THE ESTABLISHMENT OF REGRESSION MODEL ON MANPOWER RATIONALIZATION FOR PROSECUTION AGENCY IN TAIWAN*

Thomas Ching-Peng Peng, Risharng Chiang, José Chiu-C. Chen**

Abstract

In Taiwan, manpower rationalization of prosecution agency is a wicked issue. The authorities are both looking for the method to rationalize human resources allocation. The research purpose of this article is to design a regression model for Taiwan prosecution agency based on our multiple data resources. The research questions are what factors have influences on manpower rationalization policy of prosecution agency? How many of them can be included in the regression model based on evidence-based statements?

Besides literature review, through in-depth interview and focus group interview, this research concludes the core disputes. Furthermore, a questionnaire survey of daily working hour is conducted for evidence-based data of individual workload. Thirdly, according to the research result above, the Delphi questionnaire is designed to clarify the problems of non-rationalized human resources deployment.

Finally, Analytical Hierarchical Process (AHP) is applied to evaluate the significance among factors which are recognized as the key predicators on manpower rationalization for prosecution agency in Taiwan. Those predicators include: (1) "jurisdiction population and number of households" which are to present "the basic need of manpower in each prosecution agency; (2) "the average household income, the total household income of each jurisdiction, and the degree of urbanization" which are to present "the degree of social and economic development in each prosecution agency's jurisdiction"; (3) "the caseload of each prosecution agency, the incidence of cases, the average time of case investigation" which are to present "the workload of prosecution agency". Based on these three predicators, this research proposes a "pooled regression model" for manpower rationalization for Taiwan's prosecution agency.

Keywords: public personnel reform, prosecution agency, manpower rationalization, pooled regression model, transaction cost analysis (TCA)

** Thomas Ching-Peng Peng and Risharng Chiang are both associate professors in the Dept. of Political Science at National Taiwan University. José Chiu-C. Chen is an assistant professor in the Dept. of Public Management and Policy at Tunghai University and is the corresponding author. (Contact information: josechen@thu.edu.tw; P.O. Box 363 Tunghai University, Taichung, Taiwan 40704).

In Taiwan, manpower structural reform of prosecution agency is an issue of judicial reform in a broad sense. Its importance gained great attention in the previous judicial reform movements[1]. However, the related discussions did not focus on the manpower structural adjustment and manpower rationalization until the time when the Judicial Reform Foundation issued a paper announcing that "no warrior in the western frontline". Although Taiwan government has been streamlining its public personnel, the judicial organ and prosecution agency, under the support of Central Personnel Administration (CPA) of Executive Yuan, can still increase their manpower every year. Nevertheless, the prosecution agency is still complaining about work overload and serious shortage of manpower, while the data of crime rates, conviction rates[2], and satisfaction survey on law and order[3] all show that there is a bottleneck in administration of justice and low satisfaction rate from the general public towards judicial work.

Under the aforementioned context of judicial reform, strict control of staffing in the government agencies by the CPA, and keen competition for human resources among all levels of courts under the Judicial Yuan and the Prosecutors Offices under the Ministry of Justice of Executive Yuan, no solution has ever been offered to the manpower rationalization of prosecution agency due to absence of support of specific case studies and data. To solve these problems, prosecution agency must calculate its workload and manpower requirements and then provide a reasonable explanation to the general public and CPA. Therefore, the main research purpose of this paper is to offer recommendations to solve the issue of manpower rationalization of prosecution agency.

To realize the aforementioned research purposes, we first introduce the environment in which Taiwan's manpower rationalization of prosecution agency is facing. Then, we will try to answer two research questions--What factors have influences on manpower rationalization policy of prosecution agency? How many of them can be included in the regression model based on evidence-based statements? The seven study methods that we have applied in this study are literature analysis, in-depth interviews, focus groups, questionnaire survey, Delphi method, Analytic Hierarchy Process (AHP), and Regression Analysis. In the process, we have successfully understood the background and the current status of the policy issues, investigated various types of workload in the prosecution agency, constructed the dimensions in which manpower rationalization of prosecution agency should be considered, calculated the weight of various evaluation variables, constructed a pooled regression model, and proposed a reference model for estimating the manpower scale for prosecution agency in the future.

I. BACKGROUND OF THE ISSUE AND THEORETICAL INSPIRATION

In Taiwan, the responsibilities of prosecutors have been expanded in the recent years, while the cases they handle have also become increasingly diverse and complex, complicating the quantity and quality of workload for the prosecution agency. Take prosecutors for example. Their basic work includes "crime investigation, trial attendance, supervision of an autopsy, implementation of public prosecution, enforcement of verdict, and delivery of other judicial administrative order". In order to solve financial difficulties, the central government decides to

---

[1] Major movements included the Judicial Reform Commission launched by the Government in 1994, the Prosecutors Reform Association established in June 1999, the National Judicial Reform Conference organized by the Judicial Yuan in July 1999, the Judicial Reform Foundation officially registered in 1997, and so on.

[2] Take criminal cases for example. The rate is calculated by the number of criminal cases handled per 100,000 people, which was on a rising trend before 2004, reaching up to 2442.21; the so-called conviction rate is the percentage derived by dividing the number of guilty cases over the total of guilty and innocent cases. According to the statistics of "investigation correctness" announced by Ministry of Justice, the District Prosecutors Office maintained a correct rate in the range between 92-96%. However, the conviction rate for corruption cases reached only 55%.

[3] The survey data released by National Chung Cheng University in 2010 showed that 75.5% of the respondents are not satisfied with the performance of the Government to improve law and order.

downsize all the organizations in general, but it fails to take into account the manpower needs of an individual organization (eg: prosecution agency) (Wu, 1998; Tsai, 2007; Taiwan High Prosecutors Office, 2009). In addition, there is also competition for talents between the courts and Prosecutors Offices, while either side has to deal with its own internal problems on how to allocate the limited budget and personnel. Take the prosecution agency for example. It has to decide which category of manpower to increase: the Prosecutors, Assistant Investigators, or Law Clerks? Would it be better to simultaneously solve the manpower shortage problem at all levels by building up a set of reasonable formulas for staffing? In addition, the decision regarding how to allocate the limited personnel budget is quite complex in that it involves different transaction costs in different units. Moreover, if you analyze those factors from a political point of view, you have to think over how to reduce departmentalism and budget maximizing so as to avoid the risk of government failure. Those factors are what we put into background for analysis and theoretical inspiration.

A. Background analysis

Taiwan prosecution agency is divided into three levels to match the levels of a court. They are one Supreme Prosecutors Office, 6 High Prosecutors Offices, and 21 District Prosecutors Offices. Taiwan's prosecution system operates under the "procuratorial integration" principle. In practice, the Chief Prosecutor is responsible for supervising and directing prosecutors at all levels of office to implement criminal investigation, trial attendance, review and enforcement of criminal judgments, direct post-mortem examination cases, judicial protection, etc. as well as other duties set by law. In addition, the Ministry of Justice is responsible for all kinds of prosecution policy and administrative work, such as the inspection, investigation, and oversight on the prosecution service of all levels. Moreover, Taiwan government has set up the "Special Investigation Group" at the Supreme Prosecutors Office to combat corruption since 2007. This "Special Investigation Division" is set up by recruiting part of the talents from the prosecution system to get rid of the complex corruption-based offenses under the "co-investigation" principle. Operation of this Group not only highlights the issue of manpower quality in the prosecution system but also worsens the problem of manpower shortage. Taiwan's prosecution system is mainly composed of Prosecutors, Assistant Investigators, and Law Clerks. In addition, there are manpower for general affairs, including Judiciary Police, Probation Officer, Interpreter, Clerk Assistant, Forensic Medical Examiner and other administrative staff.

To clearly understand the background, we have arranged one in-depth interview, four regional seminars, and one comprehensive seminar. In total, 34 experts[4] were invited to participate in this research phase, and we were able to get an overview on the overall situation of manpower utilization in Taiwan's prosecution agency and their insights on some of the organizational structure problems, such as whether to expand or to cut down the business scope of an office and how to divide the tasks and responsibilities among workers. We will hereafter describe the factors and issues concerning manpower rationalization of prosecution agency in Taiwan:

(A) A serious shortfall of core human resources in the prosecution agency

According to the "Legal Statistics Annual Report" published by Ministry of Justice in 2010, the authorized complement of prosecutors in Taiwan first-instance-level Prosecutors Office (including the Chief Prosecutor and

---

[4] Invitees included 15 prosecutors, 6 prosecutor's investigators, 4 clerks, 8 judiciary police, and 1 member from the Prosecutors' Reform Commission.

Head Prosecutor) should be 1,178 but the number of vacancies is amounted to 102. In addition, the authorized complement of Assistant Investigators and Law Clerks should match that of the Prosecutors, but the number of vacancies for the Assistant Investigator is 66 (authorized complement of 571), and that for the Law Clerks is 34 (authorized complement of 1299). If the number of absentees who leave without pay, are loaned to other units, or study abroad on leave, is taken into account, the "talent gap" of the core human resources in the first-instance-level Prosecutors Office would be a much more serious problem than it appears.

(B) Prosecutors are overloaded with complex work

Former Parliamentary Secretary (Mr. Wen-Ding Xie) to Taiwan's Ministry of Justice, pointed out in a speech in 2003 that the number of prosecutors in each respective county of any state in the U.S.A. is about three to six times as many as that of the criminal court judges. The number of prosecutors in Japan is about 2.4 times the number of judges, while the number of prosecutors in Singapore is about 2.3 times the number of criminal court judges. Moreover, prosecutors in the United States and Singapore are only responsible for public prosecution and are not engaged in investigation work, while in Japan, there are prosecutors completely dedicated to indictment, the investigation prosecutors are generally engaged in complementary investigations, and they are assisted and supported by equivalent number of assistant prosecutors and prosecutor's investigators in their investigations. Nevertheless, prosecutors in Taiwan are responsible for not only investigation (including field testing and inspection) but also indictment as well as the enforcement of cases in a verdict of guilty. In comparison, they are much more overloaded than their counterparts in the United States, Japan, and Singapore.

(C) Administrative and supplementary talents are not taken into account in the increase of manpower

The majority of respondents expressed in the interviews or seminars that the authorized complement of prosecutors may be referred to the number of judges. In addition, the prosecution agency has in the recent years recruited mainly prosecutors without paying much attention to supporting talents (Assistant Investigator) and administrative auxiliary manpower (Law Clerk, Judiciary Police, etc.). It is thus recommended that the highest priority should go to manpower in the middle or low level when adjusting the organizational structure of the prosecution agency.

(D) Inappropriate design of the system leads to uneven workload

Workload of the prosecutors increases mainly due to some innovative policies (such as the establishment of anti-illegal and anti-corruption projects) and flexible judicial services (eg. the tasks derived from "postponed" prosecution). Assistant Investigators are mainly to help and assist the prosecutors. Nevertheless, the survey done by Taiwan High Prosecutors Office in 2009 found that the jobs of Assistant Investigator vary greatly in different areas. There are about six ways leading to workload imbalance among Assistant Investigators. Distribution of workload among the Law Clerks is even more complex and out of balance due to such reasons as excessive burden derived from assuming managerial positions as a part-time job, uneven staffing ratio between agencies, and unequal pay for equal workload. All of these have created a vicious cycle leading to high turnover and uneven workload.

(E) The ratio of prosecutor to jurisdiction population can not explain the allocation of manpower

Take ratio of prosecutor to jurisdiction population for example. In average, a prosecutor has about 20,000 to 30,000 people under his or her jurisdiction. However, in the outlying islands and remote areas (such as Lian Jiang,

Taitung, Penghu and Hualien) and in urban areas (such as Taipei), a prosecutor in the District Prosecutors Office is in charge of far less than 20,000 people, in a range of approximately 5000-18000 people. It is obvious that jurisdiction population is not the only factor affecting the number of prosecutors in each prosecution agency. There must be some other factors to take into consideration.

(F) Staffing is not as reasonable as the prosecution agency in foreign countries

In terms of the ratio of prosecutors to total workforce, it is 18.45% in South Korean, 22.14% in Japan, 30% in the UK, and 37.8% in Taiwan. In terms of auxiliary manpower[5], we have found that it is 9,063 positions in Japan and 7,638 in Korea, about 5 times and 4 times as many as those in Taiwan (1,770), even though most of us think that Japan and Korea have similar prosecution culture and social atmosphere to Taiwan.

(G) There is a gap in the proportion of judges to prosecutors[6]

Although the number of judges and prosecutors has been increasing every year since the National Judicial Reform Conference held in 1999, the two sides have been wrestling for the authorized complement ever since then. According to the statistics published in 2009, Taiwan had 1,787 judges and 1,266 prosecutors. The overall ratio was about 1.41 to 1, while the ratio was about 1.13 to 1 in the first trial level, 2.24 to 1 in the second instance level, and 3.54 to 1 in the third trial level (the Judicial Yuan, 2009; Ministry of Justice, 2010). The aforementioned gap in the staffing ratio, together with the fact that the trial system in Taiwan is still two-level trials of facts and that the public prosecutor should present himself or herself at court after the judicial reform, has highlighted the importance of manpower rationalization of prosecution agency in Taiwan.

In the following, the issue of manpower rationalization of prosecution agency in Taiwan is divided into three categories, namely "manpower structure, workload, manpower utilization practices" to facilitate the explanation of the factors that different positions should consider system-wise and operation-wise (see Table 1)

Table 1: Factors and considerations for manpower rationalization of prosecution agency

Position / Dimension		Prosecutor	Assistant Investigator	Law Clerk
Manpower structure	institutional	Number of prosecutors should be in proportion to that of judges	Number of prosecutors should be increased	Number of prosecutors should be increased
	operational	Lack of overall supporting manpower	Prosecution manpower quality	Lack of staff manpower
Workload	institutional	Too much policy-related business	Emphasis on local conditions for work allocation	Complex workload
		Too much flexible judicial business		
	institutional	The increase rate of cases	Standards for division of labor with prosecutors differ everywhere	Existing in different agencies the phenomenon of different jobs for the same position
		Identification of core business	Imbalance in workload	Imbalance in workload among

---

[5] Considering the core functions of prosecutors, the function of auxiliary manpower is mainly to take care of criminal investigation with deployment of such positions as Assistant Investigators and case workers, etc.

6 According to articles 3 and 4 of "Act governing the total employment in the central government agencies" promulgated on February 3, 2010, there are five categories of personnel, among which the Judicial Yuan and its subordinate agencies can have 13,900 posts, while the Ministry of Justice can have 6,900 posts. A simple comparison on the number of posts, the Judicial Yuan and its subordinate agencies can hire more than twice as many employees as the Ministry of Justice.

				different units in the same agency
Manpower utilization practices	institutional	Serious shortfall	Difficult to implement professional grouping	Overburdened by assuming the part-time jobs of department head
	operational	Too much loaning of manpower	No precise criteria for manpower utilization	Unequal pay for the same job

B. Workload analysis for the prosecution agency

Unlike the Judicial Yuan, which commissioned other experts to survey working conditions and working hours in 2005 and 2006 to highlight the problems concerning workload of judges and the shortage of manpower in the courts, the prosecution agency did not take action in face of the same problems. Thus, before we explore the issue concerning manpower rationalization of prosecution agency, we have first designed a questionnaire to investigate workload. The questionnaire was pre-tested and revised in a seminar held in Banciao District Prosecutors Office on August 20, 2010 by inviting representatives from different positions[7]. Using "Urban vs. Rural" as a criterion for selecting samples, we decided to take samples from Prosecutors Offices located in the cities in northern Taiwan and in the country side of central Taiwan. The questionnaire was then sent to the entire work force in two prosecution agencies. All the employees in these two organizations were asked to fill out their working hours for different working items at their own will.

The working-hour survey was conducted for 4 weeks from August 23rd, 2010 to September 19th, 2010. The questionnaires, which were filled out and collected back four times, were printed and prepared for every one in the two organizations. The questionnaires were delivered 1 week before to the personnel staff in the Prosecutors Offices, who helped to distribute, collect back, and mail the answered questionnaires to us. For the urban-area Prosecutors Office, 374 questionnaires were sent weekly and the valid questionnaires returned were 224, 197, 187, and 129 during each of the four weeks, with an average response rate of 49.3%; For the rural-area Prosecutors Office, 97 copies of questionnaires were sent every week, and valid questionnaires collected during the four weeks were 49, 31, 30, and 16, with an average recovery rate of 32.5%.[8]

Results of the survey showed that prosecutors in urban-area Prosecutors Office worked about 50.7 hours every week on the average, while prosecutors in the rural-area Prosecutors Office worked for 46.0 hours. The overall average was 48.4 hours. Compared with the basic 40 hour work week, they worked 8.4 hours longer than normal, apparently indicating a heavier workload. In terms of work items, prosecutors spent 34.2 hours in investigation work every week on average, followed by the public prosecution (8.5 hours) and enforcement (3.5 hours).

The survey found that Assistant Investigators did not have serious overtime problems. Assistant Investigators in urban-area Prosecutors Office worked on the average 41.0 hours every week, while rural-area Assistant Investigators worked 40.8 hours on average. Nevertheless, they also spent the most time in investigation (35.2), even more time than the prosecutors; The second most time-consuming work item that Assistant Investigators were

---

[7] Participants in the pre-test seminar were Head Prosecutor, Prosecutors, Assistant Investigators, Law Clerks, Judiciary Police, Forensic Investigator, Probation Officer, Clerk Assistant, and Interpreter.

[8] In this study, questionnaires were issued to Prosecutors, Assistant Investigators, Law Clerks, Judiciary Police, Forensic Medical Examiner (including Forensic Investigator), Probation Officer, Clerk Assistant, and Interpreter. However, only less than one copy of questionnaire was returned from Forensic Medical Examiner (including Forensic Investigator) and Interpreter. Thus, there was no significance in the analysis.

engaged in was "others" (2.9 hours per week), which mainly referred to participation in international mutual legal assistance, international conferences, meetings between prosecutors and police, regular meetings in Prosecutors Office, and other matters.

In summary, in urban-area Prosecutors Office, the most serious overtime situations happen on Prosecutor (50.7), Law Clerk (46.5), and Judiciary Police (44.8), while in rural-area District Prosecutors Office, the most serious case of overtime fell on Judiciary Police (59.8) and Law Clerk (50.2). In overall, working overtime is a common phenomenon in both prosecution agencies. Compared with the basic 40-hour work week, the three types of officials who worked overtime most seriously were Judiciary Police (52.3), Prosecutor (48.4), and Law Clerk (48.4). Nevertheless, when compared with the preliminary findings obtained in-depth interviews, we found that working overtime did not appear as serious as expected (see Table 2).

Table 2: The survey results for working hours in each job category of the prosecution agency

Duty	urban-area Prosecutors Office	rural-area Prosecutors Office	Average
Prosecutor	50.7	46.0	48.4
Assistant Investigator	41.0	40.8	40.9
Law Clerk	46.5	50.2	48.4
Judiciary Police	44.8	59.8	52.3
Probation Officer	43.8	46.4	46.1
Clerk Assistant	41.8	39.8	39.6

As the questionnaires were filled out in a self-perceived manner, we were quite concerned about the possible exaggeration on working hours. However, judging from the survey results, in which only the working hours of Judiciary Police in rural-area Prosecutors Office reached as high as 59.8 hours, we concluded that there was no exaggeration on working hours. Nevertheless, we were still worried about whether those with the heaviest workload could spare some time responding to our survey. Although the survey results of working hours might not be as perfect as expected, we were still able to clearly grasp the factors which may affect manpower rationalization of prosecution agency by combining the results that we had obtained from literature analysis, in-depth interviews, and focus groups.

C. Theoretic inspiration

From the perspective of human capital, increasing the number of personnel may not necessarily improve the performance of public sector. It is not only a controversy over "the quantity and quality" but also an inspiration to think more on manpower rationalization. An organization must be designed based on future manpower needs and transaction costs. Analysis of transaction costs is derived from the behavior assumptions of neoclassical economics, paying attention to the plight caused by bounded rationality and opportunism. Williamson (1979; 1981; 1985) believed that the main factors affecting the transaction costs were asset specificity, trading frequency, uncertainty, and immeasurability, among which asset specificity is particularly important in theory. Thus, Williamson (1985, 1991) further divided assets specificity into site specificity, physical asset specificity, human asset specificity, brand

name capital, dedicated asset, and temporal specificity, etc. In short, Williamson (1975: 40) believed that a transaction can not proceed smoothly because human factors and environmental factors lead to market failure, resulting in difficulties in market transactions and trading costs.

Is there a similar problem in the manpower recruitment and screening system of government agencies? Take the workforce issues in the prosecution agency for example. Not only did the aforementioned factors affect the decision of human adjustment policies, but the information asymmetries of performance evaluation system and the civil service eligibility protection also caused system costs, such as adverse selection and moral hazard. Under the premise of bounded rationality, how can we address the difficulties caused by limited information processing capacity of an individual or an organization, and the uncertainty caused by decision-making behavior and its internal and external environments[9]. In this paper, we will use the transaction cost theory to further analyze the relevant research data. In the following, we will explain the source and type of transaction costs in terms of Asset Specificity, Environmental Uncertainty, Behavioral Uncertainty (see Table 3). Take the fight for and allocation of manpower in the prosecution agency for example. The issue of "self defense between agencies" often happens due to the nature of human assets, specificity, and timeliness, resulting in costs of crafting safeguards to control the increase in the number of personnel; changes in manpower systems may also result in difficulties in adaptation and problems in performance evaluation and transaction costs due to communication and screening.

Table 3: Sources and Types of Transaction Costs

Cost ／ Source	Asset Specificity	Environmental Uncertainty	Behavioral Uncertainty
A. Source of Transaction Costs			
Nature of Governance	**Safeguarding**	**Adaptation**	**Performance Evaluation**
B. Type of Transaction Costs			
Direct Costs	**Costs of crafting safeguards**	**Communication, negotiations, and coordination costs**	**Screening and selection costs (ex ante) Measurement costs (ex post)**
Opportunity Costs	**Failure to invest in productive assets**	**Maladaptation; Failure to adapt**	**Failure to identify appropriate partners (ex ante) Productivity losses through effort adjustment (ex post)**

Resource: Rindfleisch & Heide, 1997: 46.

However, the issue of increasing the number of personnel and manpower allocation in prosecution agency involves a wide range of stakeholders. Thus, after clarifying the possible transaction costs and environmental factors, we still need to borrow the public choice theory to explain the complex interactions among the Government departments (Buchanan, 1984: 13). The impossibility theorem proposed by Kenneth Arrow (1951) claims that when decision makers face more than three options, they will have no mechanism to transform the preferences of individual members into a consistent preference for the society while satisfying the following five conditions at the same time. Four among the five conditions are: nondictatorship, individual sovereignty, unanimity, freedom from irrelevant alternatives, uniqueness of group rank[10]. To respond to this research topic and to establish

---

[9] The concept of uncertainty can be very broad. For example, the environmental uncertainty may result in an increase in consultation costs and adaptation costs, while the uncertainty of behavior refers to the difficulties in supervising trading partners to execute transactions (Williamson, 1985).

[10] "Nondictatorship" means that the preferences of an individual should not become the group ranking without considering the preferences of others. "Individual sovereignty" means that each individual should be able to order the choices in any way and indicate ties.

a decision-making basis for the manpower rationalization of prosecution agency through a complex selection and consensus-building process on a variety of affecting factors, we have carried out in this study the workload analysis, the identification of factors and their weights for manpower rationalization, and the establishment of a regression model for manpower rationalization. Research results will be described in sequence as follows.

II. THE USE OF DELPHI METHOD TO EXPLAIN THE VARIABLES

The conclusions that we have obtained from literature study, theoretical analysis, in-depth interviews, and focus groups show that manpower rationalization of prosecution agency can be affected by many factors, namely the jurisdiction population, the number of cases, the quality of cases, differences between urban and rural regions, the number of test cases, handling accuracy, clearance rate, the criteria to classify levels of the existing prosecution agencies, the ratio of judges to prosecutors, the concentration of office buildings, the demand of detention or arraignment, and the demand of policy business. It is demonstrated that factors affecting the manpower rationalization of prosecution agency can be very complex and their level needs to be clarified. Otherwise, it would be difficult to interpret, forecast, and evaluate the manpower supply and demand for the prosecution agency, and neither can we propose strategies and recommendations for improvement.

To achieve the aforementioned purpose, the researchers have constructed the Delphi questionnaire[11], and invited 10 officials from the prosecution agency to the seminar of Delphi on August 6th, 2010. It was hoped that insights from those experts could help construct a model for the manpower rationalization of prosecution agency. Please refer to Table 4 for detail of the attendance list. The number of invitees was decided based on the relevant operation principles[12]. The invitees (including Chief Prosecutor, Head Prosecutor, and Prosecutor from district Prosecutors Office) were selected by purposive sampling after considering the differences between urban and rural regions.

Table 4: Experts invited to attend the seminar of Delphi

Current Post / Experience	A Head Prosecutor	B Prosecutor	C Head Prosecutor	D Head Prosecutor	E Head Prosecutor	F Chief Prosecutor	G Prosecutor	H Prosecutor	I Prosecutor	J Head Prosecutor
Currently (Formerly) Chief Prosecutor	V					V				
Currently (Formerly) Head Prosecutor	V	V	V	V	V	V		V		V
Currently (Formerly)	V	V	V	V	V		V	V	V	V
Currently (Formerly) Prosecutor of Special	V	V			V		V			

"Unanimity" indicates that if every individual prefers one choice to another, then the group ranking should do the same. "Freedom from irrelevant alternatives" means that if a choice is removed, then the others' order should not change. "Uniqueness of group rank" point out that the method should yield the same result whenever applied to a set of preferences. The group ranking should be transitive.

[11] The three questions on the questionnaire were "What are the unreasonable manpower phenomena in the prosecution agency in Taiwan?", "What are the reasonable calculation criteria for manpower rationalization of prosecution agency?", and "What are the main manpower rationalization measures for prosecution agency?"

[12] Most of the study designs are based on the principles of anonymity, iteration, controlled feedback, statistical group response, and expert consensus. The number of invitees was decided by referring to the operation principle of "at least seven people, at most 50 people, and the most typical size is from 8 to 12 people" (Mullen, 2003).

Investigation Division										
Abundant experience in felony prosecution	V	V	V		V	V	V	V	V	V
Rotation in various District Prosecutors Office	V			V	V	V		V		V
Familiarity with the businesses of Assistant Investigator	V	V		V	V	V				V
Others (Seniority)	26	25	19	15	16	27	8	20	10	17

The Delphi survey was conducted in 3 rounds of discussions, as described in the following (see Table 5):

A. The test process and analysis of results in various rounds

(A) The test process and analysis of results in round one

Experts were asked to provide 20 specific opinions to each problem. They were asked to write about 10 words for each opinion. The purpose of round one is mainly to collect from the 10 experts their individual viewpoints, which would be integrated and discussed in round 2 to get a focus. In round one, seating was arranged in advance and experts were required and reminded to follow the principle of anonymity in filling out the Delphi questionnaire. The results showed that 119 pieces of expert opinions were obtained for question 1; 70 for question 2; and 93 for question 3. All the opinions were then screened by merging similar opinions and excluding repetitive views. After consolidation, 72 specific comments were collected for question 1; 36 for question 2; and 37 for question 3.

(B) The test process and analysis of results in round two

Round 2 was operated based on the principle of iteration. The research team first explained the results obtained from round 1 to all the respondents and then asked them to select 20 options which they felt the most important for each question from the round-1 results (72 for question 1; 36 for question 2; and 37 for question 3). Analysis of the second-round answers showed that "Manpower planning did not go hand in hand with the reform of judicial system", "Manpower imbalance exists between Courts and Prosecutors Offices", and "Staffing between Public Prosecutor and Tribunal judges was not well assessed and balanced" were the top 3 irrational phenomena chosen by the experts (question 1). "The caseload of a prosecutor and the service to meet the policy needs must be included in the calculation criteria" was considered the most important reference standard by all the experts (question 2). "The manpower ratio between the Courts and Prosecutors Offices should be maintained" and "Adequacy of manpower should be considered when promoting new business" were the 2 best solution strategies agreed upon by all the experts (question 3).

(C) The test process and analysis of results in round three

The principle of iteration was still applied in the third round. We first explained the 20 opinions that the experts had reached consensus for each question and then asked the respondents to select the 10 important affecting factors. Take the results for the first question as an example. It was found that "Manpower imbalance exists between Courts and Prosecutors Offices", "Manpower planning did not go hand in hand with the reform of judicial system", and "Insufficient manpower for Assistant Investigator" were the top three answers from the experts, while the answers to question 3 were similar to those in the second round.

B. Reasonable manpower calculation criteria for prosecution agency

To transform the results that experts had reached consensus for Question 2 of the Delphi questionnaire into the calculation of manpower rationalization of prosecution agency, this article used literature analysis, in-depth interviews, focus groups to analyze the contents and results. Based on five categories of factors, namely "jurisdiction population", "the number of cases", "the nature of cases", "policy issues", and "urban-rural gap", we divided the calculation criteria agreed by more than half of the experts into five categories. Among them, "The caseload of a prosecutor and the service to meet the policy needs must be included in the calculation criteria" was agreed upon by all the experts, while "jurisdiction population" and "the degree of urbanization" were highly recognized as calculation criteria by the experts (see Table 6).

The issue of manpower rationalization of prosecution agency in Taiwan must be discussed in two fronts. The first one is how to get outside support for increasing the number of personnel and the second is how to allocate the human resources internally. The prosecution agency has not properly investigated its own manpower needs for a long time, resulting in its inability to explain the manpower predicament to the outside world. Thus, this paper first studied the working-hour issue and used it to explain the background and then used the Delphi survey to explain the process to construct a model for manpower rationalization of prosecution agency.

Table 6: The calculation criteria agreed upon by more than half of the experts

Question	Question 2: What are the reasonable calculation criteria for manpower rationalization of prosecution agency?		
No.	Final comments	Counts	Attributes
1	The caseload of a prosecutor (number)	10	Jurisdiction population Number of cases
2	Estimates of manpower for the future (future manpower)	7	
3	Calculation of manpower for the second-trial prosecution agency in accordance with the nature of business	8	Nature of cases
4	The number of prosecutors and the manpower for investigation should be counted separately.	8	
5	Types of business, differences of case types	8	
6	Manpower for the Special Investigation Division should be counted separately according to its nature of business	6	
7	Appropriate training and leisure should be counted as reasonable working hours.	6	
8	Weight of cases should be differentiated according to regional population and the nature of cases	9	Jurisdiction population Number of cases Nature of cases
9	Manpower for prosecutors should be calculated with reference to the number of Tribunal judges.	9	
10	The ratio of Prosecutors to Assistant Investigators should be 1:1	7	
11	The ratio of Prosecutors to the judges should be 2:1	6	
12	Policy business needs should be included in the calculation criteria.	10	Policy issues
13	Loaned manpower should be deducted.	9	
14	Manpower should be calculated according to the needs for flexible juridical work	8	
15	The rights of prosecutors loaned out to other departments (such as investigation department) should be included for reference.	6	
16	Regional differences, such as differences between urban and rural areas and the level of economic development	6	Urban-rural gap

III. CALCULATION OF THE WEIGHTS FOR VARIABLES BY ANALYTIC HIERARCHY PROCESS (AHP)

Based on the Question 2 (What are the reasonable calculation criteria for manpower rationalization of prosecution agency?) on the Delphi questionnaire and other related analysis, the researchers designed the AHP questionnaire, aiming to propose a hierarchical and structured view and obtain a consistent view from experts on the assessment on the variables and their weights. The AHP seminar was held on September 27, 2010, to which nine (9) representatives were invited from the prosecution agencies of different trial levels, different functions and duties, and different areas.

At the beginning of the seminar, decision-making factors must be first clarified. Usually, you can combine AHP with brainstorming, focus group, Delphi, and other group decision-making methods to help researchers to identify the attribute of evaluation variables and model them as a hierarchy. To achieve the aforementioned purpose, we used in-depth interviews method, focus group, and the Delphi method to obtain relevant analysis results, which were then used to support the construction of an APH model.

The AHP questionnaire is comprised of four dimensions for "manpower rationalization assessment", including "the workload of prosecution agency, policy needs, urban-rural gap, the basic manpower requirements" (which were further divided into 13 manpower rationalization evaluation variables). Based on the results of pairwise comparison, the respondents evaluated the assessment dimensions and items for manpower rationalization policy of prosecution agency for their relative importance. The four evaluation criteria are explained in the following:

(A) Procuratorial workload

The measurement of workload in prosecution agency was broken down into four evaluation variables, namely the caseload of an investigation prosecutor, the caseload of a public prosecutor, the caseload of an enforcement prosecutor, and the workload of a prosecution agency on duty.

(B) Policy needs

The measurement of the work contents of a prosecution agency was broken down into two evaluation variables, namely policy business needs and judicial protection business needs.

(C) Urban-rural gap

The measurement of manpower rationalization of prosecution agency was broken down into three evaluation variables, namely "jurisdiction population, the level of economic development in the jurisdiction, and the transportation convenience level in the jurisdiction".

(D) Basic manpower requirements

The manpower required to fulfill its mandate in a prosecution agency was evaluated by four variables, namely "the manpower demand for Special Investigation Unit, mobile manpower of a prosecution agency, the number of Tribunal judges, and the ratio of prosecutors to their supporting manpower".

After the comparison matrix was established, we used Expert Choice software to calculate the largest eigenvalue and eigenvector for the evaluation variables at different levels and the weights for evaluation dimension. The Inconsistency Ratio Index (IR) and the Overall Inconsistency Ratio Index, (OII) calculated by the Expert Choice were suitable to explain the results of Consistency Ratio Index for "Integrated Weight Model". The related studies point out that the IR value and OII value of the Expert Choice must be less than 0.1; otherwise, any questionnaire with a value higher than 0.1 must be removed. Our analysis found that the OII value of our research

objectives was 0.02, lower than the 0.1 criterion and the OII values of all the four evaluation dimensions were also lower than the 0.1 criterion. If the four evaluation dimensions were arranged according to their weights, they would appear in sequence like "the workload of prosecution agency" (0.406), "basic manpower requirements" (0.320), "policy needs" (0.166), and "urban-rural gap" (0.108), while the top four evaluation variables among the 13 (in terms of weighted value) were: "the caseload of an investigation prosecutor"(0.602), "the ratio of prosecutor to other investigation manpower" (0.430), "Policy business needs" (0.708), and "the level of economic development in the jurisdiction" (0.536).

Table 7: The evaluation variables and their weights for the manpower rationalization of prosecution agency

Evaluation Dimension	Weight	Evaluation Variables	Weight
1.Procuratorial workload (O.I.I.=0.03＜0.1)	0.406	1.1 The caseload of an investigation prosecutor	0.602
		1.2 The caseload of a public prosecutor	0.182
		1.3 The caseload of an enforcement prosecutor	0.065
		1.4 The workload of a prosecution agency on duty	0.151
2. Policy needs (O.I.I.=0.00＜0.1)	0.166	2.1 Policy business needs	0.708
		2.2 Judicial protection business needs	0.292
3. Urban-rural gap (O.I.I.=0.01＜0.1)	0.108	3.1 Jurisdiction population	0.193
		3.2 The level of economic development in the jurisdiction	0.536
		3.3 The transportation convenience level in the jurisdiction	0.271
4. Basic manpower requirements (O.I.I.=0.01＜0.1)	0.320	4.1 The manpower demand for Special Investigation Unit	0.094
		4.2 Mobile manpower of a prosecution agency	0.245
		4.3 The number of Tribunal judges	0.231
		4.4 The ratio of prosecutor to other investigation manpower	0.430

IV. THE CONSTRUCTION OF MANPOWER RATIONALIZATION REGRESSION MODEL

To further discuss whether the manpower scale of a prosecution agency and its current status of manpower deployment are reasonable or not, to conduct the quantitative analysis and study on the appropriateness of the scale and the "future" manpower needs of prosecution agency, the researchers tried to build a regression model for the selected 21 Prosecutors Offices in Taiwan. We collected the actual numbers of personnel and the statistics of case processing of each prosecution agency in 2006 - 2009, as well as the statistics related to social and economic developments in the jurisdiction of each prosecution agency. All the data were processed by "pooled regression" combining "pooled time series and cross-section data" to build up a model to estimate the main manpower needs for each Prosecutors Office.

A regression model is built to describe the relationships between explanatory variables and explained variables. When the values of explanatory variables change, how will the values of explained variables change accordingly? The basic assumptions of a regression model should include that the variables are normally distributed and that the linear relationship and residual averages should be 0. Based on the above findings, this article originally used "the authorized number of posts for main prosecution manpower" (including the Prosecutor, Assistant Investigator and Law Clerk) as explained variable, and four categories of factors as "explanatory variables", which included the use of "population, number of households" to reflect the "basic manpower requirements"; the use of "average household income, the total household income of each jurisdiction" to reflect

"the level of economic and social development in the jurisdiction"; the use of "the degree of urbanization" to reflect the "social and economic differences"; and the use of "the number of cases, the incidence of cases, the average processing days of a case, and the average number of cases that a prosecutor handles" to reflect "the workload of prosecution agency".

However, in order to avoid overestimating the explanatory power of the regression model, the research team applied three principles, including "whether the explained variable can estimate the symbols of explanatory variable correctly", "whether the ability of explained variable to estimate the explanatory variable is significant", and "whether there is a high correlation between the explanatory variables" to review the contents of each variable. We finally reduced the number of explanatory variables to three groups, namely "the degree of urbanization" (reflecting "the social and economic differences"), "the total household income of each jurisdiction" (reflecting "the level of economic and social development in the jurisdiction"), and "the number of days that the cases entitled with the word "detection" extend[13]" (reflecting "the workload of prosecution agency"). Then, a "pooled regression model" combining "pooled time series and cross-section data" was developed to estimate the reasonable manpower scale for prosecution agency in Taiwan. The "pooled regression model" was presented as follows:

$$Y_{it} = \alpha_0 + \beta_1 X_1 it + \beta_2 X_2 it + \beta_3 X_3 it + \beta_4 X_4 it + \varepsilon it$$

Where Y is explained variable (such as prosecution manpower)；
　　　X is explanatory variable (such as the total household income of each jurisdiction)；
　　　t (representing time) = 1 ... T, in total, there are 4 years (i.e. 2006 to 2009);
　　　i (representing jurisdiction) = 1 ... N, in total, there are 21 areas.

Before estimation, the regression analysis model should be tested by hypothesis. In the selection of optimal regression models, we may set up the null hypothesis (the model does not have explanatory power) and the alternative hypothesis (the model has explanatory power). In addition, we also need to judge whether the explained variable can significantly influence the explanatory variable. In generally, this can be done through the null hypothesis (Explanatory variables have no effect on the prosecution manpower) ($\beta = 0$) and the alternative hypothesis (Explanatory variables can influence the prosecution manpower) ($\beta \neq 0$). In the study, we first tested whether the signals of possible variables were positive or not and their significance. Then, those explanatory variables that passed the aforementioned tests would be tested by the three principles[14] mentioned in the preceding paragraphs and would be removed if there were any doubts about the variables. The researchers finally proposed their best model for the actual estimation as follows:

Prosecution manpower =constant +β_1 urban area + $\beta2$ total household income +$\beta3$ the number of days that the cases entitled with the word "detection" extend + residuals

---

13　The reasons why the cases entitled with the word "detection" were used to represent the total number of days of extension include: (1) failure to obtain the numbers of days in enforcement cases and others; (2) The cases entitled with the word "detection" are comprised of the bulk of prosecution service.
14　Conditions to remove a variable are: the emergence of a negative signal; inability to pass the test that the explanatory variable does not have effect on the prosecution manpower ($\beta \neq 0$); high correlation between variables, resulting in collinearity.

The regression models and parameters to estimate the future manpower needs of "Prosecutors (Y_1), Assistant Investigators (Y_2), and Law Clerks (Y_3)" are listed as follows:

$$Y_1 = 16.1358 + 30.55586 * X_1 + 2.078977 * X_2 + 13.3252 * X_3$$

$$Y_2 = 4.583051 + 15.91888 * X_1 + 1.056889 * X_2 + 7.9348 * X_3$$

$$Y_3 = 22.2648 + 34.10172 * X_1 + 2.254391 * X_2 + 14.9801 * X_3$$

Where, X_1 represents whether the Prosecutors Office is located at the urban area, X_2 represents the total household income of each jurisdiction, and X_3 represents the number of days that the cases entitled with the word "detection" extend.

Table 8 is a regression analysis for the prosecution manpower. The t-test value is statistically significant under a 5% significance level, indicating that the preceding three explanatory variables can fully explain the manpower of Prosecutors Office in the past four years. In addition, the parameters of each individual variable passed the test that the parameter value should not be zero; the response variables also passed the chi-square test for collinearity; and the coefficients of adj. R2 were 0.8038, 0.7877, and 0.7964, representing that the regression models had explanatory power reaching about 80%, 79%, and 80%, respectively, and that the regression models had very good ability to explain the rise and fall of the prosecution manpower in the last four years.

Table 8: The regression analysis for the estimates of main manpower of prosecution agency in Taiwan

Model / Factors	Model 1 Number of prosecutors	Model 2 Number of Prosecutor's Investigator	Model 3 Number of Clerk
Urban area (Rural area)	30.55586[*]	15.91888[*]	0.0186[***]
The total household income of each jurisdiction	2.078977[*]	1.056889[*]	3.3934[*]
The number of days that the cases entitled with the word "detection" extend	13.3252[*]	0.7.9348[*]	18.7488[*]
Constant	16.1358[***]	4.583051*	14.1112[***]
Number of samples	76	76	76
White's test (X^2)	42.37837[***]	47.12069[***]	44.28706[***]
R^2	0.8116	0.7962	0.8046
adj. R^2	0.8038	0.7877	0.7964

Remarks:

*p<0.05，**p<0.01，***p<0.001.

Urban area is a categorical variable, which can be handled as a dummy variable. The variables within the parentheses are the variables in a control group. The value of 1 represents an urban jurisdiction, while 0 for rural jurisdiction.

The total household income of each jurisdiction = the number of households in the jurisdiction of a respective county * the average household income in the jurisdiction of a respective county (The unit of measurement for the total household income is hundreds of billions of new Taiwan dollars.).

The number of days that the cases entitled with the word "detection" extend = the number of case entitled with the word "detection" * the average processing days for the case entitled with the word "detection" (The unit of measurement is in thousands of days).

V. FINDINGS AND LIMITATIONS OF THIS STUDY

It was found that there were three types of models which could explain the growth and decline of manpower in prosecution system in the past four years with an average of about 80% of explanatory power. These three

models were thus applied to estimate the optimum number of personnel for the 21 District Prosecutors Offices in Taiwan. Although the estimates are highly valuable for reference in the adjustment of the future number of personnel, some points are also worthy of attention. The so-called "optimum number of personnel" in this article is estimated by putting some selected explanatory variables of the jurisdiction into the existing model. As a regression model is a "reduction" type of model which may screen out variables, it can not explain all the sources of variation in manpower. Thus, the estimates may not so optimal in the real world. Nevertheless, after putting such variables as the social and economic differences, the level of economic and social development in the jurisdiction, and the workload of prosecution agency into consideration, the estimates for prosecution manpower can be a good reference for "adjusting the manpower for each prosecution agency".

Table 9 is a comparison between the actual and estimated number of personnel for major manpower in each prosecution agency in 2009. It is found that all the necessary variables for the current manpower deployment in the prosecution agency of Taiwan have been included in the Model but a few results generated by the Model are arguable. Take Taipei District Prosecutors Office and Shihlin District Prosecutors Office for example. Although both Offices are located in Taipei City, their social and economic developments are quite different, resulting in differences in the nature of cases, workload, and manpower patterns. The use of average household income data of Taipei City, instead of those of each jurisdiction, has resulted in underestimation of economic development and manpower needs in Taipei District Prosecutors Office and an overestimation in Shihlin District Prosecutors Office.

Secondly, the regression model applies the concept of "average" or "mean" to make estimation. However, the concept may not apply to Taipei District Prosecutors Office. The economic development in Taipei City has been much better and faster than that of other areas. As a result, the major economic crime cases that Taipei District Prosecutors Office must handle are far more complex than those in other District Prosecutors Offices, and Taipei District Prosecutors Office needs to put in ten times or even hundred times of manpower into such cases. Thus, the concept of "average" or "mean" may not be so appropriate for the regression model.

The gaps between the actual and estimated number of personnel for Changhua District Prosecutors Office are too large. The phenomena may be primarily due to the nature of cases and political intervention in the jurisdiction. Finally, the District Prosecutors Offices of Kinmen and Lian Jiang on the outlying Islands have much higher estimated numbers of personnel than the actual ones due to failure to effectively reflect the differences in the nature of cases. The manpower estimation model proposed by this paper can appropriately reflect the current and future situations in the manpower allocation of the prosecution agency in Taiwan, Nevertheless, it is strongly suggested that in addition to the more precise and extensive statistical data, more explanatory variables should be included, so that restrictions to the current Model can be reduced or complemented.

Table 9: A comparison between the actual and estimated number of personnel for major manpower in each prosecution agency in 2009

District Prosecutors Office	Prosecutor			Prosecutor's Investigator			Clerk		
	Actual N. of personnel	Estimated N. of personnel	Difference	Actual N. of personnel	Estimated N. of personnel	Difference	Actual N. of personnel	Estimated N. of personnel	Difference
Taipei	146	138	-8	79	70	-9	160	158	-2

Shihlin	63	94	31	28	46	18	68	108	40
Banciao	121	113	-8	56	57	1	130	130	0
Taoyuan	97	95	-2	46	48	2	112	111	-1
Hsinchu	36	36	0	17	15	-2	48	44	-4
Miaoli	25	25	0	10	10	0	33	32	-1
Taichung	122	124	2	61	63	2	141	143	2
Changhua	51	32	-19	23	13	-10	61	40	-21
Nantou	25	24	-1	9	9	0	31	31	0
Yunlin	28	25	-3	11	9	-2	35	32	-3
Chiayi	33	29	-4	16	12	-4	45	36	-9
Tainan	71	77	6	36	38	2	86	90	4
Kaohsiung	133	135	2	69	69	0	152	154	2
Pingtung	34	33	-1	15	14	-1	41	41	0
Taitung	15	20	5	6	7	1	20	27	7
Hualien	19	23	4	5	8	3	27	30	3
Ilan	20	23	3	5	9	4	23	30	7
Keelung	25	26	1	11	10	-1	34	33	-1
Penghu	7	9	2	1	1	0	10	13	3
Kinmen	4	9	5	1	1	0	6	12	6
Lian Jiang	2	8	6	0	1	1	2	11	9
Total	1,077	1,100	23	505	510	5	1,265	1,306	41

REFERENCE:

Becker, G. S. (1964). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. New York, NY: National Bureau of Economic Research Press.

Brooking, A. (1996). *Intellectual Capital*. London: International Thomson Business Press.

Chen, P., et al. (2001). Layoffs, Shareholders' Wealth, and Corporate Performance. *Journal of Empirical Finance*, 8: 171-199.

Davenport, T. (1996). *Human Capital: What It Is and Why People Invest It*. San Francisco, CA: Jossey-Bass Publisher.

Dess, George G. & Joseph C. Picken (1999). *Beyond Productivity: How Leading Companies Achieve Superior Performance by Leveraging Their Human Capital*. New York, NY: AMACOM Books.

Edvinsson, L. & Michael S. Malone (1997). *Intellectual Capital: How to Measure the Value of Invisible Assets in the Information Age*. New York, NY: Harper

Ingraham, Patricia W., et al. (2000). People and Performance: Challenges for the Future Public Service-the Report from the Wye River Conference. *Public Administration Review*, 60 (1): 54-60.

Lazear, E. (1998). *Personnel Economics for Managers*. New York, NY: John Wiley & Sons.

Perry, W. Steven. (2006). Prosecutors in State Courts, 2005. **Bureau of Justice Statistics Bulletin**. Office of Justice Programs at U.S. Department of Justice. Retrieved from http://www.ojp.usdoj.gov/bjs/pubalp2.htm#prosecutors, 2010/10/1.

Saaty, T. L. & L. G. Vargas (1984). The Legitimacy of Rank Reversal. *OMEGA*, 12(5): 513-516.

Schultz, T. W. (1961). Investment in Human Capital. *American Economic Review*, 51 (1): 1-17.

Williamson, O. E. (1975). *Markets and hierarchies: Analysis and antitrust implications*. New York: Free Press.

Williamson, O. E. (1985). *The Economic Institutions of Capitalism*. New York: Free Press.

Williamson, O. E. (1991). Strategizing, Economizing, and Economic Organization. *Strategic Management Journal*, Winter Special Issue(12): 75-94.

Rindfleisch, A. & J. Heide (1997). Transaction cost analysis: Past, present, and future applications, *Journal of Marketing*, 61(4): 30-54.