THE CONTINGENT VALUE OF ORGANIZATIONAL INTEGRATION

VIRPI TURKULAINEN • MIKKO KETOKIVI

Abstract: We elaborate the link between organizational design and effectiveness by examining organizational integration and performance in the context of modern manufacturing. Through careful contextualization and empirical analysis of 266 manufacturing organizations in three industries and nine countries, we uncover a joint effect of integration and complexity on organizational effectiveness. The results extend structural contingency theory, in particular the mechanisms that link organizational integration to organizational effectiveness. We conclude by discussing the continuing relevance of structural contingency theory.

Keywords: Organizational integration; contingency theory; organizational effectiveness; organizational complexity; task complexity

Structural contingency theory builds on the notion that organizations cope with the demands of their environments in their quest for organizational effectiveness (Donaldson, 2001; Lawrence & Lorsch, 1967). Despite decades of research on organization design starting with the classics (e.g., Lawrence & Lorsch, 1967; Thompson, 1967), the general link between organization design choices and organizational effectiveness remains elusive (Pfeffer, 1997; Siggelkow & Rivkin, 2009). We suggest that one potential reason for this is the context-dependence of effectiveness. As Donaldson (2001) noted, effectiveness is measured by whatever the organization is trying to achieve: some organizations are interested in innovation or growth, others in patient well-being, yet others in employee satisfaction. Context dependence is particularly crucial to consider when the organization is embedded in a broader organizational or social system where the outputs of one become the inputs of others (Parsons, 1956). The enduring problem in research on organizational effectiveness is that the dependent variable is normatively declared or assumed, not empirically derived.

In this study, we aim to shed further light on the link between organization design and organizational effectiveness. To this end, we examine one of the fundamental variables of structural contingency theory, organizational integration. Our motivation is to address the mixed evidence on the effects of integration on organizational effectiveness (Donaldson, 2001; Pfeffer, 1997). One of the reasons for not having a clear answer to how exactly integration benefits the organization could be that both early as well as contemporary research on integration uses accounting-based measures, such as various profit measures (Lawrence & Lorsch, 1967), return on assets (Cannella, Park, & Lee, 2008; Nohria & Ghoshal, 1994), and sales growth (Lawrence & Lorsch, 1967; Nohria & Ghoshal, 1994).These are distant outcomes that are affected by a host of mediating and moderating variables many of which have little to do with organizational integration or even organization design. Measures of financial performance are readily available from financial reports, but as proxies for organizational effectiveness post-appropriation measures are fundamentally flawed (Coff, 1999). What, exactly, is the mechanism that links organization design choices to, say, return on assets? Which is being affected, the numerator or the denominator, or both?

We seek to address crucial questions pertaining to organizational integration by:

Journal of Organization Design
JOD, 2(2): 31-43 (2013)
DOI: 10.7146/jod.7864

(a) explicating the mechanism by which integration, through a joint effect with organizational and task complexity, links to proximate organizational effectiveness;
(b) empirically contextualizing effectiveness. What does it mean for the *organization* (not the firm or the profit center) to be effective in its specific context? We do not assume the organizational task or even infer it from the context; we address it empirically. We also use proximate pre-appropriation measures of effectiveness that can be linked to organizational actions (March & Simon, 1958).
(c) operationalizing integration directly, not by its antecedents or outcomes, but as an organizational state (Lawrence & Lorsch, 1967).

What emerges is an empirically tractable elaboration of the mechanism that links integration to effectiveness: the beneficial effects of integration stem from the organization's ability to solve the information-processing problem in the context of its mission and overall task. One of the key criteria for choosing specific organizational effectiveness measures is that the link from improved information processing to the outcome be tractable. The organizational task, in turn, is important to incorporate because increasing task complexity leads to more need for information processing (Galbraith, 2012). For similar reasons, we incorporate organizational complexity because it, too, links to the information-processing challenge.

In summary, our general premise is that organizations of high organizational and task complexity face more challenging information-processing needs and, consequently, integration is both more crucial and more difficult to achieve. In terms of effectiveness, we hypothesize performance differences between integrated and non-integrated organizations to be more pronounced in the case of high organizational and task complexity. In short, the effect of integration is contingent on complexity. This overall proposition is examined in a sample of 266 manufacturing organizations from three industries in nine countries.

EMPIRICAL CONTEXT AND KEY CONCEPTS

Before we define the key concepts, it is important to introduce the empirical context. In this study, we examine the context of modern manufacturing in the automotive, electronics, and machinery industries. The manufacturing plants ("sites") in our study host not just manufacturing activities but a much broader set of activities ranging from product development and process engineering to customer relationship management. Accordingly, these manufacturing sites employ not just manufacturing personnel but also product and process engineers, product development teams, and prototype production. Cross-functional activities are ongoing in these organizations, and indeed they constitute an organizational capability (Wheelwright & Clark, 1992). Consequently, one of the central challenges in managing these organizational units is the management of functional interfaces and, hence, cross-functional integration.

Four concepts are central to our theorizing: integration, effectiveness, organizational complexity, and task complexity. We define *integration* as a state variable – the degree to which organizational subunits coordinate their activities toward a common objective (Barki & Pinsonneault, 2005). Integration is "the quality of the state of collaboration that exists among organizational units" (Lawrence & Lorsch, 1967: 11), thus referring to the state of *achieved* integration across units within an organization. This is to be distinguished from integrative devices, the managerial tools through which integration is sought (Lawrence & Lorsch, 1967). Our focus is specifically on functional (manufacturing and product development) integration.

Regarding *organizational effectiveness*, we focus on the operational performance of a manufacturing organization. Operational performance refers to those measures of organizational effectiveness that are the direct, measurable outcomes of organizational activities. Typical measures of organizational effectiveness in a manufacturing context can be found in the operations management literature (e.g., Hayes & Wheelwright, 1984): manufacturing cost efficiency, conformance-to-specifications quality, flexibility (both product mix and volume), and delivery (both speed and timeliness). To avoid the normative imposition of such measures, we do not accept them at face value but, instead, explore empirically whether they are in fact central to the manufacturing organizations in our sample.

Organizational complexity can be defined in different ways. Here we refer to the complexity of the vertical dimension of the organizational design. Organizational complexity is associated with two structural features relevant to our inquiry. First, different organizational levels come to possess different stocks of knowledge and expertise (Blau & Scott, 1962). Second, organizational integration across functions becomes more challenging with added vertical complexity (Blau, 1970; Damanpour, 1991). The upside of vertical complexity is that it promotes economies of specialization, but the downside is that it amplifies the integration challenge.

Task is what the organization is trying to achieve, its overall objective. We focus specifically on the *complexity of the organizational task*. Following Skinner's (1969) terminology, we define the manufacturing task through the operational objectives (cf. Bourgeois, 1985) the organization's management considers to be important. Some tasks are more complex than others because some manufacturers pursue a broader set of objectives. In the manufacture of standard products in a highly cost-competitive environment, low unit cost may be the overriding objective. In other contexts, manufacturers may try to be simultaneously both cost-efficient and flexible (e.g., Adler, Goldoftas, & Levine, 1999). Both environments are challenging in their own way, and organizations with a more complex manufacturing task face a greater organizational information-processing and integration challenge (Galbraith, 1973).

THEORY AND HYPOTHESES

We formulate two hypotheses of *joint effects* that link organizational integration to organizational effectiveness. The underlying logic for each hypothesis is that the benefits of integration are moderated by complexity.

Integration is more valuable to an organization that simultaneously reaps the benefits of specialization (Lawrence & Lorsch, 1967). Due to vertical complexity, there are more organizational levels possessing different stocks of knowledge which link to specialization and economize on bounded rationality (Conner & Prahalad, 1996). High organizational complexity, however, simultaneously poses challenges in terms of information processing, increasing communication channels and making decision making slower and more difficult as information needs to be processed through a number of levels to reach other units (Damanpour, 1991). Complementing the vertical organization with cross-functional integration facilitates efficient information processing in the organization (Galbraith, 1973). Thus,

> *Hypothesis* 1: High organizational complexity and integration jointly increase operational performance.

The second hypothesis is that integration is more valuable with more complex organizational tasks: increasing task complexity leads to more complex information flows. Focusing on a broader set of priorities requires a more complex set of behavioral responses (Daft & Macintosh, 1981), which in turn increases the need for joint decision making (Williams & Wilson, 1997). A manufacturing organization that copes primarily with, say, a productivity challenge faces a simpler set of organizational challenges than one that seeks both productivity and flexibility. Consider two examples. Adler, Goldoftas, and Levine (1999) examined how NUMMI, the GM-Toyota joint automobile assembly plant, sought both flexibility and efficiency in its manufacturing operations. This required "differentiated subunits to work in parallel on routine and non-routine tasks" (Adler et al., 1999: 43). Although routine tasks can be completed in parallel without integration of subunits (Blau & Scott, 1962), non-routine tasks cannot. Ward, Bickford, and Leong (1996) argued, in the context of manufacturing objectives in particular, that simultaneously emphasizing quality, cost efficiency, and innovation required the development of various stocks of knowledge through cross-functional activities. This poses managerial challenges that organizations which compete on just a few dimensions do not face. Thus,

> *Hypothesis* 2: High task complexity and integration jointly increase operational performance.

METHOD

We tested the two hypotheses in a sample of 266 mid- to large-size (at least 100 employees) manufacturing sites in three industries in nine countries (Table 1). Data were collected as part of the third round of the High Performance Manufacturing Research Initiative (Schroeder & Flynn, 2001). In order to obtain a similar number of sites for each combination of country and industry, we used stratified sampling. The plants were identified by industry experts in order to obtain a representative sample. Each plant represents a different company. The data were collected by written surveys, using the key informant method to identify the proper informants for each section of the survey. For our analyses, we used the survey sections that addressed organization design, organizational objectives, and effectiveness (operational performance). Data in each country were collected in the native language of the country, using translation and back-translation to check for consistency (Behling & Law, 2000). Some residual bias may remain across countries, but this is not a concern in this study because we did not compare countries to one another. The survey response rate was approximately 65 percent, which was achieved by contacting each organization in advance. Each participating plant further received a benchmarked profile in which the focal plant was compared to the rest of the sample. The profile served as an incentive not just to participate but also to eliminate at least the intentional bias from the survey responses as giving biased data would lead to a biased plant profile.

Table 1. Sample Stratification

	Country [a]									
Industry	AUT	FIN	GER	ITA	JPN	KOR	SPN	SWE	USA	Total
Electronics	10	14	9	10	10	10	9	7	9	88
Machinery	7	6	13	10	12	10	9	10	11	88
Transportation	4	10	19	7	13	11	10	7	9	90
Total	21	30	41	27	35	31	28	24	29	266

[a] Austria, Finland, Germany, Italy, Japan, South Korea, Spain, Sweden, United states

Variables and Measures

There were no readily available measures for the key constructs, so we used psychometric measuring instruments that rely on expert judgment. The details of the measures for organizational integration and organizational complexity are shown in Table 2, and the descriptive statistics and correlation matrix of all continuous variables are given in Table 3.

Table 2. Integration and Organizational Complexity Measures

	Factor loadings[a]			Composite trait reliabilities[b]			
	Informant 1	Informant 2	Informant 3	Informant 1	Informant 2	Informant 3	All together
Integration[c]							
The functions in our plant are well integrated	0.61	0.56	0.42	0.68	0.71	0.52	0.80
Problems between functions are solved easily in this plant	0.53	0.47	0.45				
Functional coordination works well in our plant	0.53	0.57	0.34				
The functions in our plant work well together	0.50	0.65	0.43				
Our plant's functions coordinate activities	0.44	0.41	0.28				
Our plant's functions work interactively with each other	0.44	0.58	0.42				
Organizational Complexity[c]							
Our organization structure is relatively flat[d]	0.54	0.60	0.50	0.64	0.64	0.60	0.83
There are few levels in our organizational hierarchy[d]	0.60	0.51	0.57				
Our organization is very hierarchical	0.53	0.50	0.47				
Our organization chart has many levels	0.55	0.59	0.55				

[a] Informant-specific standardized loadings from the Correlated Uniquenesses factor model, obtained using the WLSMV estimator in Mplus. All estimates are significant at the 0.001 level. The three informants for the two constructs are:
Integration: SBU manager, plant general manager, process engineer.
Organizational complexity: SBU manager, HR manager, and shop floor supervisor.
[b] All reliabilities are calculated based on the standardized loadings of the Correlated Uniquenesses factor model.
[c] 7-point Likert-scale: 1 = Strongly disagree … 7 = Strongly agree.
[d] Reverse-worded item. Item score is transformed such that a higher value indicates higher organizational complexity.

Organizational integration. We asked three informants – an SBU-level manager, the general manager of the plant, and the process engineer – to assess the extent to which they thought the organization's functions successfully coordinated activities and integrated them into a unified whole (Barki & Pinsonneault, 2005; Lawrence & Lorsch, 1967). Importantly from a content validity point of view, this operationalization addresses the level of achieved integration not its antecedents (integrative devices) or consequences (outcomes).

Effectiveness. Because effectiveness is a multidimensional construct, disaggregation (e.g., Ray, Barney, & Muhanna, 2004; Richard et al., 2009) is necessary. We examined five dimensions of effectiveness: unit cost efficiency, conformance-to-specifications quality, design flexibility, volume flexibility, and development lead-time. These dimensions are typically mentioned in the literature on organizational effectiveness in a manufacturing context (Hayes & Wheelwright, 1984). Also, they were all deemed by at least two-thirds of our total of about 720 informants as either "very important" or "absolutely crucial" measures of effectiveness for their organizations. Thus, these five dimensions are demonstrably the key metrics for organizational effectiveness in our empirical context.

Table 3. Descriptive Statistics

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10
1. Manufacturing cost efficiency	3.22	0.89										
2. Conformance quality	3.88	0.69	.25 **									
3. Design flexibility	3.88	0.74	.22 **	.17 **								
4. Volume flexibility	3.84	0.80	.26 **	.18 **	.56 **							
5. Development lead-time	3.36	0.92	.22 **	.27 **	.37 **	.29 **						
6. Integration[a]	0.00	1.00	.23 **	.22 **	.13 *	.27 **	.21 **					
7. Organizational complexity	0.00	1.00	-.06	-.14 *	-.14 *	-.17 **	-.02	-.18 **				
8. Task complexity	3.16	1.29	.13 *	.21 **	.20 **	.24 **	.23 **	.25 **	-.10			
9. Size	5.97	0.99	.15 *	.04	-.04	.05	.08	.10	.21 **	.26 **		
10. Age	40.32	27.52	-.10	.07	.01	-.05	-.05	-.01	-.09	.03	.11	
11. Market share	26.06	21.27	.08	.02	.05	.02	.05	-.09	.09	-.09	-.02	-.06

[a] These are factor scores obtained from the factor analyses. Factor scores are created so that their mean is zero and standard deviation is one.
† p < .10
* p < .05
** p < .01

In terms of the actual assessment of effectiveness, we relied on the judgment of general managers as they are the best experts to evaluate operational performance (e.g., Richard et al., 2009). Relying on managerial judgment is necessary because there are no readily available measures of disaggregated effectiveness. To achieve commensurability across organizations, the effectiveness items were further calibrated to industry standards by asking the general manager to assess the operational performance of the manufacturing plant with respect to competition in the focal industry. We used a 1-5 scale as the metric (1 = poor, low end of industry competition to 5 = superior, high end of industry competition).

Organizational complexity. We followed the literature on organization design (e.g., Blau, 1970; Dewar & Hage, 1978) when assessing the complexity of the vertical organization. Instead of simply counting the number of levels, we asked three informants at different levels in the organization (HR manager, the SBU-level manager, and a shop floor supervisor) to judge the complexity of the vertical organization using psychometric measures.

Task complexity. We operationalized organizational task complexity by asking three informants – the SBU-level manager, the general manager, and a process engineer – to assess the importance of five organizational objectives: low unit manufacturing costs, conformance-to-specifications quality, design flexibility, volume flexibility, and rapid ramp-up for new products (Hayes & Wheelwright, 1984). Importance was evaluated on a scale of 1-5 (1 = unimportant to 5 = absolutely crucial). Task complexity was ultimately operationalized as the number of objectives (out of the total of five) that the informants considered on average to be either "very important" or "absolutely crucial."[1]

Control variables. To control for sample heterogeneity, we included both country and industry controls. We also controlled for size (logarithm of the total number of employees) (Bluedorn, 1993) and for age (number of years since the building of the plant). Finally, we also controlled for market share because it might affect the comparative operational performance measures.

Assessment of Reliability and Validity

While we did our best to ensure that the proper experts evaluated each construct, reliability and validity of informant reports must be established empirically. To this end, we conducted a confirmatory factor analysis of the organizational integration and organizational complexity constructs such that the individual responses constituted the items. For example, three

1 The choice here is admittedly arbitrary but at the same time does not make much of a difference: the results do not change appreciably with alternative operationalizations. This is to be expected because, in general, using alternative weights for variables forming a composite is well known not to affect the results (Ree, Carretta, & Earles, 1998).

informants evaluated each of the four items measuring the organizational complexity construct. This translates to a 12-item one-factor model where the disturbance terms of items that share the same informant are allowed to correlate with one another. In factor-analytic terms, this is the Correlated Uniquenesses *(CU)* model (Conway, 1998). The integration construct, in turn, has six indicators and three evaluators, effectively translating to an 18-item, one-factor CU model. The CU models enable the proper examination of reliability and validity as they capture the "proportion of systematic variance in a set of judgments in relation to the total variance in the judgments" (James, Demaree, & Wolf, 1984: 86). In order to incorporate the fact that individual responses to each item were ordinal scaled, the CU models were estimated using the robust weighted least squares estimator available in the Mplus software (Muthén & Muthén, 1998-2010). We have included details about validity and reliability assessment in the Appendix.

For the operational performance variables, we chose to rely solely on the expert judgment of general managers because they are best informed about the operational performance of the plant. While using a single informant may cause some concern, empirical research has found that use of perceptual measures does indeed result in adequately reliable and valid measurement of operational performance in particular (Ketokivi & Schroeder, 2004). Further, the possible random measurement error in performance variables is not problematic because they are dependent variables, and random error only affects the efficiency of the estimate but does not cause estimation bias (Kennedy, 2008).

RESULTS

Because the dependent variables are measured on a discrete ordinal scale, we used ordinal regression analysis (Agresti, 2002). The joint effects were operationalized through interactions. We estimated five ordinal regression models (Table 4). Two assumptions need to be assessed for ordinal regression: (1) the absence of multicollinearity and (2) the assumption of parallel lines (Cohen et al., 2003). First, our analysis suggests that multicollinearity is not a concern; the variance inflation factors (Hair et al., 1998) are low (maximum VIF is 2.31). Second, we calculated the χ2-statistic testing the assumption of parallel lines for each model (Cohen et al., 2003). The statistic was non-significant ($p > .05$) in three of the five models, suggesting that the independent variables have the same impact on all the thresholds. In two of the models (low unit manufacturing costs and development lead-time), the assumption of parallel lines is not met and, therefore, the results should be interpreted with caution. In particular, poorly fitting models or non-findings may be associated with the violation of the parallel slopes (proportional odds) assumption (Agresti, 2002).

Table 4. Ordinal Regression Analysis Results

	Effectiveness Dimension				
	Manufacturing cost efficiency	Conformance quality	Design flexibility	Volume flexibility	Development lead-time
ORDINAL Full Model [a]					
Firm size	0.46 (0.18) *	0.29 (0.19)	0.07 (0.19)	-0.10 (0.18)	0.15 (0.18)
Firm age	-0.01 (0.01)	-0.01 (0.01)	0.00 (0.01)	-0.01 (0.01) *	0.00 (0.01)
Market share	0.00 (0.01)	0.00 (0.01)	0.01 (0.01) †	0.00 (0.01)	0.00 (0.01)
Austria	0.48 (0.85)	2.09 (0.89) *	-0.01 (0.90)	-1.34 (0.87)	0.10 (0.83)
Finland	0.65 (0.63)	0.85 (0.65)	0.02 (0.66)	-0.79 (0.64)	0.15 (0.62)
Germany	1.39 (0.67) *	1.68 (0.69) *	0.66 (0.70)	0.45 (0.68)	0.27 (0.65)
Italy	1.86 (0.65) **	1.16 (0.65) †	0.37 (0.66)	-1.02 (0.65)	-0.12 (0.62)
Japan	1.26 (0.64) †	1.53 (0.67) *	-0.72 (0.67)	-0.25 (0.66)	-0.02 (0.63)
Korea	1.38 (0.93)	-0.05 (0.93)	-0.81 (1.02)	-0.97 (0.93)	-0.94 (0.94)
Spain	0.80 (0.66)	0.68 (0.69)	-1.13 (0.69)	-1.76 (0.69) *	0.51 (0.66)
Sweden	0.29 (0.71)	1.72 (0.75) *	0.77 (0.75)	-1.01 (0.73)	-0.18 (0.69)
Electronics	-0.51 (0.37)	-0.17 (0.39)	0.01 (0.39)	0.35 (0.38)	0.05 (0.37)
Machinery	0.14 (0.38)	0.19 (0.40)	-0.19 (0.40)	0.36 (0.39)	0.19 (0.38)
Integration	-0.33 (0.45)	-0.34 (0.44)	0.02 (0.44)	0.10 (0.43)	-0.69 (0.43)
Organizational complexity (OC)	-0.34 (0.19) †	-0.17 (0.20)	0.11 (0.20)	-0.12 (0.19)	0.12 (0.19)
Task complexity (TC)	-0.09 (0.14)	0.08 (0.15)	0.27 (0.15) *	0.07 (0.14)	0.26 (0.14) *
Integration x OC	0.31 (0.18) *	0.13 (0.18)	0.34 (0.18) *	0.10 (0.18)	0.48 (0.17) **
Integration x TC	0.31 (0.15) *	-0.01 (0.14)	0.08 (0.14)	0.22 (0.14) †	0.30 (0.14) *
χ^2	49.46	24.16	21.69	37.82	27.49
p-value	0.00	0.15	0.25	0.00	0.07
$\Delta\chi^2$ (p-value)[b]	21.36 (<0.01)	6.28 (0.28)	10.82 (0.05)	23.31 (<0.01)	16.35 (<0.01)
Concordance index	49.1%	62.3%	60.5%	57.1%	43.0%

[a] In these models, the base line country is USA and the baseline industry is transportation. Standard errors are in parentheses.
[b] Comparison to controls only model.
† $p < .10$
* $p < .05$
** $p < .01$

Table 5. MANCOVA Analysis Results

	Effectiveness Dimension				
	Manufacturing cost efficiency	Conformance quality	Design flexibility	Volume flexibility	Development lead-time
MANCOVA Full Model [a]					
Intercept	1.86 (0.55) **	2.98 (0.47) **	3.52 (0.48) **	4.18 (0.53) **	2.38 (0.63) **
Firm size	0.19 (0.08) *	0.08 (0.07)	0.01 (0.01)	-0.01 (0.08)	0.08 (0.09)
Firm age	-0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)
Market share	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Austria	0.00 (0.00)	0.68 (0.31) *	-0.03 (0.32)	-0.52 (0.35)	0.06 (0.42)
Finland	0.25 (0.27)	0.24 (0.23)	-0.05 (0.23)	-0.41 (0.26)	0.11 (0.31)
Germany	0.53 (0.28) †	0.53 (0.24) *	0.17 (0.25)	0.09 (0.28)	0.13 (0.32)
Italy	0.81 (0.27) **	0.45 (0.23) †	0.14 (0.24)	-0.40 (0.27)	-0.07 (0.31)
Japan	0.53 (0.27) †	0.44 (0.23) †	-0.23 (0.24)	-0.18 (0.26)	-0.04 (0.31)
Korea	0.52 (0.41)	-0.07 (0.35)	-0.22 (0.36)	-0.42 (0.40)	-0.41 (0.47)
Spain	0.39 (0.28)	0.22 (0.24)	-0.38 (0.25)	-0.77 (0.28) **	0.29 (0.32)
Sweden	0.16 (0.30)	0.56 (0.26) *	0.18 (0.26)	-0.42 (0.30)	-0.08 (0.35)
Electronics	-0.20 (0.16)	-0.09 (0.14)	-0.01 (0.14)	0.16 (0.16)	-0.01 (0.18)
Machinery	0.07 (0.16)	0.06 (0.14)	-0.07 (0.14)	0.18 (0.16)	0.09 (0.19)
Integration	-0.16 (0.18)	0.07 (0.16)	-0.01 (0.16)	-0.09 (0.18)	-0.30 (0.78)
Organizational complexity (OC)	-0.14 (0.08) †	-0.05 (0.07)	0.01 (0.07)	-0.05 (0.08)	0.04 (0.09)
Task complexity (TC)	-0.02 (0.06)	0.06 (0.05)	0.09 (0.05) †	0.03 (0.06)	0.11 (0.07)
Integration x OC	0.12 (0.07) †	0.04 (0.06)	0.12 (0.06) *	0.05 (0.07)	0.23 (0.07) **
Integration x TC	0.12 (0.06) *	0.01 (0.05)	0.03 (0.05)	0.06 (0.06)	0.14 (0.07) **
F	2.72	1.34	1.12	2.06	1.45
p-value	0.00	0.17	0.34	0.01	0.12
R-squared	25.4%	14.4%	12.2%	20.5%	15.4%

[a] In these models, the base line country is USA and the baseline industry is transportation. Standard errors are in parentheses.
† p < .10
* p < .05
** p < .01

Our analysis uncovered several significant effects. In order to interpret these interactions properly, we drew a set of simple regression lines (Cohen et al., 2003), which show the effect of one variable in the interaction term at different levels of the other interacting variable. However, because we are not aware of a procedure that would produce simple regression lines for an ordinal regression model, we re-estimated the models as conventional multivariate analysis of covariance (MANCOVA) models where the dependent variable was assumed to be continuous (Table 5). In terms of statistical significance, the results of the MANCOVA models are very similar, and we conclude that the simple regression lines from these models can be used to illustrate the joint effects graphically. The simple regression lines for the significant interactions are depicted in Figure 1.

Based on the results in Table 4 and the illustrations of Figure 1, we conclude that all the statistically significant interactions are in the hypothesized direction and thus unambiguously support both hypotheses. In all performance dimensions, integration is found to be more beneficial under conditions of higher organizational complexity and higher task complexity. The integration-by-organizational complexity joint effect was significant for manufacturing cost efficiency ($b = 0.31$, $p = .04$), design flexibility ($b = 0.34$, $p = .03$), and development lead-time ($b = 0.48$, $p < .01$). The integration-by-task complexity effect was significant for manufacturing cost efficiency ($b = 0.31$, $p = .02$), volume flexibility ($b = 0.22$, $p = .06$), and development lead-time ($b = 0.30$, $p = .02$). However, there were instances where a joint effect was not observed. These non-significant findings are relevant in that they highlight the importance of disaggregating the effectiveness construct.

DISCUSSION

A detailed, contextualized inquiry into the link between organization design and effectiveness reveals interesting nuances that extant research has not uncovered. Specifically, we find conspicuous evidence on the contingent value of integration. First, to understand the performance benefits of integration, one must understand how integration operates jointly with complexity. The general result is that integration is more beneficial when it is achieved under more challenging – complex organization, complex task – conditions. As the simple regression lines demonstrate, under conditions of low organizational and task complexity, the effects of integration can be negative. This could be one explanation for the mixed evidence on the effects of integration. That is, depending on the level of a (unmeasured) moderating variable, the observed effect may be either positive or negative.

Second, the empirical results underscore the importance of contextualizing effectiveness. The discrepancy between theoretical and empirical research here is conspicuous. Theorists note that organizational effectiveness must be determined by the goals and measures

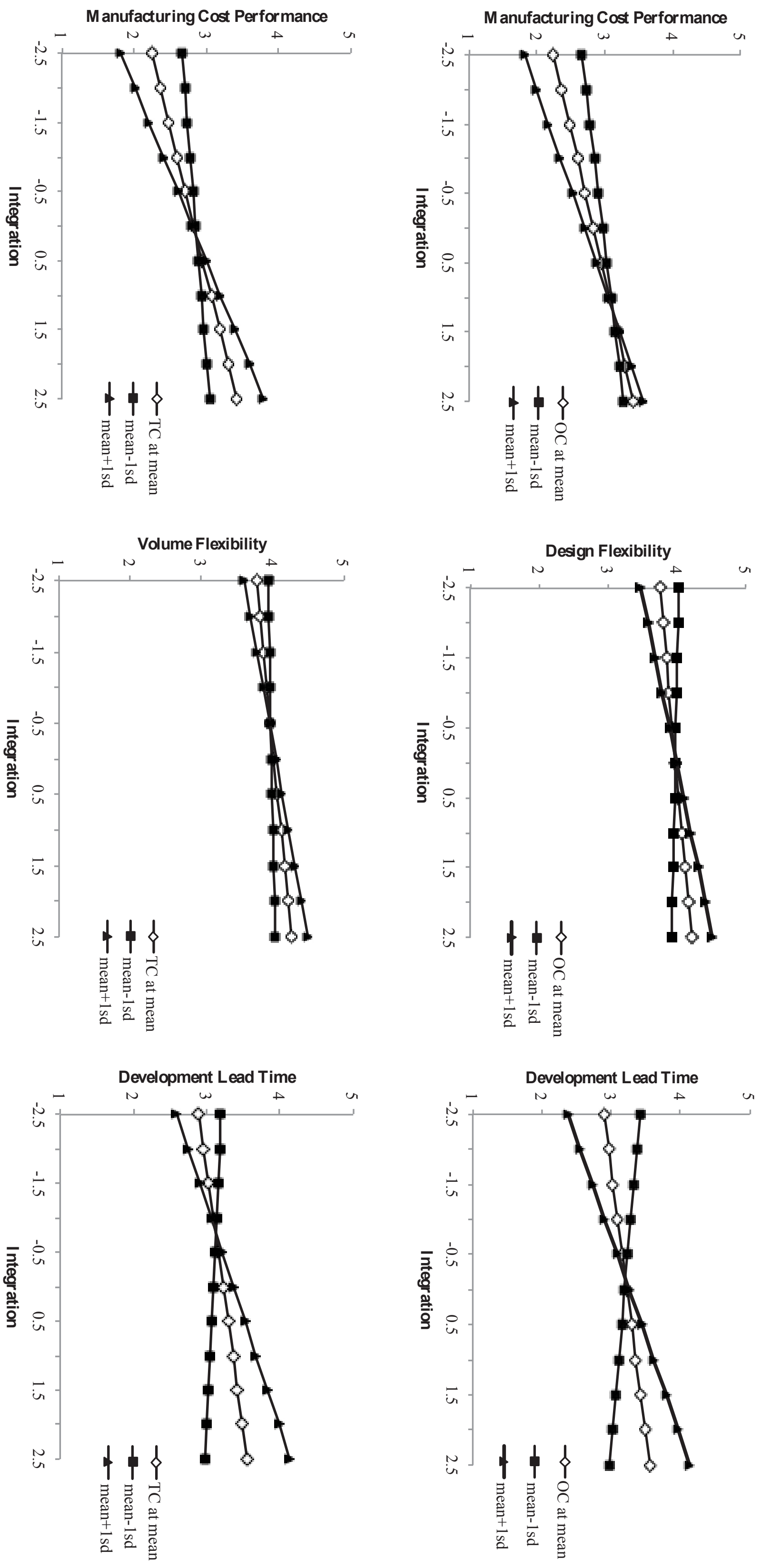

Fig. 1. Simple Regression Lines Illustrating Interaction Effects

OC: organizational complexity
TC: task complexity

the organization sets for itself. Empirical researchers rely on normative declarations and assumptions about what effectiveness is (or simply work with what they can obtain from secondary data sources). We have tried to avoid this normativity trap by empirical contextualization. We have further tried to avoid a composition fallacy by examining each dimension of effectiveness independently of the others. The results highlight the importance of doing so, as the empirical results are not the same for all dimensions of effectiveness. While we have no direct evidence as to why these differences obtain, it seems plausible that the information-processing challenge arising from trying to improve, say, unit manufacturing costs is different from the challenge of improving design flexibility. More specifically, the nature of the interdependence across functions is likely to be different: lowering unit manufacturing costs may involve reducing various upfront costs in product design and design-for-manufacturability while design flexibility involves the accommodation of engineering change orders to existing products. Upfront and ongoing concerns require different kinds of cross-functional cooperation and information processing.

Finally, we measured organizational integration directly as a state variable. Empirical studies that examine the use of integrative devices and link them directly to organizational effectiveness outcomes are forced to make the assumption that integrative devices are employed equally effectively across organizations (Ettlie & Reza, 1992; Gittell, 2002). In our study, we avoided this assumption.

LIMITATIONS AND FUTURE RESEARCH

Ours is a comparative study of organization design in a large sample of organizations, and the usual caveats for using a cross-sectional dataset apply. Given the nature of organization design, however, we do not expect the values of the independent variables in our study to change rapidly. Perhaps integration is not a *state* that organizations enter and leave but rather a more stable *trait*. Comparative case studies of the dynamics of integration and effectiveness would be useful.

Taking integration as the dependent variable is a straightforward extension of our model. It would be useful to look at the effects of employing various integrative devices on overall integration. This would help us further understand the mechanisms by which organizations achieve integration (Galbraith, 2012). Also, it would be useful to examine the comparative and joint effects of structural mechanisms, information systems, incentives, and various social mechanisms on integration. Integration is not just about the management of information flows but also involves the broader challenge of managing collective action (Gulati, Lawrence, & Puranam, 2005).

Finally, in our analysis we focused on five dimensions of organizational effectiveness that were viewed as highly relevant by our informants. An obvious extension would be to focus on dimensions of effectiveness that are important to each individual organization. One way to achieve this would be to incorporate specific priorities as independent variables in the models. Our cross-sectional data did not lend itself to such an analysis. Ultimately, our analysis imposes the five dimensions as relevant dimensions of effectiveness for all organizations in the sample. Organization-specific analyses might require a different (e.g., case study) approach.

CONCLUSION

Siggelkow and Rivkin (2009) found that the embeddedness of organizational choices within complex multi-level decision processes has the unfortunate consequence of hiding the evidence of valid theories. Structural contingency theory was mentioned as a potential example of such theory. Perhaps partly due to this, structural contingency theory went out of fashion in academic circles well over twenty years ago; the theory was too complex and simply did not seem to “fit the facts” (Pfeffer, 1997: 160). At the same time, a visit to any organization quickly reveals that the fundamental questions asked by contingency theorists are hardly out of fashion: How does one integrate a complex organization? What are the benefits? We share Siggelkow and Rivkin’s (2009) concern about evidence being “in hiding” but side with Donaldson’s (2001: Ch. 8) concern that this may be partially our own fault: we have used poor measures. Pfeffer (1997: 160) concurred by calling measures of organizational structure “grossly oversimplified.” We agree with both Donaldson (2001) and Pfeffer (1997).

Among his seven lessons offered for the improvement of empirical contingency theory research, Donaldson (2001) called for the use of better measures. Taking this lesson to heart, we have uncovered in our study several ways in which organizational integration confers information-processing benefits, reflected in a number of proximate measures of organizational effectiveness. We have also found that the observed mixed evidence of extant research may well be due to interaction effects not included in previous models. Thus, perhaps it is not organizational but *methodological* realities that are hiding the evidence from us.

Acknowledgements: We presented an earlier version of this paper at the Annual Meeting of the Academy of Management in 2011. We thank the Organization and Management Theory Division reviewers and session participants for their comments. We also thank James March, Fabrizio Salvador, Raymond Levitt, and the participants in James March’s research seminar at Stanford University in May 2012 for their valuable comments. Virpi Turkulainen acknowledges financial support from Academy of Finland, Fulbright Association, Jenny and Antti Wihuri Foundation, and The Federation of Finnish Technology Industries Foundation.

REFERENCES

Adler PS, Goldoftas B, Levine DI. 1999. Flexibility versus efficiency? A case study of model changeovers in the Toyota production system. *Organization Science* 10(1): 43-68.

Agresti A. 2002. *Categorical Data Analysis* (2nd ed.). Wiley, New York, NY.

Ambos B, Schlegelmilch BB. 2007. Innovation and control in the multinational firm: A comparison of political and contingency approaches. *Strategic Management Journal* 28(5): 473-486.

Bagozzi RP, Phillips LW. 1982. Representing and testing organizational theories: A holistic construal. *Administrative Science Quarterly* 27(3): 459-490.

Barki H, Pinsonneault A. 2005. A model of organizational integration, implementation effort, and performance. *Organization Science* 16(2): 165-179.

Behling O, Law KS. 2000. *Translating Quesionnaires and Other Research Instruments – Problems and Solutions*. Sage Publications, Thousand Oaks, CA.

Blau PM. 1970. A formal theory of differentiation in organizations. *American Sociological Review* 35(2): 201-218.

Blau PM, Scott WR. 1962. *Formal Organizations: A Comparative Approach*. Chandler Publishing, San Francisco, CA.

Bluedorn AC. 1993. Pilgrims’ progress – Trends and convergence in research on organizational size and environments. *Journal of Management* 19(2): 163-191.

Bollen KA. 1984. Multiple indicators: Internal consistency or no necessary relationship? *Quality and Quantity* 18(4): 377-385.

Bollen KA. 1989. *Structural Equations with Latent Variables*. Wiley, New York, NY.

Bourgeois LJ, III. 1985. Strategic goals, perceived uncertainty, and economic performance in volatile environments. *Academy of Management Journal* 28(3): 548-573.

Cannella AA, Jr., Park J-H, Lee H-U. 2008. Top management team functional background, diversity and firm performance: Examining the roles of team member colocation and environmental uncertainty. *Academy of Management Journal* 51(4): 768-784.

Coff RW. 1999. When competitive advantage doesn’t lead to performance: The resource-based view and stakeholder bargaining power. *Organization Science* 10(2): 119-133.

Cohen J, Cohen P, West SG, Aiken LS. 2003. *Applied Multiple Regression / Correlation Analysis for the Behavioral Sciences* (3rd ed.). Lawrence Erlbaum Associates, Mahwah, NJ.

Conner KR, Prahalad CK. 1996. A resource-based theory of the firm: Knowledge versus opportunism. *Organization Science* 7(5): 477-501.

Conway JM. 1998. Estimation and uses of the proportion of method variance for multitrait-multimethod data. *Organizational Research Methods* 1(2): 209-222.

Daft RL, Macintosh NB. 1981. A tentative exploration into the amount and equivocality of

information processing in organizational work units. *Administrative Science Quarterly* 26(2): 207-224.
Damanpour F. 1991. Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal* 34(3): 555-590.
Dewar R, Hage J. 1978. Size, technology, complexity, and structural differentiation: Toward a theoretical synthesis. *Administrative Science Quarterly* 23(1): 111-136.
Donaldson L. 2001. *The Contingency Theory of Organizations*. Sage Publications, Thousand Oaks, CA.
Ettlie JE, Reza EM. 1992. Organizational integration and process innovation. *Academy of Management Journal* 35(4): 795-827.
Galbraith JR. 1973. *Designing Complex Organizations*. Addison-Wesley, Reading, MA.
Galbraith JR. 2012. The future of organization design. *Journal of Organization Design* 1(1): 3-6.
Gittell JH. 2002. Coordinating mechanisms in care provider groups: Relational coordination as a mediator and input uncertainty as a moderator of performance effects. *Management Science* 48(11): 1408-1426.
Gulati RK, Lawrence PR, Puranam P. 2005. Adaptation in vertical relationships: Beyond incentive conflict. *Strategic Management Journal* 26(5): 415-440.
Hair JF, Jr., Anderson RE, Tatham RL, Black WC. 1998. *Multivariate Data Analysis* (4th ed.). Prentice-Hall, Upper Saddle River, NJ.
Hayes RH, Wheelwright SC. 1984. *Restoring Our Competitive Edge: Competing through Manufacturing*. Wiley, New York, NY.
James LR, Demaree RG, Wolf G. 1984. Estimating within-group interrater reliability with and without response bias. *Journal of Applied Psychology* 69(1): 85-98.
Kennedy P. 2008. *A Guide to Econometrics* (6th ed.). Blackwell Publishing, Malden, MA.
Ketokivi MA, Schroeder RG. 2004. Perceptual measures of performance: Fact or fiction? *Journal of Operations Management* 22(3): 247-264.
Khandwalla PN. 1973. Viable and effective organizational designs of firms. *Academy of Management Journal* 16(3): 481-495.
Lawrence PR, Lorsch JW. 1967. *Organization and Environment – Managing Differentiation and Integration*. Harvard Graduate School of Business Administration, Boston, MA.
March JG, Simon HA. 1958. *Organizations*. Wiley, New York, NY.
Muthén LK, Muthén BO. 1998-2010. *Mplus User's Guide*. Muthén & Muthén, Los Angeles, CA.
Nohria N, Ghoshal S. 1994. Differentiated fit and shared values: Alternatives for managing headquarters-subsidiary relations. *Strategic Management Journal* 15(6): 491-502.
Parsons T. 1956. Suggestions for a sociological approach to the theory of organizations - I. *Administrative Science Quarterly* 1: 63-85.
Pfeffer J. 1997. *New Directions for Organization Theory: Problems and Prospects*. Oxford University Press, New York, NY.
Ray G, Barney JB, Muhanna WA. 2004. Capabilities, business processes, and competitive advantage: Choosing the dependent variable in empirical tests of the resource-based view. *Strategic Management Journal* 25(1): 23-37.
Ree MJ, Carretta TR, Earles JA. 1998. In top-down decisions weighting variables doesn't matter: A consequence of Wilks' Theorem. *Organizational Research Methods* 1(4): 407-420.
Richard PJ, Devinney TM, Yip GS, Johnson G. 2009. Measuring organizational performance: Towards methodological best practice. *Journal of Management* 35(3): 718-804.
Schroeder RG, Flynn BB. 2001. *High Performance Manufacturing – Global Perspectives*. Wiley, New York, NY.
Siggelkow N, Rivkin JW. 2009. Hiding the evidence of valid theories: How coupled search processes obscure performance differences among organizations. *Administrative Science Quarterly* 54(4): 602-634.
Skinner W. 1969. Manufacturing – Missing link in corporate strategy. *Harvard Business Review* 47(3): 136-145.
Thompson JD. 1967. *Organizations in Action*. McGraw-Hill, New York, NY.

Ward PT, Bickford DJ, Leong GK. 1996. Configurations of manufacturing strategy, business strategy, environment and structure. *Journal of Management* 22(4): 597-626.

Werts CE, Rock DA, Linn RL, Jöreskog KG. 1977. Validating psychometric assumptions within and between several populations. *Educational and Psychological Measurement* 37(4): 863-872.

Wheelwright SC, Clark KB. 1992. *Revolutionizing Product Development – Quantum Leaps in Speed, Efficiency, and Quality*. Free Press, New York, NY.

Williams SR, Wilson RL. 1997. Group support systems, power, and influence in an organization: A field study. *Decision Sciences* 28(4): 911-937.

VIRPI TURKULAINEN

Post-doctoral Researcher
Aalto University
E-mail: virpi.turkulainen@aalto.fi

MIKKO KETOKIVI

Professor
IE Business School
E-mail: mikko.ketokivi@ie.edu

APPENDIX

Details of Validity and Reliability Analysis

Composite reliabilities (Werts et al., 1977) are presented in Table 2, and for integration they are 0.68 (SBU informant), 0.71 (general manager), and 0.52 (process engineer) and for organizational complexity they are 0.64 (SBU informant), 0.64 (HR manager), and 0.60 (supervisor). The composite reliability for integration (all three informant evaluations taken together) is 0.80 and for organizational complexity it is 0.83. These reliabilities are not the conventional measurement reliabilities but *trait* reliabilities (Bagozzi & Phillips, 1982), which consider reliable only the proportion of variance that can be attributed to the specific trait.

The integration and organizational complexity factors correlate at -0.20 ($p<.001$). This not only demonstrates discriminant validity (the two constructs are clearly empirically separable) but also construct validity (Bollen, 1989). Specifically, we expected integration and organizational complexity to have at least modest negative correlation because integration is more difficult in more complex organizations.

The construct of task complexity must be treated differently from integration and organizational complexity. While we may think of integration and organizational complexity as state variables with *reflective indicators* (Bollen, 1989), we operationalized task complexity as *formative* (Bollen, 1989). The informants are influential individuals within their respective organizations. Therefore, if they indicate that design flexibility, for example, is crucial, then design flexibility by definition becomes crucial. In the case of formative indicators, the individual items need not correlate with one another in order to be valid and reliable measures (Bollen, 1984). To construct the measure, we calculated the number of objectives that the managers considered crucial in their task. This number can be thought of as the dispersion or span of total managerial attention and, consequently, the complexity of the organizational task.