimulus?

Tsukuba Licensing Organizations (TLO) and the Center Of Excellence programs (COE) have been described in government documents (MEXT, 1997) as important tools in the process of reorganizations in Japan’s science and technology sector. During the course of informant interviews, I inquired about these organizations.

Informant knowledge of TLOs and COEs was virtually non-existent at the lower occupational levels in all institutes studied. Considering the publication of government documents and institute pamphlets outlining the prestige of these organizational tools, it was surprising to find that lab workers and even a small proportion of the lab managers had little knowledge of these organizational tools.

Seven of the 13 informants in institute 1 did understand what the TLO was and only 4 of these informants had ever conducted work with a TLO. All four of these informants were upper-level personnel (which included 2 junior faculty and 1 manager/Director). These latter informants in institute 1 were also the only scientists who knew what a COE was. All of the latter respondents conveyed positive testimony about the workings of the TLO and COE.

In institute 2, three of the seven informants understood the meaning of TLOs. But, only 2 of these 3 respondents knew what a COE was. This was extremely surprising, in that, the institute itself had recently been awarded COE status by the university. Two of the three informants that knew about TLOs indicated that the TLO is essentially irrelevant to their work. This is a significant finding in that Institute 2 is conducting official research within the confines of a TLO. One informant works on a project housed at institute 1 and collaborates with their TLO (inform_24). This informant conveyed to me a lack of importance of TLOs by revealing that several other organizations that are much larger and have more equipment and funding perform the functions of the TLO and will most likely make it an irrelevant entity in the future. According to this informant, TLOs are supposed to provide joint research between the university and industry. One of the TLOs main functions is to transfer university scientific results to companies, thereby stimulating industrial activity. According to inform_24, since there is plenty of other organizations already engaged in these activities, the TLO is not playing a large role in Tsukuba’s scientific work.

Three weeks prior to my arrival at institute 2, the institute was awarded COE status. According to one informant (inform_16), there are only 3 COEs awarded in Tsukuba (one each to a materials science group, biology group and sports and health group). However, informant_24 suggested to me that this status has had virtually no affect on the funding or work of his institute. The TLOs and COEs appear to be national and local management tools that are supposed to stimulate planned trajectories of scientific work in Japan. However, the TLOs and COEs in Tsukuba seem to be overshadowed by larger research organizations with more personnel, equipment and funding. Informant testimony suggests that the TLOs and COEs in Tsukuba are only having small local effects upon scientific research. For example, one informant in institute 1 noted that his institute has only produced about 5 patents in the past 2.5 years (inform_17). Several informants suggest that the TLOs and COEs are relatively new tools and that time will predict how well they perform as mechanisms of stimulation in the scientific communities of Tsukuba. This latter comment coincides with the Japanese cultural trait of more long-term expectations for large projects.

Commonalities, Contradictions and Idiosyncrasies

The above second theme in this data analysis chapter has focused on the scientific production in Tsukuba and the effects of the Japanese economic situation on structures of work and scientists. In this section, there are several commonalities, contradictions and idiosyncrasies derived from informant testimony. Perceptions of informants on the published articles and conference presentations in their laboratories were similar across institutes. However, the governmental tools observed in the literature contradict the observed laboratory practices and work tasks. Further, actual laboratory work tasks are particularistic to specific institutes and industry-related collaboration seems attached to perceptions of applied versus basic proportions of scientific work.

Commonalities

The most shared attribute of institutional scientific production in this study is seen in informant article publishing and conference presentations. Most of the informants' published articles were produced by a small number of elite scientists. More importantly, these eminent scientists produced largely English-written manuscripts but presented their papers using the Japanese language at mostly domestic conferences. This is an interesting commonality in that many informants expressed to me their troubles with writing documents (email and letters) in English. Thus, this simple commonality appears to be transformed into an interesting contradiction. If scientists in Tsukuba (and probably Japan) dislike and have problems writing in English, why do they produce most of their professional articles in English? My hypothesis is that foreign scientists (specifically, post-doctoral fellows and junior faculty) play a large role in manuscript editing for their respective institutes. This was characterized as a part of foreign-scientists' job by at least one informant (inform_8).

Secondly, government policy tools for scientific research (“TLOs” & “COEs”) appear to be largely insignificant. This is revealed in a couple of different ways. Generally, informants had not even heard of the most publicized government policy tools until I read them aloud during interviews. For the few that did recognize these policy instruments, they knew little of their purpose or function. Only top-level scientists (basically, the elite scientists in their respective institutes) were well aware of TLOs and COEs. The elite scientists in each institute were divided on the importance of these tools. Institute 1 gave a far greater weight to these government policy instruments than institute 2. Institute 3 appeared oblivious to both of these policy tools. In fact, it is interesting to note that one of the institutes I interviewed scientists in (institute 2) was a COE itself. Generally, the COEs were described as more significant than the TLOs. The reason for this may be linked to the level of formality. TLOs are linkage mechanisms that are supposed to connect basic research with industry and other researchers in order to produce patentable products for society. Thus, it is understandable that a scientific organization that is informal in nature and mainly concerned with basic science may be alienated toward TLOs whose purpose is to connect corporations with basic science and research with practical products.

Many of the scientists in my interview pool regarded these policy entities as relatively insignificant in the scientific organizations of Tsukuba. This finding suggests that there remains a divide between government policy declarations and the actual attitudes of laboratory scientists. In fact, one could carry this further by suggesting there is a larger divide between the government and university policy structures and the actual science being done in Tsukuba institute laboratories.

Contradictions

First, a small number of elite scientists produced most of the published articles in this study. These articles were mostly published in English-written journals but presented at domestic conferences in the Japanese language. This finding suggests a significant contradiction. If Japanese scientists dislike and/or have difficulties writing in English, Why/how do they produce most of their published articles in English? Testimony about published articles and presentations leads to a possible resolution for this contradiction. According to informants, foreign junior faculty and post-doctoral fellows are often utilized for English manuscript editing and conference communications in English.

The perceptions of informants on the amount of basic research versus applied research conducted in their laboratories varied remarkably across institutes in this study. Institute 1 informants generally ranked their institute’s work as conducting about 80 percent basic research. Most of institute 2 informants perceived their laboratories as conducting between 80 and 90 percent basic research (only one exception who perceived 70% basic research). Most interesting with regard to perceptions of basic v. applied research is the views of informants on “their work” versus “the institutes’ work.” On this measure, all informants in both institutes saw their own work in terms of the same amount or greater amounts of basic research than the institute they worked in. Institute 1 had

more informants than institute 2 that perceived the larger institute conducting far more proportions of applied work than their own individual laboratory research. In institute 2 all informants perceived their proportions of basic v. applied research as similar to that of the larger institute. The importance of these perceptions is that the national government appears to be prioritizing funding by the type of science being conducted in universities.

Explicit testimony from one Director provided a detailed analysis of the exact proportions of funding for Institute 2. This particular institute is funded by MEXT, Tsukuba University and corporations. Eighty-percent is provided by the government (through MEXT), 10 percent by Tsukuba University and 10 percent by corporations. This testimony fall in line with an informant from Institute 1 who suggested that they are funded 10 percent by corporations. Obviously, the government of Japan, specifically through its ministries is an essential actor in the funding of research and development. It is involved in an array of mechanisms (TLOs, COEs, Shingikai, Science Cities, etc) that promote and provide leadership to scientific research.

The governmental tools investigated in my initial literature reviews and interviews (specifically, TLOs and COEs) do not appear to coincide with most laboratory practices. Many informants did not know the meaning or the existence of these policy tools and certainly only a few scientists understood these tool's purposes. This "boundary" between government policy tools and laboratory practices indicates a need for further study. These "mechanisms" used by government appear superficial in many ways. Externally, they appear to be extensions of more fundamental aspects of Japanese science policies, which include the purported emphasis on basic science by both Japan's national government and its institutional appendages (such as Institutes 1 & 4 in this study).

Most informants suggest that their institutes conduct predominantly basic science research. However, their research practices indicate much larger proportions of "applied science being conducted in their labs. The notion that "applied institutes" are producing "basic" science is contradictory. Yet, this notion may not be in error. Instead, informant conceptions of how "basic" versus "applied" sciences are being defined may be the central issue. It may also be that scientists associate "science" with "basic research," regardless of the particular content of that research.

Idiosyncrasies

The actual work tasks were particularistic to each of the institutes studied. Institute 1 work tasks were divided among occupational statuses with increasing administrative duties given to scientists higher up in the hierarchy. Institute 2 tasks were more specialized throughout the organization and included a Director participating in actual laboratory work. The main division of labor in Institute 2 was the common practice of graduate students performing basic analytical measurements while post-docs and junior faculty process higher-level research tasks such as leading new syntheses and teaching laboratory techniques to subordinates. However, graduate students, post-

doctoral fellows, junior faculty and even the Director himself participated in synthesis of novel compounds – the “life blood” of this institute.

Most scientists in Institute 2 suggested that “discovery” of new materials or new phenomena are their most enjoyable aspects of work. However, scientists in Institute 1 tended to provide various processes and procedures of their work as aspects of *waku waku suru*. This variation in types of work enjoyment may be related to the level of formality in an organization and as such may merely distinguish institutes from each other structurally.

The most important idiosyncrasies concerned the work tasks being conducted at particular institutes. Work tasks necessarily dictates machines, equipment and other laboratory devices used in daily work. Since each of the laboratories studied conducted different types of work their tasks and equipment were quite different from each other. Each institute has a unique way of dividing labor among different classes of workers (senior faculty/Director, junior faculty, graduate student and technician). This appears to be linked with the cultural attributes of these organizations described in the previous chapter. Thus, scientific production, culture and economic affairs of each institute mesh in interesting ways to promote, transform and reproduce particular ways of doing science.

Conclusions

Commonalities, contradictions, and idiosyncrasies of the scientific production and economic affairs in this study are also revealed through informant interviews as complex elements of a larger network of social organization. The network of scientific production blends with economic affairs in the context of culture. These themes are iteratively transformed in the process of “doing science” in Tsukuba.

Interviews in this study reveal both common individual characteristics/behaviors and common structural aspects of the organizations studied. Small numbers of scientists are producing most of the scientific articles in this study. This is not a “new” finding. Previous investigations have uncovered this sort of publishing behavior (de Solla Price in Griffith, 1980). However, in the context of a move by the Japanese government to promote more collaborative and interdisciplinary research, the fact that elite scientists are producing the majority of published articles leads to a tentative conclusion that specific laboratories and specific scientists are conducting most of the published work in Tsukuba. If small numbers of scientists within scientific cliques are conducting the scientific work in Japan, at least the work that “counts,” then collaboration and interdisciplinary science does not appear to be taking hold in the laboratories of Tsukuba.

The publishing of professional articles and conference presentations in English versus Japanese language is striking among Institutes 1 and 2 (see Table 7.1 & 7.2). The proportions of these activities suggest that both institutes are focusing their attention on

international publishing in the English language and presenting articles at domestic conferences in the Japanese language. Also, Institute 2 presents at conferences more than institute 1 regardless of the venue (see bracketed numbers in Tables 7.2). Based on the numbers of articles produced and conference presentations, Institute 2 appears to be presenting most of its published articles at conferences. However, Institute 1 is not presenting a large proportion of its published articles.

The publishing data emanating out this research reinforces my observation of TLOs and COEs as symbolic policy tools. Interestingly, this sort of observation has been captured in other countries and other social institutions (Yanow, 1996). The significance of these policy tools may be more national than local. However, many informants pointed out that these tools are not affecting the scientific aspects of Tsukuba institutes. Since only top-level scientists are knowledgeable about these government mechanisms for scientific change and stimulation, intra- and inter-organizational communication appears to lack substantive quality over issues of national policy. This latter statement is tentative due to my observations of only two such instruments of government policy. But, certainly future research in this area would help frame the social networks of government policy and laboratory practice.

Science is by no means the only institution in Japan that reveals contradictory practices and beliefs. One such contradiction is that the eminent scientists that are doing all of the publishing may not really be doing this alone. Although elite scientists in this study produced most of their articles in English-written articles, their conference presentations were largely given in the Japanese language at domestic conferences. Why would elite scientists publish most of their articles in English journals and present most of their findings at domestic conferences in the Japanese language? Tentative answers to this question include “readability” among international colleagues. Most informants reported that if an article is written in Japanese, very few in their discipline around the world will read it. Thus, writing in English appears to be a prestige-making endeavor for Japanese scientists. The interesting contradiction in this notation of publishing and conference presenting is that most informants believe that they can speak in English better than they can write. This begs the question, why not present in English? The above explanation of “readability” partially explains this contradiction. However, one tentative conclusion that I observed is that the foreign post-docs appear to be utilized by institutes for their English writing capabilities. Thus, the readability issue coupled to the utilization of foreign labor allows scientists in Japan to write articles in English that in turn help them raise their international credibility and prestige.

I observed two major policy instruments that the Japanese government uses to promote its brand of science in Japan. The TLO and the COE are essentially symbolic mechanisms that do not appear to be integrated to the bench-level in scientific laboratories. These governmental tools appear to affect scientific production and the economics of science in an indirect manner. In fact, most scientists in this study are not aware of the purposes of these mechanisms. These tools are important in that, they suggest that government policies are not having large effects upon laboratory practices in Tsukuba. Instead, laboratory personnel perceived their work to be basic research (as

the government suggests they do) but, their daily practices exhibit much more applied work. The type of work practiced was particular to the each institute.

Institute 1 work tasks were strictly divided by occupational status. Thus, lower level scientists (specifically technicians) did most of the tedious work such as cleaning and basic measurements. The higher level scientists in this institute concentrated mostly on experimental procedure and laboratory management. In institute 2 the work was more evenly divided across occupational status. Thus, graduate students mostly conducted cleaning, measurements and other laboratory maintenance. However, they were also integrally involved in the experimental processes of this lab. The Director of institute 2 performed weekend lab work and the junior faculty leaders were involved in helping graduate students perform the required experimental process of their respective themes.

There were no “training manuals” in any of the institutes in this study. All of the knowledge gained by scientists for their scientific work was learned on the job, through tacit knowledge, equipment manuals, and other various instructions – nothing written in an institute “manual” per se. Therefore, “management” focused on detailed analysis of scientific results that were presented during in-house meetings and in day-to-day interactions in the laboratory. This laboratory work was perceived in different ways by different scientists. The Japanese generally like their work. However, there are distinct differences in what they like about their work. Most scientists in institute 1 tended to see particular processes or procedures as their most enjoyable work (*waku waku*). In institute 2, “discovery” and finding something new, even when a mistake occurred were the most enjoyable aspects of scientists’ work.

Chapter 8: SUMMARY & DIRECTIONS FOR FUTURE RESEARCH

Summary

Although some in Japan cling to beliefs of a pure ethnogenesis, one that emanates out of the creation of Japan as an "...unbroken line of descent of emperors to the sun goddess Amaterasu that gave Japan its innate superiority," others visualize a more interconnected ethnogenesis (Hudson, 1999 p.24). Long before contemporary "scientific" analyses, these stories of Japanese culture were described in the Kojiki (AD 712) and Nihon Shoki (AD 720). These two texts describe the origins of the land and people of Japan. Debates over the ethnogenesis of the Japanese people continue today. More importantly for this study are the connections of Japan's history with its contemporary social organization of science. The archaeological, anthropological and sociological evidence suggest that the primary linkages to the development of the Japanese people were primarily related to immigration (Hudson, 1999). This is significant in the sense that it presumes no purity of a people and instead links Japan's culture with Altaic languages and other Asian societies. It is also important to note that Japan is still in transformation and its culture often relies on common, contradictory and idiosyncratic values and beliefs to negotiate and transform its societal structures.

The cultural and scientific production/economic affairs themes within the context of a reflexive evaluation have led to findings that suggest several socio-structural factors that affect the organization of scientific work in Tsukuba. These findings reveal important aspects of organizational behavior, hierarchies, networks of labor, attitudes about Tsukuba, scientific funding in relation to Japan's economy, dedication and work time, creativity in the workplace, meetings, publishing and conference presentation activities, laboratory work, and economic affairs.

Findings

The findings in this study have revealed several important cultural, productive and economic factors that impact structural elements of the organization of science in Tsukuba, Japan. Both the cultural and scientific production/economic affairs themes in this dissertation uncover several factors that have important consequences for the structural organization of scientific institutes in Tsukuba.

Culture

Tsukuba is a planned scientific community with a variety of scientific organizations. This study focused attention on particular institutes within the central research and organization district on Tsukuba University's campus. The Japanese culture, Tsukuba culture and the culture of science affect the organization of scientific work in Tsukuba.

The institutes on this campus are generally portrayed as interdisciplinary, “flat” hierarchical organizations with collaborative structures. However, in the present study, this “ideal type” was not observed. The universally observed forms were “top-down” organizational structures that varied with the particular formality of operations. These different “styles” of organization within top-down structures appear to affect the type of work conducted across occupational statuses of scientists. For instance, in Institute 1 work tasks are confined along rigid occupational lines. These work task demarcations provided taken for granted tasks that are assigned to particular categories of workers. However, in Institute 2 the work environment was much more informal than in Institute 1. Work tasks are more divided across the occupational hierarchy and the hierarchy itself is perceived as somewhat blurry below the highest levels of status in this laboratory. Institute 2 technicians and graduate students are engaged in the full research agenda from maintenance to procedures, to theory and discovery, while similar scientists in Institute 1 tend to perform select maintenance and processes rather than more abstract participation in their institute’s research. The fact that Institute 2 is more directly connected to Tsukuba University in its funding acquisitions and personnel support than Institute 1 may be a mitigating factor in these differences.

The personnel in these institutes are conceived in the context of networks of labor which were identified in both Institute 1 and Institute 2. Unique accumulations of labor are centralized in the offices of the elite scientists in both institutes. These labor networks extend to foreign countries and across Japan. Educational histories are an important link between the elite scientists and the labor acquired. Thus, most of the connections between the elite scientists and the scientists working under them are located in past educational/academic settings. Some of the scientists acquired through these networks are women and foreigners. Institute 1 contained a majority of women scientists in the laboratory. However, there were no women scientists observed in Institute 2. Interestingly, women scientists did not hold any of the elite positions in either institute. Yet, one woman scientist in Institute 1 held an important position as an assistant to this institute’s elite scientist. Japan’s national government plays a large role in providing the funding and resources that keep Tsukuba running and allow for the accumulation of networks of labor.

The government of Japan has spent a large quantity of resources on the development of Tsukuba Science City. Yet, generally, the scientists and families living in Tsukuba dislike living in this community. Informants were mostly exuberant about their work but their perceptions about this “planned” city reveal a cultural artifact about Japanese communities. My informants described how Tsukuba lacks “chaos.” Their perceptions of “real Japan” consist of myriad descriptions that all include a “little chaos.” Thus, a “nice” or “good” city to live in for a Japanese scientist is one which has some of this chaos. Tsukuba is perceived as having little to no chaos within its overly planned boundaries. The importance of this finding is that the Japanese government has launched several development projects that include new transportation and communication links between Tokyo and Tsukuba. Much of this development is a purposeful attempt to move some of Tokyo’s population out of Tokyo while still keeping these workers employed in Tokyo. These Tokyo workers would live in Tsukuba and

commute to Tokyo on the new transportation links. As the population of Tsukuba grows, specifically Tokyo commuters, the “planned” orientation of this city will have wider effects on both Japanese and the economic development of the country. In recent years, Japan’s economy has been a key focus for government bureaucrats. However, science and technology funding in Tsukuba does not appear to have been affected by the ups and downs of this economy. Informants perceived very little to no change in their institutes’ government funding during the 1990s. This relationship seems fertile for further research. The fact that the Japanese government is providing consistent funding (to specific research agendas) regardless of the condition of its economy is indicative of the perceived weight that science and technology has on economic development. However, the resources utilized, specifically nominal quantity of time and monies in this city are important factors in the organization of work.

Tsukuba scientists spend an extraordinary amount of time at work. Although this phenomenon is common throughout Japan, some informants (specifically in Institute 1) suggested that the nominal quantity of work time is associated with worker dedication. This association was observed only in Institute 1 – the more formally organized institute. The inference here is that more formally structured organizations (Institute 1) in this study put a larger value on time spent at work than the other institutes (Institutes 2 & 3). The work time documented in this study varied within institutes and between institutes. However, the elite scientists revealed similar patterns of hours. These latter scientists spent far more hours at work than their subordinates.

Lower occupational levels of scientists (technicians and graduate students) were perceived by superiors as less creative. Specifically, in Institute 1, this perception was universal among high-level scientists (post-docs, junior faculty and elite Professors). However, since time at work in Institute 1 appears associated with scientists’ dedication to their work (and dedication to their organization) and lower-level scientists (technicians and graduate students) tend to spend less time at work, there appears to be a more complex association than first observed. I feel that lower-level scientists are not given the flexibility in work tasks or schedules and thus, may not feel inclined to conduct research that is really “not their own.” This lack of flexibility observed in work tasks and work time in Institute 1 may be a factor in this institute’s perceived low levels of dedication and creativity for lower-level scientists.

A final factor uncovered in the cultural theme is the scientific meeting. Informants provided detailed information about the meetings in their institutes. However, I did not observe any meetings in-person. Informant testimony reveals that all institutes had weekly meetings (in some cases more than one meeting per week for all scientists). Institutes 1 & 2 scientists at the elite scientist and junior faculty levels appear to have similar time constraints for meetings. Institute 2 lower-level scientists (technicians, graduate students and post-docs) spend more time in meetings than their respective colleagues in Institute 1. This is due to Institute 2’s weekly, 3 hour meeting. Institute’s 1’s weekly meeting is usually shorter in time length.

However, much of the work day for higher-level scientists (elite scientists) in all institutes was consumed by administrative duties and meetings. I felt that almost all informants detested the amount of time they spent in meetings. This may indicate a need for support personnel (more technicians, more administrative support) specifically, in Institutes 1 & 2. However, an impediment to this conclusion is the lack of training mechanisms in both of these laboratories. There were no “training manuals” observed and no informant suggested that training manuals were available in either of these laboratories. This appears to be further evidence that “cross-training,” “interdisciplinary collaboration,” and the need for more support staff will be difficult challenges in the future.

Scientific Production/Economic Affairs

The scientific production/economic affairs theme reveals important factors that play an integral role in organizing and operating the scientific work of Tsukuba institutes. One of the most significant findings in both major institutes (Institutes 1 & 2) is that a few elite scientists from each of the institutes produced a majority of the published articles in their respective organizations. Interestingly, a majority of these articles were published in international journals and written in the English language. However, the same elite scientists presented their article findings predominantly at domestic (Japanese) conferences in the Japanese language.

It was expressed to me by informants that Japanese have trouble writing in English and communicating in English via email. It was also conveyed to me that Japanese can verbally communicate in English with less trouble than they experience with their writing. Thus, why would Japanese scientists in Tsukuba who presumably have trouble writing in English and less trouble speaking English produce most of their professional articles in English but present them at conferences in Japan in Japanese? I initially presumed that this contradiction can be explained via the use of foreign scientists that are accumulated in the labor networks and provide the needed English writing skills. However, since I only observed a handful of foreign scientists and 50% of them were from countries outside of England and the United States (Hungary and Ireland), this conclusion seems oversimplified and requires additional research.

Institute 1 produces a majority of the articles as compared to Institute 2. However, Institute 2 presents far more papers at both domestic and international conferences than Institute 1. This is partly explained by numbers of scientists at each institute, especially considering Institute 2 personnel appear to spend less time at work than their Institute 1 colleagues. Institute 1 employs more than twice the number of scientists in Institute 2 and thus has more labor assets to produce published articles (see Table 7.1 & 7.2).

Another important factor in daily scientific production is actual lab work in the institutes. Scientists in the institutes studied revealed varied types of work tasks. Much of the difference is due to the type of work the institutes participate in. However, the

segmentation of certain types of work for certain levels of workers was much more evident in Institute 1 than in Institute 2. In Institute 1, lower-level scientists (technicians and graduate students) tended to perform routine maintenance, cleaning, and data collection while their higher-level colleagues were immersed in proposal submissions, experiment designs and administrative duties. This latter group in Institute 1 showed more interest in “discovery,” but a majority of Institute 1 scientists focused attention on specific processes and tasks. In Institute 2, most scientists regardless of occupational level focused on “discovery” and the search for “novel” materials. Work tasks in this institute were more shared across occupational levels. In fact, the Director of this institute conducted lab work on his own time. No elite scientists in Institute 1 conducted such laboratory work.

The importance of this difference in type of work conducted at the different institutes and at different occupational levels may be explained by Institute 2’s more direct connection to the university and Institute 1’s more isolated position on campus. Thus, Institute 1 may be more focused on the production of scientific results rather than novel discovery or new phenomenon. This latter conclusion is directly linked to the economic affairs in Tsukuba and larger Japan.

The economic affairs in this study are centered on particular university and governmental policy tools (TLOs and COEs) and the perceptions of informants on applied versus basic scientific research. Generally, only high-level scientists had knowledge about the TLOs or COEs. This is particularly interesting for Institute 2 which was recently awarded COE status and has one project located within Institute 1 (the location of a TLO). It is also significant regarding Institute 1 in that this institute houses the TLO and very few scientists from this institute knew about the existence or function of the TLO. The effective use of policy tools by the national government can play an important role in institutional change. However, defining the “success” or “failure” of these policy tools that are imparted on scientific institutions is another question.

Some observers have testified to the recent failures in the Japanese economy, educational system, and other social institutions and have led a concerted drive toward answers to these failures (Hatamura, 2002). In fact, an organization called the “Association for the Study of Failure” has recently been established. Its home office is in Tokyo and it has the stated purpose of “...offer(ing) methodologies to prevent accidents or failures that may lead to economic loss...” The Japanese government, through MEXT, has developed a database that is collecting information on research and development failures (Japan Information Network, 2001). The present study has not necessarily been about the “successes” or “failures” of Japan. Instead, this qualitative exploration is an analysis of the social relations that make up the social networks in the cultural field of Tsukuba science. However, the social structures that are inherent in the cultural boundaries that demarcate institutes may be important factors in these institutes’ “success” or “failure.”

The findings from this substantive analysis suggest organizational structures have worked to the advantage of some scientists and to the disadvantage of others. These

structures are uncovered in the cultural and scientific production/economic affairs of Tsukuba institutes. While the Japanese government and other associations are trying to understand failure, organizational structure still appears to be left out of the equation. Those involved with focusing on “Japanese failure” in science must eventually try to understand the organizational landscapes that structure the scientific community. All of these factors may not even be located within Japan. Science is still perceived as an important form of knowledge in the development of many societies.

The perceptible indications of science in Tsukuba, Japan are arrayed in a complex network of socio-cultural relations. These signposts of socio-cultural relations interconnect other aspects of Japanese society. In this study, science has been construed as an embedded institution within the boundaries of Japanese culture. The historical legacies of the factory, the family, land, and changing political regimes are intertwined with more contemporary relations of population dynamics, ministerial policy structures and tools, scientific labor networks, workers attitudes, and organizational structures in a synergy that is transforming the culture of science in Tsukuba. In a sense these signposts construct a story of Japanese science that is uniquely Japanese and at the same time collectively similar to other cultures of science around the world.

The norms, values and beliefs embedded in this cultural field reveal commonalities, contradictions and idiosyncrasies that are being negotiated and contested at the boundaries. In this research, I have discovered that the system of Japanese science is not necessarily a fixed field of culture. Instead, its boundaries are being redrawn as new disciplines become foci and new forms of stimulus are created. Some of these transitions and negotiations are meaningful when put in the context of other institutions in Japan. For instance, the *ie* family organizational system appears to be an historical artifact that may contribute to particular forms of organization in other institutions, maybe even science and technology. As a cultural legacy, the *ie* is a connection to the past. It offers consistency and a form of continuum to those that practice its patterns of behavior.

A recent newspaper headline holds implicit meaning for this family structure

Japan's empress dowager dies (Stoddard, 2000)

Recently, Empress Dowager Nagako, Emperor Hirohito's wife of 65 years passed away. She had witnessed two world wars and the rise of a modern technological culture. Interestingly, the article suggests that the Japanese media had “widely reported” that the Empress had treated her daughter-in-law, Michiko “harshly.” The new Emperor Akihito, married Michiko, a “commoner.” But, tension between the Empress and Michiko centered on Michiko's being a “commoner” and not giving up her career after marrying Akihito. This short tale of a transformation in the Imperial family's household suggests change in the values, beliefs and norms of a society. According to the article, a Tokyo housewife responded to the Empress' death

She's the last person from the old system of the imperial family, and I'm hoping that this will open the door to a new type of imperial family (Sumiko Omor, age 66 – Stoddard, 2000).

The symbolic power of the imperial family may have lost some of its appeal to the younger generation in Japan. However, this family is still held in high esteem by many Japanese and others around the world. These indications of the imperial family clinging to the *ie* form of household organization reveal the importance of embedded cultural artifacts. Within the context of the *ie*, the economy of Japan has been in decline for more than a decade and this decline led many of my informants to reveal several different forms of uncertainty. At the same time, the faltering economy does not appear to have greatly affected national funding of science. The economic failures observed in Japan during the 1990s have had profound effects on this country's institutional arrangements in many of its cultural spheres. Yet, with regard to funding science and technology research at the laboratory level, Tsukuba institutes remain largely unscathed. Regardless, these effects lead many to have feelings of uncertainty about the future of their children, their families, and even their country.

After leaving Tsukuba, I had realized that my initial perceptions of this "science city" had been drastically transformed. These changes have led to an increased understanding of the culture, scientific production and economic affairs within a very interesting Japanese town. The commonalities, contradictions, and idiosyncrasies revealed from interviews, observations, and other data sources provide a preliminary description of a unique Japanese site of cultural production. However, there are many unanswered questions that can lead to interesting, informative and policy-relevant future research.

Directions for Future Research

It has been demonstrated in this dissertation that several areas of future research would help elucidate a better understanding of the organization of scientific work in Japan. First, Tsukuba is an isolated case with regard to "science in Japan." Therefore, future work should entail comparative analyses that put Tsukuba within a larger context of Japanese culture. One avenue for this sort of analysis would be the inclusion of pertinent institutes from the Kansai Science City in southwestern Japan into a comparative study with the institutes observed in the current project.

From a macro-perspective, research is needed in the area of Japan's national economy's effects on the funding of Japanese science. In the present study, no relationship was found between the Japanese economy and scientific funding at the laboratory level. It may be that more research is needed in the analysis of cultural factors affecting scientific funding in Japan. One of the most pressing research items is the influence of the *ie* upon scientific organizations in Japan. Several investigations have queried the structure of household organization (Nakane, 1974; Hall and Hall, 1987; Hamabata, 1990). However, few have analyzed this cultural structure within the context of scientific work. Another social aspect of scientific work that needs further

research is the *scientific meeting*. This particular aspect of scientific culture appears understudied and may lead to more provoking insight into the “inside” mechanisms that drive scientific work. An understanding of the intricacies of the scientific meeting may also lead to knowledge about the connections between government policy and scientific practice. A substantive research project on meetings would be an important contribution to a better understanding of laboratory funding.

I also suggest that an investigation of the *boundaries* between government policy tools and laboratory practices is needed. Thus, an investigation of the structure of COEs and TLOs is pertinent for understanding the ways in which national policy is implemented and/or circumvented. Further, this type of investigation would supplement other projects concerned with the economy/laboratory funding “divide.” I have demonstrated the need for further research in this dissertation and these pertinent areas are summarized below.

The *ie* and laboratory work may be connected through cultural and productive spheres. Important questions that can be addressed include:

How are family businesses (*doozoku gaisha*) affecting scientific work in Tsukuba?

How does the *ie*'s organizational structure overlap with university scientific institutes' organizational structures in Tsukuba?

How do corporations influence the social structure of university science?

Family structure in Japan has been characterized as a cultural artifact that thrives within the realm of other social institutions. Specifically, the structure of the family appears to be a tool of organization in the business work environment (Nakane, 1974; Hall and Hall, 1987; Hamabata, 1990). However, an in depth study of the relationship between the *ie* and scientific organizations has yet to be investigated. This sort of analysis would provide insight into specific social relations that couple the “inside” of science with the “outside” of culture and provide further understanding of the “social” in “science.” There are important linkages between family structure and the organization of science in Japan. The scientific meeting is one such connection. Important questions that can be addressed in this social sphere include:

What is the content and style of scientific meetings in university vs. corporate scientific organizations in Japan?

How well does the “high-context” (Hall and Hall, 1987) model of Japanese communication fit in with meetings held in Tsukuba institutes and other Tsukuba organizations?

How does the content of institute meetings relate to the practice of laboratory science?

How do scientific meetings address scientific issues that are located in boundary areas (e.g., scientific issues that are located between government policy circles and university laboratories – such as particular types of research to conduct)?

Institutes varied with regard to their prevalence of meetings but, not to their importance. Most scientists perceived their institute's weekly meetings as essential aspects of the organization of their labs. I suggest that an understanding of the content, structure and purposes of these scientific meetings could provide more knowledge of the organization of science in Tsukuba. An analysis of scientific meetings may also provide evidence of boundary work.

Boundary work connects the scientific laboratory with “outside” cultural factors. Important questions that can be addressed here include:

What are the negotiations/conflicts that are occurring at the boundaries of Japanese government policy and university laboratory practice? [Are these negotiations/conflicts related to cultural aspects such as the ie?]

Which of these negotiations/conflicts (if any) affect laboratory science in Tsukuba? (Who wins? Who loses?)

Who is establishing these boundaries?

Boundary work is characterized as a useful conceptual apparatus for studying science within a multidisciplinary frame. It also has the potential for being used as a tool in looking at the maintenance of cognitive authority (Gieryn, 1983; Guston, 2001). In the current study, Japan is epitomized as a high-context communications culture that generally operates in a top-down hierarchical manner within organizations. However, between organizations, at the boundaries, other forms of organizational structure may persist. Thus, fundamental research into the institutes, organizations, processes and informal practices at the boundaries of the scientific field are essential to developing a wider view of scientific organization in Japan.

These three general areas of future research lead to a fourth focus. Recently, the Japanese government has been focusing on the economic and social problems that may arise from “failure” (Hatamura, 2002). The Japanese government has developed a database that is collecting information on research and development failures. These efforts should be considered appropriate for substantive investigation.

The “successes” and/or “failures” in scientific organizations are important aspects of organizational life in Tsukuba. Important questions that can be addressed include:

How do the actors in the scientific networks of Tsukuba define “success” and “failure” in the university institutes?

What sort of scientific “success”/“failure” policy tools are being created and implemented by the Japanese government?

What is the MEXT failure database?

How does this database work?

What “successes”/“failures” are included in this database?

What science is included/excluded in this database?

How does MEXT run the database?

Who is involved with the decisions on this database? (shingikai, legislative committees, university administrative committees?)

A focus on different institutional forms of organization such as those in the family and private industry, Japan’s national economy’s effect on the funding of science, the scientific meeting, the boundaries that mark lines of conflict between science and culture, and “success”/“failure” in organizations would provide more understanding of the organization of science in Tsukuba. The above future research and their associated research questions are important for their connections between scientific organizations, culture, and the scientific production/economic affairs in Japanese science. By incorporating these ideas into a comparative study that encompasses multiple Japanese cities, I could improve upon the present findings and uncover further knowledge in the *field* of science in Japan. The future research outlined would also lead to important questions outside the social spheres of Japan. In fact, today, science is not only local, it is global. Thus, other localities, cities, regions, nations, organizational types and cultures could benefit from an increased focus on the organization of scientific work.

Appendix A: Figures & Tables

Chapter 2: Figures

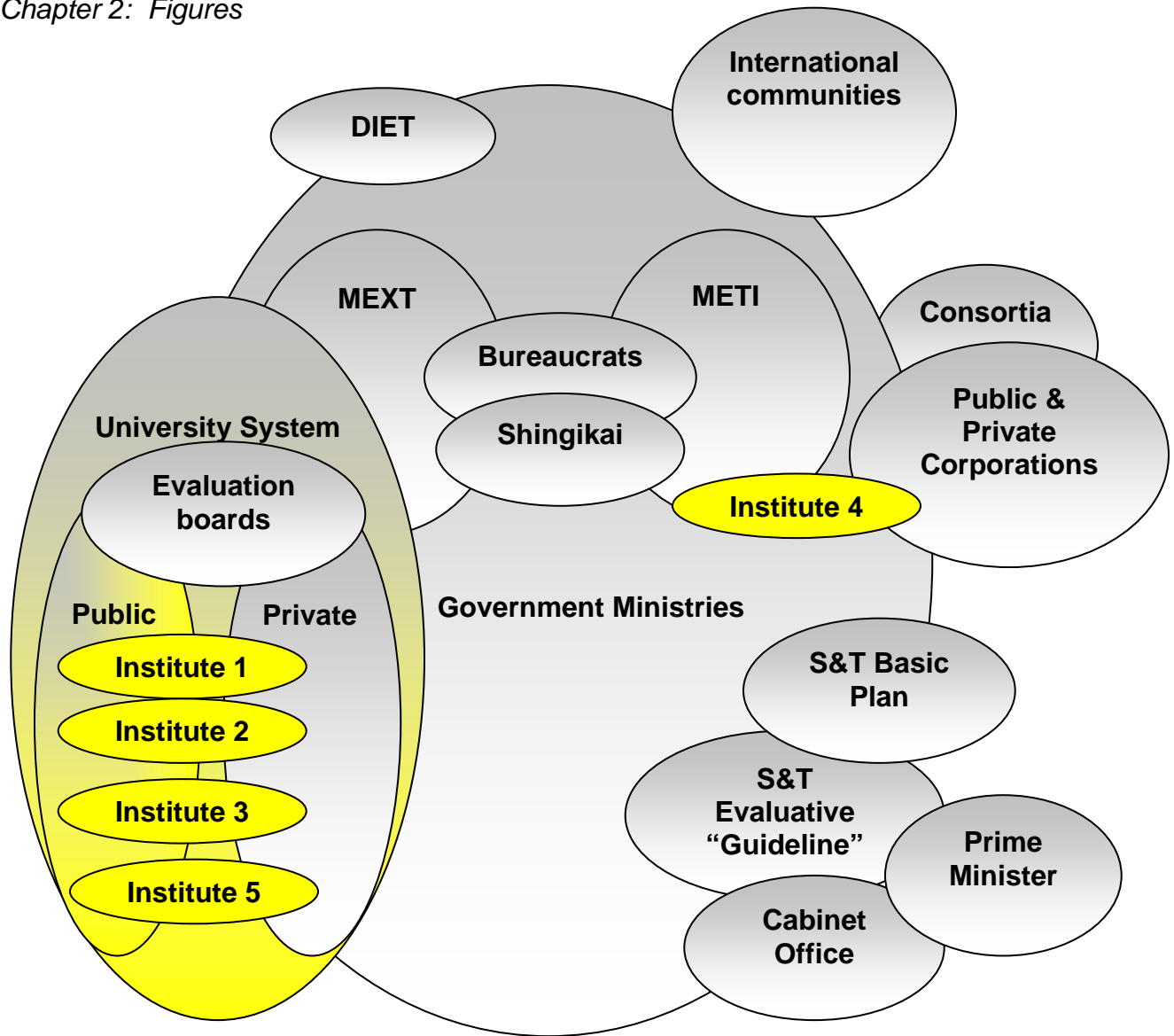




FIGURE 2.1: Actor-Network Map of Japan's Science & Technology Policy Stakeholders in Relation to This Study's Research Site

KEY:

-  Actors outside the direct field of research for this study
-  Strategic research site

Chapter 4: Figures

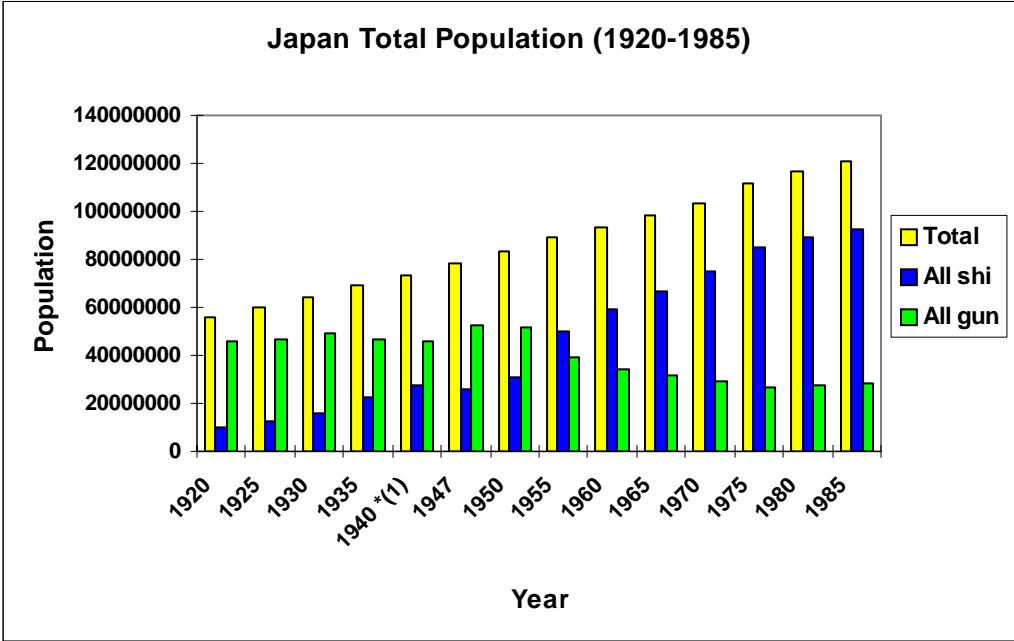


FIGURE 4.1: Japan’s Total Population (1920-1985)

source: *Historical Statistics of Japan (1868-1985)*, Statistics Bureau, Management and Coordination Agency, Japan Statistical Association, and Shouwa Information Process Co., Ltd., 1999
 shi (“City” in Japanese)
 gun (“County” in Japanese)

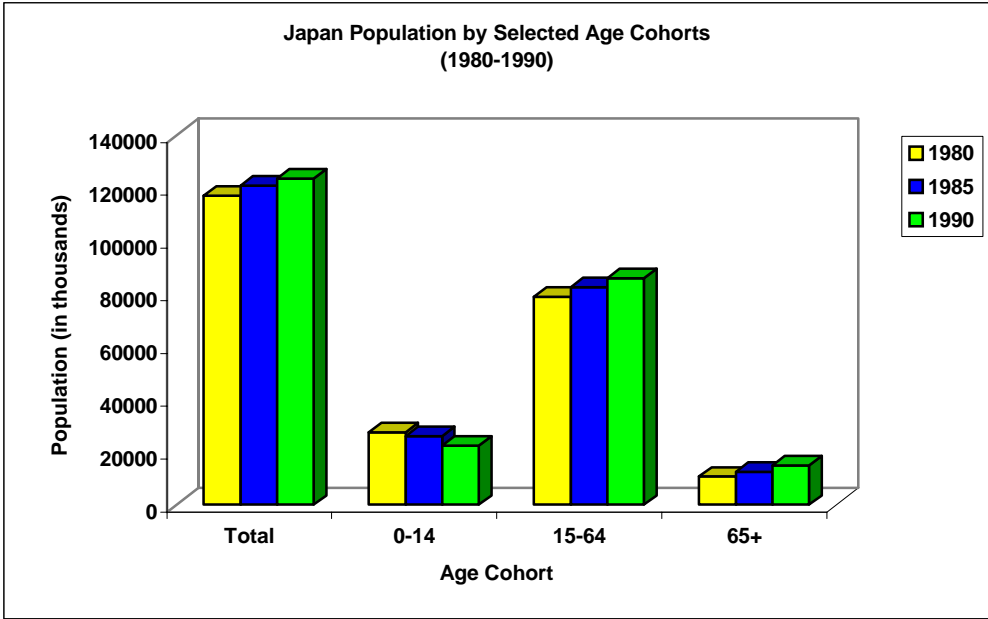


FIGURE 4.2: Japan’s Population by Selected Age Cohorts (1980-1990)

source: *1993 Annual Report of the Institute of Population Problems*, Ministry of Health and Welfare

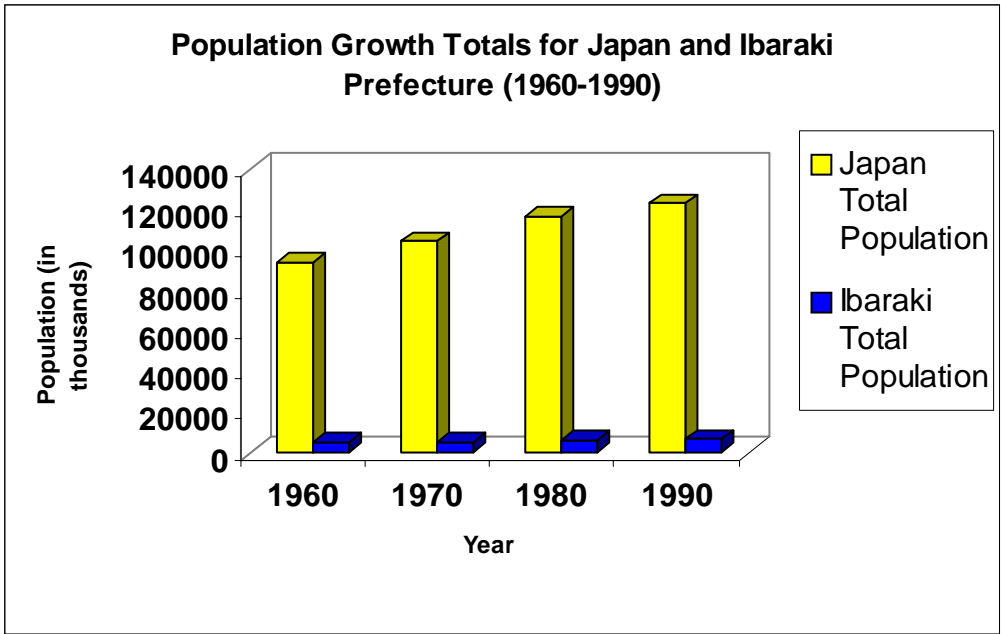


FIGURE 4.3: Japan's Total Population Growth versus the Population Growth in the North-Kanto Region of Japan

source: 1993 Annual Report of the Institute of Population Problems, Ministry of Health and Welfare

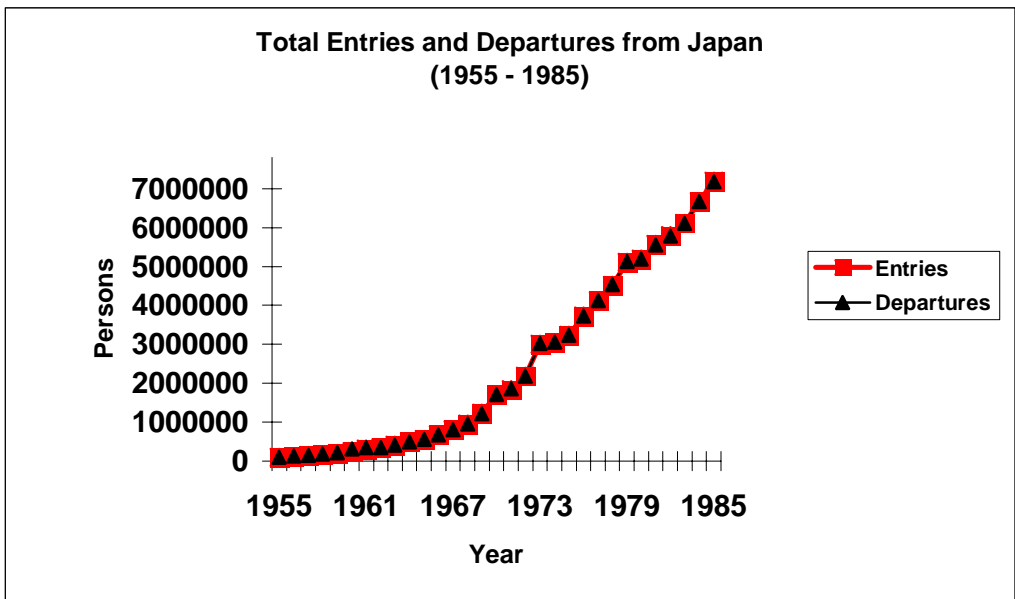


FIGURE 4.4: Japan's Immigration and Emigration (1955-1985)

source: Historical Statistics of Japan (1868-1985), Statistics Bureau, Management and Coordination Agency, Japan Statistical Association, and Shouwa Information Process Co., Ltd., 1999

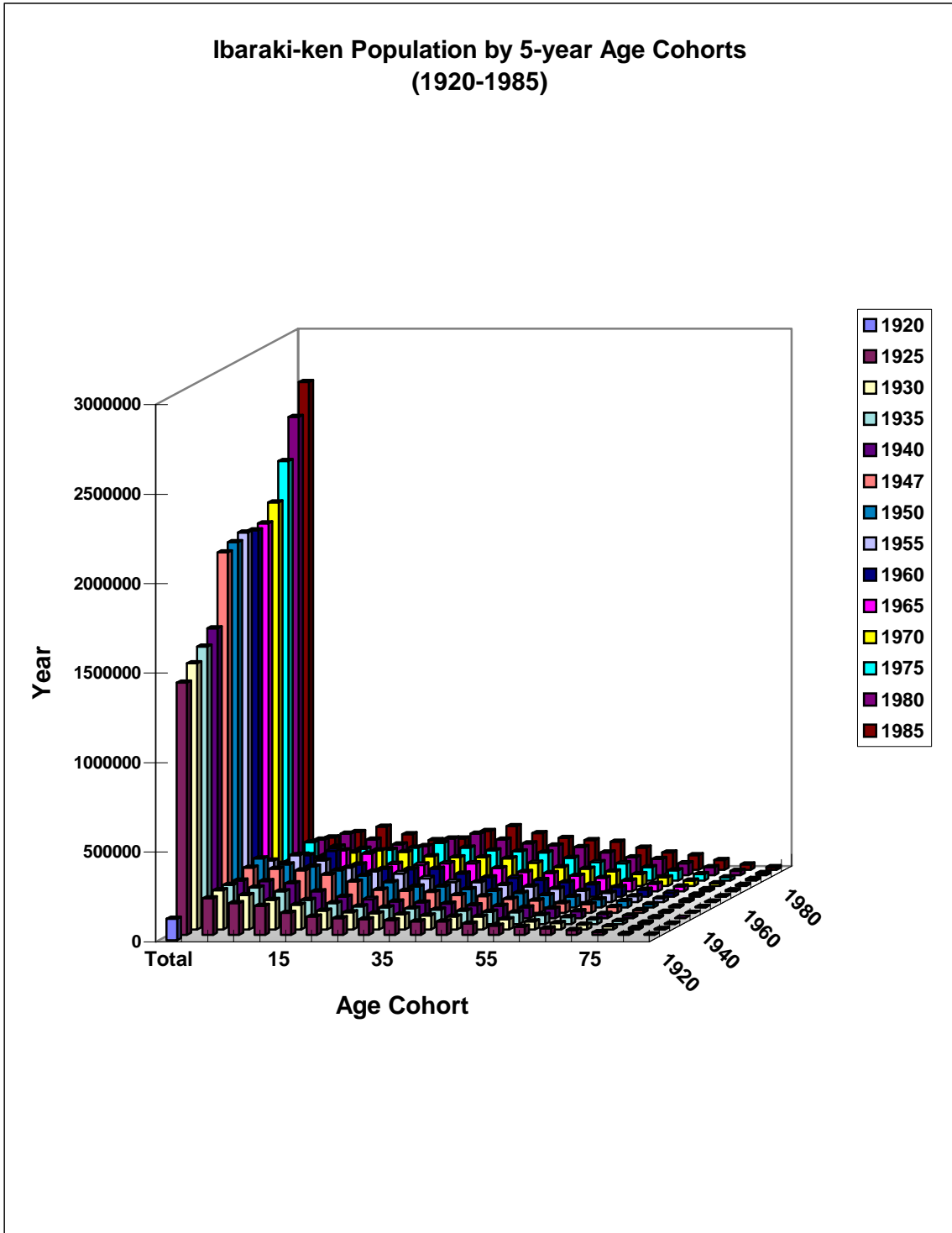


FIGURE 4.5: Ibaraki-ken Population by 5-year Age Cohorts (1920-1985)

source: *Historical Statistics of Japan (1868-1985)*, Statistics Bureau, Management and Coordination Agency, Japan Statistical Association, and Shouwa Information Process Co., Ltd., 1999

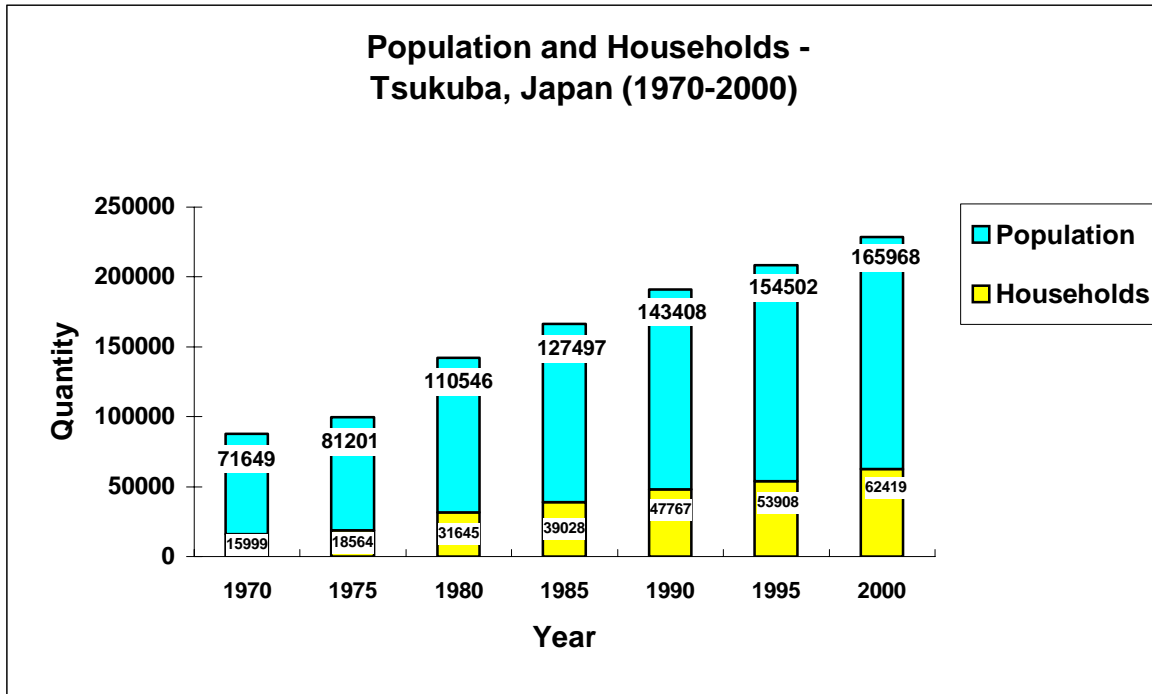


FIGURE 4.6: Population and Households – Tsukuba, Japan (1970-2000)
 Source adapted from Tsukuba Center Visitor Center's Map of "My Town Tsukuba"

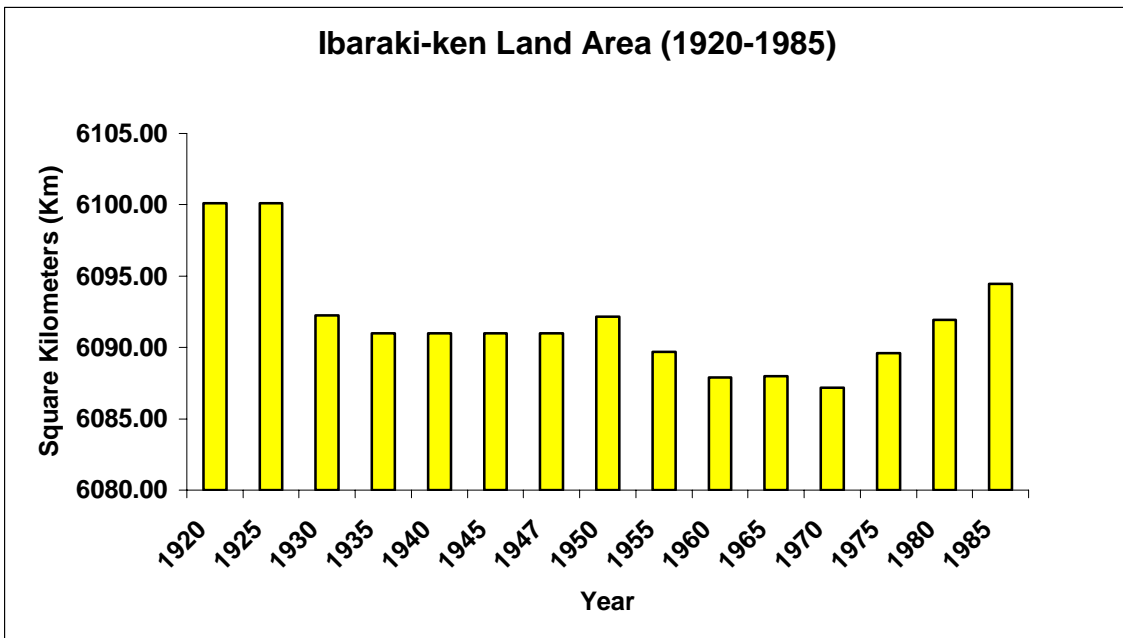


FIGURE 4.7: Ibaraki-ken Land Area (1920-1985)
 source: Historical Statistics of Japan (1868-1985), Statistics Bureau, Management and Coordination Agency, Japan Statistical Association, and Shouwa Information Process Co., Ltd., 1999

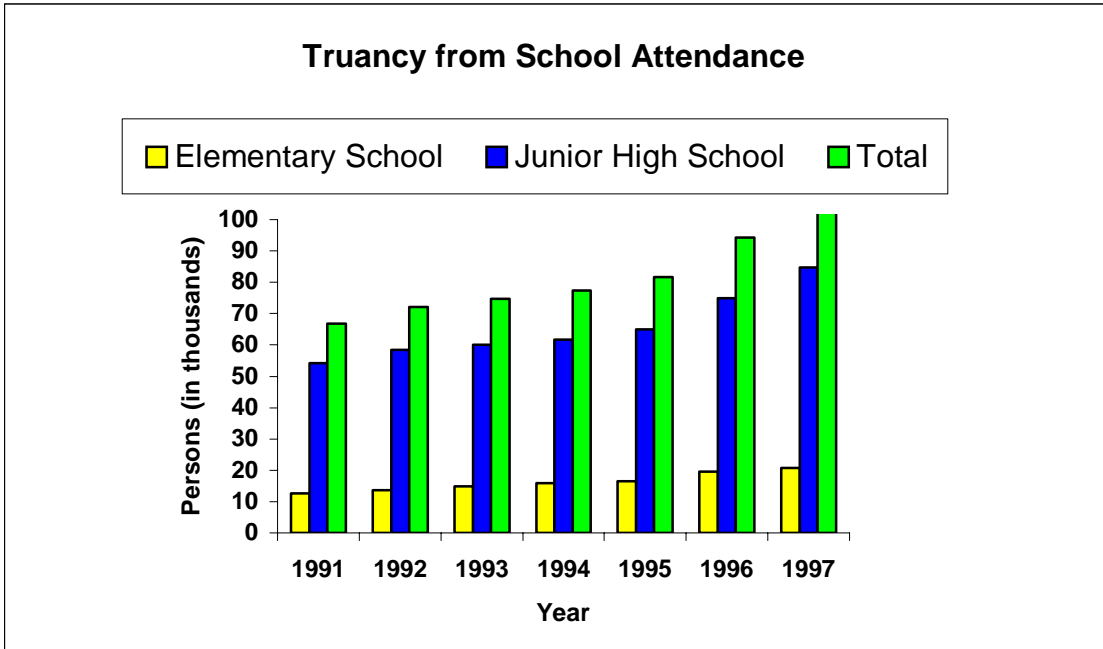


FIGURE 4.8: Truancy in Japanese schools (1991-1997)

Source: Domoto, 2003 (data source taken from Monbusho, 1997)

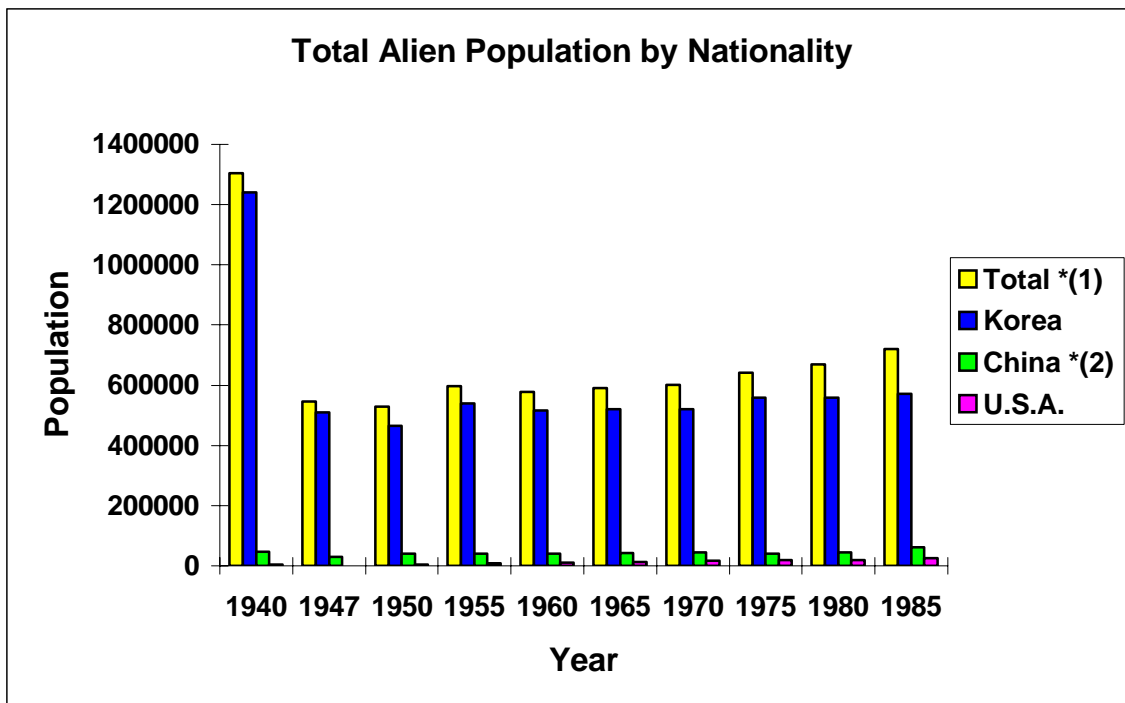


FIGURE 4.9: Japan's Total Alien Population with 3 Comparison Countries (1940-1985)

source: Historical Statistics of Japan (1868-1985), Statistics Bureau, Management and Coordination Agency¹, Japan Statistical Association, and Shouwa Information Process Co., Ltd., 1999² *1 & *2 see Endnotes

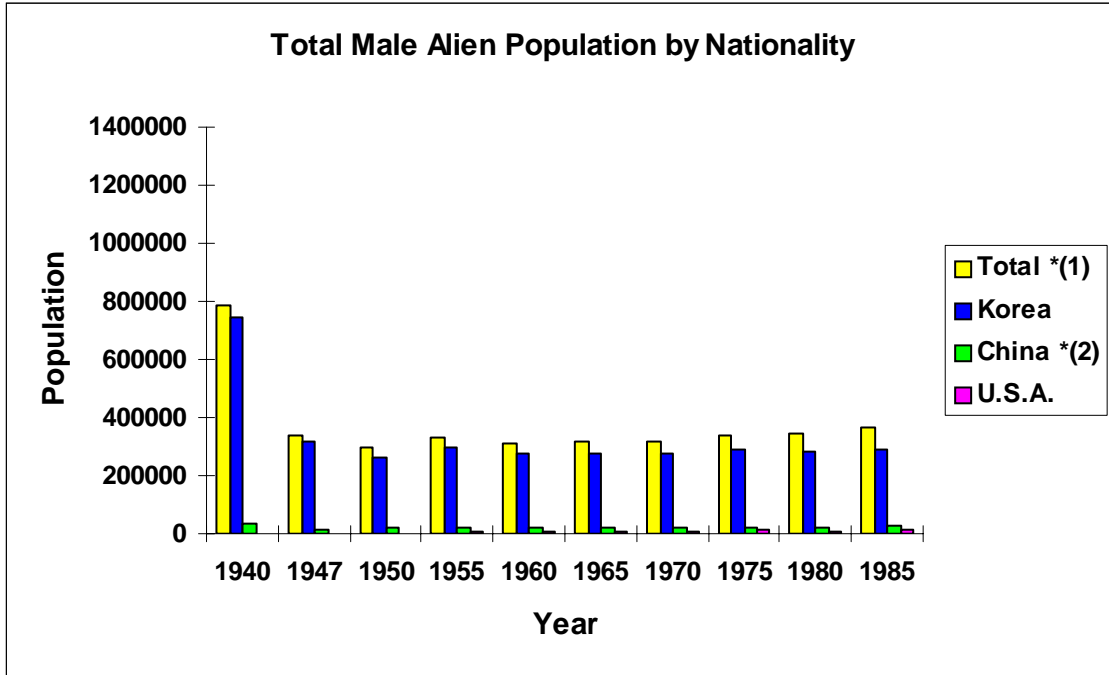


FIGURE 4.10: Japan’s Total Male Alien Population with 3 Comparison Countries (1940-1985)

source: *Historical Statistics of Japan (1868-1985)*, Statistics Bureau, Management and Coordination Agency, Japan Statistical Association, and Shouwa Information Process Co., Ltd., 1999. *1 & *2 see Endnotes

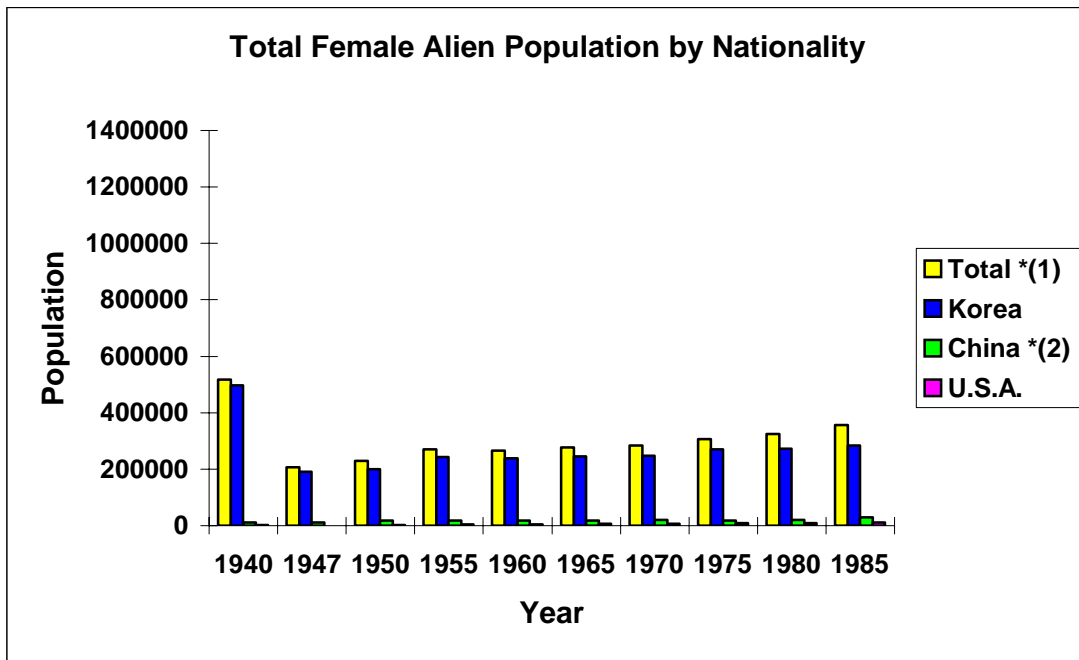


FIGURE 4.11: Japan’s Total Female Alien Population with 3 Comparison Countries (1940-1985)

source: *Historical Statistics of Japan (1868-1985)*, Statistics Bureau, Management and Coordination Agency. *1 & *2 see Endnotes

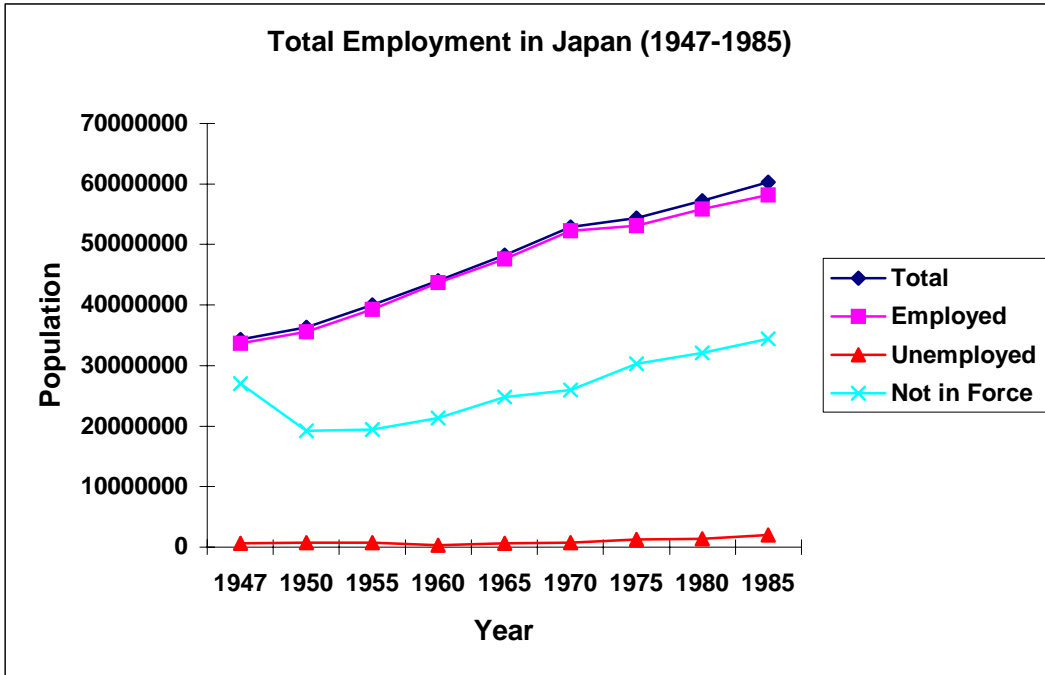


FIGURE 4.12: Total Employment in Japan (1947-1985)

source: *Historical Statistics of Japan (1868-1985)*, Statistics Bureau, Management and Coordination Agency, Japan Statistical Association, and Shouwa Information Process Co., Ltd., 1999

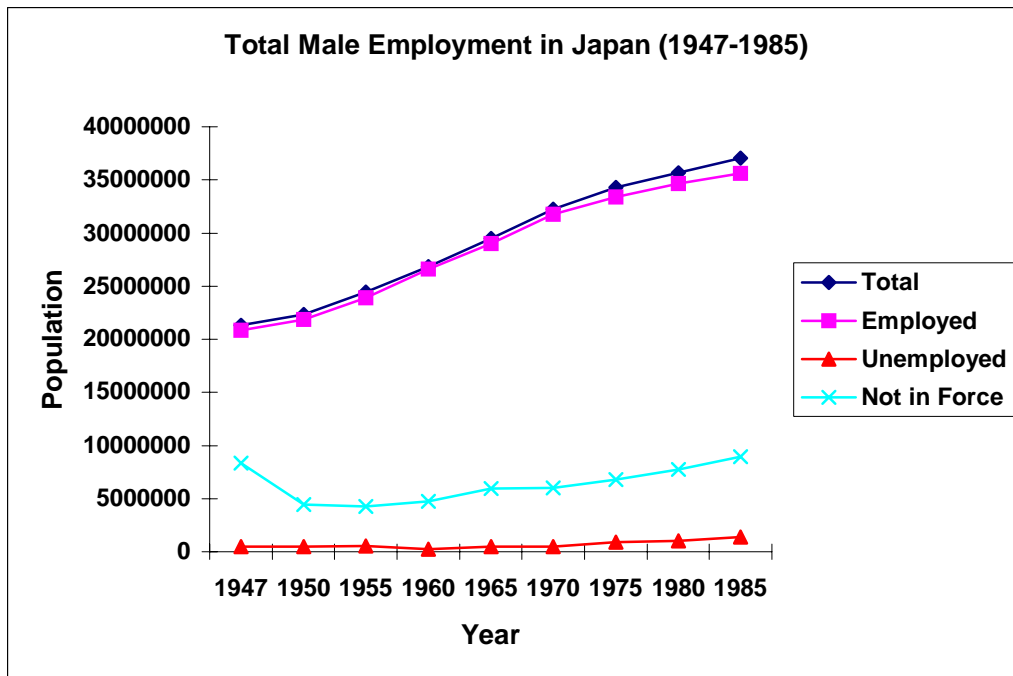


FIGURE 4.13: Total Male Employment in Japan (1947-1985)

source: *Historical Statistics of Japan (1868-1985)*, Statistics Bureau, Management and Coordination Agency, Japan Statistical Association, and Shouwa Information Process Co., Ltd., 1999

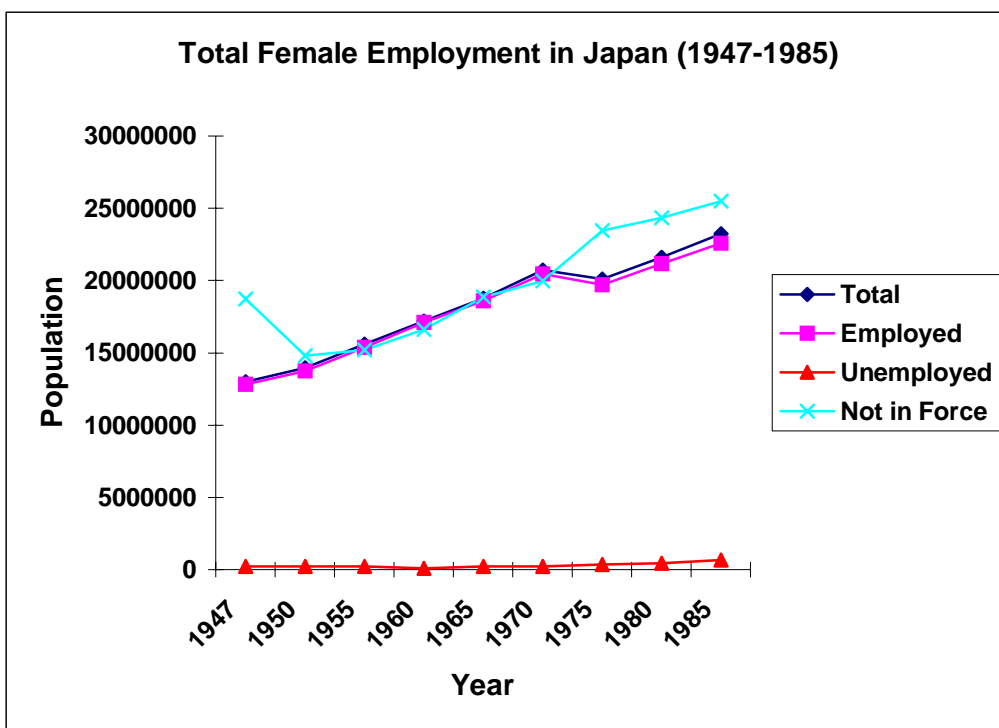


FIGURE 4.14: Total Female Employment in Japan (1947-1985)

source: *Historical Statistics of Japan (1868-1985)*, Statistics Bureau, Management and Coordination Agency, Japan Statistical Association, and Shouwa Information Process Co., Ltd., 1999

TABLE 4.12: Japanese Life Expectancies and Numbers of Survivors at Selected Age Cohorts

Year	Life Expectancy at Birth		Number of Survivors (per 100 births)					
			15 years old		65 years old		75 years old	
	Male	Female	Male	Female	Male	Female	Male	Female
1921-1925	42.06	43.20	72.47	73.26	30.52	35.02	12.80	18.71
1926-1930	44.82	46.54	75.70	76.52	33.81	39.59	14.81	22.10
1935-1936	46.92	49.63	79.10	80.12	36.22	43.55	16.48	25.26
1947	50.06	53.96	82.91	83.97	39.85	49.15	18.49	28.95
1950-1952	59.57	62.97	90.02	90.82	55.11	62.85	29.44	40.45
1955	63.60	67.75	93.19	93.98	61.84	70.61	34.57	47.62
1960	65.32	70.19	94.87	95.82	64.78	75.21	36.12	51.47
1965	67.74	72.92	96.75	97.54	69.08	79.96	39.86	57.14
1970	69.31	74.66	97.57	98.20	72.07	82.57	43.53	61.17
1975	71.73	76.89	98.15	98.62	76.82	86.09	51.05	67.80
1980	73.35	78.76	98.60	98.95	79.39	88.50	55.74	72.68
1985	74.78	80.48	98.96	99.18	81.12	90.09	60.25	76.94
1990	75.92	81.90	99.10	99.30	82.60	91.32	63.04	79.85

source: Adapted from 1993 Annual Report of the Institute of Population Problems, Ministry of Health and Welfare, The 17th Life Table, and Abridged Life Tables.

***TABLE 4.13: Major Results from the Japanese Basic Land Survey**

	Type of Land		Number of Corporations/Households which own land	Ownership (%)
Corporations	Land		603,950	34.6
		Developed land	558,280	32.0
		Land Assets for Sales	48,460	2.8
		Agricultural land	24,700	1.4
		Forestry	61,700	3.5
		Others	390	0.0
	Land		23,260 (1,000 households)	57.4
Households	On which households reside		21,816	53.8
	Other than land on which households reside		9,493	23.4
		Developed land	5,121	12.6
		Agricultural land	5,276	13.0
		Forestry	2,987	7.4

Source: Adapted from Fig. 6, LOC doc 96-12799 – “Major Results of the Basic Land Survey, Fall 1993

*Since there are corporations/households that own several types of land, the total number of corporations/households is different from the sum of each item of corporations/households.

TABLE 4.14: Standard Number of School Hours for Elementary School Students in Japan (April 1992)

Curriculum	Grade					
	1 st	2 nd	3 rd	4 th	5 th	6 th
Japanese language	306	315	280	280	210	210
Social Studies, Life & Environment	102	105	105	105	105	105
Arithmetic	136	175	175	175	175	175
Science	-	-	105	105	105	105
Music, Art & Handicrafts, Homemaking	136	140	140	140	210	210
Physical Education	102	105	105	105	105	105
Moral Education	34	35	35	35	35	35
Special Activities	34	35	35	70	70	70
Total	850	910	980	1015	1015	1015

Source: Stevenson, Lee and Nerison-Low, (1996) adapted from Jichi Sogo Center, 1991

TABLE 4.15: Prescribed Subjects and Number of School Hours in Junior High Schools (April 1992)

Curriculum	Grade		
	7 th	8 th	9 th
Japanese language	175	140	140
Social Studies	140	140	70 / 105
Mathematics	105	140	140
Science	105	105	105 / 140
Music	70	70	35
Fine Arts	70	70	35
Health and Physical Education	105	105	105 / 140
Industrial Arts or Homemaking	70	70	70 / 105
Moral Education	35	35	35
Special Activities	35 / 70	35	35
Electives	105 / 140	105 / 210	140 / 280
Total Minimum Required	1050	1050	1050

Source: Stevenson, Lee and Nerison-Low, (1996) adapted from Jichi Sogo Center, 1991

* **TABLE 4.16: Comparisons of International School Participation Rates**

	Primary school		Secondary school		Post-secondary school	
	Male	Female	Male	Female	Male	Female
Japan	100	100	96	98	36.6	26.1
United States	99	98	77	79	64.1	79.1
United Kingdom	97	98	79	81	28.2	27.3
Germany	93	94	98	96	-	-
France	100	100	85	89	41.1	50.3
Korea	99	100	87	89	57.2	34.6

Source: Domoto, 2003 (data source taken from Monbusho, 1997)

* **TABLE 4.17: Percentage of Students Entering into Kindergarten, High School, College and University in Japan (1988-1996)**

		1988	1989	1990	1991	1992	1993	1994	1995	1996
	Average	63.7	64.0	64.0	64.1	64.1	63.8	63.5	63.2	62.8
Kindergarten	Male	63.2	63.5	63.6	63.6	63.5	63.3	62.9	62.7	62.2
	Female	64.3	64.5	64.5	64.6	64.7	64.5	64.2	63.9	63.5
	Average	94.5	94.7	95.1	95.4	95.9	96.2	96.5	96.7	96.8
High School	Male	93.4	93.6	94.0	94.3	94.8	95.3	95.6	95.8	95.9
	Female	95.7	95.9	96.2	96.4	96.9	97.2	97.5	97.6	97.8
	Average	36.7	36.3	36.3	37.7	38.9	40.9	43.3	45.2	46.2
College/University	Male	37.2	35.8	35.2	36.3	37.0	38.5	40.9	42.9	44.2
	Female	36.2	36.8	37.4	39.2	40.8	43.4	45.9	47.6	48.3

Source: Domoto, 2003 (data source taken from Monbusho, 1997)

TABLE 4.18: Distribution of the Lowest-Scoring Student Accepted by Type of School for the Tokyo Metropolitan Area High Schools in 1983

Standardized Score ^(a)	Academic	Vocational ^(b)
66 and >	1.4 % (2)	--
61-65	13.9% (20)	--
56-60	18.1% (26)	--
51-55	23.6% (34)	5.7% (6)
46-50	20.8% (30)	13.3% (14)
41-45	20.8% (30)	46.7% (49)
36-40	1.4% (2)	28.6% (30)
< 35	-- (0)	5.7% (6)
Total	100.0 % (144)	100.0 % (105)

"()" = number of schools

Source: Stevenson, Lee and Nerison-Low (1996). This is a table from their report for the Third International Mathematics and Science Study (TIMSS). Their analysis is on 1996 TIMSS data

Note (a) referred to as *hensachi* in Japanese, the standardized score is the average score of 12th-grade mock entrance examination texts, standardized so that the mean of all students is 50 and the standard deviation is 10.

Note (b) includes industrial and commercial courses in vocational high schools only. Stevenson, et al utilized Dore and Sako, 1989

TABLE 5.10: Tsukuba University Foreigners

Classification of Foreigner	Total Numbers	China	Korea	U.S.	Malaysia	Others
Total Foreigners	1089	371	225	33	29	431
Foreign Faculty	78	17.9%	17.9%	14.1%	1.3%	48.7%
Undergraduate Students	109 (* 56)	30.3% (* 15)	17.4% (* 9)	0%	12.8% (* 8)	39.4% (* 24)
Graduate Students	644 (* 277)	37.0% (* 110)	22.7% (* 61)	0.5% (* 2)	0.9% (* 4)	39.0% (* 100)
Non-degree research students	149 (* 74)	49.0% (* 29)	18.1% (* 17)	0.7%	2.0% (* 3)	30.2% (* 25)
Other Students	109 (* 57)	11.9% (* 10)	17.4% (* 14)	16.5% (* 7)	4.6% (* 4)	49.5% (* 22)
Foreign Country Proportions		34.1%	20.7%	3.0%	2.7%	39.6%

*indicates females

**the "Other" category includes students from 77 "other" countries

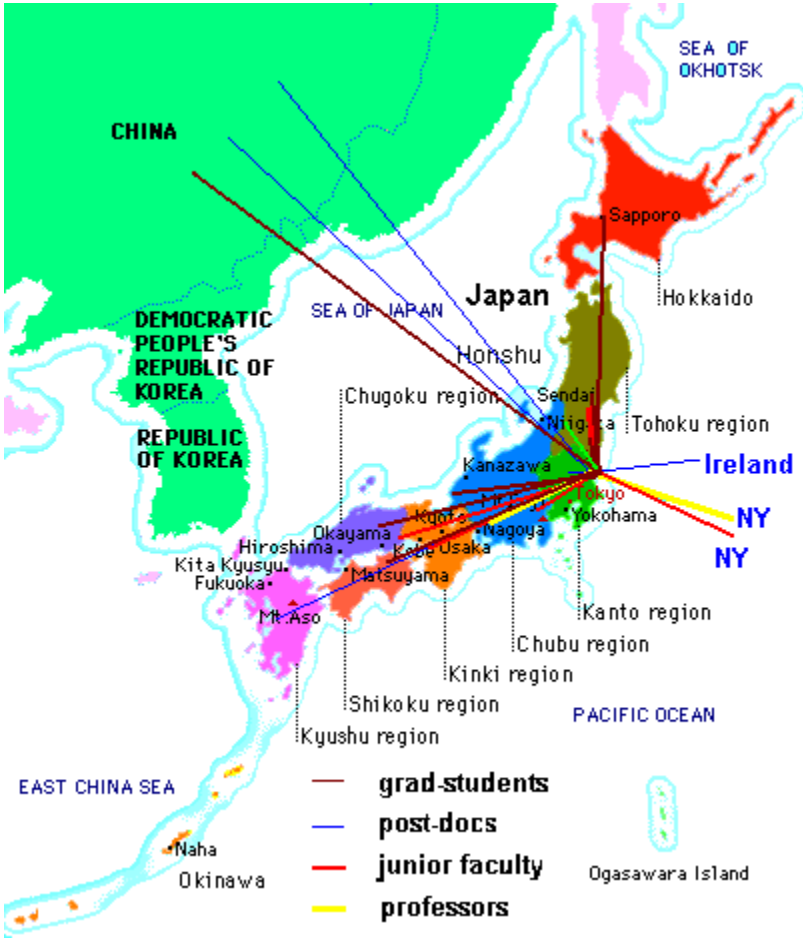


FIGURE 6.1: Informant Origin Network MAP

Appendix B: Acronyms Used in this Study

Acronym	Description of Acronym
<i>DIET</i>	The Japanese legislature
<i>FGC</i>	Fifth Generation Consortium
<i>ICOT</i>	Institute for New Generation Computer Technology
<i>Institute 1</i>	Primary Institute in this study focusing on biomedical genetics and materials science
<i>Institute 2</i>	Primary Institute in this study focusing on physics and materials science
<i>Institute 3</i>	Primary Institute in this study focusing on agriculture, forestry and biology
<i>Institute 4</i>	Secondary Institute in this study acting as “collaborator” among many fields of science
<i>Institute 5</i>	Secondary Institute in this study focusing on political science, policy and economics
<i>Institute 6</i>	One of the largest materials science institutes in Japan
<i>LDP</i>	Liberal Democratic Party
<i>METI</i>	Ministry of Economy, Trade & Industry (used to be called <i>MITI</i>)
<i>MEXT</i>	Ministry of Education, Culture, Sports, Science & Technology
<i>MITI</i>	Ministry of International Trade & Industry
<i>MOE</i>	Ministry of Education
<i>MOF</i>	Ministry of Finance
<i>MOPT</i>	Ministry of Public Management, Home Affairs, Posts & Telecommunications
<i>Section “A”</i>	Institute 1 branch division
<i>Section “B”</i>	Institute 1 branch division
<i>TU or UT</i>	Tsukuba University or University of Tsukuba University
<i>Virginia Tech</i>	Virginia Polytechnic Institute & State University

Appendix C: Japanese Words/Phrases Used in this Study

Japanese Words/Phrases (“romanji”)	English Translation
Ba	“field” in Japanese Physics
Bunkei	slang term for those educationally trained in business
Chugakko	junior high school
Daigaku	university
daigaku nyugaku shiken & senta shaken	university entrance exams
doozoku gaisha	Family businesses
gakureki shakai	credentialist society
Gikan	Researcher / technician
Gun	county
Hoikuen	day care center
Hoikusho	day care center
Honne	inner-reality
Ie	Japanese system of household organization
Ijime	bullying
Jimukan	government bureaucrat
Juko	cram schools for elementary, junior high and high school entrance exams
Keiretsu	A concept referring to the networks and ties that interlink certain Japanese companies
Ken	prefecture
koko nyugaku shaken	high school entrance exams
Kotogakko	high school
Koza	chair of subject-specific area in any given department in Japan’s higher education institutions
Meiji Period	1868-1912 (approximately)
Monbukagakusho	MEXT or Ministry of Education, Culture, Sports, Science & Technology
Rikei	slang term for those educationally trained in science
Shi	city
Shingikai	government advisory councils or deliberation council
tanki daigaku	junior college
Tatemaie	public face of cooperation
Tokko	WWII era “Thought Police”
toko kyohi	refusal to go to school
Yobiko	cram schools for university entrance exams
Yochien	kindergarten
waku waku suru	be excited (specifically in workplace)

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End Notes

Chapter 2

¹ At the end of an interview with three informants at Institute 4 I thought it would be a good time to ask all of them their impressions on Tsukuba and their happiness or degree of fulfillment in this city. So, I asked the question: **“How do you feel about Tsukuba and are you happy in Tsukuba?”** The backdrop of the question was situated in the context of criticisms by Japanese themselves of the high rates of suicide and discontent of scientists in Tsukuba. Tsukuba has been said to be “odd” by many Japanese. The senior scientist replied first: **“I love my work and I get a chance to meet with prestigious people all around the world.”** **“However, I do not like living in Tsukuba.”** I was surprised at how forthright this scientist was, especially considering he was the most senior of the group. He went on to tell me that some of the bad press about Tsukuba is true - that suicides were very high in the beginning of the making of this city. He blamed much of this on the **“Japanese need a little bit of “chaos”** in their lives. The fact that Tsukuba is a “planned city,” **limits the amount of chaos. In other words, “...your neighbors are just like you – scientists.”** Also, the children of parents in Tsukuba do not see any variety which can lead to many social pressures. For instance, **“...regarding IQ in Tsukuba is quite high.”** Tsukuba is a **“...monotone society,”** and thus, **“...the standard of competition for children in school is extremely high, higher than other parts of Japan.”** This senior scientist went on to talk about the pressures he sees in his two children and that **“...children in Tsukuba must compete with the best of the best.”** In the same interview, this senior scientist spoke about how he believes that Institute 4 is a novel innovative organization that is attempting to make a **“flat organizational”** style (vs. the hierarchal style of top-down) work for better innovation. Since there is only one President, this informant sees a chance for the new system to work. In my words, he was trying to describe too many heads of one household can cause trouble and the organization will have trouble functioning. The more junior scientist answered similarly, although he indicated he does not have children, he loves his work, but does not like being in a planned city away from some of the traditional city life of Japan (*“Tsukuba Journal 2002,” entry 10-09-02*).

² Today, I awoke about 9am with rested body parts from my travels through the Ginza and around Yashukan (Yasukuni jinja). On Saturday (10-26-02), my visit to Tokyo was rejuvenating. The people flock in around the city during the weekends. However, I noted that 11am until 1:30pm on Saturday was extremely crowded in the Ginza district and around Tokyo station. Yet, from 1:30pm through 5pm, the Ginza and surrounding area was “calmed” down a bit and there were less people about as I exited a sushi shop which I thoroughly enjoyed! (*“Tsukuba Creative Journal 2002,” entry 10-27-02*).

From 11am through 5pm on Saturday, I ate lunch at a small Japanese restaurant located on the North end of Tokyo station. I also toured the Yashukan (located toward the East side of the Imperial Palace). This tour of a traditional *jinja* was an invaluable experience of Japanese history, controversial politics, and religion in the context of Tokyo. As I approached the main arches of the entry way into Yasukuni (Yashukan – the main temple building of the Yasukuni jinja) jinja, I was surrounded by school boys and girls (teenagers in school uniforms with umbrellas of various colors, pink and black stand out as a majority of the colors – but the color spectrum was represented in full). Saturday is a day that many Japanese flow in and out of this jinja. This jinja is particularly interesting, in that, it is surrounded by cultural controversy. In 1979, this shrine enshrined several A-class Japanese war heroes (obviously, WWII “heroes” were included and this is where the controversy arises). Many other Asian countries, Japanese too, and American and Europeans were upset at this action due to a difference of opinion on raising the level of status of these soldiers that were not considered heroes by many in the world. During my first visit to the shrine, I did see a protestor that was protesting an upcoming visit to Yashukan by the Prime Minister (Koizumi) of Japan. The protestor was wearing an American-issue soldier cap carrying both the Japanese &

American flags. He started near the jinja main building (Yashukan) and seemed to be getting approval from a guard at the shrine, and then paraded off in military marching fashion up the main path, away from the shrine carrying a protest banner (in Japanese Kanji) (*"Tsukuba Creative Journal 2002,"* entry 10-27-02).

On this, my second visit, there were no such protests. Rain softly fell and the air (partially covered with a light fog that held the viewing distance to about 100 yards) was moist and cool. However, I did see a lot more people and many of them were gathered at the museum (the main glassed-in museum building with a Japanese WWII plane and railway car in it). Many of the visitors appeared to be older Japanese (both men and women of the WWII era). However, many middle-aged men and women had children with them and there were the flocks of school children included in the crowds as well. I was entertained by two young girls who were dressed in full Kimono garb and the other young girls with short skirts and blazers giggling with school friends. All of these people were marching toward the Yashukan. In a side building of the Yashukan, a presentation was going on with several men and women (mostly older) seated while a video was playing inside. This appeared to be a "history" of wars, the war-dead and the jinja. As I walked around to the museum, the same icons of fish/"Dolphins" that were previously seen at the imperial palace are located on either side of the main steps going into the museum. The glassed-end museum building held the plane and railway car and had two or three floors. It appeared to be a main attraction for visitors. In the back of the Yashukan is a Koi pond with feeding veranda (pagoda style small shelter to throw purchased food (from a vending machine) into the water to feed the Koi). Making my way out of the jinja compound was enjoyable. The large arches and wooden doors give one the feeling of something special, something with historical meaning. At the same time, "something special" may mean something different to anyone that visits this shrine. There was something special about this place for me – the cool damp air with light rain provided an interesting mood and context from which to witness this jinja. I often thought about how the other people at the jinja perceived an obvious western-gaijin like myself, knowing themselves that they were at a very controversial location. Yet, I never saw anyone (out of 100s of people) that appeared anxious or troubled by my being here. Again, this may be a contradiction set within another location of Japanese society. As I exited the jinja from a side exit, out of nowhere stood a stark contrast of a stone shrine lantern half-covered with trees slung downward from the rain and above the lantern stood a large office building across the street labeled "Toyota." This mix of new and old (contemporary & historical) was all around me in Japan (*"Tsukuba Creative Journal 2002,"* entry 10-27-02).

Leaving the jinja, the weather started to clear up and I was able to walk back through the Imperial Palace on to Tokyo Station and then to the Ginza district for dinner. The Ginza is simply an amazing site for a westerner to see. The streets are sometimes medium in size (for Japanese streets), but quickly widdle down to small alleyways that many cars cannot fit in. It was these alleyways that I enjoyed the most. Many interesting restaurants, pubs and amusement businesses are located in these small "out of the way" locations. However, near the "GinzaInz," a large department store, the people are flocking everywhere. As you walk further along into the maze of streets in the Ginza district, you notice quickly that this is an upscale place with designer clothing, shoes, and hairdressing around every corner. The people walking in this district alongside me, are a part of this upscale climate. The obvious clothes of upper and middle-class Japanese are a hybrid of Japan-Europe-USA. Hats of all sorts are fashionable. Some of the most popular were floppy-hats (appearing out of the USA 1960s – suede was popular as a material) and fashion-oriented ski-caps (especially on young 20s/30s Japanese women) that are tight around the head and only parts of their hair shows. A reddish tint was the most popular color of hair (on both men and women, especially teens and 20s individuals). I stopped into a sushi shop (alone with three workers - a sushi "chef" and two compatriots – waiters and cleaners). I had a "variety" sushi bowl (manguro, egg, other fish on nori-gohan rolls and loved the wasabi/soy sauce mix). I chatted a bit with the older waiter who informed me that his daughter is living in Hawaii and just married a US serviceman. They often fly to New York. I spoke broken-Japanese in response to his broken-English but, it all seemed to flow. The noise and mayhem (and organized chaos if this is possible) of Tokyo Station and the Ginza was

a huge contrast to the symbolic and peaceful Yashukan. Even though, I still have trouble comprehending all of the contradictions (e.g., recycling many things but, throwing away 8 billion wooden hashi every year, the peaceful settings of the Imperial Palace surrounded by a booming city that never sleeps and the Yashukan-Toyota contrast right next to each other) (*Tsukuba Creative Journal 2002,* entry 10-27-02).

- ³ The Cabinet Office has four major Councils that advise the Prime Minister on important issues in Japan. It was restructured in January 2001. This reorganization affected a potentially important political element in science & technology policy in Japan. This element is the *Council for Science and Technology Policy (CSTP)*. CSTP was established within the Cabinet Office in January 2001. It formulates policy and ensures the general coordination of science and technology in Japan. The Council formulates a strategy and sets funding priorities for budgets and personnel. It also evaluates R&D activities of national significance. Thus, the Council appears to be a major actor in the agenda setting and coordination of policy between the Ministries. It is also important to note that the Cabinet Office is charged with "...finding solutions to issues confronting Japan, such as the conversion to a vibrant economy and society, the construction of communities with peace of mind and the preservation of the global environment" (*cabinet office document*). This sounds very similar to Tsukuba Science City and its mission statement. This may indicate an intention by CSTP to couple scientific development with social change in Japan.

Chapter 3

- ¹ 10-16-02 @ 10:45am – 11:00am (15 minutes): counted people moving in and out of Institute 1, thirty-six arrived and came in the front door of this institute (Institute 1) and fifteen exited this institute during the 15 minute time period (*field notes*).

10-18-02 @ 12:22pm – 12:41pm (19 minutes): counted 4 (3 middle-aged men and 1 young 20s woman) people arriving and coming the front door of this institute (Institute 1) and 6 people (2, 20s males, 1 middle-aged male, 2 young 20s females and 1 middle-aged female) exiting this institute during this 19 minute period (*field notes*).

Laboratory (Institute 2, lab #1) contents: 4 desk areas containing 3 flat screen monitors (one 15" monitor, one 17" monitor, one 24" monitor), 1 laptop. There were not computers in Institute 2, lab #2 (*field notes*).

Equipment related (Institute 1, inform_16 lab – contained two different NMR machines, the larger one costs about \$500,000 (*field notes*)).

² Besides keeping a daily journal, I also made occasional entries while traveling and/or during “down-time.” Below, is an adapted list from my journal compiling the “pros” and “cons” as I experienced them – while I was making my way via bus from Tsukuba Center to Tokyo Narita Airport at the end of my travels (*field notes*).

Tokyo	Tsukuba
Small streets	Large open spaces
Lots of neon	Part rural
Crowded streets	No close trains
Great train and subway systems	Good city and campus bus systems
Everyone in a hurry	Everyone in a hurry
Some large parks	Lot's of open space and large parks
Museums	One or two museums
Diversity!!	No diversity in occupations
Affluent people all around	Prices cheaper than Tokyo
Homeless in many places	I didn't see one homeless person
Yoyogi park has many homeless	
Great social life	Social life small to little

Chapter 5

¹ Ingelhart, et al., (2001) provide an interesting data set on Japanese cultural variables. After analyzing the 1995-1997 wave of this data set, several different associations between different attitudinal variables showed interesting and significant results. For instance, the weight placed on work versus leisure is negatively associated with gender (-0.203**). Also, an attitude toward a university education being more important for a boy versus a girl is positively associated with the attitude that if jobs are scarce, men have more rights to take them (+0.425**). Also, the attitude that if jobs are scarce, men have more rights to take them is negatively correlated with Japanese respondent attitudes toward foreign workers (-0.178**). In this latter variable (attitude toward foreign workers), respondents were asked about which option the government should choose in dealing with foreigners wanting to work in Japan. The choices ranged anywhere from letting any foreigner work in Japan who wants to, to prohibiting foreign workers from coming at all. All of these correlations had sample “n’s” greater than 1,000 and are significant to a 0.001 level. Although, these elementary and relatively low-magnitude correlations say nothing about causation, in combination with other studies such as the 1995 survey above, conducted by a Japanese Ministry, they allude to some preliminary cultural attitudes that may provide the basis for understanding some of the complexities of Japanese attitudes toward education, gender, foreigners and work and occupations in Japan.

² The Institute for Scientific Information (ISI) provides The *Journal Citation Reports* as an essential, comprehensive, and unique resource for journal evaluation, using citation data drawn from over 8,400 scholarly and technical journals worldwide. Coverage is both multidisciplinary and international, and incorporates journals from over 3,000 publishers in 60 nations. The *JCR* is the only source of citation data on journals, and includes virtually all specialties in the areas of science, technology, and the social sciences. *JCR Web* shows the relationship between citing and cited journals in a clear, easy-to-use framework. *JCR Web* is available annually in two editions: The Science Edition contains data from roughly 5,000 journals in the areas of science and technology. The Social Sciences Edition contains data from roughly 1,500 journals in the social sciences (taken from Institute for Scientific information website).

Chapter 6

- ¹ An Eastern-European scientist (inform_34) explained to me his interests in Japanese consumption and what sort of environmental solutions they have. For instance, according to inform_34, Japanese households produce 20 billion tons of food trash each year. Yet, 30 billion tons of food is imported per year. Thus, a focus for agricultural economic scientists is to utilize the 20 billion tons of food trash in order to curb the 30 billion tons of imports. According to inform_34, a “Closed Technological Chain” is the key to solving this problem.
- ² While watching my guest-house manager clean the front steps, a young Korean boy walked by on his way to school. The manager of my housing unit explained to me (via showing me on his face) that Koreans have more curved eyebrows than Japanese. I found this conversation quite interesting, in that, it showed the taken-for-granted differences among Asians, that an American might miss in passing (*field notes*).

Chapter 7

- ¹ An interesting contrast between Tsukuba and Tokyo that I witnessed was the location of “private” within “public” or “social.” In other words, much private business or private behavior is done within the public or social. For instance, my wonderful dinner in Iidabashi with the *family friends* was at a restaurant within a private room (*tatame mats and Japanese pillows*) where our conversation could only be heard by us – our group. In a Karaoke pub in Tsukuba, we Karok’ed the night away within a private room (one of several in a row) fitting six or seven grad-students. Finally, the private within the social environment of work. I noticed that very few of Institute 1 or Institute 2 scientists or grad-students participated in social events with their own coworkers. However, this appears to be a contradiction if contrasted with Tokyo or other large cities in Japan. In these other cities the “business” after regular business hours usually entails staying out most of the night with coworkers drinking (specifically, for men). On the other hand, my informants’ views on Tsukuba itself and their own workplaces in the scientific institutes of Tsukuba reveal explanations for why many in Tsukuba do not “play” with their coworkers – they only “work” with them (“*Tsukuba Creative Journal 2002,*” entry 10-27-02)
- ² Pachinko is believed to have originated in Chicago, Illinois (although, no source can be completely verified) being derived from a game called “*Coringth*” in the early part of the 20th century. However, it never became popular until it was introduced in Japan. Pachinko’s name is derived from the Japanese phrase “*pachi pachi,*” which is roughly translated into “clicking of small objects.” The first Japanese pachinko hall was opened during the 1920s in Osaka Prefecture (Belson, 2003; O'Neill, 2003).

Figures & Tables

- ¹ Beginning in 1950, the alien population in naichi (Japan proper), as of October 1 each year. Each year beginning in 1945, areas are those under Japanese jurisdiction.
- ² In the population census from 1920 to 1940, nationalities of people in areas under Japanese rule were classified as “non-alien,” however, as “alien” in this publication.

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Education

- Dec. 2003 Ph.D., Sociology, Virginia Polytechnic Institute and State University, Blacksburg, VA., specializing in sociology of science, Dissertation title: *The Common, the Contradictory and the Idiosyncratic: Signposts from a Qualitative Exploration into the Structural Factors Influencing Scientific Work in Tsukuba, Japan [1997-2002].*
- Aug. 1996 M.A., Sociology, George Mason University, Fairfax, VA., specializing in Crime, Delinquency and Corrections, Thesis title: *Mental Illness and Control Theory: A Biosocial Model of Violent Behavior*
- May 1985 B.S., Marine Biology, Texas A&M University, Galveston, TX.

Professional Work Experience

- Fall, 2003 Research projects for Professor Toni Calasanti. One involves qualitative research (using personal interviews) on care-givers of Alzheimer's patients. The second research project involves coding and analysis for an investigation into "anti-aging" websites.
- Fall, 2003 *Graduate Teaching Assistant* for Professor Toni Calasanti - Sociology Department, Virginia Polytechnic Institute and State University (44 student "Social Problems" course - grading, monitoring, and daily assistance with course)
- Fall, 2002 Dissertation research in Tsukuba, Japan using qualitative in-person survey instrument
- Jun, 2002 *Instructor*, "Individual in Society," 2000-level undergraduate course at Virginia Polytechnic Institute and State University

Professional Work Experience (cont.)

- Fall, 2001 *Instructor*, "Social Problems," 2000-level undergraduate course at Virginia Polytechnic Institute and State University
- Jun, 2000 *Instructor*, "Social Problems," 2000-level undergraduate course at Virginia Polytechnic Institute and State University
- Spring, 2001 *Instructor*, "Individual in Society," 2000-level undergraduate course at Virginia Polytechnic Institute and State University
- Fall, 2000-01 Mentoring study for Professor William Snizek, Ph.D., website construction, organization and scheduling, statistical workup of progress in mentor and control groups (2 years)
- Fall, 2000 *Graduate Teaching Assistant* for Sociology Department, Virginia Polytechnic Institute and State University, Fall 2000. (600 student Introductory Sociology course - grading, website construction and monitoring, and daily assistance with course)
- 1999 – 2000 *Graduate Teaching Assistant* for Sociology Department, Virginia Polytechnic Institute and State University, Fall 1999 through Spring 2000. (2, 600 student Introductory Sociology courses, 1 Sociology of the Family, and 1 Sociology of Aging class)
- 1998 – 1999 *Java™ Programmer and statistics tutorial creator* for SABLE project, Computer Science Department, Summer, 1998 through Spring 1999. (SABLE is an interactive environment for statistics classes)
- 1998 – 1999 *Graduate Assistant* for Sociology Department, Virginia Polytechnic Institute and State University, Spring 1998. (Computer maintenance/repair & troubleshooting)
- 1997 – 2000 *Supplemental Instructor* for Introductory Sociology, Virginia Polytechnic Institute and State University, Academic Enrichment Programs, Fall and Spring semesters: Tutor for Minority Group Relations and Introductory Sociology, Athletic Academic Advising, Virginia Polytechnic Institute and State University, Fall and Spring semesters
- 1987 – 1997 *Senior Supervisor*, Reagent Production, Iodination/Antisera/Government Contracts (1996-1997); Supervisor, Reagent Production, Iodination Group, 1993-1996; Group Leader, Iodination Laboratory (1991-1993); Research Associate, (1989-1991); Research Assistant, (1988-1989); Senior Laboratory Technician, (1987-1988), at Hazleton Biotechnologies Company, Vienna, VA. (In 1996, changed to Covance, Inc., Vienna, VA.)

Professional Work Experience (cont.)

- 1994 – 1997 *Case Manager*, Virginia Office of Criminal Justice Services, Manassas, VA.
- 1986 – 1987 Senior Laboratory Technician, Johns Hopkins University
- 1985 – 1986 Foreign Fisheries Observer, National Oceanographic and Atmospheric Administration (N.O.A.A.), Seattle, WA., working on Japanese Fishing Vessels off the coast of Alaska

Professional Training

- 2002 Development of qualitative research instrument for dissertation
- 2002 Association for Asian Studies Conference, Washington D.C., April 3-7
- 2001 International Presentation at WES Conference, Nottingham, England, September 11-13
- 1998 - 1999 Computer Science systems training for web-based interactive statistical software project
- 1997 - 1998 Supplemental Instruction training for tutoring Introductory Sociology and related classes
- 1996 – 1997 ISO 9001 quality standard training and implementation, Covance Inc., Vienna, VA.
- 1997 Eastern Regional Annual Meeting, American Association of Pharmaceutical Scientists (AAPS). New Brunswick, NJ.
- 1996 Annual Meeting of the American Association for Clinical Chemistry (AACC), Chicago, IL.
- 1995 Dale Carnegie Leadership Training for Managers, Covance Inc., Vienna, VA. (28 hours, 2.4 continuing education credits)
- 1993 Computer Program Design and Development, Northern Virginia Community College, Sterling, VA. (4 credits)
- 1992 Management Development Training, DCM & KMB Associates, Covance Inc., Vienna, VA. (76 hours)

Professional Affiliations

- 2002 – present *Association for Asian Studies (AAS)*
- 2000 – present *Policy Studies Organization (PSO)*
- 1999 – present *Society for the Social Studies of Science (4S)*
- 1999 – present *Japan-America Society of Washington, D.C. (JASWDC)*
- 1997 – present *American Sociological Association (ASA)*
- 1997 – present *New York Academy of Sciences (NYAS)*

Publications and Papers

1. Hertel, B. R., and John D. Wilkins. "Work and Well-being Among White Americans: How Much Work is Too Much?" in-process paper, 2004 submission to journal
2. Hertel, B. R., and John D. Wilkins. "Patterns in the impact of Hours of Workforce Participation on Psychological Well-Being and Self-Assessed Health of White American Adults, 1972-1998," Paper presentation at Work Employment & Society Conference, September 11-13, 2001, Nottingham England
3. John D. Wilkins, rev. of "New Atlantis Revisited: Akademgorodok, The Siberian City of Science," by Paul R. Josephson, Science, Technology, and Human Values, Autumn 1999, Vol.24 No.4.
4. John D. Wilkins, rev. of "The Sun, the Genome, & the Internet" by Freeman J. Dyson, Science & Technology, July 2000, <http://www.techsoc.com>
5. John D. Wilkins, rev. of "Has Feminism Changed Science?" by Londa Schiebinger, Science & Technology, June 2000, <http://www.techsoc.com>
6. John D. Wilkins, rev. of "Building A Bridge to the 18th Century," by Neil Postman, Science & Technology, May 2000, <http://www.techsoc.com>

Professional Accomplishments / Awards and Honors

- 2000-2001 Freelance writer for web-based science and technology book reviews
(<http://www.techsoc.com>)
- 1996 CPS "Connections" Award for outstanding Antisera and Iodination
laboratory supervisory and technical performance, Covance, Inc., Vienna,
VA.
- 1994 "Volunteer of the Month - January 1995," Community Corrections,
Manassas, VA.
- 1987 – 1997 Various "Customer Satisfaction" surveys for excellence in supervisory and
technical performance
- 1983 – 1984 Distinguished Student Award, Texas A&M University

Courses Qualified to Teach

- Contemporary Science Policy & Planning
- Introduction to Sociology of Science
- Social Problems
- Individual in Society
- Introductory Sociology
- Criminology, Corrections, and Juvenile Delinquency

Research Interests

Work and Organizations

Japanese Culture

Japanese science policy

Science cities and Research Parks

Japanese Education

Time & Society

Scientific knowledge, practice and culture

Computer Skills

- Environments: Windows XP, 98/95; Linux (Mandrake 9.1); Unix, Gnu-Win32 (Cygnus), CVS, Apple systems
- Statistics Software: SPSS, STATA, NUD*IST – N6 (qualitative software), and Sipina_W (qualitative and quantitative pattern recognition software)
- Word processors: MS Office XP/2000 & 97 (Word, Excel, Powerpoint, Access), Word Perfect; Lotus Ami Pro
- Spreadsheets/
Databases: Microsoft EXCEL (including programming and statistical analysis); Microsoft Access
- Programming
Languages: HTML, JavaScript™, Java™, Python, Visual Basic™, Quick-Basic™, Assembly, C™ and C++™
- Other: Adobe Acrobat, Microsoft PowerPoint; Microsoft Publisher; Digital Cameras; CD-RW peripherals; HTML Programming; scanning equipment; Olympus DS-320 recorder / transcriber.