LESSONS IN MATCHMAKING:

CONFLICTS IN JOB ASSIGNMENTS FOR CHINA'S SCIENTISTS AND TECHNICIANS

by

J. CASEY HAMMOND

B.A., History and Asian Studies
University of Notre Dame
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Signature of Author _____
Department of Urban Studies and Planning
May 19, 1988

Certified by _____
Donald A. Schon
Thesis Advisor

Accepted by _____
Tunney Lee
Department Head

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ABSTRACT

The talents and efforts of scientists and technicians in the People's Republic of China are essential to the modernization of that country. Demand for their assistance, however, far exceeds their ability to provide it. In order to ensure a rational distribution of scientific and technical (S&T) skills in this situation of scarcity, S&T graduates are allocated to work units by a planned job assignment system. Nevertheless, many of China's scientists and technicians are matched to jobs that poorly suit their training or tastes. Moreover, there are few means for them to transfer to another job after receiving an assignment.

If it is reasonable to assume that the scarcity of S&T talent will not soon be resolved and that the job assignment system will continue as a means of allocating S&T talent in this situation of scarcity, then it is worthwhile to learn how scientists and technicians can be better matched to jobs. Improved information, coordination, and communication would lead to better matches. Any technical solution must, however, be implemented in view of the conflicting objectives of individuals and groups involved in job assignments. Therefore, in an attempt to understand the forces shaping the outcomes of the job assignment process, this thesis analyzes the conflicts within and among the participants.

The analysis of the conflicts offered here reveals a complex pattern of authority and exchange mechanisms. These mechanisms tighten and loosen as groups and individuals compete to exercise or expand their ability to achieve objectives. The dual processes of authority and exchange within the job assignment system provide different incentives and account for some of the unintended outcomes in the job assignment system. Methods of refining this approach, as well as an alternative approach, are proposed for further study of this system.

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1. INTRODUCTION

China's ambitious plans for modernization in the late 20th century are dependent upon its attempts to integrate scientific and technological research with economic production. As a part of these efforts, China's top leadership has explicitly stated its desire to promote the full use of scientific and technical personnel (WHITE PAPER 1986: 13-14). Given the serious shortage of scientists and technicians to meet the country's needs, these persons might be optimally employed. The institutional means for assigning them to jobs after they graduate, however, often put them where they do not want to be and perhaps do not belong.

Because of the disequilibrium in the supply and demand for scientific and technical (S&T) talent in the People's Republic of China (PRC), the state has attempted to achieve a balance through a planned allocation system of job assignments. This system is designed to allocate S&T talent in accordance with state plans for development of targeted regions in the interior and countryside, as well as targeted projects and sectors (ECKSTEIN 1978: 140; ORLEANS 1986: 8). The outcome in many cases is, however, a poor match between graduates and jobs.

The concept of a good match has both macro- and micro-level aspects which are measurable by fairly objective criteria. A good match occurs in a macro sense when the required numbers of S&T personnel in a given field are assigned

to regions and sectors so that a surplus does not result in one and a shortage in another. In a micro sense, a good match results when a scientist or technician is assigned to a job that suitably matches his or her training. A good match at the micro level can also be said to occur when a job assignment matches the preferences of a scientist or technician. This last aspect is, however, subjective and therefore difficult to measure. Moreover, it complicates measurement of matching or mismatching. For example, a person may be well suited to a job assignment because of his or her training, but the job location may not suit his or her preferences. If this last situation is not a strict mismatch per se, it nonetheless deserves attention if it lowers the morale and productivity of scarce S&T talent.

A few qualifications to this study are needed. First, although S&T personnel are assigned to non-state sector, as well as state sector, work units, this study focuses mainly on mismatches in the initial assignment of these persons to state sector jobs. Much of the literature on S&T personnel concerns those in the state sector; all of the interviewees with whom I spoke were also state sector employees.

Second, although this thesis focuses largely on mismatches in the initial job assignment, mismatches can also occur later in a person's career. A person who is well matched to a job initially may become mismatched later when knowledge in his or her field has changed rapidly but the person has not been retrained; when a person does not learn on the job as quickly

as others or learns more quickly; or when state plans change so that his or her work unit is no longer targeted by the state and its personnel become underemployed.

Finally, it is very important also to note that this thesis focuses upon the shortcomings of the job assignment process and does not discuss its positive aspects. Assuredly, the system functions well in many respects, as evidenced by the remarkable strides in science and technology that the PRC has made in the past 40 years. I focus on the shortcomings in order to understand how Chinese scientists and technicians might be more appropriately trained and employed in order to satisfy both the development needs of their country as well as their own personal needs.

The precise extent to which PRC scientists and technicians are mismatched to their jobs probably cannot be known. If judged from the considerable attention of Chinese policy and the Chinese press to this situation, then it undoubtedly exists on a scale that demands correction. Estimates of that scale are suggested by two recent surveys. One survey of over 10,000 specialist technical personnel in Shanghai (KEJI RIBAO 1987a) revealed that 19.8 percent of these persons are assigned to jobs not particularly suited to their training; that 16.5 percent are unsatisfied with their job even though it suitably matches their training; and that 25.2 percent have no tasks or are not fully engaged. Another survey of over 30,000 middle-aged technical people conducted nationwide in more than 500

enterprises (RENMIN RIBAO OVERSEAS EDITION 1986) showed that 11.2 percent are not used effectively at all. The latter survey does not, however, attribute any causes for these mismatches.

In regard to macro-level mismatches, there are numerous recent reports on the imbalanced distribution of scientists and technicians among different regions and sectors in China. These reports usually describe a scarcity of S&T talent in the countryside, interior, small enterprises, applied work, and the currently targeted sectors of energy, transportation, communications, and materials; or a surplus in large enterprises, large cities, basic research, and traditional heavy industries (GUANGMING RIBAO 1986a; 1986b; BEIJING REVIEW 1984, 1985; KEXUEXUE YU KEXUE JISHU GUANLI 1987a; YANG 1986; WHITE PAPER 1986: 116).

In order to correct this situation of mismatching (or to "rationalize the flow of S&T talent," as the Chinese refer to the situation), the state has introduced new reform policies in recent years to complement the planned allocation of talent by the state. Despite the ostensible increase in opportunities for better matches and greater mobility provided by the reforms, reports of mismatches persist (JILIN S&T COMMISSION 1987).

Why do these mismatches result from a planned system that is designed to prevent them? What do these unintended outcomes of a planned system reveal about its mechanisms? Are answers

to these questions generalizable to Chinese workers outside the S&T sector? What does the process by which the scientists and technologists are matched to jobs imply for the further development of China? Finally, how does a better understanding of this process assist that development?

One way to approach these questions is to analyze the weaknesses in the centralized planning system, such as inadequate forecasting of labor requirements, insufficient collection and processing of information, and slack verification of requests for S&T talent by work units. This approach assumes, however, that all participants in the job assignment process share a uniformity of interests and that enhanced technical planning methods are sufficient for solving mismatches. It disregards the possibility that groups and individuals may have conflicting interests and that mismatches may result when each pursues his or her own objectives within the assignment process.

The shortcomings of this approach suggest another method, which is to examine precisely what each group participating in job assignments for Chinese scientists and technicians wants from that process. The groups involved are the state (represented by the State Education Commission, Ministry of Labor and Personnel, State Planning Commission, State Economic Commission, and State Science and Technology Commission), the work units (represented by their administrative and party cadres), and the corps of scientists and technicians

themselves. The universities and other institutions of higher education, from which the S&T contingent graduates, also play an important role that needs to be examined. Conflicts occur within and among these groups over the objectives that they hope to achieve from the job allocation system.

In the hope that the information uncovered by this latter approach will clarify how state and work unit authorities might and might not effectively control the flow of S&T talent, I shall focus on these conflicts as a first step in analyzing the particular forces shaping the job assignment process.

Not having access to government ministers, work place authorities, or university staff, I have analyzed the conflicts in job assignments as revealed to me by a small number of scientists and engineers from the PRC who are in the United States (see Appendix). My analysis is based upon a small body of data collected from interviews with these men and women. These interviews were balanced with a review of selected PRC documents and related articles by scholars outside China.[1] The privileged background and superior education of most of the scientists and engineers with whom I spoke are undoubtedly

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[1] Especially useful were the "White Paper," a 1986 analysis of major science and technology policies of the Chinese Communist Party and PRC government since the Chinese reforms began in late 1978; and Leo Orleans' 1986 paper, "Reforms and Innovations in the Utilization of China's Scientific and Engineering Talent." I am indebted to Mr. Orleans for having granted me permission to use his paper for my research.

atypical of the "average" scientist or engineer back in China. Possible biases are described in the appendix to this paper. Nonetheless, many of the thoughts of these temporarily U.S.-based Chinese scientists and engineers regarding their jobs are probably shared widely among their colleagues in China. What the interviewees, supported by the documents, reveal about their own objectives, as well as their interpretation of the objectives of government officials, work unit authorities, and university staff, can serve as a starting point for further examination of the logic of the outcomes of the job assignment system for Chinese scientists and technicians.

In the remainder of this paper, I first review some of the background information on China's scientists and technicians and the job assignment system; second, I describe the objectives that each group seeks in the assignment system and how the system can assist or foil them in achieving their objectives; third, I examine the conflicts within and among the groups and how these conflicts prevent better matches of scientists and technicians; and finally, I attempt to answer questions raised by this study.

2. BACKGROUND

In order to understand any explanation for the mismatches between China's scientists and technicians and their jobs, I first review briefly four topics: scarcity of S&T personnel, importance of the initial job assignment, process of the job assignment system, and introduction of reforms into this system.

2.1 SCARCITY OF S&T PERSONNEL

China's total science and technology contingent, numbering 7.8 million at the end of 1985, includes 3.4 million engineers, 450,000 agricultural technicians, 336,000 research scientists, 2.2 million medical personnel, and 1.5 million mathematicians (WHITE PAPER 1986: 315). Statistics for the S&T contingent in 1984 show that 45 percent hold first degrees from a higher institution and 41 percent hold degrees from vocational schools (WHITE PAPER 1986: 317). The number holding graduate degrees is presumed to be relatively small. Only nine out of every 10,000 Chinese are enrolled in higher education, ranking China 113th in this regard among all nations (WHITE PAPER 1986: 315).

Although the number of scientists and technicians in China has grown at a rate ten times faster than that of the population as a whole since the founding of the PRC in 1949 (DONG and CHEN: 1), the demand for these highly skilled personnel continues to outstrip the supply. This shortage was

intensified by the Cultural Revolution (1966-1976), which brought China's higher education to a virtual standstill. China would have had an additional 0.9 to 1.0 million S&T personnel aged 30-39 years in 1985 if the Cultural Revolution had not disrupted education (DONG and CHEN: 8). In 1985, 23.7 percent of China's total S&T contingent were under the age of 30, many of them still students, whereas only 8.8 percent were in the age 30-39 years cohort (DONG and CHEN: 8). Given the weakness of China's education system during the Cultural Revolution, those in this last cohort are not only small in number but are probably less adequately trained as well.[2]

2.2 IMPORTANCE OF INITIAL JOB ASSIGNMENT

The importance of the initial job assignment cannot be overemphasized. In China, a person is generally assigned to a work unit for lifetime tenure. Although he or she may be promoted within the work unit, an employee finds it extremely

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[2] The scarcity of S&T talent certainly is not due to a lack of interest among Chinese students in pursuing science or engineering degrees. In the PRC, S&T personnel generally tend to enjoy (except during past anti-intellectual campaigns) a more elite social status than do many of their American counterparts (ORLEANS 1982: 472). Speaking for Chinese students in general, one interviewee gave the following reasons, aside from status considerations, for wanting to study science: it provides employment that is less susceptible than many other jobs to the vicissitudes of politics (despite past anti-intellectual campaigns); it allows a person to achieve accomplishments without using or being used by other people; and it allows a person always to pursue the "truth" (Interviewee no. 1). If these reasons are widely shared by other Chinese students, then it seems Chinese attitudes about science and technology, as well as about S&T personnel, may differ from American attitudes in some striking ways.

difficult to transfer out of it. Quitting is equally unlikely. The state-run job bureaus only assign a person to a job once. If a person refuses an assignment or quits, he or she is effectively excluded from state sector employment, which generally provides better welfare benefits than any other type of employment. (see WALDER 1983: 56-57)

Much of the difficulty in transferring can be attributed to the hoarding of employees by work unit cadres. Kornai provides an economic motive for such hoarding in his analysis of the traditional socialist firm that is always kept solvent by the state:

> Accordingly, its demand is hardly constrained by solvency considerations. The firm, as buyer, tries to acquire as much input as possible in order that shortage should not hinder production. (KORNAI 1980: 28-29)

A cadre may thus attempt to prevent the transfer of a highly trained, but underutilized, employee because the cost of his or her labor will ultimately be paid by the state. Furthermore, in a situation of scarce S&T talent, a similarly highly skilled person may be hard to find if and when he or she is finally needed.

Once assigned, Chinese state-sector employees are dependent upon their work unit for far more than just their wages. The work unit also provides housing, ration coupons for consumer goods and some foodstuffs, medical care, labor insurance, welfare, social security, and other important goods and services (WALDER 1983: 53-54). As Walder points out, employee dependence is heightened not only by the lack of

markets for many of these goods and services, but also by the lack of alternative employment of a comparable sort. Even across state-sector work units, these benefits vary enough to make a noticeable difference in a person's standard of living. Everyone wants to be assigned to a work unit that offers the best possible conditions.

2.3 THE JOB ASSIGNMENT SYSTEM

The PRC has had a huge gap between supply and demand for scientific and technical talent since its founding in 1949. Given the ideological and economic impossibility of allocating this scarce human resource according to the very high wages it could command in an open labor market, the state devised a centralized allocation system that has been used, with various modifications, since the early 1950s (ECKSTEIN 1978: 139-42). Although I was unable to find a complete description of this system, a partial description by Eckstein written after the tumultuous Cultural Revolution in 1978 states that it was "...unclear how the manpower planners made their assignment decisions, what criteria were used for determining priorities, and what principles governed the rationing of scarce manpower" (ECKSTEIN 1978: 140).

My interviews with Chinese scientists and engineers in the United States revealed more about the operation of this system than I could find in the literature. The system is complicated by being split among the different levels of the national hier-

archy. Which level of government assigns a graduate to a job depends on the institution from which he or she graduates. Graduates of institutions directly under the State Education Commission are assigned by the central ministries, graduates of provincial institutions are assigned by provincial authorities, and so on down the national hierarchy. Although interviews and written sources indicate that the system is modified fairly frequently, this hierarchical organization seems to remain constant (ECKSTEIN 1978: 139-42; ORLEANS 1986; SIMON 1987: 143).

I relate here a description of the allocation system provided by one of the interviewees. Although his description differs from others in regard to precisely which ministries, commissions, or positions perform which functions, no two sources of information were entirely consistent in this regard; however, his description was relatively consistent with all others regarding the levels at which decisions are made.

This particular interviewee (no. 1) described the centralized allocation system for university graduates as working "like a military process," comparing it to recruitment into a branch of the military. The key agencies involved in the early 1980s, he reports, were the Ministry of Education and the Ministry of Labor and Personnel, which act as a check and balance on each other.[3] Eligible work units request new

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[3] The Ministry of Education was elevated to the State Education Commission, a super-cabinet-level body, in 1986.

graduates through the Ministry of Labor and Personnel, specifying the number and type of degree-holders required. Universities send lists of graduating students to the State Education Commission. The number of requests received by the Ministry of Labor and Personnel inevitably exceeds the number of graduates reported to the State Education Commission. In 1986, for example, work units requested 700,000 new graduates, of whom only 321,000 existed (ORLEANS 1986: 5). Thus, requests are prioritized by the Ministry of Labor and Personnel in accordance with the priorities of central government plans.

Work units may request a particular student and a student may request a particular work unit, but the entire process is run with very little, if any, direct contact between work units and students. According to the same interviewee, the Ministry of Labor and Personnel hands down a list of positions at various work units to the university and university staff then match graduates to the list. A key person in determining the matches is the **banzhuren**, an instructor who acts as an academic and personal advisor for a group of students throughout their degree program. Often the **banzhuren** announces all of the openings to the students and may allow each to list his or her top two or three choices (Interviewees no. 2 and 4). Although the **banzhuren** generally knows the performance, capability, personality, and preferences of each student, poor matches sometimes result nevertheless. In making a match, the **banzhuren** often has no more information about a work unit other

than its name and location. For example, a group of 13 civil engineers (including Interviewee no. 7), were assigned to a construction work unit on the basis of their degree and the name of the unit; however, the work unit actually needed chemical engineers, which they were forced to become. Needless to say, many graduates are unhappy with their assignments. One interviewee (no. 1) reported that about one-third of the graduates at his university attempt to change their assignment as soon as they receive it from the **banzhuren**, but very few of them succeed.

Orleans' description of the allocation system reveals a somewhat different process:

> ...graduates of universities under the State Education Commission are assigned to production ministries, which then appoint them to their own bureaus, which place them in companies, which finally assign them to a specific job in a factory or some other enterprise. (ORLEANS 1986: 3)

The major difference between these two descriptions seems to be whether a student is assigned by the **banzhuren** to a specific work unit or to a ministry, which, in turn, assigns him or her to a work unit. It is possible that the job lists handed down to the universities contain both types of assignments. The **banzhuren** may not, however, always play a key role. Some students are assigned directly by the state without the involvement of the **banzhuren** or any other university staff (ORLEANS 1986: 6).

The enormous complexity of the centralized process of matching graduates to jobs and the inevitable mismatching that

results are revealed in the following statement:

> Even with the best of intentions (which cannot be taken for granted), and even if all the necessary data were available (and they are not), it is impossible for the central government planning institutions to forecast the enormous and diverse needs of every economic sector for specialized professional manpower and then to achieve a precise match between the needs and the current crop of university and college graduates, who have already been in the "pipeline" for three, four, or more years. The process is further complicated by the hierarchical levels through which an assignment must pass. (ORLEANS 1986: 3)

The difficulty of conducting such a complex process without error is recognized by the state, which has added reforms both to ensure better matches for new graduates and to allow some adjustment for mismatched graduates assigned in the past.

2.4 REFORMS IN THE JOB ASSIGNMENT SYSTEM

New mechanisms have been added to the job assignment system in recent years to refine the crudity that sometimes characterizes its processes. These new mechanisms can be divided into two types: those that allow the centralized allocation system to make better initial job assignments, and those that allow a measure of mobility after the initial job assignment has been assumed.

2.4.1 Allocation Reforms. Those who seek reforms that allow the centralized system to make better initial assignments implicitly assume that the state is capable of directly or indirectly matching graduates to jobs better than anyone else. These persons also implicitly assume that graduates will be

allocated in accordance with state development plans and that priority projects, sectors, and regions will receive necessary labor inputs. The results of limited and experimental reforms show that the state has more difficult time ensuring the accuracy of the latter assumption when it loosens its authority over assignments. The certainty of the former assumption is difficult to know when individual preferences are a criterion for judging matches.

In 1983, the State Council, China's highest executive body, approved a set of experimental reforms for the allocation system, at the same time stressing that assignments may not be altered or rejected (ORLEANS 1986: 5). First, assignment plans would be prepared a year in advance in order to allow work units and universities more time to cooperate (according to Interviewee no. 1, whose description of the allocation system is given above, the entire matching process at his university is generally completed within only a month). Second, the assigned graduate would undergo a one-year probationary period within the work unit in order to ensure the suitability of the match. Third, work units would be allowed to interview and test graduates before accepting them. The extent to which these reforms have been implemented is uncertain; Orleans suggests that direct contact between work units and students prior to assignment remains extremely limited (ORLEANS 1986: 5-6).

Another set of reforms affecting all graduates, of whom

science and technology graduates are only a part, were tried in 1985 at most of the higher institutions under the Ministry of Education. These reforms and their results are noted by Orleans (ORLEANS 1986: 6-8). Even in this case, it was the authority of the schools in determining matches that was expanded, rather than that of the students or work units. Contacts between schools and employers provided jobs for 63.8 percent of university graduates, whereas 23.6 percent of the graduates were assigned jobs directly by the state without the involvement of their university. These reforms were suddenly reversed the next year when officials discovered that the new system did not ensure the required flow of graduates into key projects and into the interior and countryside. In 1986, 69 percent of the graduates were assigned jobs directly by the state.

This policy shift reveals the conflict between the desire of the state to ensure sufficient numbers of S&T personnel for targeted work units and the attempts of the state to ensure better job matches for S&T personnel through less centralized hiring decisions. If students had been given more direct choice over their job assignments in 1985, then it would not be surprising that targeted work units, especially those in remote and backward regions, did not receive enough graduates. It should be noted, however, that this result occurred when greater authority over assignments was given to the universities. Why did this result occur? Why should

universities make assignments different from what the state would have made? Were the universities able to match graduates to suitable jobs better than the state could have done? What criteria should used to compare matches made by the university with those by the state? Were the universities able and willing to accommodate the preferences of graduates better than the state?

The conflict between the desire of the state to assign some S&T graduates to certain places and the preference of those graduates to be assigned elsewhere makes it even more difficult to measure the actual extent of mismatching. Many graduates are likely to complain about being mismatched to a job in the interior or countryside just because the location and its amenities do not suit their tastes. Although, as Orleans notes, some graduates of prestigious universities may have unrealistic expectations about where they should be working, agencies responsible for job assignments should be especially careful not to waste scarce S&T talent through faulty job allocations (ORLEANS 1986: 11).

2.4.2 Mobility Reforms. Reforms for mobility are generally divided among four major types: policies to recruit S&T talent into undeveloped regions, policies to facilitate personnel exchanges, policies to develop research contracts, and policies to promote spare-time work. My categorization of these four types, based upon Orleans' review of mobility policies, implies

that the allocation system fails to send and retain enough S&T personnel in the interior and countryside and that it fails to produce suitable micro- and macro-level matches consistently.

In 1983 the State Council stated the need for S&T personnel "to flow from the city to the countryside, from the large cities to the medium-size and small, from the developed coastal regions to the frontier, and from overstaffed organizations to those urgently needing employees" (quoted in ORLEANS 1986: 14). Thus, reforms for mobility are intended to create flows only in certain directions. "Mobility," warns a journal article, "does not mean that an enterprise may recruit people in any way it wants to, nor may an individual go to work anywhere he wants to" (quoted in ORLEANS 1986: 13).

Although S&T personnel generally cannot transfer between state-run work units without the approval of those in charge on both sides, they can, at least in theory, transfer to collective work units (which are outside of the state sector) without the approval of their initial state-run work unit. I am unable to conclude with certainty, but it seems that small urban enterprises, especially those in the collective sector, often are not considered important enough to have a college graduate assigned to them and thus are not eligible to request a S&T graduate from the assignment process (ORLEANS 1986: 13). Many rural collective enterprises apparently face the same constraint (BEIJING REVIEW 1984, 1985). Recent economic reforms have, however, allowed some collectives, particularly

those in the countryside of prosperous regions, to become wealthy enough to attract S&T talent away from state-run work units by offering higher wages. For this reason, the same journal article whose warning about mobility is quoted above also asserts that state-run work units require protection to maintain the stability of their S&T personnel (ORLEANS 1986: 14). Officials who desire more liberal mobility reforms for S&T personnel can thus expect to encounter resistance from the authorities of some work units.

In order to attract scientists and technicians into the interior and countryside, the State Council and pertinent jurisdictions under the central government have adopted special policies regarding terms of service, wages, and retirement in order to strengthen the S&T contingent in less developed areas, such as Gansu and Tibet, and to reverse the trend of their outflow from these areas (WHITE PAPER 1986: 116). The governor of Yunnan Province has sent teams into other parts of China to recruit S&T personnel to work in his province, where their pay scale, position, seniority, grain ration, and household registration will be recognized (ORLEANS 1986: 15). The household registration system is the means by which the Chinese government controls internal migration. Generally, a Chinese person can obtain work, housing, and food rations in an urban area only if he or she is legally registered to live there (WALDER 1984: 19). The Yunnan governor's policy thus reassures S&T personnel from the relatively developed large coastal

cities that they will be able to move back home at some point in the future.

Another set of mobility policies refer to the exchange of scientific and technological talent through exchange centers. These centers assist both the transfer of people to jobs that make better use of their expertise, and the transfer of S&T personnel between units that lack such talent and those that have a surplus (ORLEANS 1986: 16). An employee can apply with a center in order to find a new job, and an employer can apply to find a new employee. In 1984 there were 746 of these S&T personnel exchange centers in China (WHITE PAPER 1986: 116). This number had increased to around 2,000 by late 1987 (CHINA DAILY 1987a). For the period 1984 to 1985, the number of transfers completed by these exchange centers rose from 16,000 to 220,000, though this was only a small proportion of total applicants (WHITE PAPER 1986: 116). According to statistics, the "flow of scientific and technological personnel" in China constituted two percent of the total number of such personnel in 1983 and three percent in 1984 (WHITE PAPER 1986: 116). This statistic increased to four percent in 1985 (CHINA DAILY 1987a). I am unable, however, to determine whether these statistics refer only to permanent transfers or include temporary contract workers as well.

The last two types of mobility reform, those regarding research contract and spare-time work, are based more upon monetary incentives. Research contracts are an extension of

the "paid contract system" that has appeared in many forms in different parts of the Chinese economy since the late 1970s and became official policy in the early 1980s (ORLEANS 1986: 22). The goal of research contracts, from the point of view of the state, is to loosen the financial dependence of research institutes upon the state by forcing them to earn income to cover their operating expenses. In 1983, 3,563 research institutes directly under the control of the central government were cited by Orleans to have paid for 36.6 percent of their operating expenses with income earned from research contracts (ORLEANS 1986: 23). Contract work is further encouraged by its exemption from taxes (ORLEANS 1986: 23-24).

Contract research not only facilitates the integration of research with production, but also more fully utilizes scientists and technicians by sharing their talent among different work units that need it (ORLEANS 1986: 22). Nonetheless, contract research has at least two problems. First, as pointed out by Orleans, income earned through outside contracts is generally distributed among research institute personnel at the discretion of the cadres; this subjective manner of distribution is likely to create a new set of problems (ORLEANS 1986: 24). Second, the practice of contract research, despite its rapid growth, still remains limited to research institutes that concentrate on applied, rather than pure, research (Interviewees no. 3 and 4).

The other type of mobility reform based upon monetary

incentives is spare-time work. A policy statement by the Central Committee in 1985 states:

> On the premise of fulfilling their duties at their own posts and not infringing on the technological rights and economic interests of their own units, scientists and technicians may, in their spare time, perform technical work and render consultative service. In the case of utilizing the technological achievements, material and equipment of their own units, they should obtain the consent of such units and turn over part of their compensation. (WHITE PAPER 1986: 117)

In practice, S&T personnel earning extra income from spare-time work have encountered obstacles by work unit cadres who rightly or wrongly charge them with ignoring their assigned duties to pursue outside profits. Orleans in his recent review of spare-time work policies offers this conclusion:

> ...what the authorities throughout China are striving for is a more systematic and a more formal approach to spare-time work by scientists and engineers. They prefer agreements between units, rather than between the scientist and secondary employer, and they prefer written contracts with carefully spelled out responsibilities of both parties, rather than ad hoc arrangements. (ORLEANS 1986: 28)

It is noteworthy that in the case of spare-time work, just as in that of job assignments for graduates in 1985, the authorities are concerned with preventing employee and employer from making arrangements directly between themselves. Whether initial assignment or later mobility, authorities seem concerned with maintaining an opening in the relationship between employee and employer. Although I am uncertain of their reason for doing so, it may be that it helps ensure a greater degree of state influence over the employee-employer relationship. This situation needs to be better understood.

One additional current reform is the "professional appointment system" mentioned in the 1986 "White Paper" (WHITE PAPER 1986: 118). This system, which requires jobs to have specified duties, tenure, and wages, was experimentally introduced in 51 work units in scientific research and engineering, as well as agriculture, public health, higher education, and journalism, in July 1985. Chinese press reports in early 1987 claimed that the system is widely supported by intellectuals, and that it has allowed a large number of outstanding young and middle-aged persons to be promoted over commonly used seniority criteria. These reports admit that there will be unavoidable problems in implementing the new system in local areas, but professes unbounded optimism that such problems "can always be resolved" by the policies of the central committee and S&T personnel. (KEJI RIBAO 1987b, 1987c) These press reports indicate that the professional appointment system is being applied to persons who are already assigned to work units, rather than to current graduates. One interviewee (no. 8), who was assigned to a work unit upon completion of his Ph.D. in 1986, received his letter of professional appointment in early 1988. The appointment states that he will be employed by his work unit for a three-year term upon his return to China. He is convinced, however, that his work unit will not let him seek work elsewhere when his term expires because he will be too valuable an employee to let go.

In regard to the overall reforms in allocation and

mobility, they may be too recent, and perhaps too limited, to know what impact they have had on improving job assignments. Press articles and policy proposals continue to stress the need for further reform, as I have pointed out above. Orleans cites a July 1986 statement by the State Council which points out that, despite some progress, "overstocking, wasting and misusing scientists and technicians has not been fundamentally eliminated" (quoted in ORLEANS 1986: 21). If additional reforms are to be more effective, the causes of mismatches must be better understood.

3. EXPLAINING THE MISMATCHES

Although most of China's science and technology graduates may be well matched to their jobs, many probably are mismatched due to certain weaknesses of bureaucratic methods for achieving rational choices in politico-economic organization (LINDBLOM 1977: 65-75). Information, coordination, communication, and internal control requirements are too vast to be achieved for a centralized process on a scale as large as all of China. Incentive mechanisms for allowing work units to release underutilized talent and for encouraging S&T talent to flow into priority areas are also poor.

First, the planning system performs the procrustean task of fitting a given body of graduates, who have been "in the pipeline" for several years already, as Orleans pointed out above, to a set number of jobs, the composition of which may change from year to year according to shifting state priorities. Mismatching that results from changes in government priorities and other factors was noted by a Chinese engineer: "Many scientists and technicians who are originally well suited to their jobs become underutilized due to policy changes, new innovations, or bottlenecks in production processes" (Interviewee no. 4). If present bureaucratic methods are insufficient to ensure a suitable initial match for all graduates, such methods are certainly insufficient to keep graduates suitably matched over the long term as their work

units encounter exogenous shocks and parameter changes.

Second, nearly all graduates are matched to jobs indirectly by either the state or their school, so that most graduates and employers never meet directly until after a graduate has been assigned to a work unit.

Third, the state and the schools in many cases assign a student to a position without knowing its job description. This situation may change if the professional appointment system, which requires a specification of job duties, is widely implemented for the initial assignment of S&T graduates. Evidence so far indicates that it is not.

Fourth, there are few ways for a graduate to change or reject his or her assignment before beginning it. Afterward, there are relatively few means for transferring to a job that would more fully utilize a person's talents. Moreover, attempts at finding better job opportunities can be blocked by work place authorities.

Fifth, there is a conflict between the plans of the state and the preferences of students over where they should be assigned. Even if a graduate is suitably matched to a job, the undesirability of its location and amenities may seriously damage his or her morale and performance.

3.1 APPROACH TO EXPLANATION

One way to explain the mismatches in China's job assignments for S&T personnel would be to focus upon the

planned technical aspects of decision making. Mismatches can be correctly attributed in large part to the bureaucratic problems given above. By developing specialized skills and instruments, progress can undoubtedly be made toward reaching better solutions through bureaucratic methods. "New and rapidly emerging mathematical and computational aids to rational decision making have vastly expanded the capacities of hierarchy-bureaucracy to solve problems" (LINDBLOM 1977: 66).

I have chosen instead to explain the mismatches by focusing on the study of individual and group objectives and conflicts. I do so because I believe that application of technical and bureaucratic decision making processes are constrained by human conflict and will remain thus unless it is true that there is only one best way to solve any given problem (CROZIER 1964: 156-60; LINDBLOM 1977: 247-60). Technical and bureaucratic decision making alone will provide the optimum solution only if we accept Lindblom's assumptions that, for such a model, an underlying harmony of people's needs can be known to a guiding elite and that intellectual capacity can conquer the complexity of the social world. I find more realistic Lindblom's alternative model that assumes harmony of needs for all individuals is not only undiscoverable, but nonexistent, and that intellectual capacity is no match for the complexity of society.

I do not mean to overlook the importance of rational methods of problem solving, as Crozier and Lindblom refer to

processes abstracted from individual preferences. Rather, I mean to shift the focus of problem solving in another direction. As Crozier notes, "...the illusion of perfect rationality has too long persisted, weakening the possibilities of action by insisting on rigorous logic and immediate coherence" (CROZIER 1964: 159). It is my intention to highlight problems of the job assignment system that cannot be solved by rational technical means, but recognition of which will undoubtedly enhance such means regardless of whether they are employed by a centralized or decentralized decision making process. In this regard, Crozier states two important points. First, rational processes cannot suppress power and discretion in human relationships (CROZIER 1964: 157). And second, rational processes for achieving goals must be devised with consideration toward the human means of implementation (CROZIER 1964: 149).

Adopting the above approach, I examine first the objectives of the groups and individuals involved in the job assignment process and, second, the conflicts among their objectives that can help explain resulting mismatches.

3.2 OBJECTIVES OF PARTICIPANTS

For everyone who participates in assigning scientists and technicians to jobs, the process is not an end in itself so much as it is a means toward a larger objective. The state desires that its orchestrated allocation of scientists and

technicians serve its larger objective of modernizing the national economy. Two of the state's major goals in this development effort are to achieve balanced regional development and to integrate research with production (WHITE PAPER 1986: 10). Full utilization of scientific and technological personnel is an explicit part of the overall development effort.

Work place authorities hope the allocation of scientists and technicians will allow their work unit to meet its production requirements, increase its earning ability, and enhance its prestige. The allocation system helps ensure a flow, albeit uncertain and uneven for many work units, of relatively low-cost scientific and technological talent. At the same time, as noted above, not all work units that need scientific and technical assistance are apparently eligible to request it. It is in the interest of work units that they become eligible to request S&T talent from the allocation system or that the state decentralize hiring decisions to the level of the work unit.

Universities and other higher institutions that graduate scientists and technicians often hope to increase their role in job assignments because this process allows schools to establish lucrative connections with work units (BEIJING REVIEW 1984). This is a welcome opportunity for many universities that suffer from poor research facilities and inadequate funds to improve them (ORLEANS 1986: 7; GUANGMING RIBAO 1986c;

Interviewee no. 4). It should not be surprising to find that in some cases informal as well as formal exchanges take place between schools and work units: "Some schools may demand money from the work unit before assigning [an S&T graduate] there" (Interviewee no. 4). Some schools believe that their role in assigning jobs motivates academic competition among students (GUANGMING RIBAO 1986c), but the discretion of university staff in making assignments often influences the behavior of students in other ways, as I will point out later. Further decentralization of decision making in the allocation process probably would not be opposed by the schools if they are able to maintain their intermediary role between students and employers. As long as there is a job assignment system there will be such intermediaries. It remains to be seen how the potentially profitable intermediary role of schools develops in the future.

Finally, scientists and technicians want the allocation to result in an assignment that provides them with both opportunities and amenities. In a society of strong competition for a limited number of status positions (ORLEANS 1986:36), the allocation system generally guarantees S&T personnel a coveted state sector job (if they are graduates of an institution under the State Education Commission) regardless of how highly motivated they are. At the same time, as virtually all interviewees lamented, the system deprives them of greater control over their career.

Each of these groups encounters conflicts in what they hope to achieve from the process of job assignments. Some conflicts arise when a single group or individual simultaneously holds internally inconsistent goals. Other conflicts result from a clash of objectives between different groups or individuals belonging to different groups. Not surprisingly, the objectives of different groups, or certain members of different groups, are sometimes aligned. In order to evaluate the policy on S&T job assignments, it is necessary to examine its outcomes in terms of the particular patterns of conflict and alignment that it creates.

3.3 CONFLICTS WITHIN AND AMONG PARTICIPANTS

In this section, I describe the conflicts among the individuals and groups that participate in job assignments. These conflicts reveal a pattern of authority and exchange mechanisms that respond to different incentives and account for some of the unintended outcomes of the job assignment system.

3.3.1 State. The central government sometimes pursues two inconsistent policies so that each hinders successful implementation of the other. One example is the simultaneous pursuit of policies to achieve balanced regional development and to create horizontal linkages between research and production (WHITE PAPER 1986: 10). Given that most scientists and technicians are very reluctant to work in the less

developed regions of China, pursuit of balanced regional development requires an authoritative assignment of S&T personnel to these regions. Pursuit of horizontal linkages between research and production units, on the other hand, requires entrepreneurship and flexibility that presumably must extend to hiring practices. If the state surrenders its authority over job assignments, however, many work units in the interior and countryside would be unable to attract S&T talent and balanced regional development would be very difficult to achieve.

In some cases, such as Jiangsu and Zhejiang Provinces, both balanced regional development and horizontal linkages are being achieved (GUANGMING RIBAO 1986b). This success is due to the locational advantages of these provinces; they contain or surround large urban areas, such as Shanghai, that have high concentrations of S&T personnel who perform contract work for small local enterprises. It seems reasonable to assume that horizontal linkages and balanced regional development are most easily achieved in regions near large cities, where S&T personnel are least resistant to being assigned. Contrary to this, the further from a large city and the deeper into the countryside or interior, the more difficult it is to develop horizontal linkages based on economic agglomeration and the more necessary it is to use authoritative means to allocate S&T talent to those regions.

3.3.2 State and Individual. One particular form of mismatch already mentioned is that in which the location of an otherwise suitable job fails to suit the preference of the scientist or technician assigned to it. In such a case, there is a conflict between the needs of the state and the desires of the individual.

There are any number of reasons why someone might prefer one location to another. One engineer preferred her hometown of Shanghai to Peking because she thought that she would come into hopeless competition with the children of V.I.P.s in the latter city (Interviewee no. 4). Another engineer, who initially was glad to get a prestigious assignment in Peking, later was relieved to leave that city when the political climate became tense (Interviewee no. 7). These examples inaccurately imply that Peking is not a desirable location; in fact, it is one of the most coveted places in which to receive an assignment. The most unwelcome assignments are generally those in the interior and countryside. Scientists and technicians resist these assignments because undeveloped regions usually cannot provide the amenities that these highly skilled persons demand. Both the interviewees with whom I spoke and the Chinese documents that I reviewed consistently agreed that the amenities that most concern S&T personnel are their living standards (including household registration status, wages and housing), their children's education, their own intellectual development, their career opportunities, their

political environment, and their autonomy over their own research (GUANGMING RIBAO 1987, 1986a, 1986d; RENMIN RIBAO OVERSEAS EDITION 1986; BEIJING KEJI BAO 1986; YANG 1986; WHITE PAPER 1986: 113-18).

None of these amenities is easy to provide, even in large cities. There are some attempts, however, to provide at least a few amenities in order to attract S&T personnel into less developed regions, as Orleans' example of the Yunnan provincial governor showed. Maintaining a person's standard of living by recognizing his or her original household registration and providing attractive wages and housing can be done on a piecemeal basis with perhaps relatively little difficulty, but providing the other amenities generally requires a complex set of social and physical infrastructure that takes a long time and a lot of money to build.

The educational opportunities that scientists and technicians tend to demand for their children require substantial long-term investments in plant and organization. In the meanwhile, this problem might be solved by enabling their children to attend schools outside of the region or for them to be given preferential treatment on the competitive entrance exams for middle school, high school and university. This concern over education is illustrated by one interviewee (no. 7) who gladly accepted a job at a university in Peking partly because his three year old son would be able to attend the excellent university-run kindergarten and thus gain a head

start in the ultimate competition for degrees.

Some of the other amenities also require long-term investments for which there are few satisfactory temporary substitutes. As regards intellectual development, one interviewee (no. 2) described the difficulty that Chinese S&T personnel face in keeping up-to-date in their field, even at the best job assignments. At her prestigious research institute in Shanghai, the library regularly collects about 200 professional journals, mostly from the United States (only five to ten percent of the journals were Chinese). These journals are, however, usually six months old by the time they become available. Virtually all interviewees attached great importance to professional journals from abroad as a means of keeping up in their field. Work units in the interior and countryside certainly would not have regular access to such a library and its journals.

Work units in the interior and countryside may not be able to provide S&T personnel with many career opportunities either. In this regard, several interviewees described the importance of developing contacts with experts in their field. Three of the eight persons with whom I spoke attributed their current research opportunity in the United States to visiting American scientists whom they were able to meet in China (nos. 2, 3, and 8). Such opportunity would not have been possible at a less prestigious work unit in the interior or countryside, where influential experts, Chinese, American, or any other, rarely

work or visit.

Two other amenities frequently mentioned in conversation are political tolerance and autonomy over one's own work. One interviewee (no. 8) described a distinct difference in the political climate between the "liberal" coastal cities and the "conservative" interior of China. Despite his desire to avoid a restrictive environment, he admitted that in the less competitive interior he might become "a big fish in a small pond" (or, in Chinese, "when there is no tiger in the mountains, the monkey is king"). In such a case, he would more likely be able to choose his own projects rather than have them dictated to him. This situation depends, however, on the particular character of the cadres in a given work unit--officious and meddlesome personalities cross all political boundaries. Even if he were able to direct his own research, he would be, as other interviewees pointed out, limited by the generally inferior facilities and lack of materials in the interior or countryside.

Other amenities important to many Chinese are family, food, and language. There are often strong differences in food and dialects across regions of China and returning home for family visits can be difficult. One interviewee (no. 8) described a cousin from Shanghai who, upon learning of his assignment to a job in Hunan, a relatively developed interior province, cried out, perhaps somewhat exaggeratedly, "I'll die if I go to Hunan!" He cited these three amenities, along with

the other conditions mentioned here, as his cousin's biggest objections in being sent to Hunan.

I asked this interviewee if a Chinese would react the same way if he or she were sent to the United States for advanced studies and became cut off from familiar food, language, and relatives. "Being cut off from these things in America is tolerable," he said, because in the United States, even more so than in Shanghai, a Chinese enjoys a relatively higher standard of living, better educational opportunities for their children, more opportunities for intellectual development and career advancement, greater political tolerance, and increased autonomy over their own work.

Individual scientists and technicians sometimes can defy the authority of the state over job assignments. A visitor returning to the Yunnan border region for the first time since 1978 reports that many of the scientists and technicians assigned there have since moved away and that those who have not left are looking for opportunities to do so (YANG 1986). Similar outflows of talent are reported in Guizhou, Gansu, Inner Mongolia, and Tibet (WHITE PAPER: 116). In 1985, only 58 of 103 graduates assigned to a mountainous area of Sichuan arrived to take their posts as teachers (ORLEANS 1986: 9). "The state cannot <u>force</u> scientists and engineers to go where they do not want go," claimed one interviewee (no. 8). According to him and other interviewees, the state is better able to ensure that S&T personnel assume their assigned posts

when they have no other opportunities for seeking work. China's economic reforms loosen this assurance by providing some work units the opportunity to get rich and then use higher wages to lure S&T personnel away from their assigned jobs.

The conflict between the needs of the state and the desires of individuals over assignments in the interior and countryside reveal a chicken-and-egg type of problem. In order to attract S&T personnel into these regions to assist in their development, these regions must provide amenities that generally can be supported only by the social and physical infrastructure of a more advanced region. Even if the state's policy for balanced regional development argues against maximizing agglomeration economies, scientists and technicians nonetheless demand an agglomeration of non-economic amenities that can generally only be provided by a more centralized development pattern.

3.3.3 State and Work Units. The authority over the mobility of personnel that is granted to work unit cadres by the state often clashes with the state's own desires to deploy S&T personnel in the most effective manner. As regards the S&T personnel system, the "White Paper" sets forth the state's explicit intention of the state to overcome the "situation of excessive restrictions on personnel" and the "absence of rational flow of talented people" in order to "create a favorable environment for the emergence of competent people and

the full use of their abilities" (WHITE PAPER 1986: 14). The state attributes the blame for these problems to the management system, which binds the freedom of movement for scientists and technicians and restricts the development of the knowledge and abilities of S&T personnel: "Some leaders are anxious about the movement of scientists and technicians, that this will weaken the technical capacity of their own units; some fear that scientific and technical personnel will go `in droves´...and some would even rather confine scientists and technicians who have insufficient tasks or who have no tasks at all..." (JILIN S&T COMMISSION 1987).

Work units to which scientists and technicians have been assigned by the state may keep those persons in unsuitable positions and thus undermine the state´s intention to fully utilize S&T personnel. Contrary to this, other work units in the countryside and interior may release S&T personnel, as suggested by the reported outflows of S&T talent from certain regions noted above. This subverts the state´s plans for balanced regional development.

Work units not eligible to request S&T personnel from the allocation system must depend on attracting them away from their assigned jobs with offers of higher wages. This too, in some cases, undermines the state´s development plans. These conflicts between state policy and work unit management practices leads directly to the conflicts between work units and S&T personnel.

3.3.4 Work Units and Individuals. Once assigned to a job, scientists and technicians become heavily dependent upon the work unit cadres, who hold a high degree of discretion over their mobility, both within the work unit and from one work unit to another. The interests of the individual and work unit clash when a cadre uses his or her authority to block the requested transfer of a scientist or technician, regardless of whether this action upholds or subverts state policy. In the latter cases, the work unit counteracts with the state, as described above. Contrary to this, the interests of the state and individual are generally aligned when the state seeks to loosen excessive restriction on mobility.[4]

As regards intra-firm mobility, several interviewees spoke about the reluctance of S&T personnel to request transfer to a more suitable position within the same work unit. One engineer (Interviewee no. 4) felt her talents were better suited to another research department within her work unit but she never attempted to transfer because she felt certain that her request would be denied. Another interviewee (no. 3) was assigned to do manual work in a factory for two years after receiving a M.D. degree. He, too, felt certain that any request for transfer to a more suitable department within the same work

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[4] Note, however, that the state's objective to increase mobility should in some cases be distinguished from its objective to fully utilize S&T talent. The latter is a goal which less highly motivated S&T personnel may obstruct if it meant working harder or being assigned to an undesirable location.

unit would be rejected. Although both of these cases occurred before the current reform program began in 1978, similar instances still occur. For example, Orleans cites a report of applied physics graduates working in warehouses in the 1980s (ORLEANS 1986: 2). In addition, many S&T personnel are still hesitant to seek suitable transfers within the work unit for fear of upsetting cadres and coworkers, reports one interviewee (no. 2). Her report is confirmed by a recent press article: "The majority of S&T personnel dare not bring up their own concerns and needs to leaders in fear that they will be treated unjustly" (JILIN S&T COMMISSION 1987).

Work unit cadres, at least in some cases, can block an employee who seeks mobility by means of attending graduate school (Interviewees no. 3, 6 and 8). Earning a graduate degree in China is desirable not only as a way to tackle more challenging work and earn promotions; it is also a good way to transfer out of your work unit. Upon completion of graduate studies, a student reenters the allocation process and is reassigned to a different work unit. Due to the extreme scarcity of advanced degrees, reports one interviewee (no. 7), a graduate student generally has more choice over his or her assignment. Scientists and technicians fear that cadres might not permit them to apply to graduate school because they do not want to lose highly skilled personnel who, even if underutilized within the work unit, would be extremely difficult to replace.

As regards inter-firm mobility, the incentive to hoard highly skilled personnel often leads work unit cadres to block the transfer of S&T personnel to other work units. In many cases, the cadre can succeed in blocking a transfer because legal transfer between two state-sector work units requires agreement from both sides in question. Theoretically, cadres cannot block the transfer of personnel to work units outside the state sector. One interviewee (no. 8) related the story of a friend who, against the strong objection of his work unit, quit his teaching job in order to accept a job with a Japanese firm in Shanghai at a 300 percent increase in salary. There are, however, stories of other foreign firms unable to hire Chinese personnel because of the interference of work unit cadres. Xerox Shanghai Copier Ltd., a new joint venture of the U.S. multinational, has encountered considerable difficulty in its attempts to hire 200 technicians and managers because many promising candidates are not allowed to leave their existing jobs at state-run organizations (THE WALL STREET JOURNAL 1988).

Sometimes a work unit agrees to the transfer of a scientist or technician, whose mobility is in a direction opposite to the state's interest. Orleans notes that most voluntary movement of S&T personnel takes place in the direction opposite from the one intended by the state. He cites a Sichuan Province party statement to this effect: "It is necessary to prevent people from moving to better places, big cities, and higher organs..." (ORLEANS 1986: 15). When an

individual seeks and receives permission to move in a direction opposite of that intended by the state, it is usually the result of that individual's **guanxi** with a work unit cadre or another superior. **Guanxi**, as Walder describes them, are personal ties that are distinct from a purely institutional relationship. These ties play an especially important role in situations where there exists an unusually high degree of dependence of subordinates upon superiors, such as there is between S&T personnel and work unit cadres. These ties or relationships may be cultivated to be stable and long term or quickly made for a one-time-only favor. (WALDER 1983: 69) Many S&T personnel attempt to use **guanxi** to effect their transfer out of undesirable work units. Although I do not have documented statistics on such incidents, one interviewee (no. 8) estimated that 80 percent of the scientists and engineers who are assigned to the countryside and interior from large coastal cities eventually return. Virtually all of his personal acquaintances from Shanghai who had been assigned to distant regions have since come back. "Everyone can do it (return)," he said. "It all depends on how good your **guanxi** are. Some people can do it within a year or two. Others take longer. It shouldn't take more than ten years."

3.3.5 Work Units. Conflicts between work units that result in mismatches include those between work units that are eligible to request allocation of S&T graduates from the state and those

that are not eligible, and between those work units that are able to perform contract work and those that are not able. Research institutes under the central government, particularly those under the Chinese Academy of Sciences, not only offer the most prestigious graduate training and employment, but they are able to keep many of their graduates for themselves. Less prestigious research institutes that would like to employee these graduates but are unable to do so complain about this "inbreeding" (SIMON 1987: 143-44). Although one interviewee (no. 7) claims that the Ministry of Labor and Personnel limits the amount of inbreeding, another one (no. 8) argued that the debate over inbreeding is entirely internal to the research community; the government, he claims, has more important concerns.

Other conflicts occur when work units become wealthy, often through contract work, and are thus able to attract S&T personnel away from their assigned jobs. My interviews and review of documents and literature indicate that this is often a conflict between state-run work units and those not under the direct control of the state. Many of the latter are able to take advantage of contract work because their system of accounts is relatively flexible; state-run enterprises tend to have much stricter accounts that prevent them from performing contract work (KEYAN GUANLI 1987; Interviewee no.4). Orleans concurs that "non-governmental" work units tend to be more flexible (ORLEANS 1986: 32). Contract work is also generally

limited to work units engaged in applied technology rather than pure scientific research; one interviewee (no. 7) defined contract work as "applications for production in order to earn money;" in other words, as market-oriented. Thus work units that have flexible accounts and perform marketable applications of technology in many cases tend also to be outside the state sector. This allows them, at least in theory, to hire S&T personnel away from other work units without the approval of the latter's authorities (although, as cited above, state-sector cadres sometimes can prevent their personnel from transferring, even to jobs outside the state-sector). Many work units are becoming more competitive about attracting and retaining S&T personnel. It remains to be seen whether this situation can ensure a flow of S&T talent into projects, sectors, and regions targeted by the state.

3.3.6 Work Units and Schools. The relationship between schools and work units also influences the match of scientists and technicians to jobs. Universities and other schools are able to turn their role as intermediary to profitable advantage by guaranteeing an allocation of their graduates to work units that are willing to support this service (GUANGMING RIBAO 1986c). In some cases, work units can send selected employees to a school for specialized training and be certain that they will return after acquiring specialized skills (ORLEANS 1986: 7). Such a program ensures better matches of graduates to

jobs. In these cases, too, it remains to be seen whether further decentralization of job assignments to an arrangement between schools and work units will ensure a flow of S&T talent in accordance with state plans.

3.3.7 Schools and State. Scientific and technical education sometimes exacerbates the shortcomings of the allocation system. This system, as I have tried to show, often matches an individual to a job for which he or she has not been suitably trained. Such mismatches might be less of a failure of the system if scientists and technicians were more broadly prepared. Some interviewees explained that many Chinese S&T personnel receive too narrow an education at school. Their descriptions of the narrow applicability of some person's training echo an earlier description by Orleans given nearly 30 years ago:

> For example, physics is no longer taught as a distinct and integrated subject. Instead a student majoring in electrical engineering will study electricity; one majoring in mechanical engineering will study only those aspects of physics which are directly pertinent to his field, etc. Similarly, analytical chemistry is combined with technical analysis, and physical chemistry with electrochemistry. New theoretical courses have been devised for each specialty. (ORLEANS 1960: 61)

The civil engineer who, as mentioned above, was assigned to a chemical engineer's position (Interviewee no. 7) was able to adjust successfully to his position, although he said many of his coworkers with civil engineering degrees who were similarly forced to become chemical engineers could not adjust because

they lacked general knowledge upon which to draw.

Inconsistencies between the input requirements of the job assignment system and the output of the education system contribute toward some S&T personnel becoming overtrained for their jobs. For example, one engineer (Interviewee no. 7) complained that "high school graduates with technical skills would have been sufficient for many of the jobs filled by university graduates in our chemical engineering plant, but there aren't enough vocational schools to train people." His explanation for this situation was that "the companies want more vocational schools graduates, but they are unwilling to offer financial support to run vocational schools."

Orleans has a different explanation for the shortage of vocational school graduates. Although he admits that vocational schools tend to suffer for funds, he argues that China's urban youth prefer to enter college preparatory high schools. When these high school graduates fail the university entrance exams, as most do because of the extremely low admittance ratio, they then enter the work force without practical skills (ORLEANS 1986: 36). Here is an area in which the state, schools, and work units can cooperate for better training and utilization of scarce human resources.

3.3.8 Schools and Individuals. The **banzhuren,** like the work unit cadre, is an intermediary whose role prevents individuals and work units from making their own matches between employee

and employer. Like the work unit cadre, the **banzhuren** also has a large measure of discretion over the assignment of his or her subordinates. The **banzhuren** does not, however, always use this discretion to place the most talented students in the most challenging positions. The most challenging positions are invariably those in the most prestigious work units with the best amenities in the largest cities. The students who have the best **guanxi** with the **banzhuren** are often the ones assigned to these positions (that is, when students are assigned jobs by the school rather than directly by the state). One interviewee (no. 5), who graduated number one in his class of 120 students in an eight-year program, was passed over by the **banzhuren** in assigning the best jobs. The **banzhuren** said that he was "not a good student." According to his **banzhuren**, a "good" student is one who participates in political activities, interacts sociably with others, and comes form a well-connected family. The interviewee in question was somewhat bookish, uninvolved in politics, and came from a rather ordinary family. The competition for the most challenging jobs is sometimes defined by subjective criteria hinging upon a personal relationship. Some of the brightest students, reports another interviewee (no. 8), who also graduated at the top of his class, refuse to compete under such circumstances.

3.3.9 Individuals and Peers. Conflict between an individual and his or her peers does not seem to result in mismatches

between S&T personnel and jobs so much as it affects their productivity. As regards conflicts that hinder the productivity of persons who are otherwise well matched to jobs, these are a different sort of conflict than those I am examining. Nonetheless, such conflicts are important insofar as they decrease the productive potential of China's S&T personnel. Therefore, I mention briefly a few that occur among individual S&T personnel.

One scientist who worked at a prestigious research institute in the mid-1980s reported a "very relaxed atmosphere" in her work unit, with a lot of chatting, newspaper reading, and napping (Interviewee no. 2), not unlike another description of a much less prestigious work unit during the Cultural Revolution (Interviewee no. 3). She kept a busy schedule and applied herself diligently, sometimes to the consternation of coworkers, who told her, "Don't look too good--you'll make the rest of us look bad."

Productivity may be below potential for reasons other than peers pressuring each other to maintain a relaxed work environment. The same scientist mentioned in the last paragraph (no. 2) compared the openness of discussion about research in her lab in the United States with that in her lab in China, where discussion about research was generally shared only with friends. She attributed this secrecy to three reasons. First, theory and technique remain uncertain in an emerging field of technology. Researchers

attempt, however, to hide their ignorance from each other. Second, protection of ideas is uncertain. No one is certain that others will not steal his or her ideas and get the credit for them. Third, lack of mobility leads to extreme competition for promotion. This last point is, however, discounted by an engineer who claimed that there was very little competition among workers in her unit because there were so few promotions (Interviewee no. 4).

4. CONCLUSIONS

In this conclusion, I first specify some caveats about my study, then summarize my conclusions in a descriptive model of the job assignment system, and finally point out directions for further research.

4.1 CAVEATS

As a first caveat, the reader should not take this study to be more than an initial effort in analyzing the conflict that underlies and shapes the process of job assignments for China's scientists and technicians. The small number of Chinese S&T personnel with whom I had limited contact in the United States may not have accurately reflected the experiences and perspectives of the majority of their colleagues in China. A better understanding of the forces behind the assignment process could be gained from a more thorough interview technique applied to a wider variety of persons, including not only S&T personnel, but university and vocational school staff, work unit cadres, and government officials.

Second, the reader should be aware that many more reforms are being tried upon job allocation and mobility in China than could be reviewed here. Many of these reforms are devised, as well as implemented, by local agencies in accordance with local needs. Such reforms certainly far outnumber state-sponsored reforms, but are in many cases tacitly supported by the state.

Finally, the reader should know how generalizable my findings on S&T personnel are to the rest of the Chinese work force. Unlike highly skilled scientists and technicians, China's unskilled and semi-skilled labor is abundant. The problem for them is one of labor absorption. Nonetheless, unskilled and semi-skilled urban labor is allocated in a similar manner to that of S&T talent (ECKSTEIN 1978: 142-45). Furthermore, work units not only are generally unable to hire ordinary workers directly, they also tend to hoard such workers. Ordinary workers also face similar difficulties in transferring between work units. Because there is no scarcity of ordinary workers, they may have even fewer opportunities for career advancement.

4.2 A DESCRIPTIVE MODEL

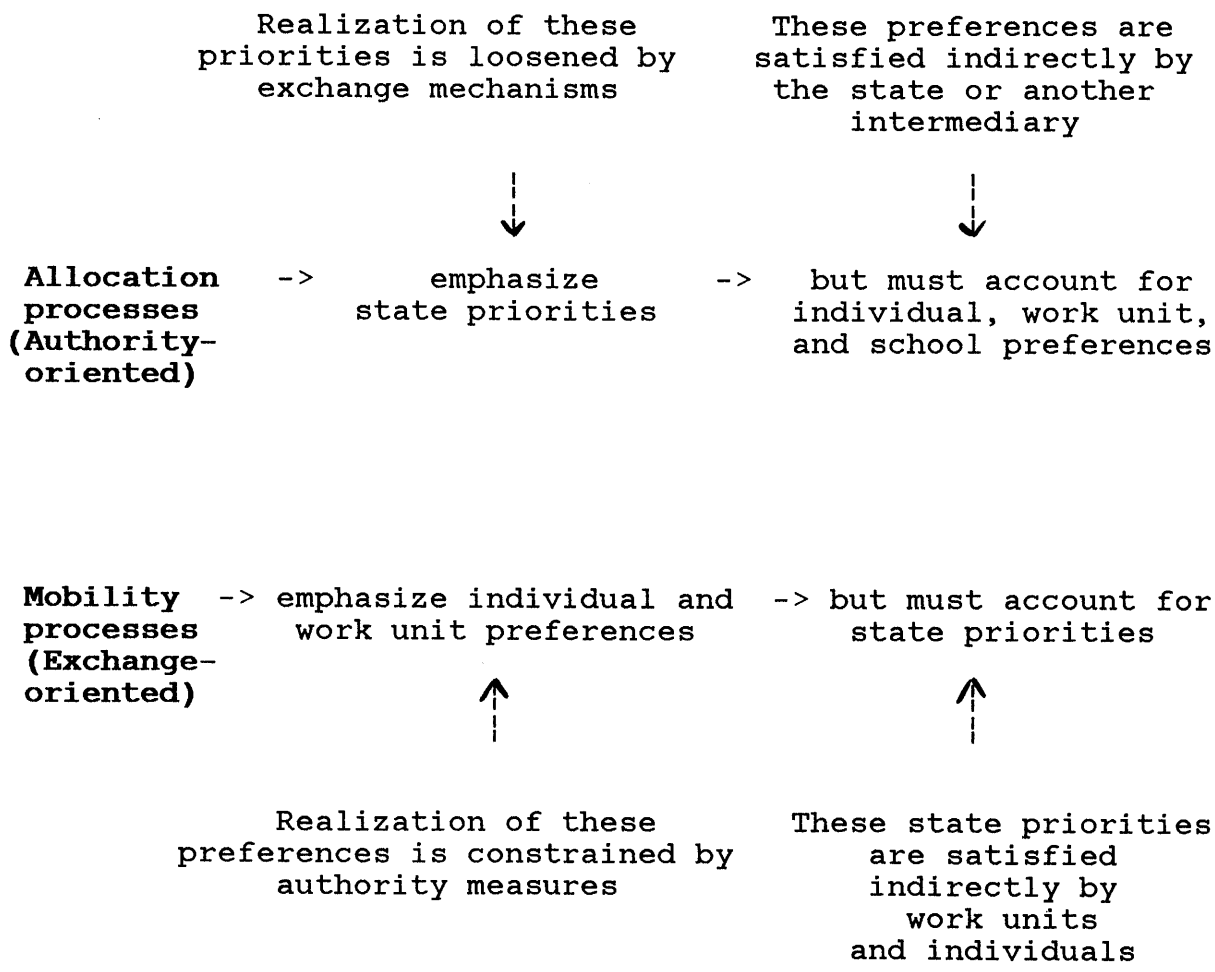
One certain conclusion to be drawn from this study is that China's job assignment system is a complex hybrid of authority and exchange mechanisms that grow and shrink as participants engage in conflicts over various objectives. Conflicts within and among the state, schools, work units, and scientists and technicians are generally the result of attempts by some individuals or groups to exercise or expand their ability to achieve objectives through exchange clashing with the attempts of others to invoke authority in order to limit those exchanges or channel them in another direction. Below, I attempt to

abstract from many of the details of the previous discussion in order to summarize my conclusions in a descriptive model of the system (see Figure 4-1).

The allocation of S&T graduates by the state is largely an authoritative process that emphasizes the priorities of the state, but must eventually account for the preferences of individuals, work units, and schools. The state exercises its authority to ensure a flow of required S&T talent into targeted projects, sectors, and regions. Realization of these priorities may, however, become less certain when exchange relationships are injected into this authoritative system. For example, if the state delegates authority over assignments to the schools, then schools and work units may establish formal or informal arrangements, whereby, in exchange for financial support, a school guarantees an allotment of its graduates to a work unit. Such an exchange relationship may counteract the intentions of the state.

When the state attempts to account for the preferences of individuals and work units, it generally does so by indirect means. For example, if the state does not assume that its own agencies are capable of satisfying the needs and desires of individuals and work units, it may decentralize the matchmaking process by delegating to the schools or some other intermediary the authority to assign jobs. Rarely does the state permit work units and individuals to satisfy their preferences by making direct arrangements between themselves.

Figure 4-1: Pattern of Authority and Exchange in the Job Assignment System for Scientists and Technicians in the People's Republic of China



Contrary to the authority-oriented allocation process, the mobility of S&T personnel after their initial job assignment is generally achieved by means of exchange. These means emphasize the preferences of work units and individuals, but must not stray too far from state priorities. The tacit or open support of the state for exchange of S&T personnel between work units indicates acknowledgment by the state that its authoritative allocation sometimes fails to produce good matches. The range of mobility that the state tolerates to correct faulty matches is, however, limited.

Realization of individuals and work units' preferences through the exchange of personnel is constrained by authoritative measures maintained by the state, such as the household registration system and state dominance over urban housing and labor markets. The near total absence of private housing in Chinese cities helps to prevent an unwanted movement of people. The monopoly that state employment bureaus hold over assignment to state-run work units also constrains the mobility of S&T personnel. The ability of the state to direct the exchange of S&T personnel is intended to be strengthened by the authority over personnel mobility that is invested in work unit cadres. This optimistically assumes, of course, that the cadres always use their authority in conformance with the state's interests.

In both the authority-oriented allocation processes and the exchange-oriented mobility processes, the state, by

prescribing the contact between employers and potential employees, can attempt to tighten or loosen authority as it sees fit. This helps the state to elicit the response that it desires from individuals and work units, and thus move their activity in a certain direction.

In both authority-oriented and exchange-oriented processes, there remain informal means of authority and exchange. These can counteract or support the state's intentions. As long as individuals are able to cultivate the type of personal relationships known as **guanxi**, they will continue to seek means of gaining special advantage when they face obstacles. The cost of relying on such relationships, however, also tends to rise and fall with the degree of tightness or looseness that the state places on exchange mechanisms.

If this description is accurate, then any improvement in the job assignment system must account for the dual processes of authority and exchange and their formal and informal methods of operation. Jobs in the S&T sector are determined by both of these authority and exchange processes, but each process provides different incentives to participants. These inconsistency incentives produce some of the unintended results in job assignments that were discussed above.

This study illustrates the conflicts over job assignments by examining the actions of the participating groups and individuals. In order to do so, I employed typological categories for the participants and then studied the conflicts among types of actors. A more penetrating study may result from further examining the conflicts I have laid out among typologoical categories and sorting these conflicts into analytical categories. Such a method may reveal more about the forces shaping job assignments than I have been able to do here.

For example, my approach uncovered the conflict between the schools and the state insofar as students are often narrowly trained yet face a relatively high probability of being mismatched because of the lack of job descriptions used in making assignments. The alternative approach would highlight the reasons for narrow training and lack of job descriptions. Another example is that, whereas my approach reveals the conflict resulting when an individual uses **guanxi** to secure the work unit's approval for transfer to a more desirable location, the alternative method might stress the forces that give rise to the development of **guanxi** and the reasons why a work unit cadre would approve such a transfer when it is contrary to the flow of S&T talent intended by the state.

Even if I were to continue using typological categories, I would want to refine them. For example, although I have

analyzed the cadres, **banzhuren**, and scientists and technicians as individuals, I have tended to examine the state, schools, and work units as single units. It is necessary to know more about the individual actors within these groups. Taking the individual as the unit of analysis may not, however, always be the most appropriate method. I have tried to analyze scientists and technicians as individuals when, in fact, as the discussion of their amenities made clear, some of their objectives are concerned with securing goods and services for family members rather than for themselves. In sum, my typological categories are incomplete and even complete categories may not provide the most profound method of analysis.

After an appropriate method is decided upon, the topic of this study may be expanded by asking whether the agencies entrusted with organizing the system of job assignments seek to maximize efficiency of S&T output or to reduce tensions that develop among groups and individuals in the S&T sector. Another direction for future research is to examine the dynamics of the allocation model. Is it moving away from large-scale bureaucratic organization toward decentralized decision making over job assignments, or can the reforms be seen as extensions of the centralized model that strengthen the ability of the center to create better matches? Finally, what does the system of job assignments imply for the future development of China? This study has highlighted the conflict

between the intentions of the state to enlist S&T personnel in the development of the countryside and interior, and the preferences of scientists and technicians for amenities that can usually be found only in China's larger and more developed cities. In a country as large, diverse, and populated as China, should development be attempted at a relatively even rate everywhere, or should regions with advantages for development be allowed to proceed unfettered?

This last question has been argued countless times in the PRC. I raise it again because of its importance to the deployment of S&T personnel. Balanced regional development and integration of research and production seem to succeed best in regions of proximity to the larger and more developed cities. In order to make the most of S&T talent while simultaneously meeting their needs, should the Chinese allow agglomeration economies to develop more freely? Would such a development pattern achieve a more rapid rate of economic growth?

As long as China maintains a planned economy and sets priorities for the development of certain projects, sectors, and regions, despite a scarcity of scientific and technological personnel with which to carry out such development, the allocation of S&T personnel under the direction of the state is likely to continue. Since this scenario is unlikely to change in the foreseeable future, it is worthwhile to further study the process of job assignments to understand how they might be improved.

APPENDIX: NOTES ON INTERVIEWS

This appendix on the interviews that I conducted as a part of my study is included in order to allow the reader a better understanding of my findings. This appendix provides some details on types of persons with whom I spoke, means by which I contacted them, patterns in their interview behavior (including those of persons who declined to be interviewed), and sample biases and other considerations.[5]

TYPES OF INTERVIEWEES

I began this project with greater focus on job mobility, rather than the job allocation system, for Chinese science and technology (S&T) graduates. I began looking for interviewees with an ideal type in mind. He or she would have been in the United States (U.S.) for one year or less, would have training and work experience as a scientist or technician in the People's Republic of China (PRC), and would have the traits of being reflective, expressive, and candid. Such an ideal was hard to locate. One difficulty was that the most "open" persons also tended to be the youngest, who were also had the least work experience. As I came to focus more on assignments for S&T graduates, this problem became less of an obstacle.

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[5] For an excellent discussion on the use of interviews as a method, see Andrew G. Walder, "Appendix A: The Hong Kong Interviews: An Essay on Method," in Communist Neo-Traditionalism (Berkeley, 1986), pp. 255-69.

I carried out 11 interviews with eight persons, totaling 26 hours, in March and April 1988. I collected 49 pages of mostly single-spaced hand written notes. My sample of eight S&T personnel included six men and two women, three of whom were 30 years old and under, four between the ages of 31 to 41 years, and one over the age of 41 years.

Five of the interviewees studied natural sciences, three of them in emerging fields. The other three studied engineering, one of them in an emerging field. Five of them were currently pursuing or had already completed a Ph.D. degree (three of which were Ph.D.s from American universities). Two persons held only a B.S. degree, and one held only a M.D. degree.

As for their length of stay in the United States, five of the interviewees had been in this country for between one and two years, one had been here for three years, and two persons for between four and five years. Five of the eight had sought out their own opportunities for coming to the U.S.; one was awarded the opportunity through competition; I do not know how the other two came to this country. One had already become a permanent resident of the U.S., another had the explicit intention to stay here, and three of the others implied that they had similar intentions.

As for the backgrounds of the eight interviewees, four were from former capitalist and landlord families, three from intellectual families, and one was the son of a minor party

cadre who had joined the Chinese Communist Party before 1949. None were from worker, peasant, or soldier families. Six of the eight persons have fathers who graduated from Western-style universities in pre-1949 China.

All eight interviewees were from coastal provinces of China; five were from the city of Shanghai. All eight also attended universities in coastal provinces, but not necessarily in their home province.

All of the interviewees had attended prestigious universities and graduated at or near the top of their class. Five attended universities in Shanghai, but only some of these five were from Shanghai. Six of the eight interviewees had post-university work experience in China; one had lengthy pre-university technical employment; and one had come to the U.S. directly after receiving the B.S. degree. Of the seven with work experience in China, only three had worked in or around Shanghai. None had, however, worked as scientists or technicians in remote parts of the countryside or interior.

MEANS OF CONTACTING INTERVIEWEES

I began locating interviewees by first talking about my project and describing my ideal interviewee type to a friend who has contacts among PRC students and visiting scholars in the United States. He later arranged for me to interview a PRC scientist. Afterward, persons whom I had already interviewed then arranged for me to interview their friends and

acquaintances. In these cases, previous interviewees had passed on to prospective interviewees the list of questions that I would ask them. Four interviewees were contacted in this manner.

In three other cases I was introduced to the interviewee indirectly by the friend-of-a-friend, rather than directly as in the first four cases.

Finally, in only one case did I approach a person and request an interview without having first been formally introduced. I did so because I was interested in that person's field of study.

PATTERNS OF INTERVIEW BEHAVIOR

Why would a Chinese student or visiting scholar in the United States agree to meet an American to talk about his or her own experiences and attitudes? I do not know for sure why any of the interviewees agreed to talk with me, but possible motivations should be considered. They may have agreed to meet me only because they were interested in the proposed topic (job mobility of Chinese S&T personnel). Certainly, it was not money that motivated them. I could not able to pay them for their time, although I always brought fresh fruit or cakes when I went to their home or office.

I made it clear to each person before arranging a meeting that the purpose of the interview was for them to speak about their work histories in as specific a manner as possible. I

also made clear the guarantee of anonymity, which they all greeted with relief. I encouraged them to speak Mandarin Chinese, thinking they would be able to express themselves better that way than in English. Few of them chose to do so. I cannot be sure why. Did they not believe that I could really understand Chinese? Did they want to impress me with their ability to speak Chinese? Not all of them spoke English very well. Did they view the interview as a free English lesson? The two who chose to speak in Chinese may have done so because their English was especially poor. Coincidentally, these two were also the least relaxed.

Many interviewees seemed to be as interested in me as they were in my topic. At each meeting, before we broached the intended subject of discussion, they would always ask me (with a why-in-the-world sort of expression) what interest an American student had in writing about the job mobility of Chinese scientists and technicians. For that matter, all of them seemed curious to know why I wanted to know anything about China. Admittedly, mine is not a topic that many American graduate students would choose for their thesis, but is it any more esoteric than others? Would they have expressed the same sort of wonder if I had approached them to talk about diesel exhaust heat wave recovery for naval vessels, or some other technical matter? Thus, I would begin each meeting with a brief tale about myself, how I studied Chinese history, learned the Chinese language, worked in Taiwan for four years, and visited

the Chinese mainland on numerous occasions. After that, I would ask them to reciprocate with a story on their own background so that I might place the views of each person into a context for evaluation.

Several of the interviewees suspected me of being extremely unknowledgable about China. They would lecture me on worn out generalities, saying things like, "China is very different from the United States. You see, China is a socialist country..." This suspicion seemed to be greatest among those who declined to be interviewed.

Almost as many people declined to be interviewed as accepted. Of the five refusals, two were from Ph.D. students and three were from visiting scholars. Of the two Ph.D. students, one considered himself unsuitable because of his field of study (although I assured him that it was indeed suitable). The other declined because he felt that he could not provide up-to-date information on China due to his long absence (five years).

The three visiting scholars who declined to be interviewed were all men over 40 years old. One of these men refused indirectly, telling a friend whom had already been interviewed that he did not care to do so himself. The friend told me that this man was afraid of suffering negative political repercussions from the interview. Moreover, he felt that I was only interested in negative criticism without having any no constructive purpose.

The two other men directly declined an interview. One of them, who was introduced by a friend who had been interviewed, was unlike all others; he was an official involved in the management of scientists and technicians. Both he and the other man, curiously, declined the interview offer in a very similar manner to decline an interview. They did not say merely, "No, thank you. I'm not interested." Instead, they lectured me for several minutes in stern tones on the worthlessness of my attempt to interview anyone on this subject. They insisted that everything I need to know about allocation and mobility of S&T personnel has already been written and can be learned from the Chinese newspapers and journals (I had already looked at these items, which are tend to be official views of general conditions and policies). They said that nothing could be learned from speaking to Chinese S&T personnel because each individual had a unique experience from which nothing can be generalized. They claimed not to understand why I was interested in learning the details of particular experiences and why I was not satisfied with information that appears in the press.

SAMPLE BIASES AND OTHER CONSIDERATIONS

The perspective of my study has been influenced by the persons with whom I spoke. Therefore, it is not only necessary to know about the types of persons with whom I spoke, but also about their degree of representativeness. In this regard,

there are several problems and biases with my sample.

First, none of the persons with whom I spoke has been in the PRC during the past year. Given the rapid pace at which reform is taking place in China, there may be some important experiments in allocation and mobility of which these people were unaware because of their absence from home.

Second, my sample suffers from an imbalanced age distribution. It consists almost entirely of scientists and engineers under the age of 40, who are a minority of China's total S&T personnel. Only one of the persons with whom I spoke in 1988 was over the age of 41, yet 66 percent of S&T personnel in the PRC were over the age of 39 in 1985 (DONG and CHEN: 8). Furthermore, in the Chinese case age may play a special role for historical reasons. It is possible that persons over the age of 30 may be generally more reticent to speak about their experiences if they are mindful of the consequences that many people suffered for seemingly trivial comments in China's recent past. Even if my study included a larger number of older persons, it might have still tended to reflect the perspectives of the younger persons if the older ones had been less willing to speak openly.

Third, the persons with whom I spoke, like most PRC scientists and engineers in the U.S., tended to be exceptionally accomplished. They are undoubtedly better educated, more intelligent, and more ambitious than ordinary scientists and engineers. Moreover, I spoke only with

university graduates, although 41 percent of Chinese S&T personnel are vocational school graduates (WHITE PAPER 1986: 317).

Fourth, this sample was too small to note any differences in attitudes between the men and women scientists and engineers. The two women in the sample claimed, however, never to have experienced any discrimination in their education or employment, despite reports of widespread discrimination against women in job assignments (ORLEANS 1986: 4; CHINA DAILY 1987b). These two women, it might be noted, were not in traditional well-established fields, but in emerging fields in which talent is especially scarce.

Finally, I could not help but notice the preponderance of persons from Shanghai in my sample. This was not a complete surprise because most of the PRC students and visiting scholars that I have met at U.S. universities in recent years are also from Shanghai. Are so many from Shanghai because that city produces the most university graduates, or because it produces the best graduates? Do Shanghai universities and work units provide so many opportunities for foreign study because they are the best funded and most prestigious, or do Chinese from Shanghai tend to have the most overseas connections?

In conclusion, my sample of interviewees was not intended to be extensive or complete because of the time and resource constraints imposed on this project. Moreover, I realized from the beginning that PRC scientists and engineers studying or

working in the U.S. are not typical of their cohort back in China. This sample was intended only to provide a further glimpse into the causes of mismatches between China's scientists and technicians and jobs than might can be had from the Chinese press.

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