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THE ROLE OF ADAPTIVE DECISION MAKING IN RESOURCE CHOICES AMONG SMEs

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ABSTRACT

This article explores the relationship between adaptive decision making and the ability of a firm to acquire certain competitively valuable human resources (HR). The characteristics of these human resources include organizational capabilities, marketing capabilities, and technological capabilities. This research tests the hypothesis that in smaller firms the negotiating mechanism that determines which resources are acquired and developed is bounded by the decision-making process of the organization's top management. The research model is tested using structural equation modeling, and the results indicate that adaptive decision making is one of the processes which drives the emphasis and selection of competitively valuable resources in small and medium-sized enterprise (SME) manufacturing environments. The hypothesized positive direct effect of adaptive decision making on the level of internal resources and capabilities is strongly supported.

It is easy to understand how resources owned or controlled by any firm are the result of past decisions. If they were acquired, invested in, and developed within the organization, there must have been a decision made to do so. The decision to acquire, invest, and develop a resource, including labor, is more than just a budgetary matter; it is a *decision process* by which a firm can increase or decrease its competitive position, ultimately impacting its very survival.

Human resources, such as highly valuable organizational, marketing, and technological capabilities, increase a firm's competitiveness and may lead to higher

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profits. This view of the firm has been referred to as the resources-based view (RBV) and has been discussed in the literature extensively over the last two decades (see literature review). According to RBV, the uniqueness of a resource is perhaps the most significant determinant of future value to the firm. The most unique resource a firm has is often found in the workforce or "human talent." One of the aspects of human resources is that they are inherently unique and easily distinguished from competitors and are therefore a potentially major source of competitive advantage for the firm.

In a large organization, the hiring of human talent is typically carried out through a very formal process which is the responsibility of a designated department (i.e., HR Department). Often, this process is concerned with legality, fairness, access, and a candidates "fit" to the open position. The negotiation process used in "purchasing" human talent is very formalized in large organizations. What about small firms that do not have the personnel depth or the financial resources to carry out extensive searches, interviews, and screening of candidates? In smaller firms, the decision process involved in the acquisition of labor resources, as well as other valuable resources, may be substantially different.

How does the small firm choose which human resources it deems more valuable, and what managerial decision-making process is employed in smaller organizations to make such a decision? Prior research [1, 2] suggests that smaller firms are more flexible and adaptive in their decision-making process for reasons that are inherent in smaller firms (aforementioned). Such a process was identified by Metts [3] with the development of a construct identified as Adaptive Decision Making (ADM) which captures the degree of emphasis that smaller organizations place on adaptation throughout the decision-making process. Does the decision-making mode of smaller firms drive resource choices such as labor? Is the hiring process determined by the firms' desire to adapt quickly to changes in the business environment and less so by the traditional processes followed in larger organizations?

In this article we seek to explore the linkage between ADM and the Internal Resources and Capabilities (resource choices) among SMEs. Our research model (see Figure 1) is explored using data from a survey of manufacturing SMEs and is tested using structural equation modeling (SEM).

LITERATURE REVIEW

Adaptive Decision Making

The term "adaptation" is common in business research. The role of adaptation has been studied in several different business contexts including buyer-supplier behavior and relationships [4, 5], supply chain [6], decision support systems [7], firm economizing behavior [8], investor strategy [9], employee psychological adaptations [10], product adaptation [11], supplier-customer relationships [12], and cultural adaptation [13].

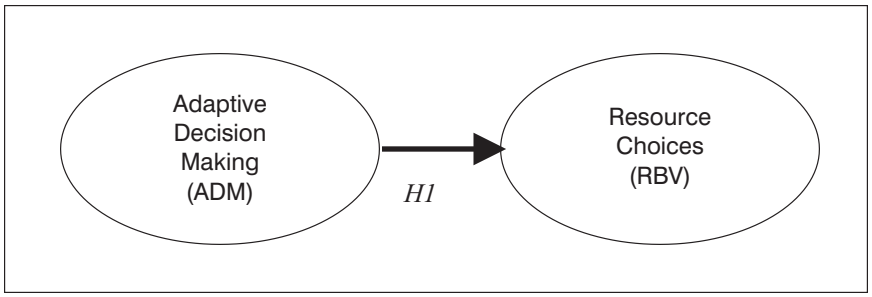

Figure 1. Research mode.

In a case study of 13 buyer-supplier relationships in the automotive and telecommunications industries, Brennan and Turnbull [4] found confirmatory evidence to support their argument that the concepts of power and social exchange in relationships are important drivers of adaptive behavior. More specifically, they found that in cases where a small supplier interacts with a large customer (OEM), the power imbalance leads to a desire on the part of the smaller supplier to respond to requests of the larger customer. This is true in the case of SMEs in general and manufacturing SMEs specifically.

With respect to decision-making processes that produce adaptations, Brennan and Turnbull [4] made two significant observations in relation to this research effort. They found that, in some cases, adaptations took place without any conscious decision having been made; other times they were the result of formal data gathering, analysis, and decision. In small companies, these adaptations are ad hoc and are made at the senior level for two reasons: 1) small companies have a flat organizational structure and therefore have fewer decision making levels, and 2) a given adaptation is comparatively more important in smaller organizations because of resource scarcity. The decision-making processes and the corresponding adaptation types described by Brennan and Turnbull [4] are represented in Figure 2.

Since small organizations lack the managerial depth to support formal processes, they are more likely to employ ad hoc or tacit adaptations that are reflected in decision-making processes. Metts [3] proposed that this adaptive tendency in SMEs is related to practically all decision areas of the business, not just those investigated in prior research.

Sharfman and Dean [14] suggest that the core of all organizational adaptation is the decision-making process. They further suggest that adaptation is "a series of choices about how to respond to perceived threats and opportunities." In a case study of 25 companies, they confirmed earlier work [15] finding that top management flexibility in decision making was a key component of an organization's ability to adapt.

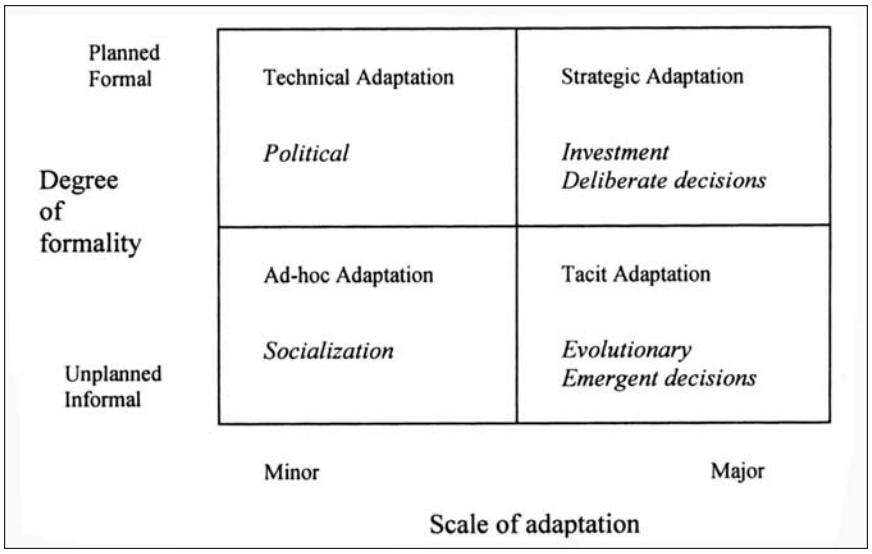

Figure 2. Adaptation process: scale and formality.
Source: [4].

This concept of adaptation in SMEs relates very well to that discussed by McCarthy and Tan [16] in an article applying fitness landscape theory (from biology) to manufacturing environments. By adopting a "complex systems" approach [17], they viewed manufacturing organizations as a system which evolves over time by adopting characteristics in order to survive. Biologists have long used fitness landscape theory to explain the mechanisms by which organisms adapt to conflicting constraints and the complex interactions of the environment. This view pictures a biological landscape where organisms adapt and search for genotypes which are "fitness peaks" on a rugged, multi-peaked, mountainous, "fitness landscape." The similarity with the modern SME manufacturing environment, which is characterized by intense competition and rapid change, is inescapable. According to McCarthy and Tan [16], fitness landscape theory could help manufacturing organizations obtain new insights about the interrelation between internal characteristics (resource) and the external environment (demands of the market). In other words, the adaptive processes are used, consciously or unconsciously, to increase performance and survivability in today's complex business environment.

The fitness points are locations of increased performance and survivability while the lower points represent non-competitiveness and the threat of extinction. While global optimums are rarely identified, local optimums, or fitness points, are sought after in order to survive. When a company finds a local maximum that

will increase performance or the likelihood of survival, it moves to that location. Once there, the search for a more optimum location continues, moving the organization about the landscape. This is result of adaptive decision making in a SME. The SME constantly seeks out a more preferable position and makes decisions based on a desire to adapt in order to avoid extinction or improve its position on the landscape.

According to Metts [3], adaptive decision making reflects the belief that the underlying mechanism driving decisions in small companies is a desire to adapt to their environment in a manageable way in order to survive. Therefore we propose that *adaptive decision making* is the basis for resource choices in SMEs.

> H1: *As the level of adaptive decision making increases, the level of internal resources and capabilities will increase.*

The scale used in this study for adaptive decision making was adopted from prior work [3, 18], consisting of eight items and three dimensions (financial adaptation, customer adaptation, and markets/pricing adaptation). Tests for content validity, construct validity, and nomological validity were conducted and reported. To establish construct validity, tests were employed for unidimensionality, reliability, and convergent validity. Reported Cronbach's alpha values of the dimensions are 0.887 for the financial dimension, 0.625 for customer dimension, and 0.641 for markets/pricing dimension of the construct. Reported measurement model fit statistics indicating excellent model fit to the data include a χ^2 value of 58.212 with 17 degrees of freedom, p value of 0.000, GFI of 0.950, AGFI of 0.894, and RMR of 0.060.

Resource-Based View

Edith Penrose's [19] book, *The Theory of the Growth of the Firm,* is regarded by many strategy scholars as the basis for the resource-based view (RBV) of the firm [20]. Penrose viewed the firm as a broader set of resources and viewed growth as the result of achieving the proper balance between exploitation of these resources and the development of new ones. Foundations of RBV include significant foundational contributions from Wernerfelt [21] and Teece [22], both of whom quoted Penrose's work. According to Cockburn, Henderson, and Stern [20] the strategy process foundations of RBV were more influenced by Stinchombe [23] and Nelson and Winter [24].

RBV views the firm as a *bundle of resources* [25]. These resources are further defined as competencies and capabilities [26]. According to Rumelt [27], the heterogeneous resources of a firm generate isolating mechanisms which separate the firm from its competitors. Thus, superior returns are achievable to the degree to which the firm's competences and capabilities are specific (i.e., imperfectly mobile), valuable to customers, non-substitutable, and difficult to

imitate [26]. In the resource-based view Ricardian rents (profits) are produced by the uniqueness of the resource base, which generate differentiated levels of "efficiency" [28, 29].

Spanos and Lioukas [25] developed a scale for Internal Resources and Capabilities (resource choice) based on RBV theory. The scale consists of three dimensions including organizational capabilities [28], marketing capabilities [30], and technological capabilities [30, 31].

Organizational capabilities consist of managerial skills and competencies, knowledge and skills of employees, organizational structure and culture, efficient coordinative mechanisms, strategic planning procedures, and the ability to attract creative employees. Marketing capabilities include building of privileged relationships with customers and suppliers, market knowledge, control over distribution channels, and a strong "installed" customer base. Technical capabilities consist of efficient production, technological capabilities and infrastructure, and economies of scale and technical experience.

The Internal Resources and Capabilities (IRC) scale was tested in prior literature [25] for content validity, construct validity, and nomological validity. To establish construct validity, tests were employed for unidimensionality, reliability, and convergent validity. Reported Cronbach's alpha values of the dimensions are 0.685 for organization/managerial, 0.764 for marketing dimension, and 0.893 for technical dimension of the construct. Reported measurement model fit statistics include a χ^2 (75) of 141.138, p value of 0.001, CFI of 0.922, and Robust CFI of 0.920.

SURVEY AND METHODOLOGY

With the valued support of the manufacturing associations of Indiana, Ohio, and Michigan, a survey was mailed to 3,965 manufacturing SMEs in the mid-west. Small and medium-sized enterprises (SME) are defined by the U.S. SBA as firms with less than 500 employees. In the regional economy consisting of Ohio, Michigan, and Indiana, manufacturing employment contributes approximately 1.5 million jobs and 70 billion in payroll (U.S. SBA, 2000). Thus, the tri-state region represents 22 percent of SME manufacturing jobs and 31 percent of SME manufacturing payroll in the United States. Therefore, the tri-state region is a significant part of the total U.S. SME manufacturing base and would serve well as a proxy for U.S. manufacturing SMEs. The number of respondents and percentages for each state is broken down in Table 1.

A wide variety of manufacture's responded to the survey, including companies involved in the manufacturer of automotive or recreational vehicle parts, specialty products, tool and die, food, wood, furniture, and numerous other manufacturing types. Over 94 percent (94.5 percent) of the respondents were CEOs or top managers (532 valid cases out of 547), and almost 70 percent (69.6 percent) represented family businesses (533 valid cases out of 547).

Table 1. Survey Response Summary

State	Valid responses	Response rate	Percentage of total
Michigan	171	11.64%	31.3%
Indiana	198	21.24%	36.2%
Ohio	178	11.51%	32.5%
Total	547	13.74%	100.0%

The data set was analyzed for missing data patterns, maximum and minimum response values, and excluded case percentages for each survey item (see Appendix C). Before any analysis was done, a random sample of 27 (5 percent sample) surveys were selected and audited for data entry errors. Every data field was audited for the selected sample of surveys and no discrepancies were found. The statistics for each survey item was analyzed including maximum and minimum values, the mean, standard deviation, and skewness. All cases were analyzed to check the number of missing and valid cases for each item as well as to make sure that the recorded response was within the appropriate range (1 to 5). Since no missing data patterns were detected, the data is considered to be missing completely at random (MCAR). Mean substitution was used to replace missing data in all subsequent analysis. The linearity and normality of the data were evaluated prior to applying mean substitution to satisfy the assumptions for multivariate procedures.

MODEL TESTING

Confirmatory Factor Analysis

In the following section, the ADM and IRC scales were tested to validate them on the data set used in this study. Structural equation modeling (SEM) confirmatory factor analysis (CFA) was conducted using AMOS 4.0 software developed by James Arbuckle [32].

Confirmatory factor analysis tests the unidimensionality of each construct. CFA is a form of latent variable SEM [33]. In SEM CFA the relationship between scores on the survey instrument (observed indicator variables) and the latent variables they are hypothesized to measure [34] are tested. SEM goes beyond simple correlation analysis by simultaneously exploring the relationships in a single model that accounts for interaction among variables.

SEM has several notable advantages over traditional multivariate procedures [35]. First of all, SEM takes a confirmatory approach by requiring that the relationships among variables be specified *a priori.* Secondly, SEM provides explicit estimation of errors, unlike traditional multivariate approaches.

In SEM, model fit is estimated using either absolute, relative, or adjusted fit indexes [36]. Absolute indexes do not impose any baseline (comparison to alternate models) for a particular data set. These indexes measure whether or not the residual (unexplained) variance is appreciable. Absolute indexes include Chi-square (χ^2), Chi-square per degree of freedom (χ^2/df), root mean square residual (RMR), and goodness of fit index (GFI). The Chi-square and Chi-square per degree of freedom look at the absolute size of residuals. While Chi-square is perhaps the most popular index to evaluate goodness of fit, it is sensitive to sample size and departures from multivariate normality. Researchers suggest that Chi-square must be interpreted with caution [37]. RMR is the square root of the mean squared difference between the elements of the predicted and observed matrices and has a value between 0 and 1. Lower values indicate better fit with 0.10 or lower indicating good fit [38]. GFI assesses the relative amount of the variances and co-variances accounted for by the model.

Relative fit indexes compare the test model to other possible models (independence or null) with the same data. Examples of relative fit indexes reported in AMOS 4.0 include NFI, TLI, IFI, and BFI or RNI. Adjusted fit indexes combine model fit and parsimony into a single index. Examples of adjusted fit indexes reported in AMOS 4.0 include PGFI, PNFI, and TLI. For additional information and detailed formulation of the indexes see Maruyama [33].

At the present time, there is no agreement in the literature on a single optimal test or even a set of optimal tests to evaluate models [33]. However, many researchers interpret these index scores in the range of 0.80–0.89 as representing reasonable fit and 0.90 and higher as good fit [37]. Several fit indexes will be provided including χ^2, χ^2/df, RMR, AGI, and AGFI for each measurement model.

Results of Confirmatory Factor Analysis

Confirmatory analysis of the adaptive decision-making scale resulted in a χ^2 value of 58.212 with 17 degrees of freedom giving a χ^2/df ratio of 3.424. The second order standardized regression loadings were 0.23 for the financial constraints dimension, 0.71 for the customer needs and preferences dimension, and 1.15 for the marketing/pricing adaptation dimension. The first order standardized regression weights for the financial constraints dimension were 0.88 (adpt6), 0.96 (adpt7), and 0.73 (adpt8). The first order regression weights for the customer needs and preferences dimension were 0.67 (adpt3) and 0.68 (adpt4). And the markets/pricing adaptation dimension had first order standardized regression weights of 0.63 (adpt1), 0.75 (adpt2), and 0.42 (adpt5). All first order standardized regression loadings were significant at the 0.01 level. The CFA model for ADM, the scale items from the survey, and the results of reliability testing is presented in Appendix A. Overall model fit indexes are shown in Table 2. The high GFI and TLI (>0.90) and the low RMR value of 0.060 (<.10) indicate good model fit to the data.

Table 2. Model Fit Indexes for Adaptive Decision Making

Model	GFI	AGFI	RMR	TLI
Default model	0.950	0.894	0.060	0.918
Independence model	0.549	0.420	0.278	0.000

The high GFI, AGFI, and TL1 (>0.80) indicate reasonable model fit, and the low RMR value of 0.060 (<.10) indicates good fit to the data.

Internal Resources and Capabilities CFA

The internal resources and capabilities (resource choice) scale used in the study consists of three unobserved latent variables including organizational and managerial capabilities (Ifo1 through Ifo7), technical capabilities (Ift1 through Ift4), and marketing capabilities (Ifm1 through Igm4) for a total of 15 items.

The CFA analysis resulted in a χ^2 value of 264.255 with 87 degrees of freedom giving a χ^2/df ratio of 3.037. The second order standardized regression loadings were 0.76 for the organizational and managerial latent variable, 0.94 for the technical capabilities latent variable, and 0.82 for the marketing capabilities latent variable. First order loadings for the organization and managerial capabilities latent variable were 0.75 (ifo1), 0.61 (ifo2), 0.57 (ifo3), 0.66 (ifo4), 0.50 (ifo5), 0.50 (ifo6), and 0.56 (ifo7). First order loadings for the technical capabilities latent variable were 0.52 (ift1), 0.52 (ift2), 0.81 (ift3), and 0.80 (ift4). First order loadings for the marketing capabilities latent variable were 0.68 (ifm1), 0.56 (ifm2), 0.49 (ifm3), and 0.51 (ifm4). All first and second order standardized regression loadings were significant at the 0.01 level.

The CFA model for IRC, the scale items from the survey and the results of reliability testing is presented in Appendix B. Overall model fit indexes are shown in Table 3.

Table 3. Model Fit Indexes for the Internal Resources and Capabilities

Model	GFI	AGFI	RMR	TLI
Default model	0.885	0.841	0.044	0.826
Independence model	0.422	0.340	0.193	0.000

The high GFI, AGFI, and TL1 (>0.80) indicate reasonable model fit, and the low RMR value of 0.041 (<.10) indicates good fit to the data.

MODEL TESTING

Testing of hypothesis 1 was conducted by constructing a structural model using the confirmed ADM and IRC scales. The structural model measures the direct effect of ADM on IRC as presented in Figure 3. The Model test resulted in a χ^2 value of 12.547 with 8 degrees of freedom giving a χ^2/df ratio of 1.568. The relationship between Adaptive Decision Making and Internal Resources and Capabilities was found to be highly significant with a regression loading of 0.39 and a *t*-value of 2.923 ($p = .003$).

The model fit indexes are reported in Table 4. The results indicate excellent fit between the hypothesized model and the data.

DISCUSSION

The structural model test indicated very strong support for the hypotheses (H1). The rigor expended in developing the model, testing the data, and testing the model engendered confidence with regard to its interpretation. As indicated by the test results, it appears that smaller organizations who are more adaptive in their decision making tend to benefit by acquiring competitively valuable resources. This is easy to understand in the SME context. SMEs do not have enough resources (personnel or otherwise) to institutionalize decision making along formal designs. Given the resource limitations, there are few choices that remain. As indicated in the work by Brennan and Turnbull [4], the lower degree of formality in SMEs would lead to either *ad hoc* or *tacit* adaptation schemes. In both of these schemes the smaller organization is reacting "consciously" in the *ad hoc* case and "unconsciously" in the *tacit* case. Both of these less formal response styles are akin to reaction instead of pro-action.

Given the flat organizational structure of SMEs and their limited resources, they are more likely to stay in reactive mode in most decision situations. Since there is not adequate resources to employ toward anticipating change, SMEs would tend to develop abilities to quickly respond to change. This explains the flexibility characteristic in SMEs. They become very good at something that they regularly practice. Since few formal processes exist, change is not anticipated; it is reacted to, and quickly.

So what does this have to do with Adaptive Decision Making and the development of the competitively valuable resources and capabilities?

If SMEs are somewhat stuck in a reactionary mode, it is critical that they are focused on the right things. In other words, if their decision process is focused on the right outcomes, they might tend to make more productive resource decisions. With Adaptive Decision Making, the degree to which they focus on three very important outcomes during the decision-making process is measured: financial, customers, and markets/pricing (competition level). The findings then agree with logic in that we would be expected, given the characteristics of SMEs and the time

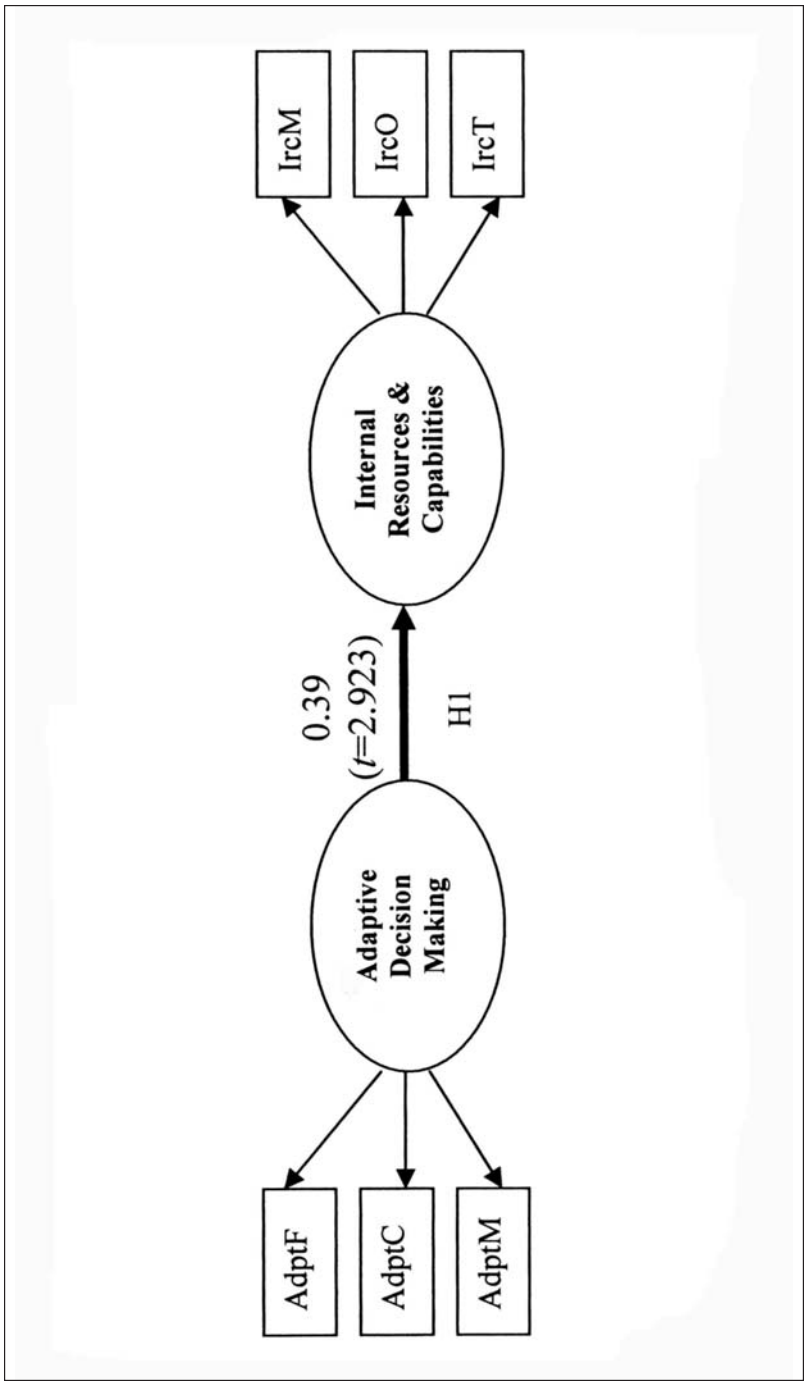

Figure 3. Research model test results.

Table 4. Model Fit for the Research Model

Model	GFI	AGFI	RMR	TLI
Default model	0.985	0.961	0.017	0.973
Independence model	0.694	0.572	0.093	0.000

The high GFI, AGFI, and TL1 (>0.80) indicate reasonable model fit, and the low RMR value of 0.017 (<.10) indicates good fit to the data.

compression of many of the managerial processes within them, that their would be a payoff to those decision makers who are focused on three vitally important factors at "crunch" time.

CONCLUSIONS

In summary, this article shows that adaptive decision making directly impacts the levels of resources and capabilities within SMEs. Very strong support was found for the hypotheses, and a potentially valuable practitioner assessment tool has been identified. SME adaptive focus in decision making can be easily measured using the eight-item scale and used for comparison purposes to establish benchmarks for improvement.

The level of resources and capabilities within SMEs has strong implications for performance based on prior research, although untested here. Therefore, there may also be performance implications from adaptive decision making. Future research should seek to ultimately connect ADM to performance to test if ADM increases performance among SMEs. Future research should also seek to test the ADM construct in a service environment.

While this research found highly significant support for the hypotheses, there are some limitations to this research that impact its generalizability and application to other regions and to other types of businesses. This research was conducted among SMEs involved in manufacturing in the mid-western United States. While the SME manufacturing concerns in the mid-west represent a significant number of the U.S. total, they are heavily focused in the auto industry. Also, there are some significant differences between manufacturing and service types of businesses that are a cause of concern. Manufacturing tends to be more capital intensive which changes the nature, and potentially the value of, their resources. Therefore the strong relationship found in this research may not hold up in service-oriented organizations. Lastly, this is largely a regional study, therefore caution should be used in evaluating its applicability to other regions of the United States and, particularly, across national boarders.

APPENDIX A

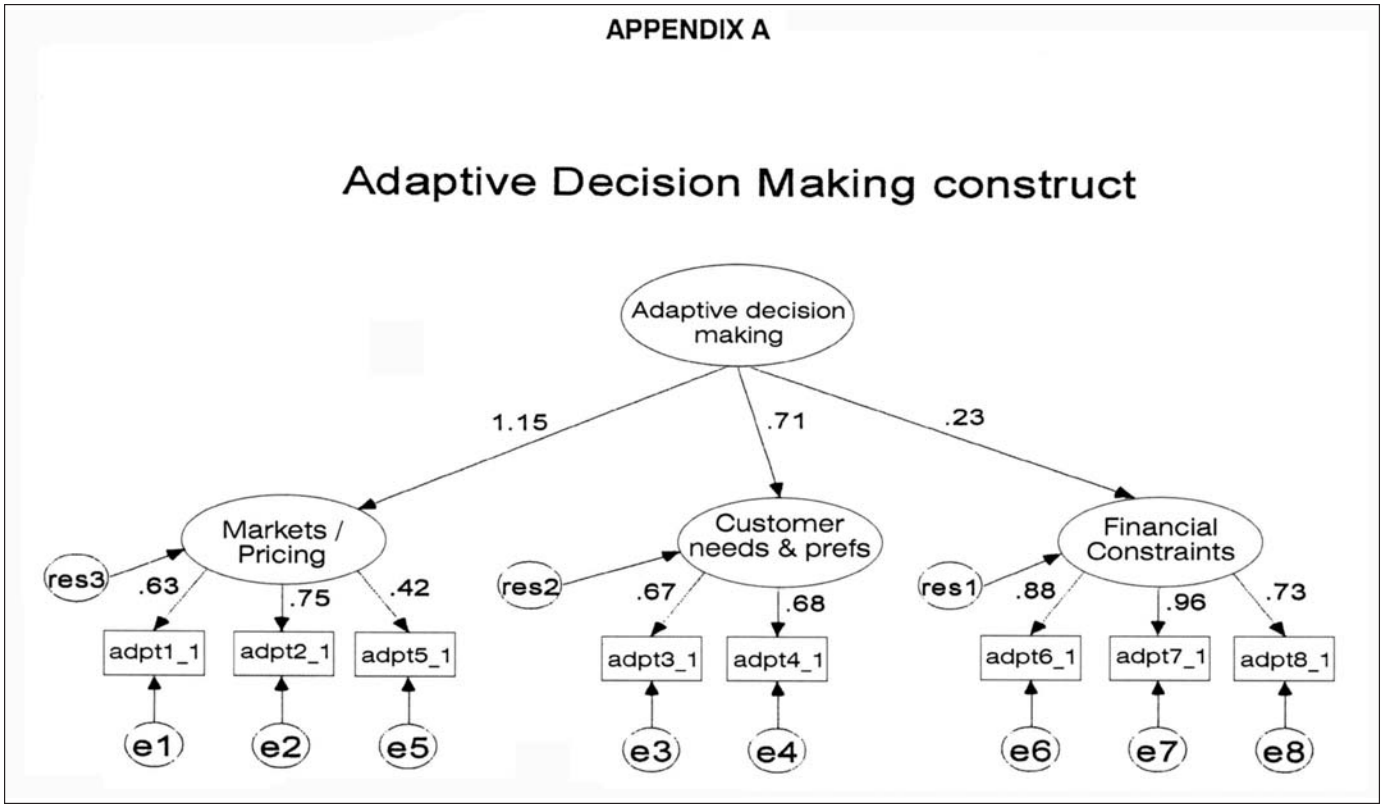

Figure A-1: SEM measurement model of Adaptive Decision Making construct (standardized regression weights).

Table A-1. Items and Coding for Adaptive Decision Making Construct

CODE	ITEM Indicate the degree of emphasis which your manufacturing plant places on the following activities/priorities
ADPT1	Adapt to competitor pricing
ADPT2	Adapt to market forces in industry
ADPT3	Adapt our resources to customer needs and preferences
ADPT4	Adapt our capabilities to the current business environment
ADPT5	Adapt our product pricing to our suppliers pricing
ADPT6	Adapt to restraints of our cash flow
ADPT7	Adapt to restraints of capital availability
ADPT8	Adapt to debt holder's (i.e., bank's) requirements

Table A-2. CITC, Reliability and Extracted Variance for the Adaptive Decision Making Scale

Unobserved variable	Items	CITC	Reliability	Variance extracted
Financial adaptation	Adpt6	.7948	α = .8870	36.9% of 71.7% total
	Adpt7	.8347		
	Adpt8	.7287		
Customer adaptation	Adpt3	.4601	α = .6251	21.5% of 71.7% total
	Adpt4	.4601		
Market/pricing adaptation	Adpt1	.5733	α = .6412	13.3% of 71.7% total
	Adpt2	.4489		
	Adpt5	.3552		

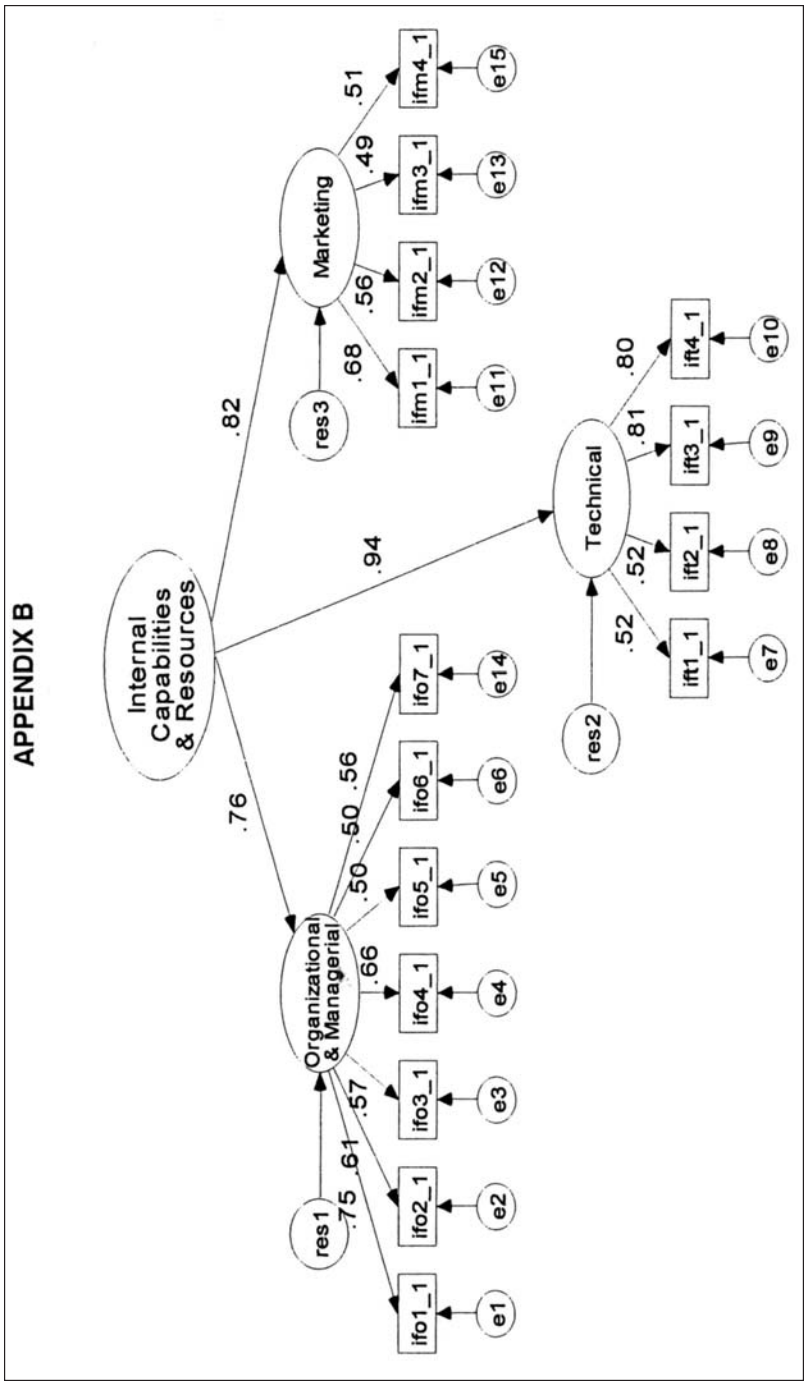

Figure B-1: SEM measurement model for Internal Resources and Capabilities construct (standardized regression weights).

Table B-1. Internal Resources and Capabilities Items

CODE	ITEM Please indicate for each of the following, your firm's strength relative to your competitors
Ifo1	Managerial competencies
Ifo2	Knowledge and skills of employees
Ifo3	Firm climate (quality of work environment)
Ifo4	Efficient organizational structure
Ifo5	Coordination between employees
Ifo6	Strategic planning activities
Ifo7	Ability to attract creative employees
Ifm1	Market knowledge
Ifm2	Control and access to distribution channels
Ifm3	Advantageous relationships with customers
Ifm4	Current customer base
Ift1	Efficient and effective production department
Ift2	Economies of scale
Ift3	Technical experience
Ift4	Technical capabilities and equipment

Table B-2. CITC, Reliability and Alpha if Item Deleted Values for the Internal Resources and Capabilities Scale

Unobserved variable	Items	CITC	Reliability	If item deleted
Organizational and managerial capabilities	Ifo1	.6078	α = .8097	.7737
	Ifo2	.5436		.7852
	Ifo3	.5709		.7801
	Ifo4	.5534		.7832
	Ifo5	.4957		.7933
	Ifo6	.5219		.7900
	Ifo7	.5314		.7871
Technical capabilities	Ift1	.5302	α = .7906	.7716
	Ift2	.5280		.7743
	Ift3	.6578		.7086
	Ift4	.6875		.6921
Marketing capabilities	Ifm1	.4871	α = .6970	.6296
	Ifm2	.4916		.6283
	Ifm3	.4433		.6556
	Ifm4	.5073		.6162

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