

**Span of Control and Public Organizations:
Implementing Luther Gulick's Research Design**

Kenneth J. Meier

Dept. of Political Science
Texas A&M University
College Station, TX 77843
409-845-4232
kmeier@polisci.tamu.edu

and

John Bohte

Dept. of Political Science
Oakland University
Rochester, MI 48309

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Abstract

In Gulick's (1937) classic essay "Notes on the Theory of Organization," he argued that span of control structures relationships between leaders and subordinates in organizations. Commenting on the state of knowledge about span of control, Gulick lamented the lack of systematic research on what he viewed as three key determinants of span of control: diversification of function, the element of time, and the element of space. This study adopts Gulick's approach to studying span of control by examining the effects of diversity of function, time, and space in structuring relationships among personnel in a sample of 678 Texas public school districts. We then investigate Joan Woodward's link between span of control and organizational performance. Our results reveal that while Gulick was correct in asserting that diversity of function, time, and space play a role in determining how spans of controls are structured, these variables have different meanings depending on the level of organizational hierarchy analyzed.

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Span of control refers to how relations are structured between leaders and subordinates in an organization. A wide span of control exists when a manager oversees many subordinates; a narrow span of control exists when a manager oversees few subordinates. While a simple concept, span of control has widespread implications for the study of organizations. For example, span of control is at the foundation of two different approaches to studying organizations. The concept is a key element in economic theories of organization that focus on hierarchical design (Alchian and Demsetz 1972; Fama 1980; Williamson 1975) because spans of control ultimately determine the number of levels, and thus transaction costs, in an organization (Perrow 1986, 30). The concept is also relevant to the human relations approach to organizations (McGregor 1960; Tannenbaum 1968; Worthy 1950) because span of control is a tool that orders relationships between leaders and subordinates in organizations and influences management styles. Span of control, thus, not only has implications for understanding organizational design but also for understanding behavior within organizations.

While span of control has virtually disappeared from academic work, it remains an interest of practical managers who must establish reporting relationships. President Nixon's proposal to create a set of supercabinet administrators, for example, was grounded in the notion that a limited span of control was a positive feature. The National Performance Review (NPR) includes limiting spans as one aspect of its efforts (Kettl and DiIulio 1995). Our examination of span of control proceeds in four steps. First, a brief review of the literature will show that

almost no research has addressed how organizations determine spans of control or what difference it makes. Second, by returning to classic work by Luther Gulick (1937) and Joan Woodward (1980), we generate some hypotheses about how organizations determine their spans of control and how those spans might affect organizational outputs. Third, we test these hypotheses using a large data set of public organizations. Our findings show that spans of control in organizations reflect how organizations manage environmental challenges and also affect organizational performance but not in the way proposed by Woodward. Finally, we discuss the implications of our findings for the management of public organizations.

The Literature on Span of Control

The literature on span of control is sparse, a fact that can be attributed to a devastating critique of the principles of management literature (including span of control) by Herbert Simon (1946). Simon argued that various principles of management were ambiguous and provided contradictory advice to managers. Lost in the aftermath of the Simon critique was the recognition that empirical studies of span of control were essentially nonexistent (for a critical view of Simon's position see Hammond 1990; on the lack of such knowledge relevant to NPR see Kettl 1998). Gulick (1937:90) himself concluded "when we seek to determine how many immediate subordinates the director of an enterprise can effectively supervise, we enter a realm of experience which has not been brought under sufficient scientific study to furnish a final answer."

As to studies, the best Gulick could point to were a series of recommendations based on European cabinets and V.A. Gracunius (1937: 185) argument in the same papers that the optimal span of control was four. With few exceptions, the work that followed Simon on span of control

was essentially descriptive (see Bell 1967; Blau 1968; Meier and Bohte 2000). Urwick (1956: 41) argued that six was the optimal span. Woodward (1980) found a median span for chief executives of 6 but values as high as twelve. At the first-line supervision level of mass production firms, however, spans of control averaged 50 and ranged as high as 90.

The irony of this sparse and often conflicting body of knowledge on span of control is that *Gulick actually answered the question of which variables are crucial determinants of spans of control in his essay*, essentially handing the scholarly community a clear plan of research for studying span of control relationships in organizations. Curiously, scholars have not taken advantage of Gulick's suggestions concerning how to design a course of research on span of control, which is one reason why our knowledge about this concept remains muddled. Gulick argued that spans of control would reflect individual preferences and abilities and, more importantly, three key organizational variables: 1) diversification of function, 2) the element of time, and 3) the element of space. In criticizing the small amount of research on span of control that did exist when he wrote his essay, Gulick (1937: 91) stated that "the failure to attach sufficient importance to these variables has served to limit the scientific validity of statements which have been made that one man can supervise but three, or five, or eight, or twelve immediate subordinates." In this study, we implement the research approach suggested by Gulick and provide a systematic examination of the role these variables play in structuring spans of control in a modern organizational setting.

The Determinants of Span of Control - Three Key Variables

As noted above, Gulick viewed three variables as crucial determinants of span of control

relationships in organizations: diversification of function, time, and space.

1. Diversification of Function

An organization that combines diverse functions (Gulick contrasts an Army general and a director of public works) will need to reduce the size of its spans of control simply because the supervisor must interact with more different types of individuals. If subordinates are all performing the same task with the same set of inputs, jobs can be routinized. This similarity of jobs should permit a single individual to supervise more subordinates. Although Gulick's discussion of diversity was terse, quite clearly the concept applies to the diversity of functions that individuals perform (or the diversity of workplace technologies), the diversity of occupations, and the diversity of inputs that workers use.

2. Time/Stability

The element of time in Gulick's view focused essentially on stability. In stable organizations, managers do not have to train and oversee new workers. Individual workers need less supervision simply because they are more familiar with their jobs. Stability might not only include stability of workers but also stability of the organization's other inputs. A stable environment that provides similar inputs to an organization over a long period of time should permit greater routinization and thus larger spans of control.

3. Size and Space

The element of space for Gulick involved the number of buildings that housed the organization; the more buildings the less face-to-face contact and, in Gulick's mind, the more closely individuals would need supervision. Because space essentially increases the transaction

costs of supervision (Williamson 1975), it can generally be thought of as an element of size.

Gulick did not discuss size, but larger organizations have larger transaction costs, all other things being equal. An alternative hypothesis could be specified for size and span of control (see Blau, Falbe, McKinley and Tracy 1976: 25). Larger organizations can specialize to a greater degree and thus are less likely to use generalists at the production level. The use of highly trained specialists with minimal supervision might generate wider spans of control. In short, there might be some economies of scale in larger organizations that permit fewer administrative oversight personnel.

Gulick hypothesized that these three variables condition spans of control. Studying the effects of these variables is important because span of control relationships can ultimately shape organizational performance. For example, Joan Woodward's (1980) classic study of British industrial firms revealed that span of control varied a great deal across different organizational settings. Examining over 200 industrial firms, Woodward classified firms according to three functional objectives. Unit production firms use small teams of workers to produce products that meet the varying specifications of individual customers (e.g., shipbuilding). Large batch production firms use more advanced technologies such as assembly lines and techniques of mass production in their work. Continuous process organizations employ the most technologically advanced techniques of production to create products over a series of stages, such as the production of chemical compounds. In looking for commonalities among exemplary firms in each category, Woodward found that structure, including span of control, was an important determinant of organizational performance. Variations in spans of control were present *across* the three different organizational categories; however, *within* each organizational category,

successful firms used similar spans of control to structure relationships between executives and employees.

Woodward's study remains one of the few systematic studies of span of control and organizational performance. It provides a precise testable hypothesis that organizations with spans of control similar to the average span for a type of organization will perform best. The implication of her findings in regard to different organizations suggests that one needs to control for type of organization to get a clear picture of how span of control operates in an organization.

Practical Applications

The practical management aspect of span of control studies should be obvious. First, larger spans of control allow an organization to operate with fewer administrative personnel. To illustrate, assume an organization with 600 production level personnel. If the span of control for this organization is set at 4, a total of 202 supervisory personnel in five layers are needed for the entire organization. Increasing the span of control to 5 reduces the number of supervisory personnel to 150 and eliminates one entire level in the organization. Effective management of spans of control, therefore, can produce significant savings to organizations.

Second, manipulating spans of control may also affect managerial relations and management styles. Narrow spans of control imply close supervision. Wider spans of control require more autonomy on the part of the subordinate. This structural factor is consistent with management philosophies based on psychological theories of motivation (see McGregor 1960) and with the philosophical work on ethics in public administration (Frederickson 1996; Wamsley et al. 1992).

Third, Mintzberg's (1979) work on organizations contends that spans of control are not uniform within most organizations (see also Blau et al. 1976: 28). The regular pyramid shape rarely occurs in a real world organization. Organizations often have broad spans of control at one point in the organization and relatively narrow spans of control at other points. In education, the concept of site-based management attempts to move decisionmaking authority from the central administration to the school level. The result of this strategy is that a large number of principals reports to a relatively small number of central office administrators. This wide span of control compensates for a narrower span of control below the principal as he coordinates tasks that were previously the domain of the central administration.

Methods

An ideal data set for examining spans of control would contain numerous organizations performing the same general function. That data set would need both measures of span of control as well as performance measures and measures of diversity, organizational size, and instability. One data set that meets these criteria is the Texas school district data set. The 678 Texas school districts with enrollments over 500 students have usable data for the years 1994 to 1997, and pooling generated a total of 2712 cases over the time frame of the study.¹ Schools are ideal organizations for examining how variations in spans of control affect relationships among organizational personnel. Schools, and school districts more generally, are highly professionalized hierarchical structures. Working relationships exist between teachers and school administrators, campus administrators and administrators at the district level, and teachers and students. Variations in spans of control can affect how each of these relationships is structured,

and such variations ultimately have implications for how schools perform in educating students.

A second reason for examining schools is they share similar functions and thus permit studying how span of control relationships affect organizational performance because they have common measures of outputs. Woodward's (1980) study examined a diverse grouping of over 200 industrial firms in Britain. Casting a wide net over different types of firms makes it difficult to come to any firm conclusions about how span of control matters in any one particular type of organization. Our strategy is to study a set of organizations that all perform the *same* function. Put another way, Woodward revealed that spans of control vary across organizations that have different modes of production. Our goal in this research is to find what determines the span of control for a set of organizations that all use the same modes of production to achieve the same goal (i.e., educating students). In this sense, our work is complementary to Woodward's and extends an important hypothesis about span of control from her research.

Using school districts as the focus of our study raises questions about how generalizable the findings will be to other public organizations. Texas school districts are extremely heterogeneous in terms of size, racial composition, and resources. This heterogeneity along with the fact that Texas contains approximately eight percent of all school districts in the United States implies that generalizations to other school districts should not be a problem. Other generalizations need to be qualified. Schools are, in fact, the most common type of public organization; more public employees work for school districts than any other type of bureaucracy. At the same time, schools are highly professionalized organizations and vest a great deal of discretion in their street level personnel (teachers); they tend to be flat organizations

composed of individuals with a common educational background. The findings here, therefore, are more likely to apply to public organizations with these characteristics; the actual ability to generalize, however, requires additional studies such as this one that examine other types of organizations.

The pooled nature of the data require one additional adjustment. Autocorrelation is often a problem in pooled data. Accordingly, all models included a set of three dummy variables representing individual years to control for serial correlation.²

Dependent Variables: Span of Control

Span of control, in general terms, can be viewed as a set of ratios that link sets of managers and subordinates. Mintzberg's (1979) examination of structures suggests that span of control will vary at different levels within an organization. Two different span of control variables are relevant for this study; first line supervision and mid-management level. The **first-line supervision** in school systems is where administrators supervise teachers; the administrative-teacher span of control is measured directly as the ratio of teachers to administrators in a district. The mean administrator-teacher span is 13.8 and has substantial variation (standard deviation = 3.3, range = 3.0 to 30.5). This variation reflects large differences in how schools structure reporting relationships.

Central office administrators supervise school-level administrators, a **midlevel management span of control**. This span can be measured as the ratio of the number of school level administrators to the number of central office administrators. The broad span of control for teachers contrasts with a relatively narrow mid-manager span of control averaging 2.4 with a

range of .2 to 11.3.³ The measure shows a great deal of variation relative to the smaller mean with a standard deviation of 1.3. As can be seen from these averages, school systems are generally flat organizations with wide spans of control at lower levels and narrow spans at the levels where administrators supervise other administrators.

Independent Variables

1. Diversity. As noted above, three sets of variables are likely to influence the spans of control in an organization; diversity, size, and instability. Diversity creates the heterogeneous demands on an organization that prevent the use of the wide spans of control common in large-batch processing organizations. Three distinct types of diversity can affect organizational structure; task demand diversity, production diversity, and role diversity.

The diversity of task demands implies that inputs to the organization vary. The greater diversity of inputs, the more likely the organization will need to treat each input as a unique case (or the more distinct categories of production that will be needed). A good indicator for task demand diversity for schools is the racial composition of the student body. All schools educate students, but educational needs vary by race and ethnicity (Jencks and Phillips 1998; Meier and Stewart 1991) simply because race and ethnicity are correlated with poverty and other factors that make the educational process more difficult. To create a single measure of task diversity, the percentages of Anglo, Latino, and black students in the district were squared and summed together. This sum was then subtracted from 10,000. The result is the equivalent of the Herfindahl index used to measure the degree of concentration/diversity in markets and a wide variety of other areas (Cohen and Sullivan 1963; Dickson 1994; Baumgartner, Jones and

MacLeod 2000; Hardin 1998). A single race school will have a value of 0, and the measure will increase as the student body becomes more diverse. The theoretical upper limit of the index depends on the number of groups. With three groups the upper limit is 6,667.

Production diversity involves the distribution of production technologies. In the case of education this is the distribution of teachers across distinct educational programs. The six different educational programs are regular education, special education, compensatory education, bilingual education, vocational education and gifted education. The specific measure is a Herfindahl index constructed using these six categories. Because all six productions are teaching, production diversity in schools is clearly relatively narrow. At the same time across school districts, there is substantial variation in how diverse or how homogeneous the curriculum is.

Role diversity attempts to tap the various different occupations/roles in the organization. Six different occupational categories are used; central administration, campus administration, teachers, support staff, teachers' aides, and auxiliary staff. The specific measure is again a Herfindahl index based on these categories. Larger numbers indicate greater diversity.

By using only one type of organization we have restricted the variation on task demands and role and production diversity relative to the diversity one might find among all organizations. Even within such restrictions, however, our measures tap the differences among schools in terms of what Gulick termed diversity.

2. *Organization Size/Space.* Two dimensions of organizational size are relevant to span of control as discussed by Gulick. Overall total staff indicates the total number of employees to be coordinated. Because this variable is skewed by a few extremely large school districts, a log

transformation of total staff was used. The other measure of size is spacial. Gulick stresses the problems that arise with organization members spread out across different buildings. As a measure of spacial size, we use the total number of campuses (buildings) in the school district.

3. *Instability.* Stable organizations allow standard operating procedures as well as the development of informal norms that facilitate work. Two aspect of change are likely to be key; changes in the inputs of the organization and changes in the production personnel. Change in the inputs of the organization is measured as the percentage change in total student enrollment from last year. Although schools are used to some changes in enrollments, large changes require shifting work assignment, hiring (or firing) personnel, and adjusting physical facilities. Change in production personnel, a variable specifically noted by Gulick, is measured as the percentage of teachers who leave the district.⁴ Compared to other public organizations, schools have high levels of turnover averaging approximately ten percent per year. Districts with high turnover in one year often have high turnover in subsequent years; this means they must add more administrative capacity to recruit, train and evaluate new teachers. Over time, such changes will affect the spans of control in the organization. Teacher turnover is related to another dimension of stability. Experienced employees are likely to know their job better and, therefore, need less supervision, allowing larger spans of control. Our measure of experience is the average number of years of teaching experience on the part of the faculty.

Findings

The model for first-line supervision (the ratio of teachers to campus administrators) span of control is found in table 1.⁵ At the first line supervisory level, role diversity matters a great

deal, with more diversity leading to narrower spans of control. For these first-line administrators, the more varied the mix of teachers, aides, support staff and counselors, the fewer individuals they supervise. Task (that is, student) diversity has a similar negative impact on span of control generating smaller spans of control at the supervisor level. Production diversity in contrast has a positive relationship. The different types of classes are associated with broader spans of control. Such a relationship makes sense within an organization if production diversity is handled by the production level of the organization; this means that the mix of students is dealt with via teacher specialization. Because teachers specialized and are likely to gain autonomy as specialists, administrators can supervise more teachers in a looser management style. Because the production level buffered the diverse inputs and technologies, the supervisory level does not need to do so.

[Table 1 About Here]

Organizational size is consistent with our hypotheses although the relationship for locations does not meet traditional levels of statistical significance. Larger organizations have larger spans of control at the first-line supervisory level. As noted above, this relationship is consistent with size permitting specialization in an effort to overcome diversity in inputs and production.

Organizational stability also affects span of control. Teacher turnover results in a narrower span of control, as expected given the closer supervision needed for employees with less expertise. Administrators would be the supervisors for these new teachers. Similarly teacher experience is positively correlated with larger spans of control. Enrollment change does

not meet traditional levels of statistical significance. Structure responds to employee turnover and experiences but not changes in workload.

Table 2 provides the results of our analysis for mid-management level spans of control. Starting first with teacher turnover and enrollment changes, neither relationship is statistically distinguishable from zero. This is consistent with our conclusion above that uncertainty is buffered at lower organizational levels. At mid-management levels, changes in either enrollment or teacher turnover have no impact on span of control. Teacher experience is negatively linked to mid-management spans of control, an unexpected finding that is not predicted by our theory.

[Table 2 About Here]

We have argued that table 1 shows how the organization buffers diversity. If we are correct, then mid-level management should be less affected by diversity. Although the relationships for diversity are statistically significant, they are smaller in absolute terms than for the other level in the organization. Role diversity, the one aspect of diversity most likely to penetrate to mid-management levels, has a negative relationship indicating that more distinct roles in the organization will narrow the span of supervision. The relationships for task diversity and production diversity are positive, but as we noted above, the bulk of the adjustment to these factors occurs at lower levels in the organization.

Overall organization size continues to matter. Just as there are economies of scale at the production level, there should also be economies of scale at management levels. Specialization allows individuals to supervise more people as long as their tasks are relatively similar.

Does Span of Control Matter?

Implicit in this research and endorsed by Woodward is the view that span of control is an important organizational variable because it actually affects how well the organization functions. Woodward (1980) contends that organizations that come closest to the average structure for organizations of a given type will be the most productive. The school district data set permits us to assess this question. Students in Texas are required to take standardized tests of basic skills in several grades. While basic skills are not the sum total of all education, they are an important aspect of how schools are evaluated. If span of control is an important variable for these school districts, therefore, it should be associated with how well the districts= students perform on these standardized tests.

Numerous factors other than span of control likely affect how well students perform on these tests. Controls for these factors need to be introduced so that the results of our test are not spurious. Performance, including performance on these exams, should be a function of the inputs organizations receive, the resources they apply to the process, and the quality of technology applied to the process (Rainey 1997). We have measures for both the inputs the organizations receive and the resources that they apply to the process. Since these organizations all perform the same function (and since we limit the study to those over a certain size), we can assume the technology used is relatively similar.

Inputs to these organizations means students, and the makeup of student populations varies widely across school districts in Texas. Urban school districts tend to have larger numbers of African-American, Latino, and low-income students than suburban school districts. Each of these types of students is likely to have learning disadvantages. Minority students come from

disadvantaged circumstances and generally score lower on standardized tests than Anglo students (Rong and Grant 1992; Jencks and Phillips 1998). The probability of low-income students having difficulties performing well on standardized tests is also high (Coleman 1966). Three variables were used to control for district student makeup: percentage African-American, percentage Latino, and percentage low-income students per district. The variable for percent low-income students was defined as the percentage of students eligible for free or reduced price meals through school lunch programs. All relationships with performance should be negative.

Resources are divided into two categories; money and experience. While the relationship of money to educational performance is controversial (Hanushek 1996; Hedges and Greenwald 1996), financial resources do provide organizations with more opportunities to deal with a turbulent environment and should be linked to production. Our three measures of resources are the average teacher salary, class size, and per student spending on education. The first recognizes that educational systems are personnel intensive organizations; some scholars even argue that teacher salaries indicate how well school systems can compete in the market for scarce skills (Hanushek and Pace 1995). Class size and per student instructional costs are reasonable measures of resources applied to actually educating students because they do not include administrative expenses and extracurricular activities. Teacher experience should be linked to learning on the job and the ability to perform at higher levels. Our measure is the average number of years of teacher experience for the district. All measures except class size should be positively related to organizational performance.

Woodward's finding on span of control is very precise. Effective spans of control are

those that approximate the average for the industry group. Because our first two tables show that similar organizations adjust their spans of control in predictable ways to environmental and internal factors, the best way to estimate the average span of control is with the regression equations found in these tables. Using the equations, we can predict the spans of control expected for each organization for each of these two levels (these are merely the predicted values for the regression). Comparing these predicted (or average values) to actual values, one can get an assessment of how close individual school districts come to these averages. We measure this convergence as the geometric distance of the actual spans of control from the predicted average spans of control on all dimensions simultaneously.⁶ This measure is the distance that a school district is from the average spans of control. Because it measures distance rather than nearness, it should be negatively related to performance based on Woodward's work.

Table 3 adds this span of control distance measure to a production function that predicts overall organization performance. The results are inconsistent with Woodward's argument. The relationship is positive and significant. Schools with average spans of control are less productive. Before rejecting Woodward, however, we need to recall her work relied on less precise measures and methods. A general pattern observed at the bivariate level as in her case often does not hold with appropriate controls.

[Table 3 About Here]

To further probe the Woodward hypothesis, we simply substituted the actual span of control measures for the distance measure in the production function in table 3 (see Table 4). The results confirm Woodward's intuition. Both spans of control have a direct impact on

organizational performance. Greater performance is associated with greater administrative to teacher spans of control and larger mid-management spans of control. Span of control does affect the outputs of the organization, but not exactly in the way that Woodward surmised.

[Table 4 About Here]

Conclusion

Luther Gulick argued that diversity, stability, and space were three key explanatory variables that determined span of control relationships in organizations. In this study, we developed various indicators of these concepts and measured their effects at two different organizational levels in Texas public school districts.

Our general conclusion is that Gulick was correct in labeling these three variables as important determinants of span of control relationships in organizations. We also found that these variables appear in different forms at different organizational levels. While task demand diversity is a key factor that structures spans of control for first level supervisors, role diversity, rather than task demand diversity is of central importance in structuring mid-management spans of control. Instability, measured in terms of teacher turnover, is an important explanatory variable at the first line supervision level, but not at the mid-management level.

What these findings suggest is that diversity, stability, and space must be defined within the context of organizational hierarchies. Hierarchical organizational designs dictate that employees across different levels are responsible for managing different problems. Diversification of function means that actors throughout an organization define their key tasks based on the specific responsibilities they are charged with addressing. Thus, one set of factors that influence

span of control relationships in a lower level of an organization may be totally irrelevant to how spans of control are structured at a higher level of that organization. Put another way, if personnel at each level of an organization are concentrating on their key tasks, the definitions of diversity, stability, and space should be level specific. As noted earlier, teacher turnover is a major issue that affects how first line supervisors structure spans of control; however, teacher turnover plays no influence in determining spans of control at the mid-management level. In short, diversity, stability, and space are relevant issues at all organizational levels. Yet as tasks vary across different organizational levels, these variables will have precise meanings depending on which levels in the organization are analyzed.

We then tested Woodward's (1980) contention that organizations that approach average structures (including spans of control) will be the most productive. Her hypothesis was not supported. Span of control did matter, however, with larger spans of control at the first line supervision and mid-management levels associated with better performance.

This study examined educational organizations, but we are confident that our findings also apply to other public organizations with similar characteristics, that is, highly professionalized organizations with discretion vested in street level bureaucrats. Because we limited the study to one type of organization in order to get comparable performance measures, we also limited the variance on many of the variables. Although the result may not apply to all other public organizations, we feel this study provides credibility to Gulick's hypotheses and a rationale for more studies of this type using different types of public organizations.

The assessment of organizational structures, we feel, should be an essential component of

management analysis. Studies such as this one not only reveal a great deal about how organizations operate, but they can also be used to provide specific guidance to public managers about how to organize employees (see table 5). Table 5 can also be interpreted as our set of hypotheses about how span of control operates in other public organizations. Span of control is only one structural component among many; systematic study of other structural aspects of organizations is likely to provide additional benefits. In the contemporary environment where public organizations are being challenged by the new public management, any factors, including spans of control, that affect organizational productivity should not be ignored.

[Table 5 About Here]

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**Table 1. The Determinants of First Line Supervision
Span of Control**

Dependent Variable = Teacher/Administrator Ratio

| Independent Variables | Slope | Std. Error | t-score |
|-----------------------|---------|------------|---------|
| Diversity | | | |
| Task Demand Diversity | -.1113 | .0309 | 3.60 |
| Production Diversity | .1155 | .0564 | 2.05 |
| Role Diversity | -2.0715 | .1476 | 14.04 |
| Organization Size | | | |
| Staff (Logged) | 1.6657 | .0561 | 29.70 |
| Locations | -.0393 | .0230 | 1.71 |
| Instability | | | |
| Teacher Turnover | -.0273 | .0104 | 2.63 |
| Enrollment Change | .0062 | .0041 | 1.52 |
| Experience | .0718 | .0344 | 2.09 |
| <hr/> | | | |
| R-square | .32 | | |
| Adjusted R-Square | .31 | | |
| Standard Error | 2.65 | | |
| F | 113.38 | | |
| N of cases | 2718 | | |

Coefficients for year dummies to correct for serial correlation not reported.

Diversity coefficients multiplied by 1000 to facilitate comparison.

**Table 2. The Determinants of Midmanagement
Span of Control**

Dependent Variable = Campus Administrator/Central
Administrator Ratio

| Independent Variables | Slope | Std. Error | t-score |
|-----------------------|--------|------------|---------|
| Diversity | | | |
| Task Demand Diversity | .0424 | .0133 | 3.18 |
| Production Diversity | .1014 | .0243 | 4.18 |
| Role Diversity | -.3501 | .0635 | 5.51 |
| Organization Size | | | |
| Staff (Logged) | .5658 | .0242 | 23.41 |
| Locations | .0176 | .0099 | 1.77 |
| Instability | | | |
| Teacher Turnover | .0011 | .0045 | .23 |
| Enrollment Change | -.0004 | .0018 | .19 |
| Experience | -.0676 | .0148 | 4.56 |
| <hr/> | | | |
| R-square | .25 | | |
| Adjusted R-Square | .24 | | |
| Standard Error | 1.14 | | |
| F | 80.06 | | |
| N of cases | 2712 | | |

Coefficients for year dummies to correct for serial correlation not reported.

Diversity coefficients multiplied by 1000 to facilitate comparison.

**Table 3. Are Mean Spans Most Effective?
A Test of the Woodward Finding**

Dependent Variable = Average Student Test Scores

| Independent Variables | Slope | Std. Error | t-score |
|---------------------------------------|--------|------------|---------|
| Distance from Mean Span of Control | .4205 | .1657 | 2.54 |
| Control Variables | | | |
| Teacher's Salaries (K) | .7095 | .1002 | 7.08 |
| Teacher Experience | .3700 | .0922 | 4.01 |
| Instructional Funding | .0005 | .0004 | 1.17 |
| Class Size | -.8583 | .1175 | 7.30 |
| % Black Students | -.2598 | .0138 | 18.78 |
| % Latino Students | -.1154 | .0104 | 11.09 |
| % Poor Students | -.2630 | .0145 | 18.18 |
| <hr/> | | | |
| R-squared | .71 | | |
| Adjusted R-Squared | .71 | | |
| Standard Error | 6.89 | | |
| F | 595.81 | | |
| N of cases | 2709 | | |

Coefficients for year dummies to correct for serial correlation not reported.

Table 4. Spans of Control and Organizational Production

Dependent Variable = Average Student Test Scores

| <u>Independent Variables</u> | <u>Slope</u> | <u>Std. Error</u> | <u>t-score</u> |
|------------------------------|--------------|-------------------|----------------|
| Span of Control Measure | | | |
| Teacher-Administrator | .1087 | .0460 | 2.36 |
| Midlevel Management | .3084 | .1108 | 2.78 |
| Control Variables | | | |
| Teacher's Salaries (K) | .6480 | .1016 | 6.38 |
| Teacher Experience | .3958 | .0924 | 4.29 |
| Instructional Funding | .0006 | .0004 | 1.38 |
| Class Size | -.9340 | .1186 | 7.88 |
| % Black Students | -.2654 | .0139 | 19.06 |
| % Latino Students | -.1173 | .0104 | 11.29 |
| % Poor Students | -.2584 | .0145 | 17.84 |
| <hr/> | | | |
| R-square | .71 | | |
| Adjusted R-Square | .71 | | |
| Standard Error | 6.87 | | |
| F | 549.69 | | |
| N of cases | 2711 | | |

Coefficients for year dummies to correct for serial correlation not reported.

Table 5. Span of Control Relationships - Guidelines for Organizing Employees

Narrow vs. Wide Spans of Control

Wide spans of control are the default in many organizational settings because such designs maximize resource flows to production and minimize resource flows to supervisory tasks. In other words, wide spans of control are desirable from an efficiency standpoint. This table describes conditions under which *narrow* spans of control are preferable to wide spans of control.

First Line Supervision

When production technologies in an organization are diverse, spans of control at the first line supervision level should be narrow.

When role diversity among production level employees is high, spans of control at the first line supervisor level should be narrow.

When there is great instability or high turnover of production level personnel, spans of control at the first line supervisor level should be narrow.

Mid-Management Supervision

When role diversity throughout an organization is high, spans of control at the mid-management level should be narrow.

Notes

¹There are an additional 300+ school districts in Texas smaller than 500 students.

Districts this size often do not distinguish between mid and upper level management (that is, the superintendent is frequently also the principal). Given the small number of professional employees in these organizations, they tend to be organizations with little structure. For these reasons, these smaller districts were not included in the analysis.

²The inclusion of individual year dummy variables is also the traditional way to correct for serial correlation in panels such as this one with few years and many cross sections. The other statistical threat to panel analysis is heteroscedasticity (Stimson 1985). The panel contained a modest amount of heteroscedasticity, but this problem was not severe and did not affect the results of the analysis

³Spans of control can be fractional because districts report personnel figures in full time equivalents. In this case, a full time superintendent might be supervising a part time principal. Individuals who split time among two or more schools are also counted in fractional FTEs.

⁴Turnover measures are not available for administrators or other personnel.

⁵To make sure the relationships that we found were not spurious, we also estimated these models with a measure of wealth (revenues per pupil), a measure of size (total school enrollment) and a measure of resources linked to special needs (funds for compensatory education). Enrollment was highly collinear with staff size and thus created some problems as a result.

These three control variables were modestly related to spans of control although not always in the predicted direction (revenues were negatively related to spans). In general, with these controls, the results were similar to those presented here.

⁶This is merely the Euclidian distance. To calculate this distance, the residuals of each equation are standardized to give each span an equal weight. The distance is then the square root of the sum of the two squared residuals for each district.

Biographies

Kenneth J. Meier is Charles Puryear Professor of Liberal Arts and professor of political science at Texas A&M University. His current research interests include developing methods more suited to public administration, assessing the impact that structural factors have on public organizations, modeling the management dimension of organizations, and introducing humor to the profession. His most recent books are *What Works: A New Approach to the Analysis of Policy and Programs* (Westview, with Jeff Gill) and *The Politics of Fertility Control Policy* (Chatham House, with Deborah R. McFarlane).

John Bohte is assistant professor of political science at Oakland University, Rochester MI. His current research interests include educational finance reform and the relationship between school bureaucracy and student performance. His research has appeared in *Public Administration Review*, *Administration and Society*, the *American Journal of Political Science*, and the *Journal of Politics*.