

The Effects of Organizational Structure on Time-Based Performance: An Empirical Study in Chinese Automobile Industry

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Abstract As firms attempt to cope with the constantly changing environment, they must implement innovational practices including business strategy, production system and organizational structure to promote the responsiveness to markets and customers. This study develops a research framework that examines relationships among various structural dimensions and time-based performance in Chinese automobile industry and a contingency approach which is taken by examining the moderating effects of firm size. Six aspects of organizational structure are considered. They are number of layers in the hierarchy, locus of decision-making, and nature of formalization, level of process, internal boundary and external boundary. Results show that those six dimensions of organizational structure have significant influence on time-based performance. Subgroup analysis reveals that these main effects are, for the most part, not moderated by firm size.

Key words Organizational structure; Time-based performance; Empirical research; Regression

1 Introduction

Time has been shown to be a new source of success for many companies. More and more companies have concentrated on employing time-based strategies to increase product development and launch speeds, or improve manufacturing, delivery, and/or compress customer response time^[1]. Several researchers in the innovation and organizational theory literature argue that initiating and implementing radical change to improve competitive capabilities can be facilitated or hindered by the firm's structure design^[2]. Since organizational structure is a key to managers' implementation of strategy, it has long been considered an important mechanism for operational strategy^[3]. One of the challenges facing firms is the need to reform their organization structure associating with time-based strategies to improve both financial and time-based performance (e.g. time to market, time to product, customer responsiveness).

The literature suggests that as firms operate in time-based environment, they need a structure that has: few layers in hierarchy^[4], a high level of horizontal integration^[15], and a decentralized decision-making^[6]. However, little empirical studies have examined the relationship between organizational structure and firm's time-based performance. It has yet to be empirically tested.

This paper develops a research framework that relates organizational structure, and time-based performance. Six most important dimensions of organizational structure are considered: (1) cut down layers in the organizational hierarchy to enable quick response, (2) play down locus of decision-making so operating issues can be dealt with effectively and quickly, (3) reducing rules and regulations to encourage creative, autonomous work and learning, (4) organizing work units around core processes to enhance value to customers, (5) breaking internal boundaries to ensure coordinated action, and (6) infiltrating external boundaries between customers and suppliers to cope with the increasing complexity and dynamics of the environment^[2].

At the same time, we consider the impact of firm size as control variable. Past research indicates that size is an important determinant of organizational structure, and contingency theory demands its inclusion^[6]. Little is known about whether the firm size influence the effects of organizational structure impose on time-based performance, this issue has to be investigated.

This paper is organized as follows. First, the constructs in the model are introduced building on the relevant literature review to identify several important aspects of organizational structure and a comprehensive set of time-based performance measures. Second, Hypotheses linkage these dimensions of organizational structure, time-based performance, and firm size are presented and discussed. Next, the sample is described and measurement issues are addressed. Confirmatory factor analysis was performed by applying LISREL8.3 for the purpose of testing unidimensionality of the scales, and Cronbach's alpha was educed to evaluate the internal consistency of items. Then, regression analyses are used for hypotheses testing, and subgroup analysis is taken to examine the moderating effect of firm size. Finally, the results of the study and their potential managerial implications are explored.

2 Delineation of Model Constructs

2.1 Organizational structure

The central constructs in this research are six dimensions of organizational structure. The first and second organizational structure variables are layers in the hierarchy and the locus of decision-making. The number of layers in hierarchy is the degree to which an organization has many versus few levels in a chain of command. The more layers in a firm will produce a more complex organizational structure. And, decisions that must be pushed through excessive layers take longer and are often made by people not directly in the “trenches”^[6]. The recent trend towards flatter organizations is a tacit acknowledgment that complexity will influence the flexibility, and can frustrate an organization’s ability to compete in time-based environment^[2].

The locus of decision-making refers to the vertical locus of decision-making authority in the firm. The importance of lower locus of decision-making has been highlighted in recent years by the emphasis on employee empowerment or autonomy in both the academic and practitioner literatures^[7]. Reducing layers and empowering low level employees to make the decisions formerly made by hierarchies are often done together.

The third organizational structure variable is the nature of formalization which refers to the degree to provide employees with rules and procedures that deprive but not encourage creative, autonomous work and learning activity^[8]. The organizational theory literature divides formalization as high versus low, where a high level of formalization is related to a mechanistic structure and a low level of formalization is related to a flexible organic structure^[2].

The fourth variable is the level of process-based. A company towards a process-based organization implies that all activities, which logically belong together in order to create value for the customer, are grouped together into one unit. Every organizational unit executes a well-defined part of the customer processes and so the objectives are always linked to customer value^[9].

The fifth and last variables are internal boundary and external boundary. In order to make effective cooperation and coordination between different role-players in organization, the firm should have blurred internal boundaries among all units, departments, or individual employees. In order to respond to the changing environment and to provide value to customers, the firm need to infiltrate the external boundary with customers, suppliers and other companies^[5]. Customers should be involved extensively and early in product development, product manufacturing, and delivery activities because customers contribute valuable feedback about products or services^[10]. As the interaction between the organization and its customers increase, both the organization and customers learn more about how a particular design meets their needs. Meanwhile, suppliers and other companies contribute valuable suggestions, technical contributions, and quality improvement actions that improve manufacturability and minimize design, produce, and delivery to market cycle time.

2.2 Dependent construct: time-based performance

Time-based performance is the dependent construct, which is a competitive strategy that seeks to compress the time required to propose, develop, manufacture, market, and deliver products^[6]. Researchers have considered different aspects of time-based performance relative to various stages of the overall value delivery cycle and have proposed several measures to evaluate them. The three most commonly discussed and also deemed key measures are time to market, time to product, and customer responsiveness^[1]. Their items, definitions and literature adapted from are contained in Table 1.

2.3 The control variable

Size, a control variable, refers to the scale of the firm and is typically operationalized in terms of assets, sales, or the number of employees. In this research, we used population (2,000) as the standard for division of firm size. According to the standard, we make the division of firms into large, small & medium-sized group.

Table 1 Items and Definitions for Time-based Performance

Item		Definition
Time to market	New product development time	The ability to minimize the time it takes to develop new products ^[1] .
	New product introduction	The ability to minimize the time to make product improvements to existing products, or to introduce completely new products ^[6,11] .
Time to product	Procurement lead time	The ability to minimize the time from order placement to the delivery of the procured item, which includes supplier lead time, transportation, and receiving and inspection ^[11] .

Continued Table 1

	Manufacturing lead time	The ability to minimize the time from when the order was released to the shop floor to the time of its completion ^[1,6] .
	Delivery speed	The ability to minimize the time between receipt of customer order and final delivery, to as close to zero as possible ^[6,11] .
Respon-siveness	Pre-sale customer service	The ability to service the customer during the purchase decision process ^[1] .
	Product support	The ability to service the customer in providing product support after the sale of the product to ensure continuing customer satisfaction ^[6] .
	Responsiveness to customer	The ability to minimize the time it takes to cater to customer needs by processing and solving customer complaints by rapid confirmation of orders and by minimizing customer information lead time ^[12] .

3 Model Hypotheses

Figure 1 shows how the six dimensions affect time-based performance, and how size moderates the effects.

3.1 Organizational structure and time-based performance

In a traditional command and control model, an expanding hierarchy may be a by-product of the systems and is justified by the need to control behavior. However, in a commitment model, the management system tends to be flat, relies upon shared goals for control and lateral coordination, bases influence on expertise and information rather than position, and minimizes status differences^[13]. Firms have a great many layer in their structure must have more complex internal environment. Too many layers will delay information transfer, and even to make it been fuzzy. This also may impede effective organizational communication. So, reforming a flatter organization is help to reduce information transfer cycle time and develop rapid response systems.

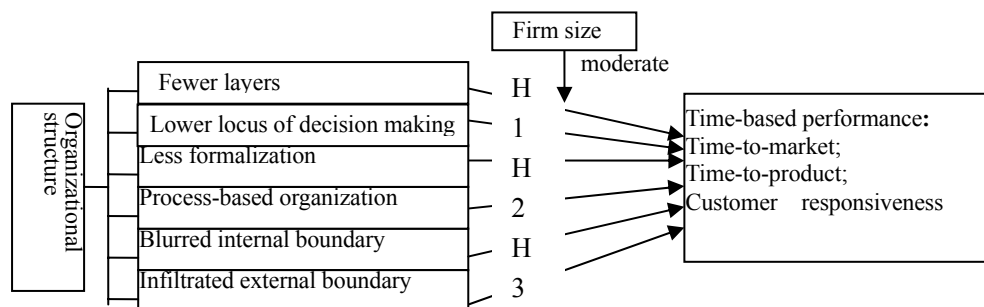


Figure 1 Research Framework

Building a hierarchy with few layers forces firms to shift decision-making low in the structure, and it enables the rapid transfer of information and ideas across the remaining levels in the hierarchy^[2]. Formal power may be taken away from the top of the hierarchy and be concentrated with the operators and their immediate supervisor. This will drive the employees in self-directed work groups learn form each other quickly, and respond flexibly to changing conditions, and provide value to customers^[14]. These changes become the basis for organization respond instantly to customer requirements.

To shift the locus of decision-making from the top to the bottom of the organization, managers should train and educate their operators and immediate supervisors in order to enhance their ability and to provide the kind of formalization that would not discourage, but rather facilitate and encourage autonomous work and learning. Formalization is described as some written rules and procedures provided to employees to guide their work. Some researchers divided formalization as high versus low, and assumed that a high degree of formalization has a negative relationship with innovation^[15]. Employees working in an organization with a low degree of formalization would have high enthusiasm and autonomy to innovate, and high flexibility to coping with problems and issues. So, less formalization is hope to encourage creativity, autonomous work and learning, and is positive to reduce the time to develop, product, and response to customers.

Hypothesis 1. Firms with fewer layers have a high level of time-based performance.

Hypothesis 2. Firms with a lower locus of decision-making have a high level of time-based performance.

Hypothesis 3. Firms with less formalization have a high level of time-based performance.

The fast changing demands of the business environment create a major challenge for firms to become customer oriented. Process-centered companies have the ability to overcome this problem, since processes bring, by definition, the customer to the fore. (Davenport 1993) argues that adopting a process view of the business implies that an organization does what is necessary to produce value for the customer^[16]. Traditional organization structures give a static view of responsibilities and reporting relation. In contrast, a process-based view is a dynamic view of how the organization can deliver value. Organize units based on key processes allows a company to be more responsive to new competitive requirements that may quickly change in complex and dynamic environments.

Hypothesis 4. Firms towards process-based organization have a high level of time-based performance.

Each of firm's activities depends on planning, preparation, and collaborated actions by employees, associated with information and other resources sharing between departments. Breaking internal boundary between departments results in open communication lines and quicker information transfer, which is helpful to collaboration and problem resolution^[5]. This suggests that breaking internal boundary among all units, departments, or individual employees could also affect time-to-market, time-to-product and responsiveness.

Hypothesis 5. Firms with blurred internal boundaries have a high level of time-based performance.

The literature suggests that infiltrating external boundaries engenders quicker product development, introduction times, and responsive speed. Different stages of the product development cycle require the expertise of key suppliers. For example, this expertise is critical in the idea generation and concept stage, sometimes called the 'fuzzy front end' of product development. In this stage, internal units that have specific knowledge of market conditions and customer needs coordinate and communicate with external units such as customers and suppliers to facilitate early involvement in product design. The fuzzy front end presents a significant business risk to all concerned, and therefore it is imperative for firms to build relationships to ensure cooperation. Firms with infiltrating external boundaries between customers, supplier and other partner companies, have the ability to improve products, processes, and services; this capability resulted in quicker resolution of problematic issues and higher responsiveness^[1].

Hypothesis 6. Firms with infiltrating external boundaries have a high level of time-based performance.

3.2 Moderating effects of size

Large firms generally are more formalized, decentralized, and have more layers than smaller firms. Larger firms also have more complex structure than smaller ones, i.e., they have more complicated coordination problem; they are less flexible to change strategies. In this way, the larger firms would have slower speed to adapting changing environment than smaller firms. The final issue addressed by this research is whether size moderates the association of organizational structure with time-based performance. The different influences of organizational structure reform vs. size on time-based performance make predictions of moderation especially difficult. The literature offers little guidance on this topic. Thus, the moderating effect of size is approached as an exploratory issue.

4 Research Methodology

4.1 Item generation

Instruments were developed for the dimensions of organizational structure and time-based performance. Item generation began with theory development and a literature review. All of the items were adapted for layers^[17] locus of decision-making^[2], formalization^[3], process-based^[17] internal and external boundary^[5], and time-based performance^[1]. The "extent of use" scale had five-points with endpoints labeled "extremely low" (=1) and "extremely high use of item" (=5). For all items, respondents were asked to subjectively "rate the degree to which the following initiatives were utilized by your firm." Detailed multi-item scales can be found in the relation literature mentioned above, or be got by correspondence to us.

4.2 The sampling procedure and sample

The study focused on manufacturing firms in Chinese automobile industry. Currently, there are approximately 3000 manufacturers in China. Thus, this industry is a highly competitive domain. Competition is forcing manufacturers to do more for their customers in order to preserve or increase their market shares. Organizational structure innovation is one key approach to enhance firm's time-based performance.

The unit of analysis was individual firm. A questionnaire was designed and mailed to 300 CEOs along with an informational letter stating the research purpose. CEOs of multiple business units were instructed to select one SBU and to forward the questionnaire to the CEO of that unit. Respondents were asked to answer for their business unit. A total of 137 questionnaires were returned and 30 were nondeliverable, leading to an effective response rate of 35.7%.

Using t-tests, the last 25% of respondents were compared to earlier ones and no differences were found in all the variables in the analysis at the 5% level. Based on the assumption that late respondents are similar to non-respondents, non-response bias does not appear to be a major problem.

Respondents represent firms from a range of ownership and sizes. Of the 107 manufacturers in the analysis, 38.3% were state-owned enterprise, three-form enterprise, and 23.4% were private enterprise. With a standard number of employees of 2,000, 58.9% were larger enterprise, and 41.1% were small & medium enterprise.

Descriptive statistics (means and S.D.) as well as the correlation matrix of all variables are presented in Table 2. The constructs were formed by taking the mean of their respective measurement items.

Confirmatory factor analysis was performed by applying LISREL8.3 to 107 responses for the purpose of testing unidimensionality of the scales and estimating overall model fit^[18]. The overall fit was good ($\chi^2= 265.86$; d.f.=155; $p=0.0044$; NNFI=0.93; CFI=0.94; RMSEA=0.079). Next, We evaluate the internal consistency using Cronbach's alpha (which indicates reliability of the mean): all exceeded 0.70, which indicate that the alphas are acceptable (Table 2).

Table 2 Means, Standard Deviations and Correlations

	Mean	Std. Deviation	Cronbach's alpha	Fewer layers	Formalization	Process-based	Locus of decision-making	Break Internal boundary	Infiltrate external boundary	Time-based performance
Fewer layers	3.25	0.651	1	1						
Formalization	1.9629	0.72214	0.8654	-0.369(*) ^①	1					
Process-based	3.4206	0.83846	0.8181	0.266(**)	-0.266(**)	1				
Locus of decision-making	3.6124	0.63219	0.6984	0.476(**)	-0.428(**)	0.444(*)	1			
Internal boundary	3.5167	0.67623	0.7119	0.355(**)	-0.307(**)	0.407(*)	0.583(**)	1		
External boundary	3.3900	0.69111	0.8819	0.378(**)	-0.210(*)	0.181	0.369(**)	0.717(**)	1	
Time-based performance	3.7061	0.69490	0.9041	0.677(**)	-0.569(**)	0.361(*)	0.620(**)	0.562(**)	0.505(*)	1

5 Results

The hypotheses were tested using regression. The regression results of testing for the effects of organizational structure on time-based performance are in Table 3. The results show that all the six proposed organizational structure dimensions have positive influences on time-based performance, and those six hypotheses were fully supported.

Table 3 Multiple Regressions For Time-Based Performance

Independent variables	Dependent variable (time-based performance)			
	R2	Beta	t-value	Sig.
Fewer layers	.458	.677	9.420	.000
Less formalization	.318	.569	7.095	.000
Process-based organization	.130	.361	3.963	.000
Lower locus of decision- making	.385	.620	8.101	.000
Blurred internal boundary	.316	.562	6.960	.000
Infiltrated external boundary	.255	.505	5.999	.000

①**: Correlation is significant at the 0.01 level (2-tailed); *:Correlation is significant at the 0.05 level (2-tailed)

In order to test the moderating effect of size, the sample was split on the standard for population (2,000) to make subgroup analysis. Separate multiple regression models were examined in each group with the time-based performance as the dependent variable and size, dimensions of organizational structure modeled as the predictor variables. The results are summarized in Table 4.

Table 4 Subgroup Analysis Using Multiple Regressions

	Independent variable	Beta	t-value	Sig.	R2	Model(F)
Large firm	Fewer layers	0.223	2.491	0.016	0.703	25.413
	Less formalization	0.521	5.332	0.000		
	Process-based organization	0.021	0.223	0.824		
	Lower locus of decision-making	0.039	0.402	0.690		
	Blurred internal boundary	0.078	0.694	0.491		
	Infiltrated external boundary	0.208	1.827	0.073		
Small firm	Fewer layers	0.621	5.718	0.000	0.704	18.082
	Less formalization	0.042	0.453	0.653		
	Process-based organization	0.048	0.463	0.646		
	Lower locus of decision-making	0.217	1.634	0.111		
	Blurred internal boundary	0.160	0.896	0.376		
	Infiltrated external boundary	0.067	0.421	0.676		

The “Beta” column in Table 4 display the standardized β estimates for the effects of independent variables on time-based performance separate for large and small firms. The standardized β estimates may be compared using t-value. The t-values for testing the equality of the relationship between each dimension of organizational structure and time-based performance across size groups are presented in the next column. Looking down this column, it is seen that two tests are significant: the association of layers with time-based performance when firms are small ($\beta=0.621$, $p<0.001$) is different from that when firms are large ($\beta=0.223$, $p>0.01$); the association of formalization with time-based performance when firms are large ($\beta=0.521$, $p<0.001$) is different from that when firms are small ($\beta=0.042$, $p>0.1$). ‘Fewer layers’ thus promotes time-based performance for small, but not large firms, and ‘less formalization’ promotes time-based performance for large firms but not for small.

The overall conclusion drawn from the subgroup analysis is that size with two exceptions; almost do not moderate the effects of structure reform on time-based performance.

6 Conclusion

The goal of the research was to isolate the effects of organizational structure on time-based performance while controlling for the moderating effect of size.

All hypotheses are supported, which indicates significant relationships among the dimensions of organizational structure and time-based performance. This supports the claim that the firms reduce hierarchy layers, push down locus of decision-making, have lower degree of formalization, have blurred internal boundaries and infiltrated external boundaries would have higher time-based performance. The results imply that there are several aspects of organizational structure to enhance firm’s time-based performance. Thus, firms seeking to attain time-based performance should consider the important role played by these six structural dimensions.

Finally, subgroup analysis was used to examine the moderating effect of firm size. In just two instances were moderation significant---layers associates with time-based performance when firm is small, but not large; formalization associates with time-based performance when firm is large, but not small. The results imply that managers should thus understand that for the most part, they need not concern themselves with size when reforming their organization structure to match the desired level of time-based performance.

In order to permit generalization to other industries, future research could make larger-scale investigation in all industries and test the hypotheses by industry. In addition, future research could examine the moderating effect of firm ownership considering the China’s special condition.

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