


RESEARCH ARTICLE

Dimensional research on organization structure: meta-analysis and conceptual redirection

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Abstract

A previous meta-analysis of dimensional structure research published during the latter half of the 20th century revealed significant intercorrelation among structural dimensions inspired by Max Weber's bureaucratic ideal type, providing support for continued research on dimensional structures and for the bureaucratic structural model that served as its theoretical foundation. A new meta-analysis reported in this article, motivated by questions regarding the continued applicability of bureaucratic dimensional models in the later era of new organization forms, indicates that many of the interrelationships among five structural dimensions (formalization, standardization, specialization, vertical differentiation, and decentralization) have weakened since the time of the earlier meta-analysis. The results of this study, conducted using a sample of 346 correlations from a collection of 155 published articles, are interpreted as failing to provide consistent evidence supporting a central tenet of the bureaucratic structural model, therefore, as indicating that dimensional structural research now lacks a viable theoretical foundation.

Keywords: Meta-analysis; bureaucracies; organizational structure; archival or secondary data

An organization's structure consists of patterned regularity that is reproduced as its members interact and communicate about their interactions to coordinate actions and sustain the state of being organized. Research on organization structure originated in the mid-20th century, rooted in two translations of Max Weber's bureaucratic ideal type (Gerth & Mills, 1946; Parsons, 1947). As will be described more completely in the following literature review, it first took the form of qualitative case investigations (e.g., Burns & Stalker, 1961; Gouldner, 1954; Selznick, 1949), then evolved into quantitative research on structural characteristics (e.g., Aiken & Hage, 1968; Hall, 1963a; Pugh, Hickson, Hinings, & Turner, 1968). In turn, these studies formed the foundation, during the 1970s and 80s, of a domain of research that grew to include hundreds of studies of dimensional relationships and effects (Donaldson, 2001). The dimensional models considered in this research consist of multiple continua that form profiles of structural attributes.

As research progressed on dimensional models of organization structure, so too did critical analyses that highlighted possible limitations in the ability of existing dimensional models to explain evolving structures and structural practices. Theorists proposed that the introduction of flexible work systems, self-managing teams, and similar organizational innovations would lead to the demise of then-current structures and the onset of greater autonomy and engagement (Heydebrand, 1989; Kanter, 1989). Researchers identified emerging trends in the use of various workplace involvement practices that appeared to support this position (e.g., Appelbaum & Batt, 1994; Osterman, 1994; Smith, 1997). Critics asserted that bureaucratic structural theory and dimensional models of organization structure were dated, if not dead (Clegg & Hardy, 1996; Morgan, 1997; Pfeffer, 1997).

Against these criticisms, other theorists countered that evidence from the field continued to support the viability of bureaucratic structural theory and the applicability of dimensional models of organization structure (e.g., Donaldson, 1996; Gazell & Pugh, 1990). A meta-analysis by Walton (2005) of research on dimensional models aggregated the results of research published prior to 1998 and provided cumulative evidence in support of bureaucratic theory's continued validity. Nonetheless, theorists continued to suggest that organizational innovations such as shop floor information technology and workplace automation threatened bureaucratic organization and related structural models (e.g., Boyer, Ward, & Leong, 1996; Zammuto, Griffith, Majchrzak, Dougherty, & Faraj, 2007). Arguably, the temporal span of Walton's meta-analytic sample failed to capture the duration required for the full effects of these innovations to be realized. Perhaps the threats to bureaucratic organization thought to be associated with these innovations did diminish the applicability and theoretical relevance of bureaucratic structural models and related dimensions in later years.

Structural dimensions and dimensional models continue to be incorporated in contemporary research, as substantiated by the recent studies collected for the analysis reported later in this article. It is assumed rather than questioned in this ongoing research that empirical relationships similar to those that produced Walton's findings are still evident, and, correspondingly, that bureaucratic structural theory and related dimensional models remain valid as a theoretical explanation for structural relationships and effects. Other than dimensional theorists' interpretation of Weber's ideal type, there is no widely accepted theoretical explanation for the collection of organizational characteristics codified as structural dimensions and for the relationships among these dimensions hypothesized in dimensional structural models. Absent continued empirical support for bureaucratic structural theory, contemporary dimensional models of organization structure lack essential theoretical standing.

The present article questions whether newer research continues to produce evidence of empirical relationships consistent with the findings of Walton's meta-analysis. Presented are a replication and an extension of Walton's study in which adjusted mean effect sizes from dimensional structure research published during the temporal span of Walton's meta-analytic sample are compared with adjusted mean effect sizes from dimensional structure research published subsequently. The issue addressed by this analysis is whether Walton's findings remain valid into the present and, as a consequence, whether dimensional models retain credibility as theoretical descriptions of current-day organization structures. Based on the results of this study, it is concluded that bureaucracy as interpreted in dimensional structural research no longer provides an incontestable theoretical foundation for structural studies. New research, examples of which are described in the article's closing discussion, is required to reestablish viable conceptual grounding.

Structural dimensions and hypothesized relationships

Early in the development of the field of organization theory, a significant collection of studies of organization structure emerged that traced its conceptual roots to Max Weber's bureaucratic ideal type. Research in this stream was stimulated in large part by the publication of Parsons' (1947) edited translation of Weber's *Wirtschaft und Gesellschaft*, wherein Weber identified a profile of features that constituted the bureaucratic ideal type. Mansfield (1973) summarized Weber's bureaucratic model (based on the Parsons translation) as incorporating six principles: fixed and official jurisdictional areas ordered by rules; a strict hierarchical system of authority; administration based on written documents; trained and expert management; affiliation requiring full-time occupational commitment; and management based on generalized rules.

A second translation of Weber's *Wirtschaft und Gesellschaft*, by Gerth and Mills (1946), suggested six similar characteristics: selection and promotion according to expertise as opposed to friendship or favoritism; a hierarchy of authority in which superiors have the authority to direct

subordinates' actions; rules and regulations that are unchanging, to provide the bureaucracy's members with consistent, impartial guidance; a division of labor in which work is divided into tasks that can be performed efficiently and productively; written documentation, to provide consistent guidance and a basis for evaluating bureaucratic procedures; and separate ownership, so that members cannot gain undeserved advantage by becoming owners. According to Mansfield (1973) and evident in both summaries, the critical element that separated Weber's bureaucratic ideal type from contemporaneous approaches to theorizing about organizations was bureaucracy's foundation in procedures specified and administered as impersonal, general rules.

Drawing from Weber's ideal type, initial studies of bureaucracy, conducted during the 1940s and 1950s, consisted of case analyses intended to examine potential advantages and unanticipated liabilities of the bureaucratic form of organization (e.g., Gouldner, 1954; Merton, 1940; Selznick, 1949). Research in these early studies was based on an interpretation in which Weber's analytical construct was recast as a descriptive model, meaning that his ideal type composed of a set of elements constituting theorized bureaucracy was reinterpreted as a factual description of a suite of features observable in everyday organizations. In this way of thinking, real-world organizations could be more or less bureaucratic.

Subsequently, researchers from the late-1950s onward sought to develop generalized models of structure consisting of theoretical dimensions based on the results of early case studies and inspired by Weber's ideal type. Research in this later era took another step away from Weber's theorization by reconceptualizing the normative constants of Weber's ideal type as descriptive variables able to classify organizations and describe their structures. Based on the earliest dimensional research (e.g., Dimock, 1959; Heady, 1959; Udy, 1959), Hall (1963a) proposed a model of six bureaucratic dimensions: a *division of labor* based upon functional specialization; a well-defined *hierarchy of authority*; a system of *rules covering the rights and duties* of position holders; a system of *formal work procedures*; *impersonality* in personnel relations; and selection and promotion based on *technical competence*. In a study of questionnaire data obtained from members in 10 organizations, Hall verified that his six dimensions could be conceptualized and measured as continua and found that the dimensions appeared to show evidence of combinations unique to particular business functions (e.g., marketing, administration) but not to the age or size of the organizations studied. In a second study, Hall (1963b) used the same six dimensions to examine differences among subunits within the 10 organizations and reported that hierarchy of authority, division of labor, and procedural specifications covaried with departmental purpose, and that hierarchy, division of labor, formal procedures, and impersonality had lesser effects among executives than among nonexecutives. Together, the two studies demonstrated that an organization's structure, both internally and as a whole, could be characterized by a multidimensional description and that this description was associated with organizational purpose in predictable ways.

In a second noteworthy stream of structural research, Blau (1965) identified nine characteristics of organization structure based on his interpretation of Weber's ideal type: *size*, the number of members, total assets, or resource capacity of the organization; *complexity*, the number of locations of operation, or the number of basic objectives or responsibilities of the organization; *standardization*, the extent to which formalized plans are followed in performing role or departmental responsibilities, and the specialization of those responsibilities; *expertness*, the proportion of the organization's members that are professionalized; the size of the *administrative component*, the proportion of personnel in administrative or staff positions; *centralization*, or the location of decision-making and consequent shape of the organization's structure; *formalization*, procedures stated as formal rules, indicated by the existence, size, specificity, and uniformity of written procedural documentation; *impersonality*, relations shaped by policy rather than relationship; and *career stability*, occupational longevity indicated by low organizational turnover and high length of service. Blau (1970) then examined the effects of decentralization, i.e., reduced centralized control, in organizations. Findings based on data from archival information and interviews conducted in 53 government employment agencies indicated that organization size, formalization,

and standardization were all positively related to decentralization, suggesting that as the organizations in Blau's sample grew larger they also reduced centralization and substituted formalization and standardization as mechanisms of organizational control.

To originate a third stream of research on organization structure, Hage (1965) developed a model consisting of eight variables, four identified by Hage as organizational means and four as organizational ends. The four organizational means variables, described as structural dimensions in other theorists' models, were: *complexity* or specialization, reflecting the number of occupational specialties represented in the organization and level of training required; *centralization*, or hierarchy of authority and degree of participation in decision-making, including the proportion of jobs in the organizations involved in decision-making; *formalization* or standardization, the proportion of jobs in the organization that are codified and the range of variation allowed within jobs; and *stratification*, differences in status, income, and prestige among jobs and mobility among jobs and status levels. The four ends variables, identified as outcomes in other research, were: *adaptiveness* or flexibility, assessed as the number of new programs or techniques introduced in the organization during a year; *production* or effectiveness, the number and rate of increase in units of output produced per year; *efficiency*, the cost per unit of yearly output; and *job satisfaction* or morale, satisfaction with working conditions and rate of annual turnover. Hage then proposed eight propositions and 21 corollaries that mapped patterns of association among the eight organizational variables, and these 29 proposed relationships became the basis for hypotheses assessed in a series of studies of data collected from 16 social service agencies (e.g., Aiken & Hage, 1966; Hage & Aiken, 1967a, 1967b, 1969).

In a fourth major stream of structure research, the Aston group proposed a six-dimensional model intended to guide the group's research on organization structure (Hinings, Pugh, Hickson, & Turner, 1967; Pugh, Hickson, Hinings, Macdonald, Turner, & Lupton, 1963). Dimensions included in Aston's model were: *specialization*, the division of labor within an organization, indicated by the number of specialized functions within the organization and by the degree of role specialization or narrowing down of the tasks assigned to each organizational role; *standardization*, including specification of the rules guiding decision-making, and the advance specification of roles, offices and titles, qualifications, performance measures, and rewards for performance; *formalization*, or the degree to which communication and procedures in the organization, including rules, roles, operational procedures, and decisions, are written down and preserved; *centralization*, or the location of decision-making processes and control systems, the site of the information used to make those decisions, and the location, frequency, and thoroughness of decision review procedures; *configuration*, the shape of the organization's authority structure including its verticality or number of levels of authority, segmentation into differentiated subunits, and the number of different positions in the various segments; and *flexibility*, referring to the amount, speed, and variability of change in the organization's structure.

The Aston researchers followed up with a collection of studies aimed at assessing and extending their conceptual model. Using data from a sample of 46 British organizations representing a variety of industries, Pugh et al. (1968) examined a model including five of their six original dimensions (dropping flexibility), plus the additional dimension of *traditionalism*, defined as the presence of implicitly legitimized verbally transmitted procedures. Data were collected in key informant interviews in which each structural dimension was measured as a scale that was further divided into subscales corresponding with specific interview questions. Results indicated moderate to high positive correlations among formalization, standardization, specialization, and configuration. Correlations between these dimensions and centralization were smaller and negative, suggesting that the formalization of procedures and centralization of decision-making were alternative ways of exerting control over organizational objectives and processes in the organizations included in the Aston sample.

From these four streams of founding research, analyses of dimensional models of organization structure multiplied to include hundreds of published studies. Dimensional models inspired by

Weber's bureaucratic ideal type became widely accepted as theoretically valid representations of organization structures and structural characteristics (e.g., Donaldson, 1996, 2001; Gazell & Pugh, 1990; Mintzberg, 1979). Beginning in the 1990s, however, theorists suggested that emerging forms of organization and organizational structures differed in significant ways from organizations and structures of prior years, leading to the question of whether formerly valid dimensional models would remain descriptive of organization structures of the 1990s and beyond.

Cited in support of this viewpoint were several surveys and analyses of new forms of organization. For example, Smith (1997), in describing US work organizations of the 1990s, noted a transition away from individualized work toward the use of teams, first as problem-solving groups (quality circles), and then as primary entities charged with task performance (self-managing teams). As work moved from individuals to teams, emphasis shifted from traditional structural stability and persistence to adaptability and empowerment. Flexible work systems were implemented to democratize decision-making and encourage experimentation and learning. Osterman (1994) estimated that approximately 35% of US firms with 50 or more employees made substantial use of flexibility-enhancing organizational practices including quality circles, employee involvement programs, job enrichment, self-managing teams, and continuous improvement systems. Appelbaum and Batt (1994) reported that 85% of Fortune 1000 companies were using at least one employee-involvement practice. Similar innovations were implemented throughout Europe following successful sociotechnical experimentation (e.g., Emery & Thorsrud, 1976; Lindestad & Rosander, 1977) and as part of the New Forms of Work Organization platform enacted by the European Union (European Commission, 1997; Longoni, Golini, & Cagliano, 2014).

This new perspective shaped the context within which Walton (2005) conducted a meta-analysis of published research on organization structure. The stated purpose of Walton's analysis was to assess the continued relevance of the bureaucratic structural model of organizational control in light of then-recent criticisms. It focused on structural dimensions inspired by Weber's bureaucratic ideal type and often studied in the structure literature: *formalization*, the production and retention of written rules, regulations, and procedures (Pugh et al., 1968); *standardization*, or the control and coordination of work through the application of uniform rules and procedures (Blau & Scott, 1962); *decentralization*, defined as the distribution of decision-making downward and outward in an organization's hierarchy (Pugh et al., 1968); and *differentiation*, defined as the number of formally distinguished structural subunits (Blau, 1970). Walton further divided differentiation into *task specialization*, the degree to which work activities are subdivided and job scope is narrowed, leading to an increase in the number of job titles in an organization (Blau & Schoenherr, 1971); *vertical differentiation*, or the number of hierarchical levels in an organization (Pugh et al., 1968); and *horizontal differentiation*, the number of subunits or functional specialties within an organization. This subdivision resulted in a model of six structural dimensions.

Walton hypothesized that the six dimensions would be positively related to one another based on theoretical arguments inspired by Weber's bureaucracy and developed primarily by Peter Blau and associates. According to Walton's argument, limiting job scope through task specialization occurs in order to increase task performance and facilitate control by reducing the range of activities that must be learned, accomplished, and managed (Blau, 1970). In turn, growth in task specialization increases the number of jobs that must be performed to complete a given amount of work, leading to an increase in the number of managers required to retain effective spans of control, and this increase in managers leads to vertical growth in the hierarchy needed to supervise and coordinate their work (Blau, 1968). In this manner, horizontal subunits, each with its own manager, and hierarchical levels, each coordinating and controlling managerial activities in subordinate levels, increase in stride with specialization: *the three forms of differentiation – task specialization, horizontal differentiation, and vertical differentiation – are interlinked and positively related.*

Also according to Walton, Weber's bureaucratic ideal type specified that the authority required to perform work activities is distributed to those positions responsible for the activities' performance. As differentiation progresses, authority is distributed among an increasing number of positions, both vertically and horizontally, and decision-making is increasingly decentralized (Blau, 1968). Accompanying this decentralization, Weber's conceptualization also limits the authority distributed to positions by standardizing the rules, regulations, and procedures that stipulate the duties associated with those positions (Blau & Scott, 1962). Standardization emerges as limits on authority are imposed during the process of decentralization. *Bureaucratic decentralization calls for concurrent standardization, and both increase as tasks become more specialized and the hierarchy more differentiated.*

Finally, per Walton, standardization is accomplished through the work of staff specialists who develop and record the rules, regulations, and procedures required to coordinate and control the decentralized decision-making undertaken by the holders of specialized and differentiated positions (Mintzberg, 1979; Pugh et al., 1968). These staff specialists formalize organizational processes, committing them to writing and retaining written documentation for recurrent bureaucratic use (Pugh et al., 1963). Formalization develops in organizations as standardized rules and procedures, emerging during the process of differentiating activities and decentralizing decision-making authority, are documented and preserved. Formalized standards become substitutes for centralized supervision and direct control of organizational activities (Blau, 1968). *Formalization produces the standardization required to manage the effects of decentralization due to increasing specialization and differentiation, both horizontal and vertical.* In this manner, Walton theorized positive relationships among the six structural dimensions examined in his meta-analysis.

Walton tested his hypothesis of positive dimensional intercorrelation in a meta-analysis of correlations collected from articles published between 1963 and 1997. Using methods devised by Hunter and Schmidt (1990), he found that the 15 effect size estimates representing every bivariate relationship among the six dimensions in his model were all positive, ranging in size from .37 to .75 with an average size of .54, with the exception of a null relationship between decentralization and formalization. Walton interpreted these results as indicating that dimensional models of organization structure inspired by Weber's bureaucratic ideal type retained relevance within the timeframe captured in his analysis and, by implication, despite the introduction of organizational innovations such as employee involvement, flexible work systems, and self-managing teams.

However, it is possible that the temporal span of Walton's meta-analysis failed to allow the time necessary for the full effects of these innovations to be realized. Walton estimated that 5 years passed between the collection of field data and publication of the resulting article on organization structure. If so, data for the final study included in his sample, published in 1997, were collected in 1992, prior to maturation of trends in the effects of the various organizational innovations (e.g., Castells, 2010; Knoke, 2018; Paskvan & Kubicek, 2017). Conceivably, the threats to bureaucratic organization associated with these innovations diminished the viability of bureaucratic dimensional models of organization structure in the years following Walton's study.

The following study addressed this possibility in a new meta-analysis of published research on dimensional models of organization structure that extended beyond Walton's sampling frame to include articles published between 1955, the earliest date of relevant dimensional research, and 2020, the final date of data collection for the new meta-analysis. In formulating the hypotheses for this meta-analysis, I chose to exclude horizontal differentiation for reasons indicated in the following method section. Consequently, my hypotheses and analyses examined five rather than six dimensions: formalization, standardization, specialization, decentralization, and vertical differentiation:

Hypothesis 1: The structural dimensions of formalization, standardization, specialization, decentralization, and vertical differentiation are positively intercorrelated in research published between 1955 and 1997.

Hypothesis 2: The structural dimensions of formalization, standardization, specialization, decentralization, and vertical differentiation are positively intercorrelated in research published between 1998 and 2020.

Hypothesis 3: For each pair of dimensions, comparison of intercorrelation between the two time periods will show a reduction in size of association.

Hypothesis 1 replicates Walton's primary hypothesis in order to verify that the present meta-analysis produced findings comparable to Walton's results. Hypothesis 2 is the same hypothesis extended to research published later than the studies included in Walton's sample, to examine whether Walton's findings generalize beyond the temporal scope of his study. Hypothesis 3 contrasts effect sizes between the two samples to reveal statistically significant differences over time and specifies the reduction in effect predicted by various organization theorists (e.g., Heydebrand, 1989; Kanter, 1989; Smith, 1997).

Method

The meta-analysis reported in this article aggregated correlation statistics and corrected for sampling and measurement error using random-effects procedures developed by Schmidt and Hunter (2015). To assemble the meta-analytic sample, three research associates and I began by searching the Web of Science and Google Scholar using the terms organization structure, organizational structure, bureaucracy, bureaucratic structure, formalization, standardization, centralization, decentralization, specialization, horizontal differentiation, and vertical differentiation. We chose to restrict sampling to published articles and book chapters, in contrast to the practice of including unpublished research. Our approach was consistent with the method used by Walton (2005) to collect his meta-analytic sample and also recognized the practical consideration that many researchers who had conducted early structure studies were no longer available to respond to requests for unpublished research. Including recent but not older unpublished research would have biased the sample selection process.

Our search extended from January 1955, to capture the earliest research that grounded Hall's (1963a) founding model, to July 2020, the time of the final literature scan. My colleagues and I collected all publications identified in the search that conformed to the preceding sampling criteria, that contained correlations or transformable statistics pertaining to relationships between two or more of the five structural dimensions listed above, and that reported quantitative results. In addition, we collected review books, articles, and meta-analyses to serve as supplementary sources of search information (e.g., Donaldson, 2001; Gooding & Wagner, 1985; Miller, 1987; Mintzberg, 1979; Scott, 1975; Walton, 2005). We then collected additional studies listed in the reference sections of the publications in hand, scanned their reference sections, and collected additional publications identified during the scan, and so forth, until no additional references were found.

An initial sample of 253 studies was obtained. Excluded prior to further analysis were studies that examined interpersonal ($n = 22$), group or team ($n = 5$), organizational subunit ($n = 60$), or inter-organizational ($n = 10$) structures to preserve a consistent level of analysis and theoretical explanation. This contrasts with Walton's (2005) approach, since 11 of the 64 studies included in his analysis were conducted at the department or subunit level. We also omitted one study (Ogidi, 2015) that reported exceptionally large correlations, in some cases more than two times larger than the next largest correlations for the same bivariate relationships, due to suspect

Table 1. Sample description: studies published per year, 1963–2020

Publication year	Number of studies	Publication year	Number of studies	Publication year	Number of studies
1963	2	1982	2	2002	1
1964	0	1983	2	2003	2
1965	0	1984	3	2004	2
1966	2	1985	3	2005	2
1967	2	1986	3	2006	2
1968	5	1987	4	2007	3
1969	3	1988	2	2008	0
1970	4	1989	4	2009	0
1971	4	1990	3	2010	5
1972	4	1991	2	2011	3
1973	10	1992	3	2012	1
1974	4	1993	0	2013	3
1975	4	1994	4	2014	2
1976	2	1995	2	2015	1
1977	4	1996	3	2016	0
1978	5	1997	4	2017	2
1979	3	1998	3	2018	1
1980	4	1999	0	2019	2
1981	8	2000	1	2020	2
		2001	2		

data quality. A final collection of 155 publications yielded correlations or transformable statistics (e.g., t , χ^2 , d ; Wolf, 1986). As indicated in Table 1, publication activity captured by this collection rose to peaks of 10 and eight publications in 1973 and 1981, respectively, and declined gradually thereafter. Reference information for these publications is reported in Appendix 1.

The earliest publication was Hall's (1963a) study – earlier research identified in our search failed to report data on relevant relationships. Samples spanning multiple publications were consolidated to avoid duplication, and multiple samples from the same publication were coded separately. To ensure independence among observations, a necessary precondition for meta-analytic procedures, I averaged correlations from the same sample that captured multiple measures of the same variable to create a single correlation, resulting in a final sample of 346 correlations that pertained to bivariate relationships between the five structural dimensions.

Coding the sample of source correlations relied on matching the terminology, definitions, and operationalizations provided by publication authors with the definitions of structural dimensions indicated in this article. For example, correlations from the four original streams of research were coded as indicated in Table 2. The three associates and I coded studies published prior to 1986 in an initial process of developing a coding sheet to be used to code all studies. We had 100% agreement on all coding except for coding on horizontal differentiation and specialization. Examination indicated that empirical definitions for the two dimensions shared substantial overlap since both tapped similar variation in the horizontal division of labor. In the end, we reached a complete agreement on a final coding sheet by including specialization in our study and excluding horizontal differentiation.

Table 2. Coding categories

Source	Structural dimension				
	Formalization	Standardization	Specialization	Centralization	Vertical Differentiation
Weber (Parsons, 1947)	Written rules and documentation	–	–	–	Hierarchy of authority
Weber (Gerth & Mills, 1946)	Unchanging rules and regulations	–	Division of labor	–	Hierarchy of authority
Hall	Rules conveying responsibilities	Formal work procedures	Division of labor	–	Hierarchy of authority
Blau	Formalization of rules, documentation	Standardization	–	Centralization	–
Hage and Aiken	Formalization	–	Complexity, specialization	Centralization	Stratification
Aston	Formalization	Standardization	Specialization	Centralization	Configuration

Following inter-coder agreement on the coding sheet, I conducted all additional coding and analysis myself. To begin coding, I recoded all pre-1986 coding assignments to verify the accuracy of my use of the coding sheet. After confirmation that I was able to use the sheet without error, I coded the remaining studies (1986 and later) without assistance. Source correlations incorporating scales that differed in direction from other correlations measuring the same variable were reverse coded to ensure consistent directionality. For example, correlations including measures of centralization were reverse coded to create decentralization statistics.

I began the meta-analysis by subgrouping the coded source correlations by era of publication (1955–1997, 1998–2020). The breakpoint of 1997–1998 reflected the temporal endpoint of research published in Walton's (2005) meta-analytic sample and allowed comparisons between his sample and data published beyond the timeframe of Walton's investigation. I then performed a grand means analysis for the total sample of 346 source correlations after subgrouping into 1955–1997 and 1998–2020 era of publication subgroups. Then, to conduct tests of Hypotheses 1–3, I created two era of publication subgroups (1955–1997, 1998–2020) for each bivariate association among the five structural dimensions.

For each analysis, I calculated three sets of mean correlations and variance statistics to allow observation of the effects of error correction – a first set consisting of unadjusted means and variances, a second set of means weighted by sample size to adjust for sampling error, plus associated variances, and a third set of means adjusted for reliabilities in both covariates to correct for measurement error and then weighted by sample size to adjust for sampling error, plus related variances. In instances where source studies did not report reliability estimates I averaged reliability estimates from studies that used identical measures. If those were not available I used averaged estimates from similar measures. For objective measures (e.g., number of vertical layers, employee count, annual revenue) I used reliability estimates of .90 rather than the perfect (1.0) reliability often assumed in order to account for the effects of informant errors (e.g., provision of personal estimates rather than true counts, flawed counts due to recall or retrospect biases, perceptual lapses during data disclosure) and data management issues (e.g., coding and transcription errors, lost or missing data).

Schmidt and Hunter (2015) also described a correction for range departure (whether restriction or attenuation), a source of error in which the variance among sample correlations diverges from the variance exhibited within the relevant reference population. Walton (2005) corrected for

range restriction in his analysis but I chose to forego similar correction due to the absence of appropriate updated population information (e.g., indications of the full range of variation among organizations, surviving or not, pursuing varied purposes – businesses, government agencies, educational institutions, etc. – and located in countries throughout the world). Many current meta-analysts have used the same analytical strategy and have not included range departure corrections in their studies (e.g., Chamberlin, Newton, & LePine, 2017; Hoch, Bommer, Dulebohn, & Wu, 2018; Kurtessis, Eisenberger, Ford, Buffardi, Stewart, & Adis, 2017).

Mean correlations adjusted for sampling and measurement error served as the focal statistics for assessment of the presence and degree of difference between subgroups. For each subgroup comparison, I also calculated 80% credibility intervals to assess within-subgroup heterogeneity indicative of possible moderator effects (Whitener, 1990) and 95% confidence intervals to evaluate whether adjusted mean correlations differed from zero (Schmidt & Hunter, 2015). Finally, I assessed the statistical significance of differences between pairs of 1955–1997 and 1998–2020 subgroup adjusted means with two-sample *t* approximations (Fisher, 1935; Scheffé, 1970), a procedure described in Aguinis, Sturman, and Pierce (2008) and employed in other recent meta-analyses (e.g., Breuer, Huffmeier, & Hertel, 2016; Jones, Sabat, King, Ahmad, McCausland, & Chen, 2017). I used the criterion statistic recommended by Cochran and Cox (1957) to appraise *t'* test statistical significance.

Results

Table 3 presents the meta-analysis' primary results. For each line in the table, *K* is the number of samples included in the subgroup indicated in the left-hand column, *N* is the total sample size of the *K* samples, \bar{r} is the unadjusted mean correlation for the subgroup, $\sigma_{\bar{r}}^2$ is the variance among the source correlations included in the unadjusted mean, \bar{r}' is the sample-size weighted mean correlation, $\sigma_{\bar{r}'}^2$ is the associated variance statistic, \bar{r}'' is the reliability and sample-size adjusted mean correlation and $\sigma_{\bar{r}''}^2$ is the related variance statistic, L and U are the lower and upper limits of the associated 80% credibility interval and 95% confidence interval, and *t'* is the approximate *t* test of the difference between the 1955–1997 and 1998–2020 adjusted mean correlations included in the bivariate relationship-time period block.

Reported first in the table is the grand means analysis that summarizes general tendencies in the meta-analytic sample. As indicated in the summary, 234 of the 346 correlations were from studies published between 1955 and 1997 and 112 were from studies published between 1998 and 2020. The adjusted mean correlation calculated for the 1955–1997 subsample was .24 and for the 1998–2020 was .04. A *t'*-test of the difference between the subgroup means indicated that the difference was statistically significant ($t' = 6.59, p \leq .01$).

Hypothesis 1 proposed that statistics from the time period sampled in Walton's meta-analysis would show evidence of positive relationships among the five structural dimensions, replicating Walton's results. Inspection of the 1955–1997 line in each bivariate block indicates that adjusted mean correlations were generally positive in direction and were often medium in size (Cohen, 1988). With the exceptions of the adjusted mean correlations between formalization and decentralization ($\bar{r}'' = -.03$, did not differ from .0) and standardization and decentralization ($\bar{r}'' = -.01$, did not differ from .0), the results provided support for Hypothesis 1.

Hypothesis 2 posited that statistics from the time period following Walton's analysis would also show evidence of positive relationships among the five structural dimensions, extending Walton's findings into the present. Examination of the 1998–2020 line in each bivariate block indicated that two of the 10 possible adjusted mean correlations could not be calculated due to missing data (formalization with standardization, standardization with vertical differentiation). Four of the eight remaining adjusted means were nonzero and positive (formalization with specialization, $\bar{r}'' = .26$; formalization with vertical differentiation, $\bar{r}'' = .15$; standardization with specialization, $\bar{r}'' = .43$; specialization with vertical differentiation, $\bar{r}'' = .16$) supporting Hypothesis 2.

Table 3. Dimensional intercorrelations: primary analysis

Bivariate relationship									80%		95%		
Time period	K	N	\bar{r}	σ_r^2	\bar{r}'	$\sigma_r'^2$	\bar{r}''	$\sigma_r''^2$	Credibility		Confidence		t'
									L	U	L	U	
Grand means													
1955–1997	234	16,508	.22	.11	.19	.08	.24	.09	.13	.35	.23	.25	
1998–2020	112	29,186	.04	.07	.03	.06	.04	.06	−.04	.12	.03	.05	6.59**
Formalization with standardization													
1955–1997	9	350	.56	.03	.52	.02	.72	.06	.64	.80	.68	.76	
1998–2020	0	–	–	–	–	–	–	–	–	–	–	–	–
Specialization													
1955–1997	37	2,359	.35	.10	.31	.09	.40	.10	.27	.53	.37	.43	
1998–2020	23	5,311	.21	.06	.20	.05	.26	.06	.19	.33	.24	.28	1.92*
Decentralization													
1955–1997	46	4385	.01	.12	.03	.09	.03	.09	−.09	.15	.00	.06	
1998–2020	35	10,185	−.09	.06	−.03	.05	−.03	.05	−.10	.04	−.05	−.01	1.01
Vertical differentiation													
1955–1997	20	1,366	.26	.05	.24	.03	.31	.04	.26	.36	.29	.33	
1998–2020	5	1,377	.13	.00	.12	.00	.15	.00	.15	.15	.15	.15	3.58**
Standardization with specialization													
1955–1997	15	632	.34	.11	.26	.08	.34	.09	.22	.46	.29	.39	
1998–2020	4	328	.32	.03	.35	.02	.43	.03	.40	.46	.40	.46	.77
Decentralization													
1955–1997	15	604	−.08	.07	−.02	.05	−.01	.05	−.08	.06	−.04	.02	
1998–2020	5	1,551	.01	.06	−.25	.03	−.31	.04	−.36	−.26	−.34	−.28	2.81*

(Continued)

Table 3. (Continued.)

Bivariate relationship									80%		95%		<i>t'</i>
									Credibility		Confidence		
Time period	<i>K</i>	<i>N</i>	\bar{r}	$\sigma_{\bar{r}}^2$	\bar{r}'	$\sigma_{\bar{r}'}^2$	\bar{r}''	$\sigma_{\bar{r}''}^2$	<i>L</i>	<i>U</i>	<i>L</i>	<i>U</i>	
Vertical differentiation													
1955–1997	8	672	.39	.05	.26	.06	.09	.43	.06	.12	.07	.11	
1998–2020	1	1,223	.30	–	–	–	–	–	–	–	–	–	–
Specialization with decentralization													
1955–1997	41	3,155	.15	.08	.18	.07	.23	.07	.14	.32	.21	.25	
1998–2020	30	6,567	–.01	.05	–.03	.04	–.03	.04	–.08	.02	–.04	–.02	4.72**
Vertical differentiation													
1955–1997	19	1,189	.47	.05	.40	.05	.50	.06	.42	.58	.47	.53	
1998–2020	5	1,377	.16	.01	.13	.01	.16	.01	.15	.17	.15	.17	4.73**
Decentralization with vertical differentiation													
1955–1997	24	1,796	.18	.04	.18	.03	.24	.03	.20	.28	.23	.25	
1998–2020	5	1,377	–.13	.13	–.14	.11	–.20	.11	–.34	–.06	–.30	–.10	2.89**

***p* ≤ .01; **p* ≤ .05.

Table 4. Summary of meta-analytic comparisons, 1955–1997 with 1998–2020

Correlate 1	Correlate 2	Results
Formalization	Standardization	Comparison data not available
Formalization	Specialization	Statistically significant reduction of effect ^a
Formalization	Decentralization	No statistically significant difference
Formalization	Vertical differentiation	Statistically significant reduction of effect ^a
Standardization	Specialization	No statistically significant difference
Standardization	Decentralization	Statistically significant increase in effect
Standardization	Vertical differentiation	Comparison data not available
Specialization	Decentralization	Statistically significant reduction of effect ^a
Specialization	Vertical differentiation	Statistically significant reduction of effect ^a
Decentralization	Vertical differentiation	Statistically significant reduction of effect ^a

^aResult supports Hypothesis 3.

However, the final four adjusted means were negative, in contrast to hypothesized expectations (formalization with decentralization, $\bar{r}'' = -.03$; standardization with decentralization, $\bar{r}'' = -.31$; specialization with decentralization, $\bar{r}'' = -.03$; decentralization with vertical differentiation, $\bar{r}'' = -.20$). Thus, findings related to Hypothesis 2 provided mixed support, with relationships involving decentralization serving as the source of all contrary results.

Hypothesis 3 predicted that comparisons between the adjusted mean correlations calculated for the two time periods within each bivariate block would show a reduction in size of association. Approximate t' tests shown in Table 1's final column indicate the statistical significance of these comparisons. As reported in the column, missing data precluded the calculation of two t' statistics. For the remaining eight comparisons, five showed evidence of statistical significance and the 1998–2020 adjusted mean was the smaller of the two adjusted mean correlations (formalization with specialization, $t' = 1.92$, $p .05$; formalization with vertical differentiation, $t' = 3.58$, $p .01$; specialization with decentralization, $t' = 4.72$, $p .01$; specialization with vertical differentiation, $t' = 4.73$, $p .01$); and decentralization with vertical differentiation, $t'' = 2.89$, $p .01$), consistent with Hypothesis 3. However, two comparisons failed to attain statistical significance (formalization with decentralization, $t' = 1.01$, n.s.; standardization with specialization, $t'' = .77$, n.s.) and the final comparison indicated that the 1998–2020 adjusted mean correlation for standardization with decentralization was larger than its 1955–1997 counterpart ($t' = 2.81$, $p .05$). As summarized in Table 4, for one dimension, standardization, missing data precluded comprehensive investigation. Among the remaining four dimensions, five of the six comparisons supported Hypothesis 3, indicating that relationships among formalization, specialization, decentralization, and vertical differentiation weakened appreciably between the two time periods contrasted in the study.

To test the robustness of these findings, I performed a series of moderator analyses to assess whether any might reveal specific conditions under which Hypotheses 2 and 3 would receive stronger support. As reported in Appendix 2, three of these analyses involved contrasts of manufacturing with other organization types (e.g., nonprofit service, governmental, educational, agricultural), institutional with questionnaire data collection methods, and data from the US, Canada, and Great Britain with data from all other locations. All three analyses failed to reveal findings that differed substantially from the results of the primary meta-analysis. In an additional two sensitivity analyses, also reported in Appendix 2, I reset the breakpoint between the two primary meta-analytic subgroupings from 1997–98 to 1989–90 and 2007–08. Again, results were consistent with the findings of the primary analysis

Discussion

The meta-analysis reported in this article differed from Walton's meta-analysis in three notable respects. First, Walton's meta-analysis included six dimensions while the current meta-analysis examined five. The reason for this difference has already been indicated, and it seems unlikely that it affected the meta-analysis' general outcome in any significant way. Second, Walton's meta-analytic sample and the sample of pre-1998 publications analyzed in the present meta-analysis were not identical since, as previously indicated, Walton's sample included groups and teams, organizational departments, and inter-organizational networks while the present meta-analysis focused exclusively on organizations and did not include data from other levels of analysis. Third, Walton corrected the meta-analytic mean correlations in his study for range restriction whereas the analyses in the present meta-analysis did not. This difference is unlikely to have affected the results of my meta-analysis to a significant extent given that the range correction employed in Walton's study relied on data from reference populations that were themselves limited in range.

With these differences in mind, the present meta-analysis generally replicated the findings of Walton's (2005) meta-analysis regarding dimensional intercorrelation in data from studies published between 1955 and 1997. However, it showed an overall pattern of reduced intercorrelation in data from studies published between 1998 and 2020 and a decline in effect sizes between the two date-of-publication subgroups. To the degree that dimensional intercorrelation is considered a primary tenet of the Weber-inspired bureaucratic structural model that has grounded dimensional models of organization structure, the theoretical foundation of such models has weakened substantially since Walton's (2005) meta-analysis of structure research. Bureaucratic structural theory does not appear to be able to offer the conceptual underpinning for contemporary research that it was formerly capable of providing.

Research on structural dimensions requires a new theoretical foundation to motivate and support future studies. The search for this foundation requires, in turn, additional research. Where might this research begin? One answer to this question is implied in research reported by Puranam, Alexy, and Reitzig (2014), who sought to determine whether organization theory has lost its ability to explain new forms of organization or if instead it is still useful in understanding organizations and organizational processes. In case studies of Linux, Wikipedia, and Oticon, Puranam and colleagues discovered that existing theories provide meaningful insights into each organization's processes of task division and allocation, reward distribution, and information management, leading them to suggest that new forms of organization can be described as 'novel bundles of old solutions.' Their conclusion – that existing theory elucidates much of what initially appears novel because current-day solutions to problems of differentiation and integration tend to build on established practices rather than starting from scratch – suggests that discrete dimensions from existing structural models might characterize distinctive features of 21st century organization structures even if the bureaucratic structural model from which they originated is no longer explanatory. It follows that future research might focus on identifying new theoretical explanations for the effects of individual structural dimensions on one another and on other organizational features and processes.

A second path forward is suggested by theory and research that has identified a trend away from formalization and standardization toward other means of structural elaboration and coordination. For example, Zammuto et al. (2007) and others (e.g., Galbraith, 2014; Porter & Heppelmann, 2015) have described innovations in information technology that have transformed workplace practices by enabling widespread, synchronous information sharing to take place among interdependent parties, whether individuals and teams. Such information sharing allows individuals to communicate directly with one another without the intervention of structural intermediaries. It also enables teams to form communication linkages among their members and between themselves and other teams, creating horizontal connections that render hierarchical

information management unnecessary. In this way, vertical differentiation, which would otherwise bridge horizontally adjacent teams, has become less essential as an information aggregation and distribution mechanism.

Advances in information technology also enable mass collaboration among otherwise unmanageable numbers of individuals and teams. This collaboration permits individuals and teams to visualize the entire work process, as opposed to the narrow segments otherwise accessible (Zammuto et al., 2007). In turn, this visualization enables individuals and teams to enact performance innovations in real-time and without bureaucratic formalization since the individuals and teams engaged in performance have direct access to the information required to identify deficiencies and implement corrective modifications. The role of formalization as a means of creating collective rules and procedures is substantially reduced by the shared visualization enabled by information technology.

Mutual adjustment in a technology-mediated form is the process of horizontal information sharing described by Zammuto et al. (2007) and others (e.g., Cascio & Montealegre, 2016; Claggett & Karahanna, 2018). It is a central element of employee involvement, flexible work systems, team self-management, and other new organizational practices identified as challenges to standardization, formalization, and bureaucratic organization (e.g., Palmer & Dunford, 2002; Smith, 1997). Whereas standardization is a process of coordination achieved by following plans (March & Simon, 1958; Mintzberg, 1979), mutual adjustment consists of coordination achieved through processes of communication among interdependent parties that create activity synchronization and sustain common understanding (Lindblom, 1965; Mintzberg, 1979; Thompson, 1967). Standardization as a mechanism of structural linkage and coordination is supplemented or superseded by mutual adjustment among interdependent individuals and teams.

The rise of technology-assisted information sharing as a method of coordinating activities in new organization forms suggests the development of a theoretical model of organization structure built around the concept of mutual adjustment, both face-to-face and technologically mediated, as a primary means of enacting and coordinating structural relationships. Such development might follow the lead of founding structural studies and develop quantitative dimensions through deductive reasoning and large-sample field research. Dimensions assessing degrees of information technology saturation, visualization sharing, horizontal information distribution, and coordination by mutual adjustment all relate to structural coordination in the manner described above and are offered as examples to stimulate thinking beyond existing bureaucratic dimensions and models.

As a third alternative, it appears to be equally important that qualitative research be conducted to examine the developmental origins and processes of contemporary structures and structural dimensions. To illustrate what this research might look like, studies of the development of routines in organizations have focused on the emergence of recurrent procedures using a conceptual framework that balances structure with agency (Feldman & Pentland, 2003; Pentland, Feldman, Becker, & Liu, 2012). Qualitative analyses have examined improvisational processes that replace formalization in creating routines that function as standard procedures (e.g., Feldman, 2000; Pentland & Rueter, 1994), and have described the emergence of specialization as interdependent parties routinize their work. Qualitative research's emphasis on process differs from the historical focus of structure studies on dimensional characterizations but has potential as a method of developing theoretical grounding for future dimensional research.

Conclusion

Dimensional models of organization structure inspired by Weber's bureaucratic ideal type were once a mainstay of organizational research, but the continued applicability of dimensional models is now questionable due to the emergence of new forms of organization unimagined during the earlier era of structure research. As these new forms have developed, structural dimensions that

were formerly linked together both theoretically and empirically are now minimally related in many instances. Absent the theoretical grounding provided by Weber-inspired structural theory, structural dimensions no longer form a model but instead constitute a list without conceptual underpinning.

Organizations do have structures – enduring patterns of interdependence – and describing these structures using multidimensional characterizations remains essential. For managers, the importance of research aimed at the development of new structural dimensions and associated theoretical models might not seem readily apparent, but it is demonstrably so. Current-day managers lack the structural models required to provide meaningful advice in instances where they face the prospect of dealing with structural shortcomings. Application of existing models to diagnose and solve structural problems may prove helpful in those limited instances wherein discrete dimensions yield corrective advice. However, the days of meaningful multi-dimensional diagnoses are largely in the past. Practicing managers require dimensional models of organization structure that reflect the organization structures they manage, and this match requires that new streams of structure research be initiated and pursued.

In conclusion, dimensional models of structure published in organizational research were in many ways descriptive of mid-20th century organizations. It is now apparent, however, that dimensional models inspired by Weber's bureaucratic theory do not provide solid grounding for research on organization structure, necessitating a search for new conceptual foundations. This search offers the prospect of a renewed stream of investigations that will yield novel insights into the patterned regularity and ongoing coordination that are characterized in dimensional models of organization structure. The end goal of this article is to encourage and motivate this new structure research.

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/jmo.2021.63>.

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