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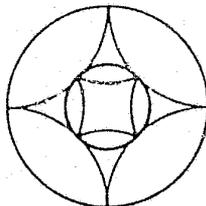
Police Services Study Technical Report

T-19

A PUBLIC SERVICE INDUSTRY APPROACH
TO THE STUDY OF POLICE IN METROPOLITAN AREAS

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April, 1976

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NCJRS

OCT 5 1976

ACQUISITIONS

The research described in this paper has been funded by the RANN Division of the National Science Foundation (Grant Number GI 43949). The views expressed herein are those of the authors and should not be ascribed as the views of the National Science Foundation.

The authors appreciate the comments and criticisms they have received on earlier drafts of this paper from Frances Bish, Phillip Gregg, Jnana Hodson, Steven Mastrowski, John McIver, Nancy Neubert and Vincent Ostrom.

A PUBLIC SERVICE INDUSTRY APPROACH TO THE STUDY OF
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Much is known about the internal operations and problems of large, central city police departments. The New York City Police Department, the Chicago Police Department, the Los Angeles Police Department, and similar large city police agencies have been extensively studied and the models used explicitly or implicitly in judging other police departments across the country.

Little is known, however, about the ways police agencies work in relation to one another to deliver services in metropolitan areas. Some studies have counted the number of police agencies serving metropolitan areas and concluded that too many departments exist. Many observers have worried about the existence of large numbers of small departments. In their opinion, these agencies cannot possibly provide the wide range of service offered by large, central city police departments. Major changes in the law enforcement systems of many metropolitan areas have been proposed. These changes are being considered without much information -- other than counts and distribution by size -- about how services are delivered in metropolitan areas.

This paper describes the approach of a research project which is attempting to fill that gap between consideration of major reforms and the information available to policy makers about current organizational arrangements.¹ The focus during the first phase of this project is descriptive.² The second phase, which is just starting, will be evaluative.³

This study takes an industry approach rather than an organizational approach. This means that we expect to find "producers," "consumers," and "financers or providers" of police services in each metropolitan area who are not necessarily the same organizational entity. We view the production, consumption and provision of public services as analytically separate processes.⁴ Given that we separately examine these processes, we can then more effectively describe, and eventually evaluate, the patterns of interactions among producers, consumers and providers.

What is the difference between an industry approach and an organizational approach? Observers using an organizational approach to study police many find that few departments employing 25 full-time sworn officers (or less) have their own homicide bureau, crime laboratory or training facilities. These observers quite typically conclude that because the organization does not undertake these activities that the services are not available to the organization. Using an industry approach, one does not stop after finding out whether the agency itself has specialized internal facilities. One continues to ask whether other agencies -- county sheriff's, neighboring jurisdictions, state agencies -- produce these services and make them available to other agencies through contract or other inter-jurisdictional arrangements.

Observers using an organizational approach may argue that if economies of scale exist in the production of some police services, entire police agencies should be made large enough (through consolidation or merger, for instance) to gain these economies. But, observers using an industry approach will ask whether these economies

can be achieved through the organization of specialized agencies who produce these services and make them available to other agencies through a variety of inter-jurisdictional arrangements.

In the private goods market, we are all familiar with the difference between neighborhood quick-service, limited selection establishments and the broad-spectrum supermarkets or full-scale department store. But many observers forget about these differences when they turn to public goods. They think instead that each political jurisdiction is sovereign unto itself and that for services to be available to citizens, each agency must produce the full range of services.

In the 80 metropolitan areas included in this study, police services were organized in many different ways.⁵ Some agencies resemble broad-spectrum supermarkets or full-scale department stores. Other police agencies resemble quick-service, limited selection establishments. Many small municipalities, for instance, patrol neighborhoods, control traffic, and investigate residential burglaries. In the event of a homicide, however, they call upon the County Sheriff, County Prosecutor, or state investigators. Any of these may be the regularly authorized units for homicide investigation and may maintain their own specially-trained investigators for this situation. The officers of the small municipality may be trained by a local community college or in a special state police academy. A county-wide agency may dispatch the community's patrol cars. If a routine traffic stop turns up narcotics, the state crime lab may be called. Suspects to be detained may be turned over to the Sheriff, who maintains lock-up facilities for the entire county.

Mutual aid agreements with adjacent municipalities may provide police officers with back-up manpower in demanding situations. When police services are seen in this perspective, the observer may find that the citizens served by a small police force do receive the full range of police services, even though the small department does not produce all of these itself. To determine whether this actually happens, however, one must examine the set of relationships for each police service in each metropolitan area.

Types of Services

Since the patterns of service delivery vary so much depending upon the type of police service involved, any systematic attempt to describe the pattern of relationships among agencies in a metropolitan area must distinguish among different types of services. We selected several services which are produced by police agencies in direct relationship to individual citizens or households. These were called direct services. The direct services examined in this study include general area patrol, traffic patrol, traffic investigation, burglary investigation and homicide investigation.

Other services are produced by one agency and consumed in the production of direct services by the same or a different agency. These were called inter-mediate services. We included radio communications, adult pre-trial detention, entry-level training and crime laboratory analysis (both chemical and narcotics). This list of services does not include all those produced by police agencies. But it does represent many of the typical services for which patterns of inter-jurisdictional arrangements may vary considerably.

The Producers

To use an industry approach for describing the patterns of relationships among agencies, one needs first to identify the set of producers to be included. We first identified the producers of direct services in a metropolitan area. For an agency to be a producer, they had to produce one of the direct services and the officers employed by the agency must have had the extraordinary power of arrest. Then, we ascertained from each direct service producer (through in-person, mail and telephone interviews) how they obtained each inter-mediate service (or, whether that service was available to them). Each producer identified through this process was included in our study as an intermediate producer. Many intermediate producers are not located in the metropolitan area studied. Many direct service producers, for example, send their recruits to a state training academy located many miles away for entry-level training. Such a state academy was considered in this study as a producer in each metropolitan area where it trained recruits.

The Consumers

For each direct service, individuals or households are the basic consumers of the service. However, due to the collective nature of many of these services and the analytical difficulty of using individuals as basic levels of analysis in a metropolitan area study, we defined service areas for each direct service. To be a service area, there must be a resident population of at least 100

people (who live in the area more than six months during the year). These residents must have some method for making collective decisions about police services in the area and have a distinct legal arrangement with a producer of a direct police service. The method of making collective decisions may vary from general election of representatives to that of a hierarchy with a single commander.

Most service areas are cities, towns, or villages. A residential campus or military base is also a service area if it has some distinct arrangements for providing a direct service. If a college campus does not have its own security force and is patrolled by the city police departments just like the rest of the city, then the campus is not a service area but is a part of the city service area in which it is located. This system of identifying service areas divides the population and area of a SMSA into a set of mutually exclusive and exhaustive groupings.

For inter-mediate services, the producers of direct police services are considered to be the consuming agencies. Not all direct service producers consume all intermediate services. Each potential relationship has to be determined empirically.

Regular and Irregular Production of Police Services

Once producers and service areas have been identified, the relationships between each producer and service area can be determined. Several types of relationships are possible.

Some police services are regularly provided to a service area. By regular production we mean that the producer makes the service available on a routine basis to individuals in the service area or

to consuming agencies. Other services are provided irregularly. By irregular production we mean that the producer makes this service available to a service area or consuming agency only in unusual circumstances. If, for example, a municipal police department investigates all reported homicides in the city, but the state police upon rare occasions assist in the investigation of a homicide, the city would be considered the regular producer and the state police the irregular producer. Although we have determined the presence of irregular producers for all services, most of our attention is devoted to the regular producers of each service.

Service Matrices

Once the producers of a service and their service areas are identified, the relationships among producers and their consumers can be arrayed in a service matrix. Each producer is listed along the left-hand side of the matrix. Across the top of the chart is listed each service area receiving a direct service or, each direct police producer receiving an intermediate service.

The type of production relationship (regular or irregular, for instance) between a producer and user is placed in the cell where the rows and columns cross.

Let us illustrate the use of our service matrices with information about several services in the Fayetteville/North Carolina SMSA.

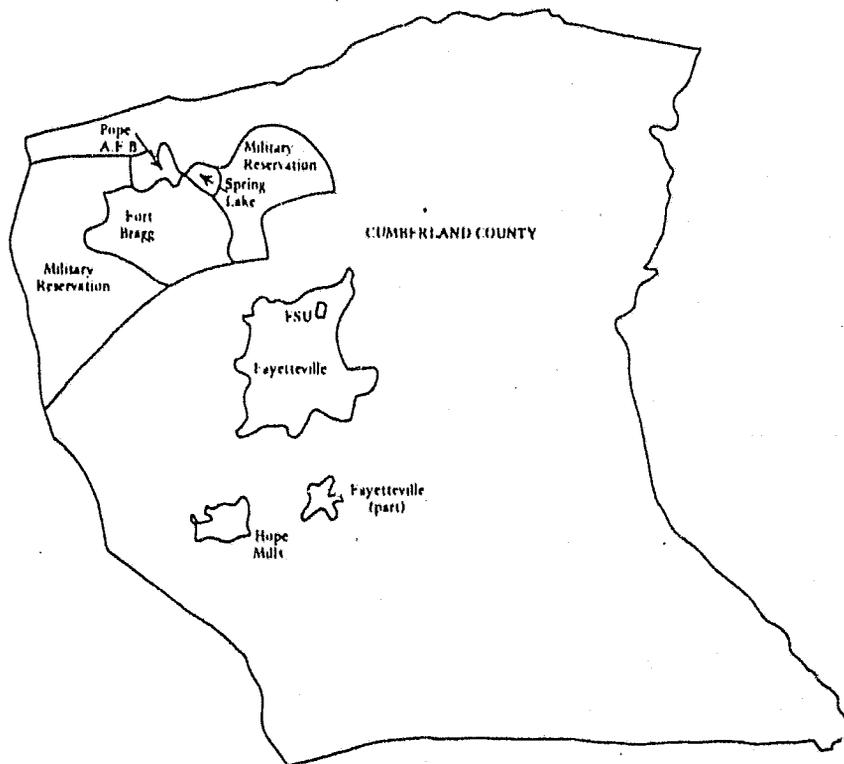
The Fayetteville SMSA, defined as Cumberland County, covers 654 square miles of North Carolina coastal plain. Like many of our other SMSAs, much of the area is rural. The urbanized area of Cumberland County includes the City of Fayetteville, two smaller

towns, and two military installations. Figure 1 shows that urban development is concentrated in the northwestern portion of the county. The City of Fayetteville, about 54,000 residents in 1970, is a center of tobacco and cotton marketing, and textile and chemical manufacturing. But the area's major industry is the military. The combined population at Fort Bragg and Pope Air Force Base together is almost as large as Fayetteville's. The entire town of Spring Lake (population 2,500) and parts of Fayetteville are residential and commercial service areas for military personnel. In contrast, Hope Mills, a quiet rural village of about 2,000, is being transformed into a middle income suburb of Fayetteville. More than half of the SMSA population lives in unincorporated areas concentrated in the northwestern areas of the county, although small clusters are scattered throughout.

Since relationships between traffic patrol producers and service areas in the Fayetteville SMSA are quite simple and clearcut, they are used as our first service matrix example. For traffic patrol, the SMSA divides into seven service areas. Each military installation in Cumberland County is a traffic patrol service area, as are the municipalities of Spring Lake and Hope Mills. Because Fayetteville State University within the City of Fayetteville receives traffic patrol from its own safety division, it is a traffic patrol service area. The remainder of the City of Fayetteville is the sixth traffic patrol area. The remainder of Cumberland County is the seventh area.

Each of these service areas is served by one -- and only one -- regular producer of traffic patrol. This relationship is shown by the diagonal row of R's in the traffic patrol service matrix shown

FIGURE 1, Fayetteville/North Carolina SMSA



1970 Population of Police Service Areas:
Fayetteville/North Carolina SMSA

Fort Bragg	41,495
Pope Air Force Base	5,500
Hope Mills	1,721
Spring Lake	2,390
Fayetteville State University	1,643
Remainder of Fayetteville	51,867
Remainder of Cumberland County	107,426
TOTAL for SMSA	212,042

in Table 1. It is interesting to note that in this SMSA, a state producer -- the North Carolina Highway Patrol -- provides regular traffic patrol in the unincorporated remainder of Cumberland County.

Definitions of Fragmentation, Multiplicity, and Independence

With the terms we have already defined and the illustrative traffic patrol service chart for Fayetteville, we can now define three of our service delivery measures and show how they are computed for the SMSA.

Fragmentation

"Fragmentation" is a term that is frequently used but rarely defined. Since the relationships between producers and users can be fragmented on either or both sides, several situations can exist. When a metropolitan area is described as fragmented, there could be multiple producers and few service areas. Or, there could be a few producers and many service areas. Or, multiple producers and multiple service areas could exist. Because of the lack of clarity in reference, one cannot know which case is being discussed. Further, one cannot undertake empirical work to determine the relative effects of any of these forms of "fragmentation" unless the concepts are sorted out.

Consequently, in developing measures we use two terms for what has generally been called fragmentation -- "fragmentation" and "multiplicity."

We use "fragmentation" to describe the division of a metropolitan area into service areas. For direct services, fragmentation

TABLE 1. Traffic Patrol Service Service Matrix: Fayetteville/North Carolina SMSA

Agency Producing Service	Traffic Patrol Service Areas						
	Fort Bragg	Pope Air Force Base	Hope Mills	Spring Lake	Fayetteville State University	Remainder of the City of Fayetteville	Remainder of Cumberland County
U.S. Army Military Police	R						
U.S. Air Force Security Police		R					
Hope Mills Police Department			R				
Spring Lake Police Department				R			
Fayetteville State University Safety Division					R		
Fayetteville Police Department						R	
North Carolina Highway Patrol							R

R - denotes regular traffic patrol production.

is defined as the number of distinct service areas. For auxiliary services, it is defined as the number of direct producers receiving that service. Since one finds a relationship between the size of a metropolitan area and the number of service areas, we have also defined a relative measure of fragmentation for direct services. Relative fragmentation is the number of service areas per 100,000 population.

In the Fayetteville area, the absolute measure of traffic patrol fragmentation is seven. Simply put, there are seven columns in the traffic patrol service matrix. The relative fragmentation measure for traffic patrol is 3.3 (seven divided by 2.12 -- the population of the SMSA stated in 100,000s).

Multiplicity

"Multiplicity" is the number of agencies producing a particular service in a metropolitan area. As an absolute measure this is similar to the lists or counts of police agencies often used by national commissions and others when lamenting the lack of a unified law enforcement system.

But a simple list of agencies does not control for the size of the metropolitan area. For direct services, relative multiplicity is defined as the number of producing units for the service per 100,000 residents of the SMSA.

In the Fayetteville SMSA, the absolute measure of multiplicity for traffic patrol is seven -- a count of the rows in the traffic patrol service matrix. In this case, the measure of multiplicity is the same as the measure of fragmentation. But, we will see,

this is not always the case. The relative measure of multiplicity is also the same as the relative measure of fragmentation (3.3).

Independence

Any other aspect of service delivery structure concerns the types of distinct legal arrangements between a producing agency and each of its service areas. Many police agencies are departments or bureaus of their local governing authority. Independence is computed as the fraction of the total number of service areas that receive a service from their "own" service agency. All but one of the traffic patrol agencies shown in Table 1 receive service from their own service agency. (For our purposes, a military base commander and a college campus administration are both "local governing authorities.") The North Carolina State Highway Patrol provides a traffic patrol in the unincorporated, off-base area of Cumberland County, while the other six service areas have their "own" producers. Independence of traffic patrol is therefore 0.86 (6/7). A related measure -- relative independence -- is the fraction of the total population served by their "own" production agency. This measure is 0.40 for traffic patrol in Fayetteville. (Sixty percent of the population of the SMSA is located in the unincorporated, off-base area of Cumberland County served by the Highway Patrol -- only 40 percent of the population is served by its "own" agency.)

Autonomy

A related measure to that of independence is that of autonomy or the fraction of service areas served by their "own" production agency

and no other agency. Relative autonomy refers to the proportion of the population served by their own and no other agency. In the case of traffic patrol, measures of independence and autonomy are the same. However, we will note later, that this is frequently not the case.

Some Additional Definitions

Traffic patrol in the Fayetteville/North Carolina SMSA is a good example of the simplest pattern of relationship we found across the 80 SMSAs. Many observers imagine that most metropolitan police service delivery is like this example -- one producer for each service area.

But, observing the actual patterns of police production, we found that several forms of production involve simultaneous regular production by more than a single producer in a service area. Two forms of simultaneous regular production occur so frequently that we developed special ways to code and measure these forms of production. These forms of simultaneous regular production are alternation and coordination.

Alternation

Alternation occurs when two agencies produce a service for the same service area but systematically divide their production activities over space, over time, or among clientele.

Patterns of alternation in space frequently occur with parks, airports, tollways, and bridges -- places that rarely have a residential population. They are usually tiny in proportion of the

area served by the regular producer for a service area. Frequently, the producers who serve them are different from those who serve the rest of the service area. If this pattern weren't coded in a distinct manner, the reader might think that two regular producers serve an entire service area.

Two slightly different patterns are found for alternation in space. In one, the alternating producer exclusively produces in some space. In the other, non-exclusive production occurs. When, for example, the alternating producer is the only producer patrolling on a freeway (and the regular producer for the consuming unit never patrols the freeway), we consider this exclusive alternation in space. But when the alternating producer is not the only producer on the freeway and the regular department also occasionally patrols there, the alternation is considered non-exclusive.

A second variation is alternation in time. A small municipality may, for instance, dispatch for itself between 8 am and 4 pm and be dispatched by the Sheriff between 4 pm and 8 am. We consider both producers to be alternating in time in the production of dispatch services for this municipality.

A third form of alternation is also possible -- alternation among clientele. Two agencies simultaneously produce a service to the same service area, but for different clientele within the district. In some metropolitan areas, for example, military shore patrol and civilian police departments patrol streets together -- but each pays primary attention to a single clientele group. In others, two detention producers provide services -- one for male suspects and one for female -- another instance of alternation in

clientele.

Coordination

A second form of regular simultaneous production is coordination. This occurs when two or more regular producers interact in planning regular service production for the same consuming unit. In many SMSAs, homicide criminal investigations are simultaneously provided by several agencies working in a coordinated manner. Even though multiple agencies work the case, they maintain a single case record and share leads.

Alternation and Coordination in Fayetteville

The pattern of burglary investigation in the Fayetteville SMSA gives us an illustration of alternation. The patterns of homicide investigation illustrate both alternation and coordination.

Burglary investigation in the SMSA has a different delivery structure than does traffic patrol. Note that Table 2 lists six service areas for burglary investigation while Table 3 lists seven service areas for traffic patrol. The Fayetteville State University Security Division does not undertake burglary investigation. As a result, burglaries reported on campus are treated like burglaries reported in other parts of the city and are investigated by the Fayetteville Police Department. Fragmentation for burglary investigation is six. Relative fragmentation is 2.8.

But nine agencies in the SMSA investigate burglaries. (Multiplicity is nine; relative multiplicity is 4.2). The Fayetteville, Spring Lake, and Hope Mills Police Departments each investigate

TABLE 2. Burglary Investigation Service Matrix for Fayetteville/ North Carolina SMSA

Agencies Producing Service	Burglary Investigation Service Areas					
	Fort Bragg	Pope Air Force Base	Hope Mills	Spring Lake	Fayetteville	Remainder of Cumberland County
U.S. Army Military Police	Ac					
U.S. Army Criminal Investigations Division	Ac					
Federal Bureau of Investigation	Ac	Ac				
U.S. Air Force Security Police		Ac				
U.S. Air Force Office of Special Investigations		Ac				
Hope Mills Police Department			R			
Spring Lake Police Department				R		
Fayetteville Police Department					R	
Cumberland County Sheriff's Department			I	I		R

Ac - denotes alternation by clientele production of burglary investigation.

R - denotes regular production of burglary investigation.

I - denotes irregular production of burglary investigation.

burglaries in their own municipalities. The Cumberland County Sheriff's Department regularly investigates burglaries reported in the unincorporated, off-base portion of the county. The Sheriff's Department also assists burglary investigations in Spring Lake and Hope Mills on an irregular basis.

Burglary investigations on Fort Bragg are divided among Army Military Police, the Army Criminal Investigations Division, and the FBI. The FBI has jurisdiction in all cases involving civilians on the base. The two Army producers have jurisdiction in all cases involving military personnel on the base but divide these cases by the reported property loss. The Military Police is restricted to thefts of less than \$250. Losses above that figure are investigated by Army CID.

Three agencies thus alternate clientele in producing burglary investigation services for Fort Bragg. Air Force Security Police, the Air Force Office of Special Investigations, and the FBI similarly alternate in burglary investigations on Pope Air Force Base. Because of the alternation, our measure for autonomy in burglary investigation is .67 while it is 1.0 for independence.

Homicide investigation (Table 3) reveals a different pattern. Our multiplicity measure is now seven instead of nine. Neither the Army Military Police nor the Air Force Security Police produce this service, leaving it to the CID and OSI respectively. The FBI alternates with each service producer by clientele. The Cumberland County Sheriff's Department coordinates with the two small municipalities. The major responsibility for conducting the case rests with the Sheriff's Department, but

TABLE 3. Homicide Investigation Service for Fayetteville/
North Carolina SMSA

Agencies Producing Service	Homicide Investigation Service Areas					
	Fort Bragg	Pope Air Force Base	Hope Mills	Spring Lake	Fayetteville	Remainder of Cumberland County
U.S. Army Criminal Investigations Division	Ac					
Federal Bureau of Investigation	Ac	Ac				
U.S. Air Force Office of Special Investigations		Ac				
Hope Mills Police Department			C			
Spring Lake Police Department				C		
Fayetteville Police Department					R	
Cumberland County Sheriff's Department			C	C		R
North Carolina State Bureau of Investigation			I	I	I	I

Ac - denotes alternation by clientele production of burglary investigation

R - denotes regular production of burglary investigation

C - denotes coordinated production of burglary investigation

I - denotes irregular production of burglary investigation

each small department participates as a member of a joint investigative effort. A single case file is maintained and leads found by one agency are shared with the other. The North Carolina State Bureau of Investigation irregularly provides homicide investigation to some service areas in the SMSA. While it shows as an eighth row on our service matrix, we do not include irregular producers in computing measures.

Auxiliary Services in Fayetteville

The three services we have examined so far are all direct services. We now examine two auxiliary services in the Fayetteville area -- adult pre-trial detention and basic training. For adult pre-trial detention we have only three producers -- a multiplicity measure of three (See Table 4). Twelve agencies use this service, making the fragmentation measure 12. Lower multiplicity and higher fragmentation is quite common for auxiliary services. Since agencies and not service areas are the users of auxiliary service, relative multiplicity is the number of producing agencies per agency using the service. In Fayetteville the three detention agencies serve 12 agencies, so relative multiplicity is 0.25.

Another example of alternation is seen in the production of pre-trial adult detention. When the Fayetteville Police Department, Spring Lake, or Cumberland County Sheriff's Department detains a member of the military, it may release the prisoner to one of the two military detention centers. All civilian prisoners, however, are sent to the Cumberland County Jail.

TABLE 4. Adult Pre-trial Detention Service Matrix for Fayetteville/North Carolina SMSA

Agencies Producing Service	Agencies Being Served											
	U.S. Army Military Police	U.S. Army Criminal Investigations Division	Federal Bureau of Investigation	U.S. Air Force Security Police	U.S. Air Force Office of Special Investigations	Hope Mills Police Department	Spring Lake Police Department	Fayetteville Police Department	Fayetteville State University Safety	Cumberland County Sheriff's Department	North Carolina Highway Patrol	North Carolina State Bureau of Investigation
Fort Bragg Detention Center	R	R						A		A		
Pope Air Force Base Detention Center				R	R							
Cumberland County Sheriff's Department			R			R	R	R	R	R	R	R

R - denotes regular provision of pre-trial adult detention

A - denotes an alternative provision of pretrial adult detention

For entry-level training in Fayetteville, we find a multiplicity measure of eight (eight agencies producing training) and a fragmentation measure of 11 (11 agencies receiving training). Each agency receiving training obtains its entry-level training from one and only one agency. (See Table 5).

Measures of Duplication

General descriptions of police service in metropolitan areas often convey the idea that the mere presence of multiple producers is equivalent to having duplication. But, when each producer serves no more than one service area, this one-to-one relationship is not a form of duplication. Duplication occurs when a service area receives a service from two or more separate producers. However, we have found that duplication occurs in many forms. Our first measure of duplication is "nominal duplication." This measure is closest to what many observers mean when they talk about duplication in service provision. Nominal duplication is measured by counting the number of service areas or consuming agencies receiving a particular service from more than one regular producer regardless of whether coordination or alternation occurs and dividing this number by the total number of service areas or consuming agencies. Whenever more than one producer serves the same area or agency in a regular manner, we count it as nominal duplication. For direct services, relative nominal duplication can be measured as the ratio of the population of units receiving service regularly from more than one producer to the total population of the area.

TABLE 5. Entry-Level Training Service Matrix for Fayetteville/North Carolina SMSA

Agencies Producing Service	Agencies Being Served										
	U.S. Army Military Police	U.S. Air Force Security Police	U.S. Air Force Office of Special Investigations	Federal Bureau of Investigation	Hope Mills Police Department	Spring Lake Police Department	Fayetteville Police Department	Fayetteville State University Safety	Cumberland County Sheriff's Department	North Carolina Highway Patrol	North Carolina State Bureau of Investigation
U.S. Army Military Police	R										
U.S. Air Force Security Police		R									
U.S. Air Force Office of Special Investigations			R								
Federal Bureau of Investigation				R							
Fayetteville Technical Institute					R	R	R	R	R		
North Carolina Highway Patrol										R	
North Carolina State Bureau of Investigation											R
Johnson Technical Institute						R					

R - denoted regular provision of basic training

While nominal duplication is the closest to what many observers seem to mean when they talk about duplication, we have observed many variations in the patterns of multiple service production and have identified three forms of such production -- alternation, coordination, and strict duplication. We thus have three more measures of duplication.

Coordination is the number of consuming units receiving service from a coordinated arrangement between two or more producers divided by the total number of such units. For direct services, relative coordination is the ratio of the population of areas receiving coordinated service to the total population of the area.

Alternation is the number of consuming units receiving a particular service from two or more regular producers where at least one of the producers alternates in time, space, or clientele with other producers divided by the total number of such units. For direct services, relative alternation is the ratio of the population of units receiving alternative service to the total population of the area.

Strict duplication is the number of consuming units in the metropolitan area that regularly receive a service from more than one producer without coordination or alternation divided by the total number of such units. Strict duplication measures the amount of duplicative service provision where some form of arrangements for either coordinating the provision or alternating have not been worked out among the multiple producers to a consuming unit. Additionally, for direct services, relative strict duplication is measured by the sum of the population of the service areas receiving duplicative service divided by the total population of

the metropolitan area.

Each of these three -- coordination, alternation, and strict duplication -- measures one or another aspect of what many observers mean when they talk about duplicative services. We believe it very important to distinguish among the different types of service provision involving more than a single agency serving a particular area or agency. When two agencies coordinate their activities or "split up" their service responsibilities by alternating, we find considerably less "duplication" in a real sense. This is why we reserve strict duplication to measure a form of multiple production that does not involve the other two types.

In Fayetteville, for example, the measure for nominal duplication for homicide investigation is 0.67 because four out of six service areas are served regularly by more than one producer. However, when one examines the type of relationships established among agencies, one finds that two of these service areas are served in a coordinated fashion by two producers (coordination = 0.33) and two of them are served by producers who are alternating by clientele (alternation of 0.33). Thus, strict duplication for homicide investigation in Fayetteville would be zero.

Measures of Dominance

Another aspect of the structure of relationships among police agencies serving metropolitan areas is the relative position of the largest producer in the area. A metropolitan area served by one large producer with many very small producers may be quite different than one with a large number of small

agencies. Our measure of dominance counts the number of service areas served by the largest producer in the metropolitan area. Relative dominance is the percentage of the metropolitan area population living in the area served by the dominant producer. In Fayetteville, the Cumberland County Sheriff's Department is the dominant producer of homicide investigation services (dominance = 0.50 and relative dominance = 0.53) and pre-trial adult detention (dominance = 0.67). The Fayetteville Technical Institute is the dominant producer (dominance = 0.45) of entry-level training.

An Overview of the Service Delivery Measures

Tables 6 and 7 conveniently summarize these measures direct and auxiliary services we have discussed in this chapter.

Tables 8 and 9 present all of the measures for the direct and auxiliary services we have discussed in Fayetteville. Even in a relatively uncomplicated SMSA such as Fayetteville, we find considerable differences in measures across services. The differences are greatest between the direct services and the auxiliary services -- a pattern characteristic of most of our metropolitan areas. Fragmentation is highest for adult pre-trial detention and lowest for burglary investigation. Multiplicity is highest for burglary investigation and lowest for adult pre-trial detention. The advantage of separating these two concepts of "fragmentation" becomes obvious when one studies these two tables.

As a group, the measures provide a method for describing differences and similarities in interorganizational arrangements for different police services within a metropolitan area. They are

a mechanism enabling one to analyze and compare even very complex arrangements. But, they are also essential for any attempt to compare interorganizational arrangements across metropolitan areas. Using these measures, for example, we can compare interorganizational arrangements providing patrol in Fayetteville/North Carolina to those in other metropolitan areas. Further, as shown in Table 10, we can use³ these measures to describe the median levels of fragmentation, multiplicity, and other concepts for all 80 metropolitan areas included in this study.

TABLE 6. Measures of Service Delivery Structure for Direct Services

Measure	Definition
Fragmentation	Number of service areas for the service.
Relative fragmentation	Number of service areas for the service per 100,000 residents.
Multiplicity	Number of producers of the service.
Relative multiplicity	Number of producers of the service per 100,000 residents.
Independence	Number of service areas receiving service from their own producer divided by total number of service areas.
Relative independence	Fraction of the population served by their own production agency.
Nominal duplication	Number of service areas receiving service from more than one producer regardless of alternation and coordination arrangements divided by total number of service areas.
Autonomy	Number of service areas receiving service from their own producers exclusively divided by total number of service areas.
Relative Autonomy	Fraction of the population served exclusively by their own agency.
Relative nominal duplication	Fraction of the population that receives service from more than one producer regardless of alternation and coordination arrangements.
Coordination	Number of service areas receiving service from a coordinated arrangement between two or more producers divided by total number of service areas.
Relative coordination	Fraction of the population that receives service from coordinated arrangement between two or more producers.

TABLE 6. (Continued)

Measure	Definition
Alternation	Number of service areas receiving service from alternating producers in time, space, or clientele divided by total number of service areas.
Relative alternation	Fraction of the population that receives service from alternating producers.
Strict duplication	Number of service areas receiving regular service from more than one producer without coordination or alternation divided by total number of service areas.
Relative strict duplication	Fraction of the population receiving regular service from more than one producer without coordination or duplication.
Dominance	Number of service areas receiving regular, alternative, or coordinated service from the producer with the largest serviced population.
Relative Dominance	Fraction of the population receiving regular, alternative or coordinated service from the producer with the largest serviced population.

TABLE 7. Measures of Service Delivery Structure for Auxiliary Services

Measure	Definition
Fragmentation	Number of direct producers receiving the service.
Multiplicity	Number of producers of the auxiliary service.
Relative multiplicity	Number of producers of the auxiliary service divided by the number of direct producers receiving the service.
Independence	Number of direct producers receiving the service from their own agency divided by total direct producers receiving service.
Nominal duplication	Number of direct producers receiving the service from more than one producer regardless of alternation and coordination arrangements divided by total direct producers receiving service.
Coordination	Number of direct producers receiving the service from a coordinated arrangement between two or more producers divided by total direct producers receiving service.
Alternation	Number of direct producers receiving the service from alternating producers in time, space or clientele divided by total direct producers receiving service.
Strict duplication	Number of direct producers receiving the service from more than one producers without coordination or alternation divided by total direct producer receiving service.
Dominance	Number of direct producers receiving the service from the producer serving the largest number of direct producers.

TABLE 8. Direct Service Delivery Measures for Fayetteville SMSA
Traffic Patrol, Burglary Investigation, and Homicide
Investigation

Measures	Traffic Patrol	Burglary Investigation	Homicide Investigation
Fragmentation	7	6	6
Relative fragmentation	3.3	2.8	2.8
Multiplicity	7	9	7
Relative multiplicity	3.3	4.2	3.3
Independence	0.86	1.0	0.67
Relative independence	0.50	1.0	0.78
Autonomy	0.86	0.67	0.33
Relative Autonomy	0.50	0.78	0.75
Nominal duplication	0	0.33	0.67
Relative nominal duplication	0	0.22	0.25
Strict duplication	0	0	0
Relative strict duplication	0	0	0
Coordination	0	0	0.33
Relative coordination	0	0	0.02
Alternation	0	0.33	0.33
Relative alternation	0	0.22	0.22
Dominance	0.14	0.16	0.50
Relative Dominance	0.50	0.50	0.53

TABLE 9. Auxiliary Service Delivery Measures for Fayetteville
SMSA Adult Pre-trial Detention and Basic Training

Measures	Adult Pre-trial Detention	Basic Training
Fragmentation	12	11
Multiplicity	3	8
Relative multiplicity	0.25	0.73
Independence	0.08	0.45
Autonomy	0	0.45
Nominal duplication	0.25	0.09
Coordination	0	0
Alternation	0.25	0
Strict duplication	0	0.09
Dominance	0.67	0.45

The data in Table 10 do reveal a wide range in the median levels of multiplicity, fragmentation and independence across services for the 80 SMSAs. Multiplicity is higher for direct services and lower for intermediate services. Strict duplication is almost non-existent for all services. Levels of alternation are highest for traffic patrol and traffic investigation, somewhat less for general area patrol, low for burglary investigation and dispatch and non-existent for the other services. Dominance is highest for the intermediate services except radio communications and lowest for the direct services.

TABLE 10. Median Value of Structural Measures for Direct and Intermediate Services for 80 SMSA Sample for Selected Measures

Industry Measures	Services				
	Patrol	Criminal Investigation		Traffic	
		Burglary	Homicide	Patrol	Investigation
Fragmentation	12	10	8	12	11
Multiplicity	13	10	8	13	11
Relative Independence	1	.93	.93	1	.88
Relative Strict Duplication	0	0	0	0	0
Relative Coordination	0	.01	.07	0	0
Relative Alternation	.36	0	0	.76	.62
Relative Dominance	.14	.17	.33	.17	.20
	Training	Dispatch	Chemical Lab Analysis	Detention	
Fragmentation	13	13	12	14	
Multiplicity	4	9	2	2	
Relative Independence	.20	.83	.08	.10	
Relative Strict Duplication	0	0	0	0	
Relative Coordination	0	0	0	0	
Relative Alternation	0	.05	0	0	
Relative Dominance	.70	.25	.96	.88	



The members of the research team undertaking this study have just started using these measures in analysis so we are not at this time able to report extensively on their relationship to other variables. Parks has found, for example, that patrol density -- number of patrol officers on the street at a particular time of day per 1000 residents -- is positively related to patrol relative multiplicity and relative autonomy and negatively related to patrol relative dominance.⁶ Thus in metropolitan areas characterized by larger number of agencies serving their own populations and with a relatively small largest producer, the number of officers on the street per 1000 residents is higher than in metropolitan areas with smaller numbers of agencies and a dominant large producer.

E. Ostrom has found that the proportion of agencies requiring higher levels of entry-level training (more than 360 hours) and requiring this training to be taken prior to the completion of six months on the job are positively related to the levels of relative multiplicity and autonomy for training and negatively related to the relative dominance measure for training.⁷ Thus, in metropolitan areas served by only a few training academies, direct service producers require less hours of training and that this training be taken later than in metropolitan areas served by a larger number of training academies.

During the next year, we will be exploring a wide range of policy relevant to questions concerning the relationship between the structure of inter-jurisdictional arrangements for the delivery of police services and the costs of police services, the policies

adapted by police agencies and the allocation of manpower to various service activities.

The industry approach has enabled us to develop quantitative measures of inter-jurisdictional structure so that a number of questions can be empirically examined for the first time. At the descriptive level we have already learned a great deal about the differences in the way different types of police services are delivered in metropolitan areas. We do know that most small, direct service producers do receive entry-level training, criminal laboratory services, detention and dispatching even though many of the agencies do not produce these services for themselves. We do know that the range of variation is very large among metropolitan areas included in the study in the way specific police services are organized. We also know that within any one metropolitan area considerable variation exists in the way different types of police services are delivered.

Our very early analyses of the relationships of police industry structure to manpower allocation, costs and police agency policies has revealed few of the predicted relationships of those who have proposed massive institutional reforms in metropolitan policing. By the time of the next Public Choice meeting in 1977, we will have a much more extensive body of analysis upon which to report.

Footnotes

¹The comprehensive report for this project, Patterns of Metropolitan Policing will be published in the fall of 1976.

²The only data already available for most SMSAs which might conceivably be used as performance variables is the FBI Uniform Crime Reports. Given that the serious problems of validity in using this data for that purpose well documented in the literature, we were limited by funding and time considerations in Phaze I to collecting data on organizational arrangements alone.

³In Phaze II, we will collect our own performance data using a multi-mode approach in three or four SMSAs, including around 75 neighborhoods.

⁴Vincent Ostrom, Charles M. Tiebout and Robert Warren in "The Organization of Government in Metropolitan Areas; A Theoretical Inquiry" (American Political Science Review 55 [December 1961], 831-842) initially proposed the idea of reviewing production, consumption and provision of public services as separate processes. See also Robert L. Bish and Vincent Ostrom, Understanding Urban Government (Washington, D.C.; American Enterprise Institute for Public Policy Research, 1973).

⁵The 80 SMSAs included in this study were randomly selected from the 200 SMSAs defined by the Census Bureau in 1970 having a population of less than 1.5 million persons and boundaries that did not cross state lines. The sample was stratified for each of the 10 regions used by the U.S. Department of Justice and other federal agencies.

⁶Roger B. Parks "Police Patrol in Metropolitan Areas - Implications for Restructuring the Police" in Elinor Ostrom (ed.) Delivery of Urban Services: Outcomes of Change, Vol. 10, Urban Affairs Annual Reviews (Beverly Hills, California: Sage Publications, 1976).

⁷Chapter 8, "Entry-Level Training" in Patterns of Metropolitan Policing, op. cit.



END