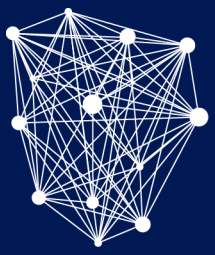

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DRIVERS OF ORGANIZATIONAL RESPONSIVENESS

EXPERIENCES OF A MILITARY CRISIS RESPONSE ORGANIZATION

ERIK DE WAARD • HENK VOLBERDA • JOSEPH SOETERS

Abstract: The topic of organizational responsiveness – where organizations need to flexibly react to strategic and operational demands simultaneously – has been under-explored in strategic management research. Our study was initiated to shed more light on this topic, primarily by studying an organization specifically designed to handle crises. By definition, crisis response organizations have to be prepared to react to unpredictable events. Moreover, the volatility of the crisis situation itself requires a high degree of flexibility to get or keep the situation under control. The study hypothesizes modular organizing and organizational sensing to be key drivers of organizational responsiveness. Empirically, we examine the effect these two variables have on the responsiveness of the Netherlands armed forces for crisis response deployment. Findings indicate that modular organizing and organizational sensing are drivers of responsiveness. In addition, our study uncovered the importance of an organization's level of system decomposition to responsiveness. A high degree of system granularity can lead to a predominantly inward focus whereas organizational responsiveness calls for a strong external orientation.

Keywords: Organizational responsiveness; crisis response; organization design; modularity

The reality of today's turbulent organizational environments is that most organizations have to deal simultaneously with the "here and now" and the future, and they should be capable of combining routine behavior with improvisation (Winter, 2003). Organizational responsiveness thus has both strategic and operational aspects. Our study examines two hypothesized antecedents of organizational responsiveness: organizational sensing and modular organizing. We define *sensing* as an organization's ability to fathom its complex relationship with the outside world. The sensing process consists of three distinct stages: noticing, interpreting, and acting (Daft & Weick, 1984; Kiesler & Sproull, 1982). Huber (2004) argues that organizational responsiveness depends on the cumulative sensing effort of all organizational members. *Modular organizing* is defined as the combination of autonomous organizational units into customized constellations (Sanchez, 2003; Schilling, 2000; Worren, Moore, & Cardona, 2002). Sanchez and Collins (2001) explain that the key merit of modularization is to increase organizational flexibility without jeopardizing performance.

To investigate organizational responsiveness, our study draws upon the crisis-response experiences of the Netherlands armed forces. It uses the expeditionary crisis-response task setting of many of today's Western armed forces as a metaphor for organizations confronted with environmental turbulence. Almost all expeditionary crisis-response operations are unique endeavors but are conducted by similarly (modularly) organized task forces (de Waard & Kramer, 2008). Various armed forces have found modular design to be a useful organizational approach to react effectively to very different crisis situations. Moreover, a deployed military task force finds itself in a permanent state of operational flux. The volatility of most crisis situations has made organizational sensing – or, in military terms, achieving

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continuous situational awareness (Alberts, Garstka, & Stein, 2000) – a critical success factor for repeatedly outsmarting the opponent and staying on top of the situation.

This line of reasoning leads to the research question that guided our study: What is the effect of organizational sensing and modular organizing on the responsiveness of the Netherlands armed forces? Our article is divided into five main parts. First, we present a theoretical model that shows relationships among sensing, modular organizing, and organizational responsiveness. Next, we describe our study's method which involved a large-scale survey carried out among 1,208 senior officers of the Netherlands armed forces. The third section presents our study's results, which show that modular organizing and organizational sensing are reinforcing drivers of responsiveness but that, in addition, the organization's level of system decomposition is an important factor to take into account. In the fourth section, we discuss our findings, including a comparison of the Netherlands, United States, and Australian armies to show how organizational size affects responsiveness. The final section is the conclusion.

THEORETICAL MODEL

The study is based on the theoretical model shown in Figure 1. Modular organizing (MO) is the independent variable, organizational sensing (OS) is the mediator variable, and responsiveness (R) is the dependent variable. Relationships among these broad variables are based on three theoretical arguments. First, because of the growing belief that strategic maneuvering and operational performance are intertwined, sensing has become a key capability associated with organizational responsiveness (Doz & Kosonen, 2008, 2010). An implicit assumption is that organizations should try to create a culture in which all members are challenged to proactively scan and interpret their immediate environment (Cohen & Levinthal, 1990; Lane, Koka, & Pathak, 2006; Todorova & Durisin, 2007). More specifically, Huber (2004: 57) states: "In tomorrow's business environment, where sources of change will be less anticipatable than in the past, eclectic responsibility will be needed to complement the practice of assigning specialized personnel to monitor and report on particular environmental components. Without eclectic responsibility, many unanticipated threats and opportunities would go unnoticed because no specialized sensor had been assigned to the source."

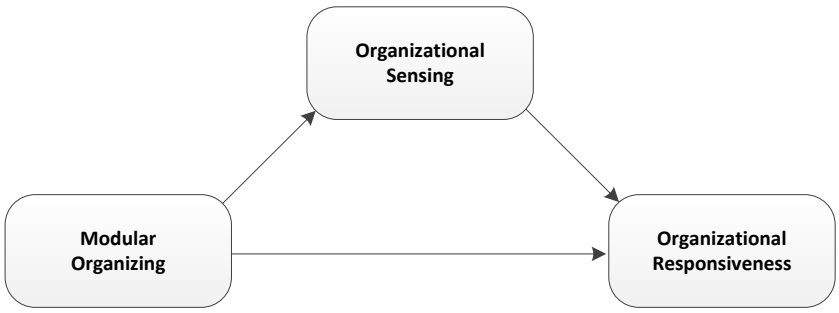


Fig. 1. Research Model

Second, modular organizing is a design strategy that facilitates strategic as well as structural and operational responsiveness. From a strategic perspective, for example, modular organizing has stimulated the invention and application of new technologies, the development of new products, and the upgrading of existing products (Brusoni, 2005; Sanchez, 1995, 1996). Taking the structural responsiveness viewpoint makes it clear that modularity has offered organizations the ability to reorganize their internal production processes in such a way that economies of scale and scope can be achieved simultaneously (Anand & Daft, 2007; Brusoni & Prencipe, 2006; Schilling & Steensma, 2001). Looking through an operational lens shows that modularity's underlying principle of loose coupling creates an organizational system that can benefit from specific advantages, such as the localization of adaptation and trouble, and the reduction of coordination costs (Orton & Weick, 1990; Weick, 1976).

Third, our theoretical model also follows existing theory explicating that modular organizing plays a dual role. It is argued that modularity not only directly influences responsiveness, but

the mixing and matching of autonomous organizational units through standardized interfaces helps organizations to flexibly tap new sources of knowledge (Hansen, 1999). Moreover, due to the autonomous and specialized nature of modular components, the speed of problem solving increases at the same time. In this regard, Pil and Cohen (2006: 1001) state: "Since each component or subsystem maintains a consistent functional focus, developers may acquire cumulative experience with certain kinds of problems faster. This enables them to search for and evaluate alternative solutions more quickly."

METHOD

The study's empirical base is a large-sample survey. A questionnaire was distributed to a large group of military officers drawn from the Netherlands armed forces. This group consisted of majors, lieutenant colonels, and colonels from the three main services: Army, Navy, and Air Force. The sampling frame concentrated on the middle and higher echelons as the research required respondents who have significant military experience and knowledge as well as potential insight into various strategic and organizational aspects of the Netherlands armed forces. The study's main objective was to gain an understanding of the way in which modular organizing and organizational sensing supported the responsiveness of the Netherlands armed forces as a whole. Therefore, the questionnaire asked respondents to describe the armed forces collectively, despite their different service backgrounds. The questionnaire also contained room for open-ended remarks at the end.

The initial mailing consisted of 3,706 paper questionnaires sent to the officers' home addresses. Within five weeks, a total of 1,533 officers filled out and returned the questionnaire by mail. Because of the high percentage of returned questionnaires, no reminders were sent to increase the response rate. We cleaned the dataset by removing questionnaires with missing values on the model or control variables. Questionnaires from respondents without actual mission experience were also disregarded. Altogether, 1,208 usable questionnaires remained, resulting in a response rate of 33 percent. An overall profile of the respondents is shown in Table 1. Preliminary statistics as well as instrument and construct validation details can be found in the Appendix.

Table 1. Research sample

Respondents		**Number of Operational Deployments**						
		1	2	3	4	5	Subtotal	
Army	Major	138	132	59	25	16	370	676
	Lt. Col.	118	78	40	14	8	258	
	Col.	26	16	4	2	0	48	
Air Force	Major	76	49	20	12	12	169	296
	Lt. Col.	43	31	20	3	4	101	
	Col.	14	8	2	1	1	26	
Navy	Major	43	29	31	11	8	122	236
	Lt. Col.	31	32	14	5	3	85	
	Col.	13	8	3	4	1	29	
	Total	502	383	193	77	53	1208	

RESULTS

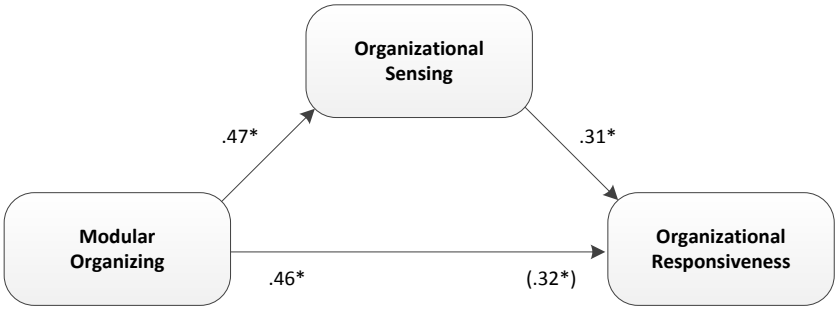
Table 2 presents the results of the hierarchical regression analysis, in which modular organizing (MO) and organizational sensing (OS) are entered in Model 2 as predictor variables of the organization's responsiveness (R). The results show that MO ($\beta = .32$) and OS ($\beta = .31$) significantly and equally contribute to responsiveness (R). Moreover, the adjusted R^2 of .29 indicates that the proportion of variance explained by these two variables is considerable.

Table 2. Hierarchical regression of variables predicting organizational responsiveness

	Model 1				Model 2			
	B	*SE B*	β	ΔR2	*B*	*SE B*	β	ΔR2
Constant	3.56	.04			1.76	.10		
Control variables:								
Dummy Service 1	.02	.03	.02		.00	.02	-.00	
Dummy Service 2	-.03	.03	-.03		-.05	.03	-.06	
Dummy Rank 1	-.16	.04	-.22***		-.09	.03	-.12*	
Dummy Rank 2	-.12	.04	-.15	.02	-.06	.04	-.08	
Predictor variables:								
Modular organizing					.33	.03	.32***	
Organizational sensing					.20	.02	.31***	.28
df				1203				1201
Adjusted R^2				.01				.29

*p < .05 **p < .01 ***p < .001

Regarding the hypothesized mediation effect of organizational sensing, there was a significant relationship between the independent variable (modular organizing) and the dependent variable (responsiveness) (β = .46, p = .000) that declined after controlling for the mediator (β = .33, p = .000). To confirm a significant decline in this relationship, a separate Sobel mediation test (Baron & Kenny, 1985) was performed, resulting in confirmation. Figure 2 schematically presents the outcome of these analyses.



*p < .05

Fig. 2. Research Model Outcomes

Note: Numbers shown are the standardized regression coefficients for the relationship between modular organizing and the Netherlands armed forces' responsiveness as mediated by organizational sensing. The standardized regression coefficient between modular organizing and responsiveness, controlling for organizational sensing, is in parentheses.

In general, the statistical outcomes corroborate earlier research findings on the crisis response performance of the Netherlands armed forces, indicating that intra- and inter-organizational collaboration has become a necessity for effectively dealing with the complexity of international crisis-response situations (de Waard, Volberda, & Soeters, 2012). Most missions seek resolution of a complex mix of military, diplomatic, economic, and humanitarian problems. Under such circumstances of causal ambiguity, no single actor can provide a complete solution. Progress can only be made when military and non-military partners work together, sharing their knowledge and generating new ideas. Working in different multinational, multi-service, multi-actor task forces has increased the armed forces organization's learning ability. Moreover, the cooperation that takes place among different individuals and organizational groups, over a long period of time and under extreme circumstances, deepens understanding of each other's ways of doing things. Not only is new

knowledge acquired, but insights may be obtained that allow new knowledge to be translated into concrete, usable routines and processes. New knowledge and insights can then be used to improve the tactics and techniques of a running mission as well as missions to come. On the whole, the strong influence of modular organizing and organizational sensing is based on the fact that they appear to reinforce each other. Essentially, a positive feedback loop develops where learning outcomes can be applied in new settings and constellations, leading to new insights that can be applied, and so on.

The regression analysis also revealed a significant effect of dummy variable Rank 1. This control variable measures the difference in scores between colonels and majors. The result in Model 2 of -.12 means that majors assessed the Netherlands armed forces' responsiveness significantly less positive than colonels. The other control variable (service background) did not show any statistically significant differences between the three services, despite the earlier ANOVA indicating otherwise. A possible explanation for the divergent opinions of majors and colonels can be found in the level of operational experience shown in Table 1. Majors constitute a highly experienced group in comparison to colonels. Even more interesting is that many of the critical remarks, made in the open question at the end of the survey, come mainly from experienced officers. A total of 39 remarks were made that relate to relationships among modular organizing, organizational sensing, and responsiveness. Those remarks point in three directions.

A first group of 19 respondents argues that the Netherlands armed forces "keeps reinventing the wheel" and does not truly learn from past experiences. A second group of 16 respondents links the problem to imperfect modularization. Their remarks refer to the organization's permanent structure not being aligned with its crisis-response role. Since a tailor-made configuration is required for each mission, the process of mixing and matching to create an ad hoc organization cuts through existing hierarchical and functional boundaries. As a result, the tailor-made military formations that are deployed sometimes have to deal with the problem of unfamiliarity. The fact that a task force is formed on an ad hoc project basis, with very specific operational assignments, can lead to situations in which units and individuals have to work together closely without knowing each other very well. Despite extra training programs, these ad hoc units seldom reach the level of operational responsiveness of standing units. Moreover, when a mission ends the units return to their original positions in the permanent organization, making it difficult to close the organizational learning cycle. A third group of only four respondents complains about the fact that the mixing and matching strategy leads to an overemphasis on task generalization. Concrete examples that were mentioned vary from Navy and Air Force personnel having to conduct infantry-like tasks to soldiers in general being deployed as surrogate aid workers or policemen.

In general, the open-ended remarks show that affinity with either the operational or the organizational/strategic level determines the assessment of the organization's responsiveness. Majors, who have a strong connection with the organization's operational-level task execution, refer more strongly to the negative, practical consequences of certain strategic-level decisions. Colonels, on the other hand, are at a higher organizational level and have a better understanding of the complex mixture of factors influencing a strategic decision. They may take for granted that "perfect" design decisions do not exist and that tricky operational consequences are just part of the crisis-response process.

DISCUSSION AND IMPLICATIONS

Overall, our study relates to the traditional organization design dilemma of differentiation and integration (Lawrence & Lorsch, 1967). Existing theory says that successful modular organizational systems thrive on the differentiation principles of near-decomposability and loose coupling (Sanchez & Mahoney, 1996). This is where the Netherlands armed forces encounter many of their organizational problems. The unpredictability and diversity of the current security environment make it difficult for the military crisis-response organizations (especially the Army) to create independent operational units within the parent organization that are capable of covering the wide array of crisis-response situations they may encounter. Embracing a modular strategy of delivering customized solutions has forced the Netherlands

armed forces to spend extra time and energy on integration mechanisms, such as joint exercises and training programs, to enhance coordination and unit cohesion.

Effects of Size on Responsiveness

The Netherlands Army is not alone in this challenge. Most Western armies with expeditionary crisis-response ambitions are confronted with the same differentiation and integration issues. Evidence from this broader field indicates that the size of the organization is an important contingency factor influencing organizational responsiveness. Table 3 summarizes the main relationships among organizational size, structure, and responsiveness across the Netherlands, Australian, and U.S. armies.

Table 3. Organizational size, structure, and responsiveness

	U.S. Army	**Australian Army**	**Netherlands Army**
Organizational Size	Large	Medium	Small
Permanent Structure	Specialized brigades	Multi-functional brigades	Specialized brigades
Deployment Structure	Specialized brigades	Fixed task forces	Customized task forces
Strategic Responsiveness	High	High	Medium
Structural Responsiveness	High	Medium	High
Operational Responsiveness	High	High	Medium

All Western land forces are hierarchically divided into standard subunits. The grouping of these organizations is divisional (Mintzberg, 1983), which means that the structure is constructed from a number of "smaller armies" of different sizes. To be precise, a military division consists of several brigades. A brigade, in turn, can be subdivided into battalions, and a battalion can be split up into companies. The smaller the building-block unit becomes, the smaller its maneuver, combat support, combat service support, and command elements will be. A brigade is perceived to be the smallest organizational building block that has a sufficient combination of functional elements to conduct military operations autonomously for a lengthy period of time. Thus, a brigade complies with modularity theory's rule of near-decomposability (Bonin & Crisco, 2004). Yet for a small country such as the Netherlands, a brigade is a rather large organization. The entire Netherlands Army consists of only two mechanized brigades, with two mechanized infantry battalions and one tank battalion as its operational core, and one air maneuver brigade made up of three light infantry battalions. Deploying a single brigade for each crisis-response mission would place too heavy a burden on the organization. Moreover, the specialized nature of these brigades – mechanized or light/heavy – makes them less useful to cover the entire spectrum of tasks. Therefore, the Netherlands Army has abandoned the brigade as its main deployment structure. When a crisis situation occurs, the different functional elements that are needed are picked from the parent organization and merged into a temporary battalion-size task force. To perform the required operational tasks, the functional units (e.g., infantry, artillery, close air support, engineers) are structurally dependent on one another and need tight rather than loose coupling.

Given its organizational approach, the Netherlands Army seems to focus on structural responsiveness. It offers the organization the potential to structurally adapt to different types of crisis-response situations. To a certain extent it also enhances strategic responsiveness because the fine-grained selection and grouping process makes it possible to execute tasks that reach beyond the limits of traditional military formations and doctrine. Having said that, strategic responsiveness is also influenced in negative ways. First, the mixing and matching strategy hinders the high-readiness, quick-response ambitions of the Netherlands armed forces, since a tailor-made task force cannot be deployed straightaway but needs to undergo additional training. Second, units that are not deployed are temporarily deprived of critical functional elements. As a result, they do not get the opportunity to train to their full potential, making it difficult to lay a solid foundation for future military deployments.

Apart from these negative consequences for the organization's strategic responsiveness, operational responsiveness also suffers. It is questionable whether use of the integration mechanisms needed to transform the mixture of different functional elements into a smoothly

working system will ultimately lead to a sufficient level of organizational familiarity, meeting Weick & Roberts' (1993) idea of "heedful interrelating." To interrelate heedfully, a tight professional bond is necessary to sense problems before they occur or to immediately recognize deviations from normal routine.

Comparison to U.S. and Australian Armies

As one of the biggest armies in the world, the problem of a brigade being too large an organizational unit does not apply to the U.S. Army. Examining the design choices of the U.S. Army offers some additional insights into the relationship between system decomposition and organizational responsiveness. An interesting parallel with the Netherlands Army is that the U.S. Army has launched an initiative to transform into a brigade-centric permanent force. The rationale is that the traditional divisional structure is too focused on a large-scale, mechanized Cold War-type scenario whereas the brigade structure better fits the high-readiness, expeditionary, crisis-response situations found in today's world. The brigade structure is smaller and more rapidly deployable. Apart from the speed dimension, the brigade structure also facilitates strategic responsiveness in two other dimensions. First, it possesses an integral mixture of maneuver, combat support, combat service support, and command elements, which enables it to conduct a wide range of military tasks. Second, its organizational independence makes it possible to be picked from the standing organization without hampering the operational capacity of the organizational units that stay behind.

Another resemblance is the grouping of specialized brigades. Although the Netherlands Army makes a distinction between its light air maneuver brigade and two mechanized brigades, it does not have – in comparison to the U.S. Army – the numeric capacity to deploy these large units integrally. As described above, the Netherlands Army uses its standing organization as a pool of military capabilities from which units can be picked and grouped into temporary, customized task forces. Because of its size (42 active brigade combat teams (BCTs) and 28 national guard BCTs), the U.S. Army has the luxury to diversify into three distinct types of brigades that can be deployed as a whole: (1) infantry BCTs, (2) heavy BCTs, and (3) medium Stryker BCTs (Krepinevich, 2002). This subdivision provides the organization with a strong base of structural responsiveness because the BCTs are tailored in advance for specific terrain and operational conditions. Furthermore, operational responsiveness benefits from the balance between the basic structure and the deployment structure. Not only do the BCTs form the backbone of the permanent organization, they are also the standard unit of action for military operations. As a result, unlike the Netherlands customization approach, no extra integration mechanisms are needed when these BCTs are deployed. In a RAND report on the pros and cons of the U.S. Army's modular force structure (Johnson, Kitchens, Martin, & Fischbach, 2012: 12), one of the respondents hails the brigade-centric modular structure by saying that it helps "… to maximize unit cohesion through habitual association among combat, combat support, and combat service support units… creating relationships of mutual confidence and loyalty within companies, battalions, and brigades, which, in turn, make units more effective in combat."

Sitting in a middle position, when it comes to size and design choices, the Australian Army is an interesting organization to assess as well. Just like the U.S. and Netherlands armies, the Australian army has transformed from a divisional into a brigade-centric organization structure. However, in contrast to the other two armies, the Australian army has abandoned its structure of specialized brigades. Instead, multi-functional brigades have been formed that possess heavy as well as medium and light combat elements (Wainwright, 2004). The aim is to cover the entire spectrum of operations with a single type of brigade. However, although it is bigger in size than the Netherlands Army, the Australian Army encounters the same sustainability dilemma as the Netherlands Army; namely, the deployment of an entire brigade asks too much of the organization as a whole. To avoid the imbalance between the permanent and deployment structures – which the Netherlands Army has taken for granted – the Australians are now considering the possibility, based on past experience, of creating basic expeditionary task force structures within the brigade itself that possess the most likely combination of functional elements needed. With these "standardized" task forces, the

Australian Army aims to develop a new, smaller, unit of action at the battalion level that can be deployed integrally for the majority of its tasks (Hutcheson, 2003; Ryan, 2003). Moreover, the Australians believe that for very specialized or unique missions this basic structure can always be further customized with additional functionalities.

On the whole, one could say that the Australian deployment approach scores especially well on strategic and operational responsiveness. With respect to strategic responsiveness, both the brigade-size and the battalion-size units have a strong multi-functional character, which supports military deployment on two different organizational levels along a broad spectrum of operations. Regarding operational responsiveness, the key point is that creating a balance between the permanent and the deployment structure leads to units of action that have a high level of system integration and unit cohesion. A downside of the Australian approach is that forming multi-functional units inherently means making compromises regarding the number of, and the rationing of resources between, combat, combat support, combat service support, and command elements. Structural responsiveness might suffer because the standardized units are not primarily equipped to cover the extremes of the military operational spectrum.

Implications for Theory and Practice

Organizations that regularly use temporary inter-team project structures may benefit from the findings and insights of our study. Some research already exists on modularity and the dynamics of recombining organizational units (Helfat & Eisenhardt, 2004; Karim, 2006). Yet, these contributions focus on the aggregate, business-unit level. Generally speaking, business units have overall responsibility for a single product-market combination. Because of their autonomous position, business units are spared from all sorts of task-related external interdependencies and, therefore, seem to comply with modularity's basic rules of near-decomposability and loose coupling. However, many organizations increasingly rely on project-based temporary organizations to react quickly to changes in the environment (Kenis, Janowicz-Panjaitan, & Cambré, 2009). These intra- and inter-organizational cooperation structures are usually formed within the business unit structure, directly addressing the competitive frontline. Our study empirically confirms Van Heck and Vervest's (2007) view that in the contemporary context of project-based organizing in networks, the trade-off between strategic and operational responsiveness strongly depends on the level of system granularity. Extracting organizational elements from a parent organization and connecting them to other network partners works better when a modular structure exists. Such a structure is more responsive because "plug-and-play" speed will increase. In addition, network coordination requirements decrease, which makes it easier to focus managers' attention on strategic responsiveness rather than being busy with internal adjustment problems.

CONCLUSION

Our study introduces the level of system decomposition as an important factor influencing organizational responsiveness. Based on recent crisis-response experiences of the Netherlands Army, fine-grained modularization can lead to various and numerous task interdependencies, resulting in extra coordination mechanisms to integrate the different parts of the organization into a coherent system. Such interdependencies could result in managers developing a predominantly internal focus. Having said this, previous studies point out that organizations cannot do without task interdependencies, because points of interdependency are where relevant information and knowledge flow across organizational boundaries (Cummings, 2004; Jansen, Van den Bosch, & Volberda; 2005; Todorova & Durisin, 2007; Tsai, 2002). So it seems that striving for completely autonomous organizational structures is also questionable. Although the U.S. and Australian armies potentially have improved organizational responsiveness by creating modular structures based on the principle of near-decomposability, both armies should be aware of the risk of designing units that may become too independent and isolated. After all, one of the key merits of the fine-grained mixing and matching strategy of the Netherlands Army is that it has boosted the organization's ability to obtain knowledge and keep learning.

Thus, regarding modularity theory, an intriguing question arises: what does the word "near" in near-decomposability actually mean? To answer this question requires researchers to determine the maximum number of task interdependencies an organization can accommodate. Moreover, it could well be that the optimal number of task interdependencies varies across different industries, sectors, and geographic regions. Sorting out the limits of near-decomposability will help managers and designers to develop organizations that are able to respond effectively to crisis situations.

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APPENDIX

Methodological Details

A first concern was the possibility of common method bias in that all variables were measured with the same questionnaire. Harman's one-factor test was conducted to investigate whether or not bias was present. The unrotated principal component factor analysis, principal component analysis with varimax rotation, and principal axis analysis with varimax rotation all revealed the presence of multiple factors. The first of those factors accounted for only 18 percent of the total variance. Thus, no general factor became apparent, which suggests that potential problems associated with common method bias did not negatively influence the reliability of the research findings (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Podsakoff & Organ, 1986).

Possible differences between early and late responders were also examined. For this purpose, each questionnaire was coded with the number of the week in which the questionnaire had been returned. An independent sample t-test showed no significant differences between groups one and five (for LC $t(435) = .944$, $p > .05$; for MO $t(435) = .843$, $p < .05$; for SF $t(435) = .673$, $p > .05$).

The sample was tested for representativeness by examining the distribution of the respondents over service and rank. There was a slight over-representation of Army respondents; therefore, an ANOVA was conducted to determine if significant differences occurred between these two categories on the model variables. This indeed proved to be the case. A post-hoc analysis (Hochberg) made clear that the Navy respondents scored significantly lower on modular organizing than the Air Force respondents. A second Hochberg analysis showed that colonels scored significantly higher than the majors and lieutenant colonels on all model variables. Based on these results, rank and service background were included as control variables.

Instrument and construct validation

Existing Likert-type scales were used to measure the variables organizational sensing (OS) and responsiveness (R). A new scale had to be developed to measure the variable modular organizing (MO) because no usable alternative was available (the measurement scales are presented below). Regarding the use of existing scales, a general point of concern was in how best to translate the individual scale items from a commercial context into a military crisis-response context. Some of these changes were relatively straightforward, such as substituting "team" for "unit." Other translations were more difficult. For example, the meaning of competitors, suppliers, and customers is clear in a business context. However, applying these terms in an international crisis-response setting that is politically driven would undoubtedly lead to problems of interpretation. To overcome such problems, experts with knowledge of both the business and military domains were consulted to help with the translation process. The resulting draft questionnaire was then discussed with a methodologist to get feedback on the nature of the questions and on wording issues. After revision, the draft questionnaire was pre-tested with a group of ten military experts from different services and officer ranks. Based on their comments about wording, layout, and length, the questionnaire was put in its final form.

To measure organizational sensing, Volberda's (1996) sensing scale was used. An exploratory factor analysis was conducted to validate the sensing construct within a military crisis-response context. Because the sample size exceeds 250, a combination of the Kaiser criterion and the scree plot was used to determine how many factors to extract from the factor analysis (Field, 2005). The analysis resulted in the extraction of a single factor for measuring organizational sensing. The variable received a satisfactory Cronbach's alpha score of 0.74.

The variable responsiveness was measured by merging Volberda's (1996) scales of operational, structural, and strategic flexibility into one scale. After running a factor analysis, again using the Kaiser criterion in combination with the scree plot, a single factor was extracted. This scale received a Cronbach's alpha score of 0.70. Despite the fact that this result is sufficient from a statistical point of view, it is considerably lower than the alpha of

Volberda's (1996) original scale. Translating the original scale items into a military crisis-response setting probably caused this deviation.

To measure modular organizing, a new scale was developed building on the earlier research of Sanchez and Mahoney (1996) and Worren, Moore, and Cardona (2002). In short, the main assumption of both studies was that a modular organization is built upon an architectural system capable of recombining organizational elements into tailor-made configurations. In order to make this architectural system work, organizations need organizational and technological interoperability. Organizational interoperability means that by using standardized interfaces such as standardized rules, procedures, and programs, a "plug-and-play" situation is created in which organizational modules can be put together, removed, replaced, and reconnected fairly easily. This same modular principle applies to the organization's technological resource base. To reach the desired plug-and-play end state, it is equally important for an organization to have compatible technological means. Moreover, looking at the human aspects, a modular organization needs people with a broad operational knowledge base and a cooperative mindset to enable it to function properly within different operational contexts and in varying organizational constellations.

A scale of 14 items, covering these various areas, was developed to measure modular organizing. Analyzing the scree plot resulted in the extraction of a single factor. Four items had factor loadings below 0.40. For theoretical reasons, however, they were retained. Specifically, items 8 and 9 had factor loadings of .31 and .35 respectively, but because they address the important aspect of organizational connectivity they had to remain part of the scale. Furthermore, items 1 (a loading of .36) and 3 (a loading of .37) were not dropped as they focus on the key issue of mixing and matching units into tailor-made organizational formations. Altogether, the modular organizing scale received a Cronbach's alpha score of 0.70.

Measurement scales

	Modular Organizing (MO)	
1	To execute crisis response operations the Netherlands armed forces merge units, parts of units, and individuals into tailor-made formations.	
2	The composition of Dutch crisis response formations depends primarily upon the task that has to be executed.	
3	Dutch crisis response formations mostly participate in larger multinational task forces.	
4	During crisis response operations the composition of a Dutch formation can be altered if the operational circumstances require this.	
5	During crisis response operations standardized work processes, such as doctrines, SOPs, and drills make it possible to cooperate with units from other services and countries.	
6	During crisis response operations our Dutch tailor-made formations rely on structured systems for planning and command & control.	
7	During crisis response operations the division of work within our Dutch tailor-made formations is defined in detailed descriptions of jobs and tasks.	$\alpha = .70$
8	During crisis response operations everything in our Dutch tailor-made formations has been laid down in rules.	
9	During crisis response operations consulting takes place between different organizational levels within the Netherlands armed forces.	
10	Dutch servicemen and women master multiple tasks, SOPs, drills, skills, and techniques.	
11	Dutch servicemen and women are up to date regarding technology and necessary know-how.	
12	Dutch technological assets can be used for different types of missions and tasks.	
13	The technological assets of the Netherlands armed forces are to a large extent compatible.	
14	Dutch technological assets are to a large extent compatible with the equipment of partnering countries.	

	Organizational Sensing (OS)	
1	The Netherlands armed forces regularly analyze how partnering countries conduct crisis response operations.	α = .74
2	Armed forces from partnering countries have no major secrets for the Netherlands armed forces regarding their organizational strengths and weaknesses.	
3	The Netherlands armed forces systematically keep track of technological developments that could influence operational tasks and performance.	
4	The lessons learned during actual deployment are systematically being registered within the Netherlands armed forces.	
5	The lessons learned during actual deployment are systematically being internalized by the Netherlands armed forces.	
6	The Netherlands armed forces belong to the trend-setters in the international military sector.	

	Responsiveness (R)	
1	During crisis response operations our units can easily divide essential operational activities amongst each other.	α = .70
2	During crisis response operations our units can easily leave certain essential operational activities to units from other countries.	
3	During crisis response operations our units can easily adjust to changing operational circumstances.	
4	During crisis response operations our tailor-made formations possess a certain amount of slack that can be used to handle fluctuating operational demands.	
5	Whatever Service our units belong to, they cooperate easily with one another during crisis response operations.	
6	During crisis response operations our units cooperate easily with units from other countries.	
7	Our organization has the capacity to easily shift functions and tasks in case a crisis response operation requires this.	
8	Our servicemen and women can easily take on alternative roles and tasks in case a crisis response operation requires this.	
9	From its permanent structure our organization is capable of repeatedly adjusting to changing mission contexts.	
10	If needed our organization can add new types of missions to its existing operational product portfolio.	
11	Our organization regularly implements new technologies.	
12	Our organization is proactive in seeking a fit between what it can offer and what our politicians are expecting.	
13	Our organization tries to secure its added value by being capable of dealing with all kinds of crisis situations	

Summary statistics and correlations

	N	Mean	S.D.	Min.	Max.	(1)	(2)	(3)
Modular Organizing	1,208	3.51	.36	1.86	4.64	---		
Organizational Sensing	1,208	3.08	.59	1.00	5.00	.47**	---	
Responsiveness	1,208	3.43	.38	1.62	4.54	.46**	.46**	---

** Significant at the 0.01 level (2-tailed)

THE DESIGN OF EQUITY OWNERSHIP STRUCTURE IN INTER-FIRM RELATIONSHIPS

DO MANAGERS CHOOSE ACCORDING TO THEORY?

PRASHANT KALE • PHANISH PURANAM

Abstract: Theories explaining the equity ownership structure of inter-firm relationships, such as the resource-based view or transaction cost economics, commonly assume a significant role for managerial choice, but this assumption is rarely assessed for its realism. In this study, we use the policy capture methodology to directly assess whether managers choose according to theory (and which theory). In a sample of 66 experienced managers, we find that managerial choices of equity ownership are indeed influenced both by competitive advantage and transaction hazards, though to a greater extent by competitive advantage. Further, only competitive advantage influences managers' choices about the extent of equity ownership in their partner; transaction hazards motivate the choice of some equity over none. We discuss implications for how inter-firm relationships are and ought to be designed.

Keywords: Equity structure; inter-firm relations; inter-organizational design

In this study, we investigate how managers choose a key design feature of the structure of inter-firm relationships – the extent to which one party has equity ownership in another. This is a fundamental design variable in inter-firm relationships that determines the extent to which one party has the authority to build organizational linkages to, or even modify the internal organization of, the other party (Gulati, Lawrence, & Puranam, 2005; Kale & Puranam, 2004). For example, in the relationship between two firms A and B, if A acquires B, this gives Firm A a large set of design and decision rights. A minority equity stake held by A may give it board membership and observation rights to B's inner workings. No equity stake leaves partners to their abilities to work collaboratively within a purely contractual framework.

The various theories that have been used to understand the factors that impact ownership choices in inter-firm relationships can be broadly classified into those that focus on resource attributes and those that focus on exchange attributes (Poppo & Zenger, 1998; Schilling & Steensma, 2002). These theories include the resource-based view (RBV), transaction cost economics (TCE), real options, knowledge-based view, and property rights. While each theory emphasizes an important determinant of the equity arrangement, we focus on the RBV (Penrose, 1959; Wernerfelt, 1994) and TCE (Williamson, 1985) theories for three reasons. First, these two theories appear to dominate thinking regarding firms' equity ownership choices in inter-firm relationships (Hagedoorn & Duysters, 2002; Madhok, 1996; Sampson, 2005; Schilling & Steensma, 2002; Steensma & Corley, 2000, 2001). Second, the two theories also emphasize somewhat different aspects in explaining equity ownership choices: TCE mainly focuses on the anticipation and control of partner opportunism in exchange relationships (Williamson, 1985) whereas the RBV emphasizes the benefits of undisputed access to resources that provide a basis for competitive advantage (Conner & Prahalad, 1996;

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Madhok & Tallman, 1998). Third, by restricting ourselves to these two theories, we maintain some parsimony in examining the relative and interdependent impact of the criteria identified by these theories on equity ownership choices.

Despite the extensive empirical literature that has developed around equity in inter-firm relationships, we know little about whether managers make this design decision as the RBV and TCE theories would predict. In order to observe how managers choose equity ownership levels in inter-firm relationships, we use a field-experimental technique known as "policy capture" (Aiman-Smith, Scullen, & Barr, 2002; Karren & Barringer, 2002; Pablo, 1994; Tyler & Steensma, 1995) to determine whether theoretical criteria representing RBV and TCE influence managers' equity ownership decisions in inter-firm relationships.

THE (UNTESTED) ROLE OF MANAGERIAL CHOICE IN RBV AND TCE THEORIES

The assumption that managers select an appropriate form of economic organization in order to optimize the net benefits of ownership is common to both resource-based and transaction cost theorizing. For instance, note the assumption of far-sighted contracting in response to hold-up concerns in transaction cost economics (Williamson, 1991a) and the quest for sustainable advantage in response to resource attributes in resource-based theories (Conner & Prahalad, 1996). As Schilling and Steensma (2002: 399) point out, both these perspectives on ownership and firm boundaries "... are based on the premise that these decisions are made (by managers) in attempts to optimize their firm's performance." Yet the nature of most studies of governance choice and performance does not allow a test of the premise that managers are indeed taking into account the criteria of TCE and RBV theories in making their governance choices.

There are at least two reasons why managerial choice criteria are still unclear in decisions about equity ownership (Kale & Puranam, 2006). First, the need for relationship-specific investments in inter-firm relationships can signal to managers not only the hazards of hold-up (as proposed by TCE) but also an opportunity to create a unique source of competitive advantage through partnership (Dyer & Singh, 1998; Zajac & Olsen, 1993) or through close coordination between partners (Monteverde, 1995), both of which are non-TCE-based reasons for seeking equity ownership. In principle, we can account for such alternative theoretical explanations by simultaneously including different variables that represent them in the empirical analysis, as some studies have tried to do (Gulati & Singh, 1998; Poppo & Zenger, 1998; Schilling & Steensma, 2002), but there are challenges in this regard. Scholars find it difficult to obtain extensive field data on these alternative drivers of governance choices, and even when such data are available they do not produce sufficiently orthogonal measures of competing constructs (Cook & Campbell, 1979). Hence, observing a positive relationship between exchange-specific assets and ownership is not sufficient to decide which of these interpretations (TCE or RBV) characterizes managers' decision making regarding ownership in studies that do not (or cannot) adequately control for such alternative explanations.

Second, there is another set of empirical tests of transaction cost economics that find a positive relationship between the "appropriate" ownership choice (from a transaction cost minimization perspective) and performance. However, as Williamson (1985) himself notes, managers might choose a particular ownership structure based on a variety of reasons unconnected with the theory, yet only those ownership decisions that are "appropriate" given the level of relationship-specific investments required will perform well (and hence be observed). Thus, even if managers make governance choices in their exchange relationships which are completely blind to the possibility of opportunism, such relationships will perform poorly relative to competition and may not survive, leading to an observed positive relationship between opportunism concern and ownership (Williamson, 1985). More generally, it is well known that for any efficiency-based theory of ownership, managers need not act in consonance with the relevant theory (or even be aware of it) for it to be valid as a theory of optimal decision making (Milgrom & Roberts, 1992). Empirical evidence of a positive association between the prescribed choice and performance certainly suggests that the theory describes optimal behavior in a strong competitive selection environment.

But based on that evidence, we cannot infer that managers taking those higher performing decisions were actually aware of, or acting in conformance with, the theory.

For these reasons, extant studies that link exchange or resource characteristics to observed ownership structures in inter-firm relationships (whether conducted using primary or secondary data) shed limited light on what factors managers actually take into account while making their ownership choice. Hence, in this study we use the policy capture technique which has been effectively used by previous management scholars to study how hypothesized theoretical factors feature in managerial decision making in situations such as evaluating acquisition candidates (Hitt & Tyler, 1991), assessing alliance opportunities (Tyler & Steensma, 1995), and managing post-acquisition integration (Pablo, 1994).

The policy capture methodology offers advantages over extant field studies based on archival or survey data: (a) in this technique we can simultaneously include criteria that represent each of the different theoretical factors that potentially influence equity ownership choices in inter-firm relationships, (b) we can experimentally manipulate the criteria representing these alternative explanations by making them as orthogonal as possible; and (c) we can then observe whether these criteria/factors have an influence on managers' ownership choices (rather than rely on observing the ownership structures or choices ex-post, which could have resulted from competitive selection forces).

THEORY AND HYPOTHESES

In this section, we present hypotheses to describe how managers might make decisions about equity ownership choices if they were to behave according to the assumptions of the RBV and TCE theories, respectively. Our goal here is not to offer new theoretical insights into how resource or exchange factors *ought* to influence managers' decisions but rather to provide the theoretical rationale underlying each hypothesis and then test it to determine whether managerial decision making does conform to existing theory.

Resource-Based View and Equity Ownership

According to the resource-based view, a firm enjoys competitive advantage over its rivals if it possesses resources that are *valuable* (i.e., they enable a firm to improve its efficiency or effectiveness), generate *unique* value in conjunction with other existing resources (i.e., they generate value in excess of their shadow prices), and are *difficult for other firms to imitate* (Barney, 1991). While the concept of competitive advantage was initially used to explain inter-firm profitability differences, scholars have since extended it to explain ownership and firm boundaries as well (Conner, 1991; Conner & Prahalad, 1996). A key assumption in such arguments is that the generation of competitive advantage is a primary motivation for choosing ownership in inter-firm relationships (Schilling & Steensma, 2002; Steensma & Corley, 2000, 2001; Steensma & Fairbank, 1999).

By obtaining ownership of an exchange partner that provides valuable resources, a firm gains the rights of use to those resources. Ownership also enables a firm to plausibly exclude rivals from gaining easy access to that resource, as well as gives the firm decision rights over future development of that resource in ways that might make it difficult for rivals to imitate. Ownership also gives a firm greater authority to manage those resources through administrative oversight (Gulati & Singh, 1998; Sampson, 2007). This enables better sharing and coordination of resources and know-how (Gulati, Lawrence, & Puranam, 2005) as well as the generation of unique value by exploiting synergies or interdependencies that might exist between them (Conner & Prahalad, 1996). Hence, RBV-based reasoning suggests that the importance of ownership is greater when the resources in question are valuable in terms of enhancing the focal firm's competitive position in the various ways described above. Thus, if the assumptions about managerial choice embodied in the resource-based view of economic organization are realistic and managers make decisions according to the logic of the RBV perspective, then we would expect that:

Hypothesis 1. Decision makers are more likely to seek equity ownership in their partner when the partner firm's resources can enhance the competitive position of their own

firm.

Transaction Cost Economics and Equity Ownership

TCE theorists assume that opportunism coupled with limited rationality (and therefore contractual incompleteness) is the primary source of transaction hazards in inter-firm relationships. These hazards are particularly salient when exchange partners need to invest in relationship-specific assets to derive expected benefits from the exchange, and when there is high uncertainty about future demand conditions surrounding the exchange (Williamson, 1985, 1991a). Investment in relationship-specific assets refers to "creation of assets by a firm that are specialized in conjunction with the assets of its partner" (Dyer & Singh, 1998), and it includes several types of asset specificity such as site specificity, physical asset specificity, or human asset specificity (Williamson, 1985). These investments are specialized to the particular relationship and have little or no value outside it. If one of the parties has to invest in such assets, the other party might "hold-up" the partner and force a contract renegotiation along terms favorable to itself. Similarly, TCE also predicts that uncertainty about market conditions suggests the need for future adaptation between partners, which is likely to be costly due to opportunistic bargaining (Williamson, 1985).

Williamson (1985), building on Coase (1998), suggests that exchanges with high transaction hazards are better organized within a firm than across firms because hierarchy enables firms to alleviate or control the transaction hazards or costs linked to some of the factors mentioned above. A stream of literature has built on this basic idea to explain when or why firms might seek ownership in their exchange partners. Ownership in or of the partner provides a firm the necessary hierarchical control to monitor opportunistic behavior and mitigate transactional hazards that might arise (Gulati & Singh, 1998). This is not only true for full ownership but also partial ownership in the partner firm – this is because even with partial ownership a firm is able to secure hierarchical oversight in terms of securing positions on the Board of Directors and/or voting rights commensurate with its proportion of ownership. Equity ownership also alleviates the hazards of opportunistic behavior by aligning incentives through the creation of mutual hostages (Ahmadjian & Oxley, 2006; Kogut, 1988; Williamson, 1985). Adaptation between exchange partners, which might become necessary in the face of future demand uncertainty, is also more easily managed through ownership than in pure arm's-length contractual exchange (Williamson, 1991b). This is because hierarchy facilitates superior cooperation (that might be required for better adaptation) through monitoring, sanctions, or collaborative incentives (Williamson, 1991b). If the assumption of managerial choice embodied in the TCE perspective on economic organization is realistic and managers make decisions according to the logic of the TCE perspective, then we would expect that:

> *Hypothesis* 2a: Decision makers are more likely to seek equity ownership in their partner when there is a need for relationship-specific investments to benefit from exchange with the partner firm.

> *Hypothesis* 2b: Decision makers are more likely to seek equity ownership in their partner when there is uncertainty about demand conditions relevant to the exchange relationship.

In addition to emphasizing the direct impact of relationship-specific investments and demand uncertainty on firms' decisions to secure ownership, some TCE scholars have also tested the hypothesis that the effect of demand uncertainty on ownership is contingent upon the level of asset specificity involved – namely, if asset specificity is low, lower levels of ownership are preferred, whatever the degree of uncertainty. Therefore, we also test the implications of this formulation in our empirical analyses.

METHOD

The setting of our study focuses on decisions regarding equity ownership in inter-firm technology sourcing relationships. These are a firm's relationships meant to source

technological know-how as embodied in its partner's products, services, or capabilities (Steensma & Corley, 2000, 2001). Sourcing relationships could range from pure contractual relationships (i.e., they do not involve any equity ownership) to acquisitions, and they include relationships with various intermediate levels of equity ownership. Beyond their widespread occurrence, technology sourcing relationships are also a useful empirical setting for a theoretical reason. Scholars have traditionally studied the costs and benefits of ownership vis-à-vis contracts to support exchange by analyzing firms' internal production vs. external procurement decision (make-or-buy). However, inferences about the exchange efficacy of ownership vs. contracts drawn from the make-or-buy decision can be potentially confounded by differences in internal and external production capabilities (Jacobides & Winter, 2005). Put simply, firms may decide to "make" instead of "buy" not because of contractual hazards associated with buying but because they are more capable of making than any potential supplier (Kogut & Zander, 1992). Explicitly accounting for capability differences is one approach to isolating the relative strengths of ownership and contracts for supporting exchange. But an alternative is to focus on conditions under which firms seek ownership instead of relying only on contracts to support procurement of an input/resource they cannot make. Technology sourcing relationships provide such an alternative because in such settings firms have already made the choice of "buying" (i.e., sourcing technology from an external player) over "making" (i.e., developing the technology internally). Firms then need to decide whether they should use equity or contracts to govern the relationship with a partner from whom they are "buying." Thus, our analysis of the choice of ownership in technology sourcing relationships complements the work of Tyler and Steensma (1995) who have used the policy capture approach to analyze the choice between internal and external technological development.

Sample

We used the policy capture technique to collect our data. Details concerning the construction of the policy capture instrument can be found in the Appendix. In selecting our sample, we tried to strike a balance between validity, convenience, and generalizability. First, we decided to collect respondent data from firms that were in industries where technology-sourcing relationships are an important part of firms' strategies. Such industries include automotive, chemicals, pharmaceuticals, computer hardware and software, communications, engineering, and defense. Second, we administered the instrument to managers who were directly responsible for their companies' strategic partnerships. This enabled us to enhance the external validity of our study by matching respondents' experience and familiarity with the experimental task to that of a group of managers to which the study's results will be generalized (Aiman-Smith et al., 2002). Since it would be difficult to identify such managers from external, archival sources, we created the sampling frame from industry practitioners who had enrolled in an executive education program on alliances and acquisitions at a major U.S. business school. The respondents in our sample were able to give significant time and attention to completing the instrument as they were required to submit it as part of the pre-program preparation (collecting the data before the program also ensured that their responses to the instrument were not in any way biased by what they learned in the program).

Table 1. Number of Respondents by Position and Function

	Alliance Management	Business Development	Strategy and Planning	Corporate Development	Other	Total
President, CEO	0	0	0	0	3	3
Vice President	6	3	3	1	1	14
Director	22	13	4	1	1	41
Manager or Senior Manager	2	1	4	0	1	8
Total	30	17	11	2	6	66

We sent 120 questionnaires to the program participants and received complete responses

from 66 (a response rate of 55 percent). Table 1 summarizes the respondents' functions and positions. The average revenue of their firms was $7.2 billion in the year 2001. Respondents' average tenure in their company was 11.67 years, ranging from five to 20 years. There was no significant difference in annual sales or industry type between the companies of respondents and non-respondents. While this sampling frame provides us some convenience in collecting the data, the fact that the respondents come from different industries where inter-firm relationships are important, and represent various functions and levels of seniority within their companies, reduces some concerns about the lack of generalizability of our findings.

Dependent Variable: Equity Ownership

The dependent variable is a categorical measure representing four different levels of equity ownership that the respondent chose from in each of thirty scenarios. The variable is coded such that "0 = contractual relationship with zero equity ownership," "1= minority equity ownership" (<= 25 percent equity stake), "2 = non-majority equity ownership" (<= 50 percent equity stake), and "3 = majority equity ownership/acquisition" (> 50 percent equity).

Independent Variables

To capture the extent to which a partner firm's resources were perceived to be valuable in generating competitive advantage for the focal firm, we used the item "Extent to which the technological resource is significant to our business and competitive position." Our fieldwork suggested that managers intuitively view the potential of resources to generate competitive advantage in terms of their significance to the business. Tyler and Steensma (1995) also used a similarly worded item in their study. To measure the TCE factor of asset specificity, we used the item "Extent of investments required by both parties to fully benefit from the partnership (e.g., investments in R&D, production, marketing) that are specific to the technology being accessed from the partner and cannot be used for other purposes" (Poppo & Zenger, 1998). Finally, we used the item "Extent to which we understand and can assess the market potential for the technology being accessed" to convey perceived uncertainty about the demand for goods and services generated by the partner's technological resources (Schilling & Steensma, 2002; Steensma & Corley, 2001). Since low values indicated uncertainty, we reverse-coded this item in the analysis.

Control Variables

Since experimental manipulation is part of the policy capture technique (i.e., information on various independent variables is randomly assigned), in principle there should be no unobserved variables that systematically correlate with the independent and dependent variables and hence lead to spurious relationships between them. It is possible, however, that despite our best efforts the wording of our items may convey meaning other than what we intended. Hence, to minimize chances that the information we provide through our independent variables is confounded with a closely related construct, we explicitly included items in the instrument to reflect other such constructs: technological uncertainty, coordination costs, value of the resource to rivals, and costs of restructuring.

The real options perspective suggests that when there is significant uncertainty about the value of a partner's resources, then taking equity ownership in the partner may prematurely increase the opportunity cost of commitment for the focal firm (Folta, 1998). In order to distinguish it from demand uncertainty, we included information on technological uncertainty via the item "Extent to which we understand, and can assess, the relative benefits and viability of the technology being accessed." As with demand uncertainty, we reverse-coded this item. Some scholars argue that ownership is a means to control not only transaction costs linked to opportunism but also the costs of coordinating interdependent activities between partners (Ghoshal & Moran, 1996; Kogut & Zander, 1992). Efforts to facilitate inter-firm coordination produce coordination costs (Gulati & Singh, 1998; Thompson, 1967). To distinguish the effects of coordination costs from transaction costs, we provided information on coordination costs arising from interdependence between partners. We did this through the item "Extent of resources we need to commit to manage the coordination and interaction between our

company and the technology-providing company to exploit or leverage the technology being accessed" (Gulati & Singh, 1998). It has been suggested that anticipated restructuring costs inhibit complete equity ownership (i.e., acquisition) and create a preference for alliances or joint ventures with potential partners. Hence we controlled for restructuring costs that may arise after complete acquisition by using the item "Extent of restructuring required to divest unwanted resources and capabilities from the partner in case of acquisition" (Hennart & Reddy, 2000). We used a fourth item, "Extent to which our competitors are likely to gain benefit from or be interested in this technology," to provide information on the value of the partner firm's resources to rivals. The value that rivals ascribe to the technology being sought may enhance its perceived value in the minds of decision makers. Finally, since industry membership and respondents' experience and tenure within their organizations have had strong effects in prior policy capture exercises (e.g., Tyler & Steensma, 1995), we controlled for these variables in our study.

RESULTS

We checked the reliability and consistency of the responses following the approach recommended by prior policy capture studies (Hitt & Middlemist, 1979; Tyler & Steensma, 1995). We estimated an OLS regression model for each respondent based on his or her response to the 30 scenarios. In previous research, managers who failed to generate a model explaining at least 40 percent of the variation in their decision making ($R^2 < 0.40$) were viewed as giving inconsistent managerial ratings, and their observations were dropped from the estimation sample (Tyler & Steensma, 1995). In our study, we did not drop any observations since all respondents met this criterion, exhibiting satisfactory consistency and reliability. Table 2 shows the correlations and descriptive statistics for all variables. None of the independent variables correlated significantly with each other ($p < 0.01$), which was expected given random assignment of values to them. Most explanatory variables were significantly correlated with equity ownership choice in the full sample. Since the dependent variable has multiple categories to reflect various levels of equity ownership, we used a multinomial logistic regression model to test the hypotheses. Since the observations might be correlated within respondents, we adjusted the standard errors for non-independence (Wooldridge, 2003).

Table 2. Correlation Matrix and Descriptive Statistics

		1	2	3	4	5	6	7	Mean	S.D.
1	Equity Ownership Level	1.00							2.35	0.44
2	Coordination Costs	0.32*	1.00						2.73	1.41
3	Demand Uncertainty (Reverse scaled)	-0.13*	0.017	1.00					2.7	1.37
4	Relationship-Specific Investments	0.04	0.19	0.17	1.00				2.53	1.28
5	Technological Uncertainty (Reverse scaled)	-0.37*	0.39*	-0.02	-0.09	1.00			2.57	1.23
6	Significance to Competitive Position	0.48*	0.23	-0.07	-0.15	0.040	1.00		2.9	1.27
7	Value of Resource to Rivals	0.34*	0.12	-0.23	-0.09	0.05	0.33*	1.00	2.7	1.53
8	Restructuring Costs	-0.02	0.17	0.07	0.04	0.23	-0.11	-0.15	3.4	1.52

*Significant in the full sample at $p < 0.01$

Results for the Independent and Dependent Variables

Table 3 provides the results of our analysis. The baseline category is "non-equity relationship," and each column presents the effect of the variables on the odds of choosing higher equity structures relative to the baseline category. The overall model is significant (LR $\chi^2 = 1089.89$ dF=40, $p<0.01$). Further, the coefficients for significance of a resource to competitive position

(χ^2 = 76.50, p<0.01, dF=3), relationship-specific investments (χ^2 = 13.36, p<0.05, dF=3), and demand uncertainty (χ^2 = 58.26, p<0.01, dF=3) are each significantly different from zero across the model. The results indicate that the value of the technological resource in terms of enhancing the focal firm's competitive position significantly influences managers to choose equity ownership over non-equity ownership in their partners, thus supporting Hypothesis 1. The results for the TCE factors, however, are mixed. The effect of relationship-specific investments on ownership is as expected, supporting Hypothesis 2a. In contrast, although uncertainty about demand conditions features significantly in decision makers' models, its impact is opposite to that predicted by theory: the greater the market uncertainty, the less likely decision makers will seek ownership in their exchange partner, which is contrary to Hypothesis 2b. To assess the relative explanatory power of these factors, we also estimated the model LR χ^2 and pseudo-R^2 for different specifications that included each relevant theoretical factor one at a time (see Table 4). The addition of the variable "significance to competitive position" to the model generates the largest increase in model LR χ^2 and pseudo-R^2 indicating that it has more explanatory power in explaining managers' choice of equity ownership than the TCE factors.

Table 3. Choice Between Non-equity Partnerships and Different Levels of Equity Ownership in Partner Firm (Multinomial Logistic Regression)

	Minority Equity vs. Non-equity	**Non-majority Equity vs. Non-equity**	**Majority Equity vs. Non-equity**
Significance to Competitive Position	0.52***	0.85***	1.08***
	0.08	0.10	0.13
Demand Uncertainty	-0.24***	-0.36***	-0.59***
	0.06	0.08	0.08
Relationship-Specific Investments	0.14*	0.30***	0.26**
	0.08	0.09	0.11
Technical Uncertainty	-0.10	-0.32***	-0.70***
	0.06	0.08	0.09
Restructuring Costs	-0.05	-0.14**	0.18**
	0.05	0.06	0.07
Value of Resource to Rivals	0.30***	0.63***	0.75***
	0.05	0.07	0.09
Anticipated Coordination Costs	0.12*	0.31***	0.29***
	0.06	0.06	0.07
Tenure in Company	0.03	0.10***	0.14***
	0.02	0.03	0.04
Industry	Included ***	Included ***	Included ***
DF	40	40	40
N	1980	1980	1980
LR Chi-square	1089.89 ***	1089.89 ***	1089.89 ***

Arguments about the determinants of ownership often implicitly assume that increasing degrees of resource value or transactional hazards proportionately lead to increasing levels of equity ownership, that is, there is a strictly monotonic relationship between the antecedents of ownership and levels of ownership (Gulati & Singh, 1998; Hagedoorn & Duysters, 2002; Steensma & Corley, 2000). Therefore, we conducted additional analyses to assess whether the impact of RBV and TCE factors on equity ownership choice was strictly monotonic. We assessed whether the coefficients for the RBV and TCE factors in Table 3 are significantly different, and increasing, across models for increasing ownership levels. We found this was true for the "significance of resource to competitive position" and "demand uncertainty" variables (χ^2 = 23.08 and 11.38, p < 0.01, dF=1 for resource significance, and χ^2 = 4.76 and 16.03, p < 0.05 and p < 0.01, dF=1 for market uncertainty). But coefficients for relationship-

specific investments were statistically identical for non-majority and majority ownership. This suggests that the effect of this criterion is not strictly monotonic – higher levels of the "need for relationship-specific investment" do not encourage managers to seek higher levels of equity ownership.

Table 4. Improvements in Model Fit and Explanatory Power

	Models with Control Variables Only	**Models with Control Variables and..**	**Models with Control Variables and..**	**Models with Control Variables and..**	**Models with Control Variables and..**
Significance to Competitive Position		Included			
Relationship-Specific Investments				Included	Included
Demand Uncertainty			Included		Included
LR Chi-square	794.42	991.47	863.99	810.98	872.58
DF	33	36	36	36	39
(Pseudo) R^2	0.15	0.18	0.16	0.15	0.16

We also tested the alternate specification wherein the impact of demand uncertainty on ownership is moderated by relationship-specific investments, as suggested by some TCE scholars. The coefficient of the interaction term as well as the interaction effect (Ai & Norton, 2003) were not different from zero. This indicates no evidence of an interaction effect, suggesting that at least from a managerial choice standpoint, demand uncertainty has a main effect on ownership choices rather than its effect being conditional on the level of relationship-specific investments as suggested by TCE theory.

Results for the Control Variables

We found that higher technical uncertainty lowered the likelihood of seeking ownership while higher coordination costs enhanced it. These results are consistent with prior research that emphasizes the real options perspective (Folta, 1998) or the coordination or knowledge perspective (Gulati & Singh, 1998) on ownership, respectively. We also found that industry effects were significant, suggesting that ownership choices in inter-firm relationships vary systematically across industries. To explore this further, we estimated the main effects model for each industry separately and compared effects across models for different industries. "Significance of the resource to competitive position" had robust and consistent effects on ownership for respondents from all industries. However, the effect of relationship-specific investment on ownership varied in terms of its importance across different industries. Respondents from the pharmaceutical industry (270 observations from nine respondents) and the engineering industry (510 observations from 17 respondents) placed greater importance on this factor than those from other industries. In various industry-specific models, demand uncertainty again impacted ownership opposite to that predicted by TCE theory, but these effects were relatively weak for respondents from the chemical (120 observations from four respondents) and engineering industry (510 observations from 17 respondents). Overall, while significance of resource to competitive position influences ownership decisions similarly across industries, there is inter-industry variation in the impact of transactional hazards on ownership decisions.

We also observed that respondents with greater experience are more likely to choose higher levels of ownership in their partner than those with lesser experience, all other factors being equal. This might be indicative of either greater responsibility assigned to them or greater confidence on their part about using equity ownership to organize inter-firm relationships. We also estimated our models including interaction terms between respondents' experience and the main RBV and TCE factors, and we found that the interaction term between experience and significance of resource to competitive position (an RBV factor) was significant, while those between experience and demand uncertainty and relationship-specific investments (the two TCE factors) were not. Further, the lack of any interaction between experience and the

TCE factors implies that, in our study, more experience does not reflect greater risk aversion or greater emphasis on transactional hazards.

DISCUSSION AND IMPLICATIONS

Our results support three main conclusions: (1) managerial choice is a significant factor in both RBV and TCE theory as regards equity ownership structure; (2) choice plays a more important role in theories of resource value than in theories of transactional hazard; and (3) choice may be invoked to explain *degrees* of ownership in theories drawing on resource value but not in theories emphasizing transaction hazards. We discuss the implications of our study for both research and practice by comparing our findings with those from other studies that have investigated the same (or similar variables) as antecedents of equity ownership in technology-sourcing relationships.

First, RBV proposes that equity ownership in inter-firm relationships is motivated by competitive advantage considerations, and previous field studies have observed either positive effects (Steensma & Corley, 2001) or no effects (Schilling & Steensma, 2002) for competitive advantage. In our study, we see that managerial choices of equity ownership are strongly influenced by the significance of the partner's resources to the focal firm's competitive position as well as by their value to rivals. Our results may be stronger because (a) we have been able to isolate the influence of resource attributes on managerial choices more precisely (through orthogonal manipulation) than might be possible in field studies and (b) we observe managerial choices directly. We thus conclude, in contrast to Schilling and Steensma (2002), that resource attributes not only influence managerial choices of partner firms (i.e., which firm to partner with) but also the ownership structure of such relationships.

Second, as predicted by TCE, we find that the need for relationship-specific investments increases the likelihood of managers choosing greater levels of equity ownership. This is consistent not only with the results of earlier studies which examined the threat of opportunism as an antecedent of ownership in inter-firm relationships but also with the voluminous TCE literature on vertical integration and firm boundaries (David & Han, 2004). In addition, however, our study suggests that TCE theorists need not rely on selection forces alone to justify their arguments about the effects of asset specificity on ownership choices; they can invoke managerial choice as well. Further, our results suggest that analyses of the effect of exchange attributes (e.g., transactional hazards due to relationship-specific investments) on the ownership structure of inter-firm relationships must account for resource attributes (e.g., resource significance) as well. Thus, both factors influence managerial choices of equity ownership.

Third, contrary to TCE predictions, we observe that demand uncertainty lowers managers' likelihood of seeking ownership in their partners, a result that is consistent with some prior empirical research (Schilling & Steensma, 2002; Sutcliffe & Zaheer, 1998). Our respondents did not seem to distinguish between the effects of market and technical uncertainty since both factors influenced them to seek lower levels of ownership, which is contrary to the predictions of TCE theory.

Fourth, we find that while both RBV and TCE attributes influence managerial choices of equity ownership in inter-firm relationships, in our sample the resource aspect has greater explanatory power than the transaction cost aspect. It appears that equity ownership choices in inter-firm relationships are motivated more by the achievement of competitive advantage due to valuable resources and less by the achievement of exchange efficiency through elimination of transaction hazards. We also find that unlike resource attributes, the effect of exchange attributes varies significantly across industries.

The above four points suggest that resource-based considerations have a greater impact than transaction cost considerations on managerial choice of equity ownership in inter-firm relationships. More importantly, some of the core factors in TCE theory, such as demand uncertainty, affect ownership choices in a direction opposite to that predicted by theory – that is, uncertainty appears to enhance managerial concerns and desires for flexibility rather than adaptive capacity (Williamson, 1991b). Thus, if managerial choice is to remain an important variable in TCE theory, scholars will need to reconsider the effects of demand uncertainty

on equity ownership. Alternately, TCE theory would need to include selection forces as the primary mechanism by which demand uncertainty leads to greater ownership. In that case, future theoretical and empirical work should include selection forces as a moderating variable in examining the relevance of this factor to ownership structure. Overall, our study findings call for the refinement of TCE theory in explaining the ownership structure of inter-firm relationships.

Our study's implications for practice are straightforward: Managers can improve their decision-making quality about equity ownership levels in inter-firm relationships by becoming aware of criteria that they may not currently feature in their decision calculus, or may feature only implicitly. For instance, we see that managerial choices seem to be systematically less influenced by transaction hazards and more by the attainment of competitive advantage. Since existing evidence shows that equity ownership choices that are responsive to transaction hazards enhance exchange performance (e.g., Poppo & Zenger, 1998), it follows that managers could improve the performance of their partnerships by taking such hazards into consideration when selecting equity ownership levels.

Limitations of the Study

Our study is based on the policy capture procedure which uses created scenarios and experimentally controls the number and wording of the decision criteria provided to managers. The scenarios are somewhat contrived, and the stakes are low for the respondents. Being an experimental technique, like all such methods it is open to questions about its face validity. But we believe that insights generated by this method in terms of assessing the validity of assumptions about managerial choice largely offset such concerns. We also note that while policy capture helps in understanding which theoretical criteria feature prominently in a manager's decision calculus about equity ownership, we still cannot assert that this calculus is identical to that proposed by theory. To do so, one would require qualitative data such as verbal protocols or extensive field interviews (Buckley & Chapman, 1997). Policy capture provides the advantages of statistical inference and greater objectivity but at the expense of richness. It enables a robust test of the first level of descriptive realism, that is, whether or not decision makers utilize theoretical criteria in their decision making.

We examined four categories of equity ownership (non-equity, minority equity, non-majority equity, and majority equity) with boundaries between categories at 25 percent intervals. In reality, the boundaries between these categories are often an artifact of legal and accounting norms, as may be the extent to which control and ownership costs increase with levels of equity. So to the extent that such norms vary across countries, one needs to consider our results with caution. In particular, in the interests of simplicity, we omitted 50-50 joint ventures since they have unique features associated with a finely balanced power distribution (Hennart, 1993; Parkhe, 1993). In the interests of parsimony, we considered just two salient theories, resource value (RBV) and transaction hazards (TCE), and even here we did not test all possible arguments. For example, we did not include transaction frequency, moral hazard, adverse selection, or the knowledge characteristics of technology nor did we parse relationship-specific investments into finer categories such as site and temporal asset specificity (Williamson, 1985). Future research into the impact of these factors on managerial choices of equity ownership clearly would be useful. Also, as noted earlier, theories other than RBV or TCE (such as real options, knowledge-based or coordination view of the firm, and property rights theory) have been used to explain ownership in inter-firm relationships. While we account and control for some of them (e.g., the real options and coordination perspective) in our study, failure to account for others means that our results need to be interpreted with caution, and future research would benefit by investigating and controlling for the direct or indirect effects of those other theoretical variables.

It is possible that our results apply more accurately to technology sourcing settings since the fast-paced nature of technological progress and competition might make competitive advantage inherently more salient in the minds of respondents than transaction hazard considerations. However, prior research has found effects for transaction hazards in this setting, and technology sourcing relationships have indeed been an important empirical

context for transaction cost theorists (e.g., Sampson, 2005). But we acknowledge that it would be useful to replicate this study in a more "placid" setting, where competitive advantage considerations are more closely balanced with transaction hazard issues. Also, in our study we assumed (as per RBV and TCE theories) that equity ownership is important to the focal firm, primarily because it has governance implications in terms of control. But in some settings ownership may have other drivers and governance implications that were not addressed here. For example, in China and India equity ownership choices are often driven by the need to meet governmental rules and norms, and hence may have less governance/control implications (Kale & Puranam, 2004). Finally, we note that the conclusions drawn in our study about the relative explanatory power of the RBV and TCE theories depend on the validity of variable measurement. In particular, the estimated effects of relationship-specific investment may understate the true effects because our measure implied the need for investment by both partners – which may have created mutual hostages and obviated the need for ownership. However, the fact that the effect of this variable seems to vary systematically by industry offers some confidence that the factor is not too conservative in suggesting the possibility of hold-up. Further, we did find significant effects for both resource-based and transaction-based considerations, though the explanatory power for the single resource-based factor was larger than both transaction attributes combined (see Table 4).

CONCLUSION

We used the policy capture methodology to directly assess whether managers make ownership choices in inter-firm relationships according to theory. This is important to assess because while theories explaining the equity ownership structure in inter-firm relationships, such as the resource-based view or transaction cost economics, commonly assume a significant role for managerial choice, these assumptions are seldom assessed for their realism. Our study shows that managerial choices of equity ownership are indeed influenced both by competitive advantage and transaction hazards, though to a greater extent by the former. Further, only competitive advantage influences managers' choices about the extent of equity ownership in their partner; transaction hazards only motivate the choice of some equity over none. These findings provide insights to researchers regarding the validity or refinement of their theories going forward. Managers can also find value in these findings in terms of improving their decision-making quality about equity ownership levels in inter-firm relationships and becoming aware of the criteria that they may not fully or explicitly feature in their decision calculus.

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APPENDIX

Constructing the Policy Capture Instrument

In the policy capture methodology, respondents are usually presented with a series of situations (scenarios) that are experimentally designed by manipulating levels of certain theoretically determined decision criteria. After reviewing the criteria in each scenario, respondents make a decision that best represents their judgment based on the information available (Aiman-Smith et al., 2002; Karren & Barringer, 2002). The manner in which respondents consider and weigh theoretically important decision criteria can be inferred by studying the derived statistical relationships between the dependent variable (i.e., the respondent's decision) and independent variables (various theoretical criteria that are hypothesized to influence the decision). Prior research has established the external validity of the policy capture technique (Hitt & Middlemist, 1979).

For our study, we developed a policy capture instrument with a hypothetical example of the respondent's company seeking a formal inter-firm relationship with another company ("Company B") to obtain technology and technological resources from that partner. Having decided to form a technology-sourcing relationship with Company B, the respondent's company now needs to decide the level of equity ownership it would like to take in that company based on the information provided on certain dimensions including those representing the theoretical factors of resource value or transaction hazards discussed in the article. Based on the hypothetical example, the instrument had 30 different partnering scenarios between the respondent's company and its potential technology partner. We created each partnering scenario by randomly assigning a different rating on a 1-5 scale where 1 = Very Low and 5 = Very High) for resource value, transaction hazards, and other theoretical dimensions. We provide one such scenario as an illustration below. Our approach to creating scenarios, by randomly assigning ratings on a numerical scale for each relevant theoretical factor, is similar to the one followed by prior studies (Hitt & Tyler, 1991, Steensma & Corley, 2001). Other policy capture studies have created scenarios, not by using a rating scale to manipulate each variable but by writing short descriptions of each situation in a story-like form wherein the levels of the relevant variables are varied qualitatively (e.g., Pablo, 1994). The advantage of our approach is that it avoids relying on the subjective interpretation of the respondents to maintain orthogonality of the manipulated factors.

We used a partial factorial design to create the 30 different partnering scenarios between the respondent's company and its technology partner. Scholars using the policy capture methodology routinely choose a small, manageable number of scenarios (as we have) rather than attempt full factorial designs (Aiman-Smith et al., 2002; Karren & Barringer, 2002; Tyler & Steensma, 1995). We presented the 30 scenarios to each respondent in different (randomly drawn) orders to minimize start-up effects for the first set of scenarios (Aiman-Smith et al., 2002). We created different scenarios by randomly assigning levels to these items such that the independent variables they represent are as close to orthogonal as possible (Hitt & Tyler, 1991) while ensuring that the scenarios are realistic. Random assignment helps make the constructs orthogonal, but sometimes it also can generate unrealistic scenarios. Since it is important to avoid such unrealistic scenarios in policy capture studies, we followed an iterative process of randomization followed by discarding unrealistic scenarios and further randomization. We finally generated a set of scenarios with acceptably low correlations between the key variables.

The construction of independent variables in policy capture studies differs from that in studies based on survey data. Rather than gather data on those variables from the respondents, here we provide data to them. The aim is not to ensure reliable measurement of the variables through multiple items but rather to ensure that respondents properly understand each item (Aiman-Smith et al., 2002; Karren & Barringer, 2002). For this reason, policy capture studies often rely on a few or even single items for each theoretical construct but take steps to ensure that they convey information unambiguously to respondents (Pablo, 1994). We took several steps to formulate items representing key variables. First, we selected the items based on prior research that have used either surveys (Poppo & Zenger, 1998; Schilling & Steensma,

2002) or the policy capture technique (Tyler & Steensma, 1995; Steensma & Corley, 2000). This ensured that each item adhered to the meaning of the theoretical construct of interest in our study. Second, the items used to represent relevant constructs need to be readily accessible to decision makers in a language they understand. Thus, as prior policy capture studies recommend, we iterated between the use of prior literature, field interviews (with senior managers responsible for their firms' strategic partnerships), and a pilot study (of 30 Executive MBA students at a major U.S. business school) to find the right wording for these items. Thus, the items not only reflect the appropriate theoretical constructs underlying them but are also comprehensible by managers (Karren & Barringer, 2002). The following is a sample scenario:

> Your company faces frequent technological change, and it seems difficult to rely on internal development alone to keep pace with all of the technological developments in your business. "R&D just keeps getting costlier and riskier for us, and customers want products yesterday!" moans your friend, the Vice President of R&D. Hence you are convinced that forming strategic partnerships with other firms to access their technology is the way forward. After screening hundreds of companies, your department has put together a set of 30 potential partner firms all of which have about 50-100 employees, and each has technological capabilities of value to your company. The CEO is willing to accept your proposal to partner with all of them. Now, assuming that cash is no constraint at the moment, he wants you to recommend an equity ownership structure for each proposed relationship. Also, you don't have to worry about the motivations of the partner for now; you can assume they are willing to go along with what you propose.
>
> Your task is to select an ownership structure for partnering with each firm that will best meet your objective, that is, gain access to cutting-edge technological resources. For each firm, your staff has done preliminary data gathering and provided ratings on a five-point scale on seven different attributes to guide your choice. A variety of equity ownership options is available for each partnership *(with the exception of joint ventures for legal reasons)*. Please assess each case and make your recommendation.
>
> Partner Firm 1

Attribute	***Very Low***				***Very High***
Extent of investments required by both parties to fully benefit from the partnership (e.g., investments in R&D, production, marketing) that are specific to the technology being accessed and cannot be used for other purposes	*1*	*2*	*3*	*4*	*5*
Extent to which we understand and can assess the market potential for the technology being accessed	*1*	*2*	*3*	*4*	*5*
Extent of resources we need to commit to manage the coordination and interaction between our company and the technology-providing company to exploit or leverage the technology being accessed	*1*	*2*	*3*	*4*	*5*
Extent to which the technology is significant to our business and competitive position	*1*	*2*	*3*	*4*	*5*
Extent to which we understand and can assess the relative benefits and viability of the technology being accessed	*1*	*2*	*3*	*4*	*5*
Extent to which competitors are likely to benefit from or be interested in this technology	*1*	*2*	*3*	*4*	*5*
Extent of restructuring required to divest unwanted resources and capabilities from the partner in case of acquisition	*1*	*2*	*3*	*4*	*5*

Assume that your company already has accepted your recommendation to partner with this company. Based on the information provided above, please choose the equity ownership structure for the partnership from among the following four choices (tick only ONE):

- Contractual agreement (no equity) [ ]
- Minority equity stake (< 25 percent equity) [ ]
- Significant non-majority stake (>= 25 percent but < 50 percent equity) [ ]
- Acquire (> 50 percent equity) [ ]

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:

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(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

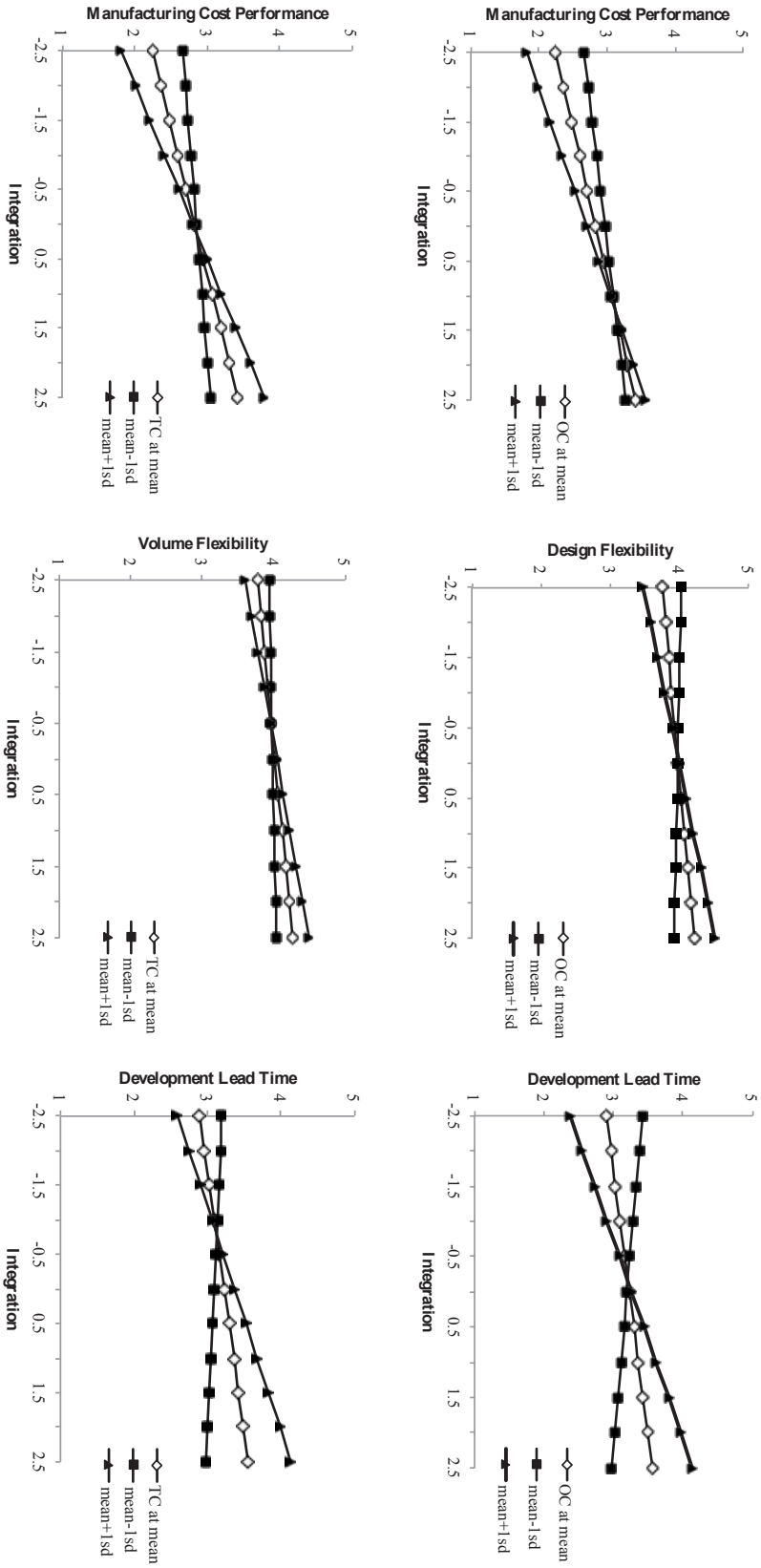
Our analysis uncovered several significant effects. In order to interpret these interactions properly, we drew a set of simple regression lines (Cohen et al., 2003), which show the effect of one variable in the interaction term at different levels of the other interacting variable. However, because we 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



OC: organizational complexity
TC: task complexity

Fig. 1. Simple Regression Lines Illustrating Interaction Effects

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.

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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.

HOW TO DESIGN FOR STRATEGIC RESILIENCE

A CASE STUDY IN RETAILING

LIISA VÄLIKANGAS • A. GEORGES L. ROMME

Abstract: Few firms can be said to be truly resilient by sustaining high performance for a long time. We draw on a case study of a large U.S.-based retailer to explore how an organization develops resilience – the ability to recover quickly from environmental jolts or misfortunes. The company's CEO, concerned about the company's ability to maintain its industry leadership and excellent performance, sought to engage the organization in a broad quest for developing resilience capabilities. Our analysis of this case suggests that generative doubt, organizational slack, and mindful engagement throughout the organization are key conditions for resilience. These three conditions need to co-exist to develop and sustain strategic resilience.

Keywords: Resilience; organizational resilience; strategic resilience; organization design; mindfulness; generative doubt; slack resources; leadership

Few firms can demonstrate resilience by sustaining high performance for a long time (Garud, Gehman, & Kumaraswamy, 2011; Hamel & Välikangas, 2003; Vogus & Sutcliffe, 2007). We present a case study of a large firm that performed well over a period of fifteen years but had a CEO who was concerned about the firm's ability to sustain its performance record. Since its founding in the early 1980s, the firm had grown to a prominent position as the leading U.S. retailer in the consumer electronics market (with a market share of about 20 percent in the USA), while also owning retail operations in Canada, Mexico, China, the U.K., and Turkey. In 2004, the CEO read a business press article about the notion of resilience, defined as the capability to adapt to change in a timely manner before the need becomes "desperately obvious." From this article, the CEO concluded that resilience capability must extend beyond a small group of company leaders (who may be more committed to past and current success than future success) and that there is no ready formula or best practice with regard to how an organization develops resilience. He inferred, therefore, that "whatever the process is, it must inevitably be experimental."

Several organization and management researchers have called for the study of the mechanisms that yield resilience in the context of recovering from difficult situations, such as organizational crises (Vogus & Sutcliffe, 2007; Weick & Sutcliffe, 2001). Our study is about how to develop those mechanisms *before* the organization needs to recover. We call this type of resilience "strategic" because it enables the organization to learn about emerging changes early and to begin to shape responses while change is nascent. Whereas operational resilience refers to recoverability from a crisis or otherwise undesirable situation (e.g., Smith et al., 2008), strategic resilience allows the organization to benefit from and act on serendipity inherent in unfolding change with its many uncertainties (Merton & Barber, 2004).

In this article, we discuss how a firm can design for strategic resilience by analyzing the experience of a large company in the retail industry. In the remainder of this article, we will refer to this company as "Corporation."

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RESEARCH METHOD

The case study was conducted inductively (Eisenhardt, 1989; March, Sproull, & Tamuz, 1991; Yin, 1994) by adopting an *empirical contextualization* strategy (Ketokivi & Mantere, 2010). Events were documented as they occurred over a period of more than 18 months. The first author joined the resilience project at Corporation as a participant observer. In this capacity, she was able to directly observe many project activities and closely interact with the project leader throughout the process, thus having access to behind-the-scenes worries, joys, ambitions, and even gossip. As a participant observer, she spent a period of 18 months in Corporation's offices, participating in all main events. Moreover, a research assistant documented the events in the company and some of the lingering program effects and was in regular contact with the project leader.

The case study draws on multiple sources of data, including participant observation, interviews, participant document analysis, and surveys. Many of the activities were videotaped, and detailed records were kept about ideas that emerged. In addition, the researchers were in constant contact with a core group of 12-15 persons who were most actively engaged in the project. This interaction allowed for bi-weekly discussions about their emergent understanding of what resilience meant for the company, why it was motivating for them personally to be engaged (or not), and what ideas related to resilient organizational design and practice they were exploring, developing, and experimenting on. Face-to-face interaction was complemented with telephone conferences and e-mail exchanges.

CORPORATION'S QUEST FOR RESILIENCE

Corporation provided a rare opportunity to study a quest for strategic resilience. Despite occasional hiccups to double-digit annual growth rates, Corporation consistently outperformed its competitors over a period of more than fifteen years – for example, in terms of return on sales or investment. Corporation had been demonstrating a competitive edge before it engaged in its quest for resilience, and its excellent performance record gave the company substantial slack resources, in terms of customer loyalty as well as human and financial resources.

Igniting Change: The CEO Mindset

The CEO felt positively challenged by the track record of his firm. In November 2004, he publicly announced his intent that Corporation would continue to be successful. He also stated that the top management team of Corporation would not be able alone to identify all significant future threats and opportunities, thereby calling for a company-wide effort. Corporation embarked on its quest for resilience in December 2004. The initial situation, characterized by substantial slack resources and a strong interest in the notion of resilience, served to create an open-ended change process that was not charged with the direct need to improve the company's (already satisfactory) performance.

Beyond the Leadership Suite: Mobilizing People for Mindfulness

After the CEO initiated the project, Corporation's top management team thoroughly discussed the notion of resilience in January 2005. The key idea discussed was that Corporation needed to reinvent its capacity to be resilient and that the reinvention process should begin at the grassroots level of the company. Top management acknowledged that resilience capacity must extend beyond a small group of company leaders and that it could not be bought or copied as an off-the-shelf capability. The key outcome of this meeting was the decision to initiate the quest for resilience. In a letter of intent circulated throughout the company, the CEO said the resilience quest sought to "make innovation an innate capability … and enlarge the circle of management innovators within this company." The CEO deliberately used the term "management innovator" at the time, in order to include everyone in the organization and not just people in managerial positions, in developing a more resilient organizational design. (This was later perceived as highly empowering by non-managerial employees of Corporation.)

In early 2005, the CEO appointed an executive sponsor to the project. In turn, this sponsor appointed a program leader, someone with an HR background and an excellent reputation and network throughout Corporation. The program leader, backed by the executive sponsor, was expected to develop fertile ground for a project that needed to operate more bottom-up than top-down. The program leader was well aware of the ambiguities involved: the absence of pre-set targets, process steps, and strict timetables as well as the nature of the change effort as an unfolding voluntary movement rather than a formal change program: "I see this program as an opportunity to design a capability by tapping into the 80,000 people who deal with customers, a large-scale engagement."

The first phase of the resilience project involved a large number of activities that served to diagnose impediments to resilience and call for volunteer action. For example, to develop a conceptual understanding of the resilience challenge, learning groups were formed to discuss essential readings on resilience capability, and external speakers were engaged to inspire and facilitate those discussions. Moreover, 21 managers were interviewed about what impedes resilience at the company (in February 2005). The questions ranged from open-ended ones, such as what currently impedes the company's ability to effectively respond to change, to specific questions about cognitive, strategic, organizational, and other barriers to strategic renewal and innovation in their area of responsibility. For example, many interviewees reported an increased "bureaucratic" sense of responsibility in Corporation. Other participants talked about inflexible policies and processes. The responses were summarized and represented as a Barrier Wall – a set of Lego-like bricks that each had a specific change barrier written on it – for example, "bureaucratic sense of responsibility" and "don't know how to drive change."

Tapping Slack: Event Organizing and Community Building

Subsequently, a small team was formed to further motivate and explore the effort. A critical challenge for this team was to get a larger number of people involved, without a formal budget or work time allocation. A team of eight volunteers proposed to design an exhibition that was to become a key communication tool throughout Corporation. Called the Resilience Deficiency Ward, the exhibition featured small beds with pillows that had names of once leading retailers embroidered on them. More than 4,000 people (including board members) visited the "resilience hospital" to ponder on the temporariness of success and analyze the causes that brought these leading companies to the brink of extinction. Each visitor, wearing a lab coat and reading the "x-rays" that depicted the malaise of the hospitalized companies, explored whether "my own company suffers from any of these resilience deficiency symptoms." The exhibit's purpose was to engage participants in the diagnosis of resilience, but it also created a personal, memorable experience.

The growing awareness of the fragility of success, arising from visits to the exhibit, served to develop a workshop that came to be known as Management Innovation Jam, an opportunity to modify Corporation's management principles, processes, and practices so that one or more of the resilience impediments could be removed. A Management Innovation Jam invited the participants – some 30-50 people at any one event – to consider the impediments to resilience at the company; resilience principles extracted from adaptive systems such as cities, markets, and democracies; and examples of management innovation from unconventional settings such as the formation of editorial rights of a website called Slashdot. Participants then sought to apply the resilience principles and examples, so that one or more novel ways of accomplishing managerial work could be created (e.g., an internal marketplace for ideas and talent). The Jam ended by encouraging participants to develop an experimental design for their management innovation ideas and try it out on a small scale.

Two Management Innovation Jams were held in the spring of 2005. The CEO attended the first Jam, where he spoke of the importance of resilience. The other Jam was attended by the Chief Operating Officer. During the Jams and thereafter, self-formed teams developed ideas for management innovation and then took these ideas forward as an experiment. As a result, a portfolio of management innovation ideas emerged (see Table 1 for some examples). Not all ideas progressed to the experimental stage: some ideas did not prove worthwhile after additional reflection, and in other cases the team gave up the effort due to a lack of time or

interest. The self-formed teams varied in terms of heterogeneity but usually had members from at least two different departments.

Table 1. Some management innovations developed at Corporation.

eBay for Human Capital: Marketplace for matching ideas and talent across the company
The Idea Reserve: A place to find a mentor or a "personal idea banker"
TagWiki: Open communication and community-building platform
Red Dragon: Technology platform for harnessing innovative ideas
WOLF: Women's Leadership Forum, a corporate network initiative that seeks to help female employees excel (by reducing turnover and helping career advancement)
Boss' Boss Learning Journey: Taking the manager to whom your manager reports to a place that both of you would find instructional and enlightening
ROWE: Work-life balance initiative that focused on results not on time spent at the workplace (later spun out as an independent initiative outside Corporation)

By attending Jams and championing resilience and management innovation, the volunteer community known as "Jampions" grew during 2005 to about 250 people (all of whom were managers or employees except for ten individuals who were directors or above). This community began to hold themed Resilience Clinics as regular (monthly) get-togethers and discussion forums. Teams of Jampions presented their ongoing experiments, but others were invited to talk about related work such as ongoing customer service experiments in stores. In addition, an internal website on Resilience was set up that invited anyone to become familiar with the notion of resilience and join the quest. Most active Jampions joined the effort to further develop content for the Management Innovation Jam, make it experiential and easy to relate to, and to redesign the Jam from the original two-day event to a one-day event. They then participated as facilitators and mentors to new Jampions, sharing their experiences as management innovators. Some new material was developed, including a play on resilience (with a number of Jampions in leading acting roles) and an inspirational video that showcased "resilience principles" and invited the audience to join the quest. Groups of Jampions met with the senior executive in their area of responsibility to share their insights and give the executive a chance to ask questions and offer support. In November 2005, a group of senior executives was asked to present its perspective on resilience in a roundtable discussion with the Jampion community.

Additional activities included an Idea Elaboration Jam, a workshop to support experimentation and development of ideas which benefited from the test methodology used by Corporation in its retail stores. Case studies were also written about other company change programs in the past, offering some potential learning in how to engage in organization-wide change.

Priorities Shift: External Pressure to Improve Short-Term Results

In November 2005, bloated administrative costs had taken a toll on Corporation's quarterly profits and gained attention from Wall Street industry analysts. The CEO of Corporation hired a COO from outside the company to reduce costs. Despite various appeals by Jampions, referring to the importance and the low cost of the work they were doing, the resilience project was cut as part of an overall effort to reduce the number of ongoing activities in the company. The company regularly engaged in this type of cost-cutting effort, according to a senior executive in a retrospective interview two years after the conclusion of the resilience project. This executive also noted that, while the project fundamentally shaped her views on management, it was only later in her career as a senior executive that she was able to benefit from the understanding that such grassroots innovation capability needed to be constantly protected against short-term performance pressures and hierarchical decision privileges. Another director blamed the financial orientation of Corporation's top management team: "Finance is the most difficult function to work with; it's very internally siloed." Moreover, the quest for resilience also appeared to suffer from an increased emphasis on customers.

One vice-president recalled from a meeting with the CEO: "He made clear that customer centricity is [now] our future."

Impact of the Quest for Resilience

Despite the fact that the resilience project was formally shut down, this quest over a period of approximately 18 months appeared to have had a lasting impact on the company, particularly in the way people perceived their role in the organization. For example, a shop floor employee in a local store of Corporation sought to serve the sailors whose ship harbored nearby, as they were buying a number of laptop computers and other electronic products for their mates who were not able to leave the ship without a visa. This "having a friend inside Corporation" strategy increased local store sales significantly and was subsequently applied in many other stores. Another innovation was created by a group of people in one of Corporation's call centers who found a way to make substantial savings by cutting idle calling time. Further, the resilience quest had a direct impact on former Jampions. One said: "I now have more confidence in taking risks. I'm simply more comfortable when things backfire. Also, I have a better understanding of the business context for innovation and can more easily grasp ideas that seem far out instead of dismissing them."

Many management innovations stemming from the resilience quest carried on as autonomous initiatives with dedicated teams. At any one time, there were between three and five management experiments running. Though often small-scale, they produced learning concerning what could be accomplished in the company in terms of management innovation (e.g., "no permission required to do this experiment in front of the company café"). While none of the experiments was immediately adopted as regular management practice, they provided important insights into resource allocation, idea harvesting, motivation, and innovation management. For example, a member of the team that pioneered eBay for Human Capital, a marketplace for matching ideas and talent across the company, argued that "the magic of the concept is the employee empowerment and the energy that is felt when a connection is made – a connection from a person with an idea to a person who has a passion for the idea. The connection may result in creating something that benefits the store or how we do our work at the corporate level. The opportunities and benefits are endless when you leverage passion as a tool to how work gets accomplished."

Overall, Corporation's superior performance as a retailer continued during the period after the formal resilience quest, including the difficult times caused by the global recession of 2008-11. Notably, Corporation's main competitor in the U.S. went bankrupt in 2009. A senior executive attributed some of Corporation's current practices to "engaging everyone in contributing to corporate growth during the resilience project." Moreover, the project "aided in instilling a culture that believes that every person is capable and expected to contribute to growth in some way…This culture of contribution is still fragile but making progress." Long after the resilience project formally ended, many of the initiatives started as part of the resilience project continued to thrive. The resilience hospital exhibit was closed only recently, having become a symbolic part of the company culture. Overall, the resilience quest appeared to have initiated a cultural change toward mindful and experimental behavior at Corporation, which invited innovation and change without the accompanying trauma.

DISCUSSION

Corporation's resilience project offered us an opportunity to study an industry-leading company seeking to sustain its strong performance by choosing to build resilience capability ahead of the need for it. In this section, we explore the conditions for strategic resilience that can be inferred from the case study. We believe three factors are especially important: generative doubt, organizational slack, and mindful engagement.

An important starting condition of Corporation's quest for resilience appears to include the CEO's mindset in which he became committed to fight cognitive and structural inertia (Tripsas & Gavetti, 2000). Rather than being complacent about the company's strong performance, the CEO did what many excellent CEOs do (e.g., Grove, 1999; Välikangas, 2010) – he worried about the company's ability to perform in the future, exercising what

Locke, Golden-Biddle, and Feldman (2008) call *generative doubt*. Rather than formulating a single strategic vision, the CEO wished to extend the search beyond the leadership suite and develop the sensing and learning capabilities distributed across the organization (Lovas & Ghoshal, 2000). He had the confidence and foresight to engage in a process of generative doubt, defined as deliberately seeking the experience of not knowing (Locke et al., 2008). The CEO was thus able to open up the quest for broader participation. Without the CEO's questioning of the company's fitness for the future, the organization might not have embarked on the quest to develop resilience. On the other hand, the project also ended per the CEO's decision, suggesting that his organizational priorities changed from resilience to current performance (and perhaps indicating the erosion of generative doubt). We conclude that it is best to engage in exploration and experimentation in good times when the risk of failure is less costly.

Second, the company had been relatively successful for a long period of time and was one of the top performers in the U.S. stock market. Consequently, it had developed *organizational slack*, a potential enabler of innovative activity (Cyert & March, 1963; Van Dijk et al., 2011). Organizational slack allows the firm to forego short-term gains in favor of enhancing long-term viability and performance (Sharfman et al., 1988). Previous studies developed an understanding of what slack is (Voss, Sirdeshmukh, & Voss, 2008), how it may promote experimentation and risk-taking (Bourgeois, 1981), and how it may provide some discretion in responding to competitor strategies (George, 2005). Moreover, by relaxing internal controls and allowing firms to undertake multiple innovation projects, resource slack may offer partial protection from unsuccessful outcomes (Bradley, Shepherd, & Wiklund, 2011). By contrast, other studies have observed that substantial resource slack may hinder the entrepreneurial process by impairing the ability to identify new business opportunities (Mosakowski, 2002) and promoting managerial complacency (George, 2005). In this respect, firms with abundant resources may be less inclined to experiment and may prefer to continue exploiting established products and markets, as resource reserves tend to induce risk averse behavior (Mishina, Pollock, & Porac, 2004). To its credit, Corporation did not allow complacency to set in.

Organizational slack in itself, however, does not appear to provide a sufficient explanation for the fact that few organizations are truly resilient (Garud et al., 2011; Vogus & Sutcliffe, 2007), because many firms with substantial slack resources would then develop resilience. Hence, the story of how strategic resilience comes about is likely to be more complex. In this respect, whereas most previous studies consider slack as an independent variable (e.g., Sharfman et al., 1988; Voss et al., 2008), our case study suggests a third factor is important to the development of strategic resilience: broad *mindful engagement* of the organization. A high level of engagement appears to be an important condition for resource slack to have a catalyzing effect, by promoting risk-taking and experimentation (rather than promoting complacency and risk avoidance). This also was the hunch of Corporation's CEO who sought to mobilize people beyond the leadership suite as widely as possible. In resilient organizations, employees and managers act mindfully (Levinthal & Rerup, 2006; Weick & Sutcliffe, 2001) – for example, by continually questioning and reassessing the purpose and effectiveness of organizational practices and systems.

The resilience literature has thus far focused on the mindfulness of front-line employees (e.g., nurses, firefighters, customer service staff). Mindful front-line workers continuously develop, refine, and update a shared understanding of the situation they face, the problems defining it, and what capabilities exist to ensure or improve, for example, the safety, well-being, or satisfaction of clients (Gittell et al., 2006; Weick & Sutcliffe, 2006; Weick, Sutcliffe, & Obstfeld, 1999). Our case study suggests the need to broaden the notion of mindful engagement for resilience beyond front-line operational activities to include management innovation (Hamel, 2006; Hamel & Välikangas, 2003). Many resilience impediments in Corporation appeared to stem from organizational or managerial rigidities that required ongoing experimentation to develop alternative management practices (e.g., marketplaces for ideas and talent). This can only happen when mindful engagement is widespread.

The three conditions for strategic resilience inferred from the case study and literature also serve to synthesize the notions of problemistic versus slack-driven search developed

by the Carnegie School (March & Simon, 1958; Cyert & March, 1963). Search in most organizations, according to the Carnegie School, is motivated by an immediate problem and will be as simple as possible in that it operates in the "neighborhood" of the problem and the solutions already being used. To be able to search for novel solutions – possibly by redefining the initial problem – resource slack operates as a potential enabler (Cyert & March, 1963). Our case study suggests that companies that have substantial resource slack and seek to enhance their resilience need to use both search strategies, embedded in an organizational culture of generative doubt and mindful engagement.

In summary, the key conditions for resilience inferred from the case study are generative doubt, organizational slack, and mindful engagement throughout the organization. We hypothesize that these three conditions need to co-exist for strategic resilience to arise because each individual condition appears to be necessary for the other two conditions to have a positive effect on resilience. For example, without mindful engagement, resource slack may not positively affect resilience; without the CEO's generative doubt, it may not be possible to mobilize and engage people in the project; and so forth.

IMPLICATIONS FOR PRACTICE

This case study describes how a leading company deliberately engaged in advancing and practicing strategic resilience. A key initiator was the CEO's leadership. Corporation's lengthy record of performance suggests that the executive leadership of a firm must have the courage to sustain an open vision of the path to resilience, one that allows the organization to mobilize people behind the quest. The case study also suggests it is important to confront past success and develop an understanding of its fragility (cf. Bunker, 1997). In this respect, generative doubt at the executive level serves to challenge the mental model often prevailing in successful organizations, in which executives rationalize particular issues away, mistake luck for smarts in explaining success, and resist admitting that current business approaches and strategies may be decaying (Argyris & Schön, 1978).

Therefore, top managers need to be able to step back and facilitate the development of a distributed organizational capability involving hundreds, if not thousands, of people throughout the organization (Romme, 1997). This implies a non-traditional role of the CEO and other top managers, which may be particularly difficult to sustain in the face of shareholder pressure (Adler, 2001), changing strategic priorities (such as Corporation's reemphasis on customer orientation), and the inability of executives in early career stages to benefit from and support a grassroots engagement (Milliken, Morrison, & Hewlin, 2003). The ability to sustain generative doubt in the executive suite provides a dual challenge for top managers: they need to overcome executive hubris, a typical result of continued success, as well as be able to not yield to quarterly performance pressures. In any case, a project that lasted for almost two years with a lingering impact on the company's operations can be judged successful, especially in corporate settings where priorities constantly shift and executives and their agendas routinely change.

Another practical implication of our case study is that the initial impetus toward the quest for resilience needs to be challenging enough to draw the interest and engagement of a broad set of volunteers (see also McGonigal, 2011). The notion of resilience had such an appeal in Corporation, partly because the content was left open for the participants to define in such a way that it became personally (and organizationally) relevant. The challenge was also very forward-looking. Adding to the appeal was the Resilience Deficiency Ward that spoke to its visitors directly in terms of the symptoms that may already be present in their own company. The challenge was to diagnose one's own company for any potential signals for trouble. This was exciting to the participants, who apparently took to the situation with "playful seriousness" (Schrage, 1999). Thus, the participants were experientially and emotionally engaged, as many later testified. The experience of becoming a Jampion encouraged participants to apply resilience ideas in their jobs (Quinn & Worline, 2008). As such, the resilience project became a sort of dress rehearsal to act differently, with more determination and imagination. It was also salient that the project was not entirely left to its own self-organization but was guided by the project manager, leaving enough room for volunteer activities yet maintaining the

momentum. Such a build-up of mindful engagement in the form of open meetings, resilience clinics, and participant testimonies was particularly important to get the project going in the beginning. These events helped create a network of like-minded, innovative people across organizational boundaries, many of whom met for the first time and realized they were not alone in pursuing strategic resilience.

Finally, our case study confirms research findings arising from earlier work on organizational slack, suggesting that a high level of slack in itself does not make an organization resilient. Slack may provide an advantage in any attempt to create strategic resilience but only if top managers continually expose themselves to self-critique in reflecting on the organization's future ability to perform *and* they are able to mobilize people in taking risks and engaging in experimentation beyond the leadership suite. This type of leadership capability involving both generative doubt and distributed organizational learning is still rarely observed in public corporations.

CONCLUSION

In this article, we discussed how a firm can design strategic resilience as a capability. Our study draws on a single case, which limits opportunities to generalize the main findings. Future research, therefore, will need to explore whether the key conditions for strategic resilience inferred from our case study also apply to other firms seeking to build a resilience capability – especially firms that do not have a long history of solid performance. Moreover, future research on strategic resilience capability should consider the *combined* role and impact of generative doubt, organizational slack, and broad mindful engagement.

Most organizational change programs focus on copying competitive moves or best practices of leading companies. By contrast, our case study of how resilience can be developed suggests that executives must be courageous enough to expose themselves to generative doubt, employees must be inspired and concerned enough to develop mindfulness, and the organization must have enough resources to engage in long-term exploration and experimentation. This is likely to spur an open-ended change process where these three conditions together contribute to strategic resilience.

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A MODEL OF THE PLATFORM-ECOSYSTEM ORGANIZATIONAL FORM

MOSHE YONATANY

Abstract: Technological advancements are driving the evolution of a form of organizing economic activity – the platform-ecosystem – particularly in a variety of ICT-enabled industries. This article builds on calls to more adequately describe and explain this form of organizing (Alberts, 2012; Baldwin, 2012; Tushman, Lakhani, & Lifshitz-Assaf, 2012). I propose a preliminary model that highlights the fundamental economic variables in the platform-ecosystem organizational form: knowledge substitution and powerful incentives. The model emphasizes knowledge-based considerations, suggesting the view that the main purpose of ICT-enabled platforms, such as smartphones, game consoles, and Internet services, is the development of complementary products, services, and technologies.

Keywords: Platform; ecosystem; ICT; model

The increasing processing power of computer chips and capacity of data storage devices, coupled with decreasing prices, enable the development of increasingly sophisticated products and services. These technological advancements are driving the emergence of platforms and ecosystems in a variety of ICT-enabled industries, including smartphones, game consoles, and Internet-based products and services. For example, the smartphone market is dominated by two *platforms*: Apple's iPhone and Google's Android. Each of these platforms has a business *ecosystem*: hundreds of thousands of *affiliates* or third-party developers that provide complementary components and applications. Similarly, producers of game consoles typically focus on developing and marketing their console (the platform) while relying on an ecosystem of affiliated game developers to provide complementary games. This type of organizational form is prevalent on the Internet as well: numerous firms focus on providing an online service (e.g., Facebook's social network or eBay's marketplace) while relying on affiliated third parties to provide complementary products, services, and technologies. Typically, a large firm provides the platform and then establishes an ecosystem of affiliated providers to develop products and services.

The platform-ecosystem form raises the questions of why this type of organization emerges and why it exists in particular environments. To answer these questions, I propose a preliminary model that highlights the fundamental conditions of such an arrangement. The model relies on theoretical arguments adopted from theories of the firm that focus on knowledge-based considerations since knowledge-intensive environments are where the platform-ecosystem form is being used most extensively. Developing such a model is important for researchers because it will provide a clearer direction for future empirical research. Moreover, a model that highlights the key variables shaping this form will allow managers to better design organizations that are effective in knowledge-intensive environments.

THEORETICAL BACKGROUND

Miles et al. (2009) described the "I-form", an organizational form designed to pursue rapid and continuous innovation. The I-form is a collaborative community of firms, and it usually includes a facilitator organization that provides administrative services and strategic

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initiatives to the community. While the model presented below takes a similar view, its focus is not on providing administrative services and strategic initiatives. Rather, I propose that in ICT-enabled industries such an organizational form allows for economizing on knowledge transfer through direction giving and specialization. Moreover, in an I-form organization knowledge flows across the community rather evenly. In contrast, I propose that knowledge of the highest significance flows in the form of directions given by the platform provider to its respective affiliates. Fjeldstad et al. (2012) showed that newer organization designs of large-scale, multiparty collaboration are based on an actor-oriented architectural scheme composed of actors capable of self-organizing, shared resources, and protocols, processes, and infrastructures that enable collaboration. However, while their main purpose is to explain *how* newer organizational forms are controlled and coordinated, my main goal is to present reasoning for *why* they exist.

In the first issue of *Journal of Organization Design*, which focused on the future of organization design, Alberts (2012), Baldwin (2012), and Tushman, Lakhani, and Lifshitz-Assaf (2012) discussed business ecosystems, permeable organizational boundaries, and open innovation as pressing design challenges. Alberts (2012) argued for an expanded definition of an organization as a complex enterprise. However, while he holds that in such enterprises there is no one "in charge," I present a somewhat alternative view, in which the platform provider plays a role that is similar to a "team leader" of its respective ecosystem. According to Baldwin (2012: 21), a key issue in business ecosystems is "…how to induce such diverse individuals to apply their skills to a given set of problems in ways that allow their efforts to be linked and aggregated into a coherent whole." Similarly, the model proposed below emphasizes incentives and the allocation of property rights. Tushman et al. (2012: 26) discuss flexible organizational boundaries and suggest that "…these choices are contingent on the extent to which critical tasks can be decomposed and the extent to which the tasks' knowledge requirements are concentrated." My proposed model complements Tushman et al. (2012) by incorporating the economics of knowledge substitution as the key factor in such choices.

Conner and Prahalad (1996) argue that competition between two firms also entails competition with market coordination, because each firm competes against the possible disaggregation of its employees into a market contracting arrangement. In a similar vein, competition between platform-ecosystems, and indeed their very existence, implicitly entails the notion that industry firms deem the platform-ecosystem to be superior to the alternative of a decentralized market. Hence, there should be certain economies that are gained through use of a platform-ecosystem.

Based largely on these organizational and economic studies, I chose to build my theoretical model on two key variables: knowledge substitution and powerful incentives offered to ecosystem affiliates.

Knowledge Substitution

The effect of knowledge substitution can be explained using a brief example. When a manager gives directions to an employee, the manager's knowledge partially substitutes for the employee's knowledge. Giving directions expands the employee's productive capacity without requiring the employee to fully absorb the manager's knowledge. Thus, direction giving can save the costs of knowledge transfer (training or education costs). Demsetz (1988) identifies industries and firms as repositories of specialized knowledge and of the specialized inputs required to put this knowledge to work. To explain the existence and boundaries of the firm, he develops the following line of argument: (a) Knowledge is costly to produce, maintain, and use; (b) economies can be achieved through specialization in these three aspects of knowledge; and (c) the difference between the cost of acquiring and using knowledge has strong implications for how to organize. Since knowledge is learned more efficiently in a specialized fashion, its use to achieve higher productivity requires the specialist to use the knowledge of other specialists. However, this cannot be accomplished by learning what other people know because doing so will undermine the gains from specialized learning. There are two methods to put knowledge to work while saving the costs of knowledge transfer and without sacrificing specialization: (1) letting more knowledgeable individuals direct less

knowledgeable individuals and (2) producing and selling goods that require less knowledge to use than is required to produce.

Demsetz (1988) holds that the firm is best viewed as a "nexus of contracts." The model developed here relies on the same notion. That is, the platform provider is analogous to the "direction giver" (manager) while ecosystem affiliates are analogous to employees. According to Demsetz (1988), in order for the nexus of contracts to be a firm, it should have the following characteristics: specialization, continuity of association, and reliance on direction. The platform-ecosystem form exhibits similar characteristics and can be distinguished from a decentralized market. (See Table 1.)

Table 1. Conceptual analogy between a firm and a platform-ecosystem

	Firm (Nexus of Contracts)	**Platform-Ecosystem**
Specialization	Produces mainly for people who are not employees of the firm	Produces mainly for people outside the platform-ecosystem
Continuity of association	Employees are associated with the firm for a long period of time	Affiliates are associated with the platform for a long period due to access to end users, switching costs, etc.
Reliance on direction	Resources are used according to directions	Directions given by the platform provider guide the efforts of affiliates

The platform-ecosystem potentially can enable higher returns to specialization while saving knowledge transfer costs, as affiliates do not need to acquire all the knowledge the platform provider possesses. However, the platform provider does not possess all the knowledge that the affiliates have. The platform provider combines technologies into new and simpler platforms until the diversity of uses further downstream is so great that it requires the firm to bear greater costs of knowledge acquisition and maintenance (if it is to continue developing innovative products and services). This is the point where vertical specialization gives way to horizontal specialization. Additional development is turned over to a variety of affiliates, each specializing in a narrow field.

Incentives to Affiliates

Much of the affiliates' knowledge does not exist ex ante; it is developed after they establish their affiliation to the platform provider. The platform-ecosystem is dynamic, as affiliates further develop their specialized knowledge through this organizational form. Alchian and Demsetz (1972: 778) argued that "The economic organization through which input owners cooperate will make better use of their comparative advantages to the extent that it facilitates the payment of rewards in accord with productivity." Consequently, there are two key demands for economic organization: measuring input productivity and measuring rewards. A decentralized market is successful in promoting productive specialization since those responsible for output changes are rewarded. Similarly, Williamson (1985) distinguished between powerful incentives provided by the market and less powerful incentives that exist within firms. Grossman and Oliver (1986) and Hart and Moore (1990) argued that the incentives of an individual to acquire asset-specific knowledge (or invest in an asset) are higher when the individual has property rights over the asset. The owner of the asset possesses the residual rights of control, that is, the rights to control the uses of the asset under future contingencies. A person who does not own an asset is not likely to make an asset-specific investment because of the risk of "hold-up" by the owner. Therefore, if asset-specific investment is necessary (e.g., acquiring a skill that is required only by that asset), the individual who makes such an investment should own the asset.

The platform-ecosystem can create powerful incentives for affiliates since it allows affiliates to keep most of the income derived from their offerings. Affiliates are likely to acquire and develop knowledge that is specific to their product, service, or technology because they own it. Interestingly, a hold-up problem can also exist here; the platform provider can demand a higher share of the income using its strong position as a provider of access to the user base. However, such a strategy is not likely to be beneficial in the long run since affiliates may migrate to a competing platform or try to establish a stand-alone offering (when the

costs of platform affiliation outweigh its benefits). Establishing trust between the platform owner and affiliated third parties seems to be crucial for the long-term viability and stability of the platform-ecosystem.

A MODEL OF THE PLATFORM-ECOSYSTEM

The essence of the platform-ecosystem is the use of complementary knowledge to create an offering (a line of products or services) in markets requiring numerous repositories of specialized knowledge. This is accomplished through a hybrid organizational mode, being neither a "firm" nor a "market," and at the same time entailing affiliation and collaboration. As shown in Figure 1, the model depicts the platform-ecosystem as an organizational vehicle for the creation of an overall offering that is complemented by three specialized offerings, each of which can be produced separately. This arrangement provides efficiencies with regards to knowledge and motivation: (a) direction giving by the platform provider allows economizing via knowledge substitution and (b) property rights over complements provide powerful incentives for third parties to affiliate with the platform provider. The overall arrangement allows all parties to specialize. Income from complements can be shared between the platform owner and affiliated third parties.

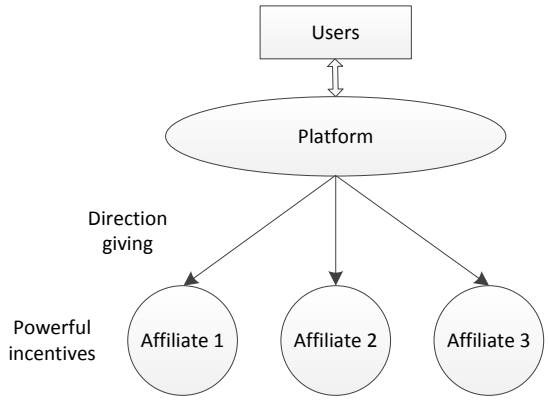

Fig. 1. The platform-ecosystem organizational form

How does this model work in action? Facebook, a company employing about 5,000 people, has hundreds of thousands of affiliates. This arrangement allows the company to specialize in developing and managing its platform while allowing each of the affiliates to specialize in a niche (e.g., an online Poker game or a dating service). Moreover, Facebook equips affiliated developers with development tools and information, organizes for them conferences (called "f8") in which they receive guidance and directions, and offers direct assistance from Facebook's employees through a dedicated site. Facebook affiliates receive the lion's share of the revenue that their applications generate (70 percent), thereby benefiting from powerful incentives to continue to develop innovative applications.

CONCLUSION

The model proposed here seems sufficient to explain the existence of the platform-ecosystem organizational form. The main contribution of this article is in making an early step in developing a theoretical model for a recent, growing organizational phenomenon. Organization design researchers may find the model useful when analyzing platform-ecosystems in ICT-enabled industries and perhaps as a building block in the further development of organization theory.

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