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The Effects of Dynamic IT Capability and Organizational Culture on Firm Performance: An Empirical Study

Li Xiao  
*Gardner-Webb University, lxiao@gardner-webb.edu*

Subhashish Dasgupta  
*George Washington University, dasgupta@gwu.edu*

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THE EFFECTS OF DYNAMIC IT CAPABILITY AND
ORGANIZATIONAL CULTURE ON FIRM PERFORMANCE:
AN EMPIRICAL STUDY

Completed Research Paper

Li Xiao
Gardner-Webb University
lxiao@gardner-webb.edu

Subhasish Dasgupta
George Washington University
dasgupta@gwu.edu

Abstract

This paper presents an empirical study that examines the effects of dynamic IT capability and organizational culture on firm performance. More specifically, this study investigates the main effects of dynamic IT capability on firm performance, the main effects of organizational culture on firm performance, and the interaction effects between the two factors on firm performance. Adopting the Resource-Based View (RBV) of the firm, dynamic capabilities theory, complementarity theory, and organizational culture theories, this multidisciplinary study uses survey method to collect data. This study finds that dynamic IT capability and organizational culture jointly predict firm performance. This research makes a contribution to both academic research and management practice. Theoretically, this study integrates multiple theories to provide a better IT business value model; practically, this study provides leaders in industry with useful advice on IT/IS strategy and IT investment decision-making.

Keywords: Dynamic IT Capability, IT investments, resource based view of the firm, dynamic capabilities theory, organizational culture, firm performance.
The Effects of Dynamic IT Capability and Organizational Culture on Firm Performance: An Empirical Study

Introduction

IT business value research examines the relationship between IT investment and firm performance (Melville et al. 2004). It has been an enduring research theme in IS literature (Kohli and Devaraj 2003). Meta-analytic studies on this topic call for further research on adopting the Resource-Based View (RBV) of the firm to explain IT business value (Melville et al. 2004), and on identifying organizational factors such as culture that may complement IT in creating business value (Dedrick et al. 2003; Kohli and Devaraj 2003). This study aims to address these two areas to better explain IT business value. The key terms used in this study are presented as follows.

- Dynamic IT Capability: The construct dynamic IT capability is developed in this study, which is an extension of IT capability to include the dynamic dimension based on dynamic capabilities theory. Dynamic IT capability is defined as the ability to integrate, build, and reconfigure IT-based resources and competences to adjust to rapidly-changing environments (adapted from Teece, Pisano and Shuen (1997) and Bharadwaj (2000)).

- Organizational Culture: “The underlying values, beliefs, and principles that serve as a foundation for an organization’s management system as well as the set of management practices and behaviors that both exemplify and reinforce those basic principles” (Denison 1990, p. 2).

- Firm Performance: The outputs or results of a firm as measured against its intended outputs. There are different measures of firm performance, such as financial firm performance, market firm performance, employee satisfaction and social responsibility. Among the various forms of firm performance, financial and market firm performances receive a lot of attention of managers and researchers because of their importance in a firm’s survival and success. As a result, this study focuses on financial and market firm performance.

The rest of the paper is organized as follows. In the next section, the theoretical framework and research hypotheses are developed. Then the method to test the hypotheses is presented. After that the data were described and results were discussed. Finally the paper concludes with a discussion of the research findings and areas for future research.

Theoretical Framework and Hypotheses

This section reviews the relevant literature, including RBV, dynamic capabilities theory, and organizational culture literature.

Resource-Based View (RBV) of the Firm and IS research

Originally developed in the field of strategic management, Resource-Based View of the firm (RBV) argues that firms possess resources and capabilities that determine their competitive advantage and firm performance (Barney 1991). Wade and Hulland (2004) review RBV in IS research and confirm the usefulness of RBV for IS research. Despite the general usefulness of the RBV, there are some limitations to the theory. One limitation of the RBV is the assumption of static equilibrium, without addressing the issue of sustainable competitive advantage in a volatile and dynamic environment (Chan et al. 2004; Wade and Hulland 2004). In order to extend the RBV to address this limitation, scholars such as Teece et al. (1997), Eisenhardt and Martin (2000), and Pavlou (2004) advocate using dynamic capabilities theory to address rapidly changing environments. Next, literature on dynamic capabilities theory is reviewed.

Dynamic Capabilities Theory

As an extension of the RBV, dynamic capabilities are defined as “the ability to integrate, build, and reconfigure internal and external competencies to address rapidly-changing environments” (Teece et al. 1997 p. 517). The
concept of dynamic capabilities offers promising hope in explaining sustainable competitive advantage and long term superior firm performance. Teece et al. argue that although well-known companies such as IBM, Texas Instruments, and others appear to have followed RBV to obtain competitive advantage and superior firm performance, RBV is not enough to explain the significant competitive advantage achieved by them. They argue that firms with superior competitive positions in market are those who can respond to technology change and market change rapidly and coordinate and redeploy internal and external resources effectively (Teece et al. 1997 p. 517).

In studying the relationship between IT and firm performance, scholars argue for inclusion of dynamic capabilities theory (Bharadwaj 2000; Wade and Hulland 2004). This study incorporates dynamic capabilities theory and proposes the construct of dynamic IT capability, which is reviewed in the following section.

**Dynamic IT Capability**

This study adopts Bharadwaj’s (2000) conceptualization of IT capability and Pavlou and El Sawy’s (2006) conceptualization of dynamic capabilities to conceptualize the construct of dynamic IT capability. Adopting RBV, Bharadwaj (2000) classifies IT capability as including the following: IT infrastructure, human IT resources, and IT-enabled intangibles. IT infrastructure refers to the physical IT assets including computer hardware, software, communication technologies, and sharable technical platforms and databases. Human IT resources include the technical IT skills such as programming skills, and managerial IT skills such as project management and leadership skills in IT functions. IT-enabled intangibles are hidden benefits of IT that indirectly impact organizational effectiveness, such as customer orientation, knowledge assets, and synergy. Drawing on the dynamic capabilities construct developed by Pavlou and El Sawy (2006), IT reconfigurability is added in this study to address the firm’s ability to adjust its IT resources to a fast changing environment. IT reconfigurability refers to a firm’s ability to adjust its IT resources to the fast changing environment. Technologies change at a fast speed. With strong IT reconfigurability, firms can reallocate and remobilize their IT resources to address the changes in market and technologies. As a result, IT infrastructure, human IT resources, IT-enabled intangibles, and IT reconfigurability are considered to be the four components of dynamic IT capability.

In trying to establish a link between IT and firm performance, researchers recommend further research on complementarity between dynamic IT capability and organizational culture, which is the focus of this study. The following section discusses relevant literature on organizational culture as a strategic resource and its relationship to firm performance.

**The Fey and Denison (2003) Organizational Culture Theory**

Organizational culture is often related to IT practices and success, such as Fedrick (2001) and Harper and Utley (2001). At the same time, organizational culture is regarded as a strategic resource in firms (Barney 1986; Barney 1991; Chan et al. 2004; Fiol 1991; Heck 2004; Kaarst-Brown et al. 2004; Michalisin et al. 2000; Michalisin et al. 1997; Wade and Hulland 2004; Zahra et al. 2004) and is related to performance (Denison 1990; Denison and Mishra 1995; Kotter and Heskett 1992). As a result, we include organizational culture in this study.

Organizational culture is a broad and multi-faceted construct. Although culture is classified as artifacts, espoused beliefs and values, and underlying assumptions (Schein 2004), culture values and beliefs are mostly operationalized and researched in literature, because cultural values and beliefs are what make one organization different from others and may justify and predict cultural behavior and artifacts. In addition to the levels of culture, the issue of general and sub culture adds to the complexity of organizational culture. Individual departments may have their unique sub-culture that is different from other departments. Despite the above issues on culture, many studies are conducted on the area because organizational culture plays such an important role in every aspect of organization and organizational performance.

Based on research on organizational effectiveness, Denison and Mishra (1995) develop a theory of organizational culture and firm effectiveness. They classify cultural values into four components based on two dimensions of cultural values as shown in Figure 1.
The Fey and Denison (2003) organizational culture survey and theory have been empirically tested to be valid and reliable in understanding organizational culture and its relationship to organizational effectiveness. This study adopts this framework because of several merits to this theory. Firstly, this organizational culture is especially relevant to IT management practices. For example, the internal vs. external focus helps us understand how firms look differently at the rapidly changing IT in their environment. Externally focused firms pay closer attention to emerging technologies and are more likely to embrace them fast. On the other hand, internally focused firms that emphasize harmonious internal characteristics tend to avoid new technologies that may change the way they operate. The flexibility vs. stability dimension also assists us to predict how firms respond to new IT. Firms that emphasize flexibility, discretion, and dynamism, such as computer software firms, are more likely to welcome an emerging IT and seize the opportunity created by it; firms that emphasize stability, order, and control, such as universities and government agencies, are more conservative in taking on new IT. Secondly, this framework is found to have a high degree of congruence with well-known categorical schemes that organize people’s values and assumptions. For example, Cameron and Quinn (1999) also conceptualize organizational culture on the dimensions of internal vs. external focus, as well as stability and flexibility.

By including the interaction between organizational culture and dynamic IT capability, this study may explain the relationship between organizational culture and firm performance better than previous studies. The following subsection reviews complementarity theory that may explain the interaction between dynamic IT capability and organizational culture.

**Interaction between Dynamic IT Capability and Organizational Culture**

The literature that directly addresses interaction between organizational culture and IT in influencing firm performance is very limited. However, organizational culture and dynamic IT capability can interact with each other in influencing firm performance in various ways. For example, cultural values interact with IT infrastructure in impacting how firms make use of their IT assets. An adaptable culture will be much more encouraging about innovation and constant product improvement than a culture that is weak on this dimension. As a result, firms with strong adaptability culture and highly integrated IT infrastructure will be more likely to do well in continuous product improvement than firms without such a combination. Similarly, values also complement human IT resources in influencing performance. For example, firms with strong human IT resources and yet a culture focusing on stability and internal characteristics will be more likely to resist the change associated with new application systems; on the other hand, firms with a highly adaptable culture but weak human IT resources will not perform their best either because of poorly designed application systems. A strong dynamic IT capability can be a valuable resource that firms use to obtain competitive advantage and superior performance, but how well firms embrace new technologies and make use of an integrated IT infrastructure and robust human IT resources lies in
their cultural values. Only those firms with a strong dynamic IT capability and a culture that is conducive to IT can achieve optimal firm performance.

Based on the above review of literature, this study proposes that organizational culture does interact with dynamic IT capability in influencing performance.

**Proposed Research Model**

Based on the literature review on IT business value research, RBV and dynamic capabilities, organizational culture, and complementarity theory, the research model is presented as Figure 2.

![Figure 2. Research Model](image)

**Hypotheses**

H1. Dynamic IT capability is positively related to firm performance. In other words, the greater the dynamic IT capability is, the stronger will be the firm performance.

H2. Organizational culture is related to firm performance.

H3. There is interaction between organizational culture and dynamic IT capability in influencing firm performance.

**Methodology**

**Measures**

Dynamic IT capability was measured by a combination of existing and developed constructs as listed in Appendix. As for measurement of culture, the Organizational Culture Survey developed by Fey and Denison (2003) was used in this study. In IT business value research, researchers used a number of variables to measure firm performance (Devaraj and Kohli 2003; Hitt and Brynjolfsson 1996). Within this research, firm performance was measured by perceived financial and market performance (Wu et al. 2006) as well as secondary measures such Tobin’s Q (Tanriverdi 2005) and Return on Assets (ROA) (Tanriverdi 2005). Please see Appendix for the instruments used in the study.

Characteristics of industries impact firm performance. Hence we focus on a single industry to control for extraneous industry factors that could confound the analysis. In addition, firm size is an important factor in determining profitability and financial performance of firms because of economy of scale. As a result, firm size is often used as a control variable in an attempt to control some of the extraneous factors. Here firm size is operationalized as the number of full-time employees of the firm. Table 1 lists the variables used in this study.
### Table 1. Instrumentation - Variables Used in This Study

<table>
<thead>
<tr>
<th>Variable</th>
<th>Components (Reference)</th>
<th>Label</th>
<th>Description</th>
<th>Data Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ind. Var.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic IT Capability (DITC)</td>
<td>IT Infrastructure (Bharadwaj 2000; Bhatt and Grover 2005)</td>
<td>ITF</td>
<td>An organization’s physical IT assets, including computer hardware, software, communication technologies, and sharable technical platforms and databases.</td>
<td>6 items on questionnaire</td>
</tr>
<tr>
<td></td>
<td>Human IT Resources (Bharadwaj 2000)</td>
<td>ITH</td>
<td>IT related skills, including technical skills such as programming skills, and managerial skills such as project management and leadership skills in IT functions.</td>
<td>4 items on questionnaire</td>
</tr>
<tr>
<td></td>
<td>Intangible IT Resources (Bharadwaj 2000)</td>
<td>ITI</td>
<td>Invisible benefits of IT that indirectly impact organizational effectiveness, such as customer orientation, knowledge assets, and synergy.</td>
<td>3 items on questionnaire</td>
</tr>
<tr>
<td></td>
<td>IT Reconfigurability (Pavlou and El_Sawy 2006)</td>
<td>ITR</td>
<td>An organization’s ability to adjust its IT resources to the fast changing environment.</td>
<td>3 items on questionnaire</td>
</tr>
<tr>
<td>Org. Culture</td>
<td>Involvement (Fey and Denison 2003)</td>
<td>OCI</td>
<td>Building human capability, ownership and responsibility.</td>
<td>9 items on questionnaire</td>
</tr>
<tr>
<td></td>
<td>Consistency (Fey and Denison 2003)</td>
<td>OCC</td>
<td>Defining the values and systems that are the basis of a strong culture.</td>
<td>9 items on questionnaire</td>
</tr>
<tr>
<td></td>
<td>Adaptability (Fey and Denison 2003)</td>
<td>OCA</td>
<td>Translating the demands of the business environment into action.</td>
<td>9 items on questionnaire</td>
</tr>
<tr>
<td></td>
<td>Mission (Fey and Denison 2003)</td>
<td>OCM</td>
<td>Defining a meaningful long-term direction for the organization.</td>
<td>9 items on questionnaire</td>
</tr>
<tr>
<td><strong>Dep. Var.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objective Firm Performance Measures</td>
<td>Financial Firm Performance (Wu et al. 2006)</td>
<td>FFP</td>
<td>Self-reported financial performance, including profitability, ROI, and cash flow.</td>
<td>3 items on questionnaire</td>
</tr>
<tr>
<td></td>
<td>Market Firm Performance (Wu et al. 2006)</td>
<td>MFP</td>
<td>Self-reported market-based performance, including sales growth, market share, market development, and new product development.</td>
<td>4 items on questionnaire</td>
</tr>
<tr>
<td><strong>Ctrl. Var.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm Size</td>
<td>Firm Size (Tanriverdi 2005)</td>
<td>SZ</td>
<td>Number of full-time employees within the organization.</td>
<td>1 item on questionnaire</td>
</tr>
</tbody>
</table>

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Data Collection and Analysis

Sample

The main population of interest was firms in the IT related industries in the US. Table 2 lists the specific descriptions of sub-industries as defined in the North American Industry Classification System (NAICS) and number of companies retrieved from Compustat database. This study chose this industry for data collection for two reasons. First, it was a very large industry with a large number of firms. There were 1,574 firms identified in Compustat, accounting for 7% of all 22,253 firms listed in Compustat. Secondly, data collection was limited to one industry to control for the effects of industry.

<table>
<thead>
<tr>
<th>Industry (NAICS Code)</th>
<th>No. of Firms in Compustat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing - Computer and Electronic Product Manufacturing (334)</td>
<td>912</td>
</tr>
<tr>
<td>Information - Telecommunications (517)</td>
<td>253</td>
</tr>
<tr>
<td>Information – Internet Service Providers, Web Search portals and Data Processing Services (518)</td>
<td>166</td>
</tr>
<tr>
<td>Services – Computer Systems Design and Related Services (5415)</td>
<td>203</td>
</tr>
<tr>
<td>Services – Management, Scientific and Technical Consulting Services (5416)</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>1,574</td>
</tr>
</tbody>
</table>

The major data collection process started in May 2007 and lasted for about five months. Both paper-based and online questionnaires were used for data collection. The surveys were addressed to senior IT executives, other senior executives, or IT managers identified through public databases, including Hoover’s Company Records, Mergent, and Compustat. Incentives to encourage participation were offered to send respondents an executive summary of the research findings of this study as an incentive for them to participate. As of early September 2007, 183 responses from 134 companies were received, 25 through paper and 158 through Internet.

Reliability

Reliability is the degree to which a measure is consistent or dependable (Trochim 2001). Cronbach’s alpha is often used to measure the internal consistency. Nunnally (1978) suggests Cronbach’s alpha of at least 0.8 for basic research. Table 3 lists the standardized Cronbach’s alpha values for the dynamic IT capability, organizational culture, and perceived firm performance measures in this study, which are all much higher than the threshold.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic IT Capability (DITC)</td>
<td>0.92</td>
</tr>
<tr>
<td>Organizational Culture</td>
<td>0.97</td>
</tr>
<tr>
<td>Perceived Firm Performance</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Confirmatory Factor Analysis (CFA) of the Dynamic IT Capability Instrument

A confirmatory factor analysis (CFA) has been done to test the structure of the dynamic IT capability instrument proposed in this study. Table 4 lists the goodness of fit of the construct structure. All the factor loadings in the
construct are significant (t value > 1.96). As a result, the proposed dynamic IT capability instrument is confirmed to be valid.

### Table 4a. Goodness of Fit of (First Order – DITC-Component)

<table>
<thead>
<tr>
<th>Goodness of Fit Index (GFI)</th>
<th>0.99</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFI Adjusted for Degrees of Freedom (AGFI)</td>
<td>0.99</td>
</tr>
<tr>
<td>Bentler &amp; Bonett's (1980) NFI</td>
<td>0.99</td>
</tr>
<tr>
<td>Chi-Square/df (0.38/2)</td>
<td>0.19 (p-value 0.83)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.00</td>
</tr>
</tbody>
</table>

### Table 4b. Goodness of Fit (Second Order - Component-Item)

<table>
<thead>
<tr>
<th>Goodness of Fit Index (GFI)</th>
<th>0.76</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFI Adjusted for Degrees of Freedom (AGFI)</td>
<td>0.70</td>
</tr>
<tr>
<td>Bentler &amp; Bonett's (1980) NFI</td>
<td>0.75</td>
</tr>
<tr>
<td>Chi-Square/df (454/203)</td>
<td>2.23 (p-value &lt;0.0001)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.10</td>
</tr>
</tbody>
</table>

### Hypotheses Testing – Results

Before the results of the statistical tests are presented, Table 5 summarizes the variables and corresponding labels.

### Table 5. Variables and Labels

<table>
<thead>
<tr>
<th>Variables</th>
<th>Component</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic IT Capability (DITC)</td>
<td>IT Infrastructure</td>
<td>ITF</td>
</tr>
<tr>
<td></td>
<td>Human IT Resources</td>
<td>ITH</td>
</tr>
<tr>
<td></td>
<td>Intangible IT Resources</td>
<td>ITI</td>
</tr>
<tr>
<td></td>
<td>IT Reconfigurability</td>
<td>ITR</td>
</tr>
<tr>
<td>Organizational Culture</td>
<td>Organizational Culture - Involvement</td>
<td>OCI</td>
</tr>
<tr>
<td></td>
<td>Organizational Culture - Consistency</td>
<td>OCC</td>
</tr>
<tr>
<td></td>
<td>Organizational Culture - Adaptability</td>
<td>OCA</td>
</tr>
<tr>
<td></td>
<td>Organizational Culture - Mission</td>
<td>OCM</td>
</tr>
<tr>
<td>Control Variable: Firm Size</td>
<td></td>
<td>SZ</td>
</tr>
<tr>
<td><strong>Dependent Variable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Financial Firm Performance</td>
<td></td>
<td>FFP</td>
</tr>
<tr>
<td>Perceived Market Firm Performance</td>
<td></td>
<td>MFP</td>
</tr>
<tr>
<td>Tobin’s Q</td>
<td></td>
<td>TBQ</td>
</tr>
<tr>
<td>Return on Assets</td>
<td></td>
<td>ROA</td>
</tr>
</tbody>
</table>
Hypothesis 1 - Dynamic IT capability is positively related to firm performance. In other words, the greater the dynamic IT capability is, the stronger will be the firm performance.

H1 looks at the relationship between dynamic IT capability and firm performance. This hypothesis is tested at two levels, i.e. the overall dynamic IT capability level, and the component level which includes four dimensions of dynamic IT capability. Tables 6a and 6b present the results of H1. Table 6a also lists the sample sizes for testing, which apply to all the tests that follow.

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>FFP (p-value)</th>
<th>MFP (p-value)</th>
<th>TBQ (p-value)</th>
<th>ROA (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Model $R^2$</td>
<td>0.14 (&lt;.0001)</td>
<td>0.18 (&lt;.0001)</td>
<td>0.04 (0.77)</td>
<td>0.05 (0.21)</td>
</tr>
<tr>
<td>Independent Variables</td>
<td>DITC</td>
<td>0.43 (&lt;.0001)</td>
<td>0.50 (&lt;.0001)</td>
<td>0.98 (0.25)</td>
</tr>
<tr>
<td>N</td>
<td>134</td>
<td>134</td>
<td>37</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 6b. Results for H1: Firm Performance = f (ITF, ITH, ITI, ITR)

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>FFP (p-value)</th>
<th>MFP (p-value)</th>
<th>TBQ (p-value)</th>
<th>ROA (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Model $R^2$</td>
<td>0.17 (0.0005)</td>
<td>0.21 (&lt;.0001)</td>
<td>0.07 (0.66)</td>
<td>0.08 (0.65)</td>
</tr>
<tr>
<td>Independent Variables</td>
<td>ITF</td>
<td>-0.01 (0.95)</td>
<td>-0.05 (0.77)</td>
<td>-0.05 (0.96)</td>
</tr>
<tr>
<td></td>
<td>ITH</td>
<td>0.31 (0.01)</td>
<td>0.33 (0.01)</td>
<td>-0.03 (0.97)</td>
</tr>
<tr>
<td></td>
<td>ITI</td>
<td>0.11 (0.41)</td>
<td>0.11 (0.43)</td>
<td>-0.24 (0.80)</td>
</tr>
<tr>
<td></td>
<td>ITR</td>
<td>0.02 (0.86)</td>
<td>0.12 (0.41)</td>
<td>1.48 (0.22)</td>
</tr>
</tbody>
</table>

Hypothesis 2 - Organizational culture is related to firm performance. In other words, the stronger the organizational culture is in Involvement, Consistency, Adaptability, and Mission dimensions, the better will be the firm performance.

H2 focuses on the relationship between organizational culture and firm performance. Unlike dynamic IT capability where the components are additive, the dimensions of culture are rather independent from each other. As a result, the hypothesis is examined at the component level, as listed in Table 7.

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>FFP (p-value)</th>
<th>MFP (p-value)</th>
<th>TBQ (p-value)</th>
<th>ROA (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Model $R^2$</td>
<td>0.14 (0.0026)</td>
<td>0.27 (&lt;.0001)</td>
<td>0.19 (0.14)</td>
<td>0.13 (0.39)</td>
</tr>
<tr>
<td>Independent Variables</td>
<td>OCI</td>
<td>0.05 (0.79)</td>
<td>0.28 (0.11)</td>
<td>1.05 (0.51)</td>
</tr>
<tr>
<td></td>
<td>OCC</td>
<td>0.10 (0.58)</td>
<td>-0.29 (0.09)</td>
<td>-2.59 (0.09)</td>
</tr>
<tr>
<td></td>
<td>OCA</td>
<td>0.01 (0.94)</td>
<td>0.18 (0.27)</td>
<td>3.13 (0.03)</td>
</tr>
<tr>
<td></td>
<td>OCM</td>
<td>0.22 (0.15)</td>
<td>0.33 (0.02)</td>
<td>-0.80 (0.54)</td>
</tr>
</tbody>
</table>
Hypothesis 3 - There is interaction between dynamic IT capability and organizational culture in influencing firm performance.

H3 examines the interaction effect between the two independent variables, dynamic IT capability and organizational culture, in influencing the dependent construct, firm performance. Since the four organizational culture values are independent, they should not be aggregated. As a result, the interaction effects are tested with the four specific organizational culture values, namely involvement (OCI), consistency (OCC), adaptability (OCA), and mission (OCM). At the same time, because there are four dependent variables including financial firm performance (FFP), market firm performance (MFP), Tobin’s Q (TBQ), and Return on Assets (ROA), the tests are conducted with all of them. Table 8a-b show the specific tests performed.

<table>
<thead>
<tr>
<th>OCI</th>
<th>FFP: $FFP = f(DITC, OCI, DITC*OCI, SZ)$</th>
<th>MFP: $MFP = f(DITC, OCI, DITC*OCI, SZ)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCC</td>
<td>$FFP = f(DITC, OCC, DITC*OCC, SZ)$</td>
<td>$MFP = f(DITC, OCC, DITC*OCC, SZ)$</td>
</tr>
<tr>
<td>OCA</td>
<td>$FFP = f(DITC, OCA, DITC*OCA, SZ)$</td>
<td>$MFP = f(DITC, OCA, DITC*OCA, SZ)$</td>
</tr>
<tr>
<td>OCM</td>
<td>$FFP = f(DITC, OCM, DITC*OCM, SZ)$</td>
<td>$MFP = f(DITC, OCM, DITC*OCM, SZ)$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OCI</th>
<th>TBQ: $TBQ = f(DITC, OCI, DITC*OCI, SZ)$</th>
<th>ROA: $ROA = f(DITC, OCI, DITC*OCI, SZ)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCC</td>
<td>$TBQ = f(DITC, OCC, DITC*OCC, SZ)$</td>
<td>$ROA = f(DITC, OCC, DITC*OCC, SZ)$</td>
</tr>
<tr>
<td>OCA</td>
<td>$TBQ = f(DITC, OCA, DITC*OCA, SZ)$</td>
<td>$ROA = f(DITC, OCA, DITC*OCA, SZ)$</td>
</tr>
<tr>
<td>OCM</td>
<td>$TBQ = f(DITC, OCM, DITC*OCM, SZ)$</td>
<td>$ROA = f(DITC, OCM, DITC*OCM, SZ)$</td>
</tr>
</tbody>
</table>

Compared to DITC, organizational culture values are much more stable and harder to change. As a result, we are primarily interested in the moderation effect of organizational culture on the relationship between DITC and firm performance. Tables 9a-b show the presentations of the statistical analyses.
Table 9a shows that with FFP, there is no significant interaction between DITC and the four organizational culture values. Charts (a) and (c) show that culture values OCI and OCA do not have significant influence on FFP, while DITC does positively influence FFP. In the case of OCC and OCM, the relationships are additive as shown in chart (b) and (d). In other words, the relationship between DITC and FFP is significantly positive, while at the same level of DITC, high levels of OCC and OCM will have higher FFP.
Table 9a also shows that with MFP, three out of the four organizational culture values, namely OCI, OCA, and OCM, significantly moderate the relationship between DITC and performance (chart (e), (g), and (h)). In other words, if OCI is high or involvement value is very strong in an organization, the relationship between DITC and MFP is positive, or, building up DITC will improve MFP. However, if OCI is low or involvement value is weak in an organization, the relationship between DITC and MFP is negative. In other words, expanding DITC will actually harm MFP. The same interaction effect is true for OCA (chart (g)) and OCM (chart (h)). At a high level of OCA and OCM, the relationships between DITC and MFP are positive and investing in DITC will yield MFP increase; at a low level of OCA and OCM, the relationships between DITC and MFP are negative, and investing in DITC will actually damage MFP.

Table 9b. Results for H3: Interaction Effect Tests with TBQ and ROA

<table>
<thead>
<tr>
<th>X axis is DITC</th>
<th>TBQ</th>
<th>ROA</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCI</td>
<td>Non. Sig.</td>
<td>Non. Sig.</td>
</tr>
<tr>
<td>OCC</td>
<td>Non. Sig.</td>
<td>Non. Sig.</td>
</tr>
<tr>
<td>OCA</td>
<td>Non. Sig.</td>
<td>Non. Sig.</td>
</tr>
<tr>
<td>OCM</td>
<td>Non. Sig.</td>
<td>Non. Sig.</td>
</tr>
</tbody>
</table>

Table 9b demonstrates the results for objective performance measures of TBQ and ROA. Contrary to previous two measures of performance, all results are non significant for TBQ and ROA. The most possible explanation of this inconsistency is the small sample size. The size for TBQ test is 37 and the size for ROA is 33. The specific sample used in this analysis may not represent the real population due to very limited size.

**Discussion and Conclusion**

The relationship between IT and firm performance is not a new topic; nor is the association between organizational culture and firm performance. In the fields of management information systems and organizational behavior, numerous studies have been carried out to attempt to explain and predict firm performance. Most of those studies, however, focus on either IT or organizational culture. Very interestingly, the two streams of research share the same concern: the findings from different studies are contradictory and inconclusive. This study tackles the topic of how IT can be used to improve business value while engaging both streams of research. Using a questionnaire survey, this study achieves two major contributions. Firstly, a dynamic IT capability instrument is developed and tested to be a reliable and valid measure of organizations’ ability to use IT to sustain and improve their business performance. Secondly, a comprehensive model illustrating the interaction between dynamic IT capability and organizational culture is tested significant.

The results of H1 provide us with an exciting understanding. With the new measure of dynamic IT capability, the findings are consistent with literature that IT does have an impact on firm performance (Melville et al. 2004). Looking at the component level, human IT resources prove to be a significant factor that positively impacts firm performance, which agrees with the latest findings in literature. For example, it is accepted in IT management that benefits from IT arise when IT enables people to do things differently and that only people such as managers and users can unlock the value in IT (Peppard et al. 2007); on the other hand, people problems such as ineffective stakeholder management, team issues or inattention to politics, are reported to count for 36% of classical mistakes in IT projects (Nelson 2007), which also demonstrates the importance of people in turning IT investments into firm performance.

Out of the four components of organizational culture, consistency is negatively related to market firm performance while mission is positively related to market firm performance. Both mission and consistency are stability focused, which means that the stability of an organization is important in predicting its market performance. This finding is consistent with the conclusions of Fey and Denison (2003).

The most exciting finding of this study is the interaction model. As mentioned before, the interaction model is significant with market firm performance with three out of four organizational culture values: involvement, adaptability, and mission. What does this finding mean? It means that the relationship between DITC and market firm performance really depends on an organization’s culture values in terms of involvement, adaptability, and
mission. For a company that is very participative and adaptable with a consistent mission, investing in improving DITC will improve their market performance; while with a culture that’s low in terms of involvement, adaptability, and mission, investing in building up DITC will be actually harming their performance in the market place. With financial firm performance, culture values involvement and adaptability do not seem to matter while consistency and mission do have an impact on it. In other words, with both high and low levels of consistency and mission values, investing in DITC will increase financial firm performance. However, at the same DITC level, a high level in consistency and mission will yield better financial performance than a low level in those two culture values.

The significant interaction between dynamic IT capability and organizational culture also confirms the unit of analysis when examining IT issues in organizations. IT issues are many times regarded as a departmental issue because the IT department is the one who conducts IT projects; however, the findings of this study show that dynamic IT capability is an organizational level measure, rather than a departmental level measure. A strong dynamic IT capability that may improve a firm’s performance is one that is supported by and aligned with prevalent cultural values across all functions and departments of the organization.

In summary, the test results provide evidence that dynamic IT capability is a valid and reliable measure of IT that may explain firm performance within the selected sample; in the mean while, the interaction research model proves that dynamic IT capability does interact with certain organizational culture values in influencing market firm performance.

**Limitations**

There are a few limitations to this endeavor. Firstly, the primary limitation of this study has to do with the data collection process. For example, the response rate of this study is low, which brings the issue of data quality. Because the study population included both private and public organizations in the IT-related industries in the US, access of information about the population is limited. As a result, there are no accurate measures of how representative the sample is. A review of descriptive measure such as firm size discloses that the sample includes both small private companies and large publicly traded ones, which may show that the sample is representative. However, without a strictly conducted statistical analysis, we cannot draw any conclusions on it. At the same time, in the case of multiple responses, the average of responses were taken as the response for that organization, which may not be the best and most accurate way to estimate organizational response. Due to the small size of this sub-sample (20), we did not conduct statistical tests to examine the congruence of the several responses from each organization. Secondly, the data set for this study is limited to the IT related industry. How the results may be applicable in other industries is not known, although the systematic approach adopted in developing the framework adds to the belief that this model may hold in other industries. In addition, IT practice has its unique cultural issues that may not be completely captured by the Fey and Denison (2003) general culture framework.

The limitations identified above suggest avenues for further research. For instance, if a data collection strategy can be successfully implemented to ensure higher response rate with more responses from each organization, the generalizability of research findings will be improved. Also, replicating this study in other industries will help validate the research findings. As research interest increases in IT and culture, research on cultural values specifically focused on IT practices will help further our understanding on this area.

**Contributions**

This study makes a contribution to both academic research and to management practices. This study contributes to academic research in several areas. Firstly, the dynamic IT capability instrument was tested to be valid and reliable in this study as a measure to explain the relationship between IT and firm performance. This instrument helps classify the key components of the IT measurement, including IT infrastructure, human IT resources, intangible IT resources, and IT reconfigurability. It also provides a benchmark for comparison of dynamic IT capabilities of different organizations.

The second theoretical contribution of this study lies with the development of the research model. This study synthesizes several streams of research including Resource-Based View of the firm, dynamic capabilities, organizational culture, and complementarity theories to develop a comprehensive model. The research findings of this study add to literature of the Information Systems, Organizational Behavior, and Strategic Management fields.
The third contribution of this study comes from the promising and interesting results from hypotheses testing. Hypothesis 3 clearly demonstrates the interaction between dynamic IT capability and organizational culture in influencing firm performance. This confirms the relevance of complementarity theory in explaining the relationship between IT and firm performance. Hopefully the findings of this study arouses interest in the academic community to research on organizational and behavioral factors in examining the impact of IT on firm performance. As a first step to explore an interdisciplinary approach to IT business value research, the initial results may stimulate other researchers to engage in more research to refine and extend the research model as well as the measurements.

In additional to academic contributions, the findings of this study also provide important insight and guidance for managers and leaders in organizations and in the IT field. Firstly, development of a systematic and consistent IT/IS strategy is crucial, especially for organizations in highly dynamic industries such as the IT related industries studied in this research. The research findings of this study emphasize that organizational leaders should develop an IT/IS strategy in light of their organizational culture. As an organization gets established and organizational culture becomes stable, changing culture becomes difficult and often impractical, unless some drastic measures such as changing the ownership and leadership are carried out. Organizational leaders’ focus should be directed to building an overall dynamic IT capability that is compatible with the organizational culture, because generally dynamic IT capability is much easier to change such as by upgrading IT infrastructure and providing IT training. As explained in the Discussion section, a dynamic IT capability that is not compatible with the present organizational culture may lead to a decrease in firm performance.

Secondly, compatibility between the dynamic IT capability and organizational culture is the key to reap desired benefits from investments in IT. This means that when leaders make decisions on IT investments or try to justify IT budgets, it is suggested to consider the prevalent organizational culture in addition to the traditional financial measures of returns on investments. With a culture of low involvement, adaptability and mission, managers should know that investing in improving their dynamic IT capability may actually harm their market performance. Last but not least, a common misperception about IT in organizations is held by many leaders and employees, that only the IT department should be responsible for IT issues. However, as IT develops and the nature of technology changes transforms from generally incremental to sometimes radical, the role of IT is changing from supporting to strategic (Smith and McKeen 2006). IT has become an organizational level phenomenon and the function of IT has become central, coordinating and leading (Smith and McKeen 2006). During the data collection process, it was found that many positions of IT executive such as CIOs and CTOs are also given a second title related to innovation, strategy and development, such as “Business Continuity and IT Strategy”, “Chief Innovation Officer”, “Chief Strategy Officer”, and “Chief Business Development Officer”. At the same time, the management level of IT executives is high, such as “Chairman and CTO”, “Executive Vice President (EVP), IT”, and “Senior Vice President (SVP), CIO”. This anecdotal evidence shows that organizations are realizing the changing and increasingly important role of IT.

Given that the IS literature has other studies of IT business value, how is this project different? This study achieved its goal of contributing a theory-based synthesis and empirical evidence to further our understanding of how IT can be used to improve firm performance. The results of this study establish a theoretical framework for understanding that when aligned, dynamic IT capability and organizational culture can promote superior organizational performance. More importantly, the results of this study provide a promising opportunity to bridge different schools of thought, especially the economic and behavioral school. This study is a first step toward understanding how diverse aspects of IT issues work together to influence firm performance. It is hoped that these results will stimulate interest and efforts of other researchers to expand this stream of research.

References


Appendix. Measurement Instruments

Dynamic IT Capability Instrument
(Adapted from (Bhatt and Grover 2005a), Bharadwaj (2000), and Palvou and El Sawy (2006))

**IT Infrastructure (ITF)**
ITF1. The systems in our IT infrastructure are compatible with each other.
ITF2. The systems in our IT infrastructure are modular.
ITF3. The systems in our IT infrastructure are scalable.
ITF4. The systems in our IT infrastructure are transparent to users.
ITF5. The systems in our IT infrastructure can handle multiple applications.
ITF6. The systems in our IT infrastructure use agreed upon IT standards.

**Human IT Resources (ITR)**
ITH1. Our employees have strong technical IT skills.
ITH2. The technical IT skills of our employees are better than those of our competitors.
ITH3. Our employees have strong managerial IT skills (e.g. communications, coordination and interaction with users, and project management, etc).
ITH4. The managerial IT skills of our employees are better than those of our competitors.

**Intangible IT Resources (ITI)**
ITI1. Our IT resources assist in putting our customers’ interests first.
ITI2. Our IT resources assist in managing our organization’s knowledge assets.
ITI3. Our IT resources assist in sharing assets and capabilities across divisions.

IT Reconfigurability (ITR)
ITR1. We can reconfigure our IT resources to come up with new assets as technology and markets change.
ITR2. We often examine and adjust IT resources to better match our product and market areas.
ITR3. We can integrate and combine existing IT resources into innovative combinations.

Fey and Denison (2003) Organizational Culture Instrument

**Involvement (OCI)**
OCI1. Our decisions are made at the level where the best information is available.
OCI2. Information is widely shared and easily accessible to employees when they need it.
OCI3. Our employees believe that they can have a positive impact.
OCI4. Working in our organization is like being part of a team.
OCI5. Our organization relies on horizontal control and coordination to get work done, rather than a hierarchy.
OCI6. Teams are the primary building blocks of our organization.
OCI7. Our organization is constantly improving compared with our competitors.
OCI8. Our organization continuously invests in the skills of employees.
OCI9. The capability of our employees is viewed as an important source of competitive advantage.

**Consistency (OCC)**
OCC1. The leaders in our organization follow the guidelines that they set for the rest of the organization.
OCC2. There is a clear and consistent set of values in our organization that governs the way we do business.
OCC3. Our organization has an ethical code that guides our behavior.
OCC4. When disagreements occur, our organization works hard to achieve solutions that benefit both parties in the disagreement.
OCC5. It is easy to reach consensus, even on difficult issues.
OCC6. We often have trouble reaching agreement on key issues.
OCC7. Employees from different divisions of our organization share a common perspective.
OCC8. It is easy to coordinate projects across functional divisions in our organization.
OCC9. There is good alignment of goals across levels of our organization.

**Adaptability (OCA)**
OCA1. Our organization is very responsive and changes easily.
OCA2. Our organization responds well to competitors and other changes in the business environment.
OCA3. Our organization continually adopts new and improved ways to do tasks.
OCA4. Customer comments and recommendations often lead to changes in our organization.
OCA5. Customer input directly influences our decisions.
OCA6. The interests of final customers often get ignored in our decisions.
OCA7. We view failure as an opportunity for learning and improvement.
OCA8. Our organization encourages and rewards those who take risks.
OCA9. We make certain that we coordinate our actions and efforts between different divisions in our organization.

*Mission (OCM)*

OCM1. Our organization has a long-term purpose and direction.
OCM2. Our organization has a clear mission that gives meaning and direction to our work.
OCM3. Our organization has a clear strategy for the future.
OCM4. There is widespread agreement about the goals of our organization.
OCM5. Leaders of our organization set goals that are ambitious but realistic.
OCM6. Leaders of our organization have clearly stated the objectives for employees to meet.
OCM7. Our employees share a vision of what our organization will be like in the future.
OCM8. Leaders of our organization have a long-term orientation.
OCM9. Our vision creates excitement and motivation for our employees.

**Firm Performance:**
(Adapted from Wu et al. (2006))

*Perceived Financial Firm Performance (FFP)*

FFP1. Our organization is more profitable than our competitors.
FFP2. The Return on Investment (ROI) of our organization is higher than that of our competitors.
FFP3. Our organization's cash flow from operations is higher than that of our competitors.

*Perceived Market Firm performance (MFP)*

MFP1. Our sales growth is better than that of our competitors.
MFP2. Our organization has higher market share than our competitors.
MFP3. Our organization develops new markets better and faster than our competitors.
MFP4. Our organization develops new products better and faster than our competitors.