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Does an Information Technology Investment Contribute to Company Performance: A Further Examination of the Productivity Paradox

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Does an Information Technology Investment Contribute to Company Performance: A Further Examination of the Productivity Paradox

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The role and impact of IT on firm performance

Why does this matter?

• Firms annually expend varying, often significant, amounts of resources on IT related activities

• The impact upon company performance is subject to much on-going debate.

• The dyadic nature of the performance debate has left the issues far from resolved (Bhatt & Grover, 2014; Ravinchantrran & Lertwongsatien, 2005)
The role and impact of IT on firm performance

The measure of IT’s contribution to firm performance remains controversial.

- The “Productivity Paradox” (Brynjolfsson, 1993) posited why it is difficult to measure.
  - Mismeasurement of outputs and inputs
  - Lags due to learning and adjustment
  - Redistribution and dissipation of profits
  - Mismanagement of information and technology
The Productivity Paradox

Absence of good qualitative measures of value created by IT makes it difficult to assess.

• Carr’s HBR article ‘IT Doesn't Matter” (2003)
  – IT provides no significant advantage
  – THUS no competitive advantage

• Other researchers show that IT does contribute to organizational performance (Brynjolfsson & Hitt, 1996; Kohli & Devaraj, 2003).
The Productivity Paradox

The debate is a result of the breadth and extent of IT business contribution factors (Brynjolfsson, Hitt & Yang, 2002; Dewan & Kraemer, 2000):

• Type of IT
  – i.e., Network, CRM, AI, Data Analytics, etc.
• Management Practice
• Organization Structure

Numerous disciplines are involved; Information systems, economics, strategy, accounting, and operations research.
The Productivity Paradox

Is IT a necessary infrastructural expense providing no on-going competitive advantage for the firm or a source of differentiation and advantage?

• Viewed from the Resource Based View (RBV) perspective (Barney, 1986)
  – Scarcity not ubiquity is a necessary condition for supernormal rent generation
The Productivity Paradox
Viewed from the Resource Based View (RBV) perspective

<table>
<thead>
<tr>
<th>Infrastructural &amp; No Advantage</th>
<th>Provides a sources of differentiation &amp; Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Ubiquitous</td>
<td>• Capabilities do create uniqueness</td>
</tr>
<tr>
<td>• Increasingly inexpensive</td>
<td>• Provide a competitive advantage</td>
</tr>
<tr>
<td>• Accessible to all firms</td>
<td>• Resource Configuration</td>
</tr>
</tbody>
</table>
The Productivity Paradox

• Viewed from the Resource Based View (RBV) perspective; Bhatt & Grover (2014); Mata et al. (1995); Santhanam & Hartono (2003)
  – IT related organizational capabilities tend to heterogeneously distributed among firms
  – Leading to differentiated business value
  – Improving organizational efficiencies, effectiveness, and uniqueness
The Productivity Paradox

• How IT resources are configured by management and how they are leveraged is the differential (Miller, 2017)
  – Entails the comprehensive process of structuring, bundling, and leveraging the organization’s resources with the explicit purpose of creating value and competitive advantage (Sirmon, Hitt, Ireland & Gilbert, 2010)

• The Chief Information Officer (CIO) becomes an integral member of the Top Management Team (TMT).
  – Serves to actively manage the integration and utilization of IT resources to aid in achieving strategic objectives.
The Productivity Paradox

• Beginning in the early 1980’s considerable research focusing on the strategic impact of IT, it potential for creating firm competitive advantage (McFarlan, Jordan & Wurmfeld, 1984; Piccoli & Ives, 2005; Porter & Millar, 1985)
  – IT can lead to the creation of competitive advantage through efficiency and effectiveness improvements, differentiation, and channel domination (Sethi & King, 1994)
  – Firm moves dependent upon the use of IT designed to lead to sustained improvement in competitive position (Ross, Beath & Goodhue, 1996)
The Productivity Paradox

• Brandenburger & Stuart (1996) suggests that the totality of an activity system, depended upon IT at its core, supports the creation of economic value.
  – Utilized the lens of sustainable competitive advantage, RBV (Barney, 1986 & Wernerfelt, 1984) and dynamic capabilities (Eisenhardt & Martin, 2000; Zahra & Nielsen, 2002) to examine firm performance
  – Differences in the performance of activities chosen to perform serve as the basis of competitive advantage (Dehning & Stratopoulos, 2002)
The Productivity Paradox

We posit that:

• The Chief Information Officer (CIO) becomes an integral member of the Top Management Team (TMT).
  – Serves to actively manage the integration and utilization of IT resources to aid in achieving strategic objectives.

• While the impact of IT may differ between industry groups it DOES serve as an important differentiator within industry classes.
The Productivity Paradox

• One measure of an organization’s significance of IT is the role of IT related management within the organization.

  – We utilized the position of CIO as a proxy for evaluating the strategic import of IT within the organization.

• Organizations with a CIO or equivalent will out perform their peers that do not identify or recognize such a role within their organization.
The CIO’s importance

• Organizational CIOs emerged in the early 1980’s (Synnott & Gruber, 1981)
  – Facilitate responding to rapidly changing technology
    • Changes requiring alteration of market orientation and competition requiring new delivery channels and services
  – The emergence of the ‘information economy’ (Benjamin, Charles & Rockart, 1985)
The CIO’s importance – Positioning

- Strategy-structure paradigm postulates organizations with CIOs will outperform those where the responsibility for IT is relegated to a lower level in the organization’s management hierarchy (Banker, Hu, Pavlou & Luftman, 2011).
  - CIOs reporting to the CEO perform at a higher level than those reporting to the CFO (Banker, et al., 2011)
  - The CIO reporting relationship is indicative of the criticality of IT to the organization’s culture and strategy (Benjamin et al., 1985; Jones, Taylor & Spencer, 1995)
- CIO’s reporting to the CEO indicate that IT is viewed as a strategic asset
- CIOs reporting the CFO or lower indicate an infrastructure or ‘plumbing’ view of IT.
The CIO’s importance - Positioning

• Upper Echelon & Top Management Team (TMT) theories (Hambrick & Mason, 1984) postulate that an organization’s TMT can effect performance.
  – The CIO has become increasingly more important as IT plays an increasingly central role in the organization’s processes and strategy (Banker et al, 2011; Raghunathan & Raghunathan, 1989; Raghunathan & Raghunathan, 1993).
  – An organization’s IT structure and reporting relationships can have a significant impact on performance (Csaszar & Clemons, 2006).

• The further from the TMT the CIO is positioned is further indication of the lack of importance placed on IT within the organization (Applegate & Elam, 1992: Luftman & Kempaiah, 2007).
  – The success and influence of IT is more likely if the CIO is closer to the CEO (Armstrong & Sambamurthy, 1999).
The CIO’s importance - Positioning

An organization’s CIO contribute to value creation by increasing the strategic foresight of the TMT.

- Karahanna & Chen (2006) and Preston & Karahanna (2009) found organizations with effective CIOs consistently outperform their industry competitors.
  - The CIOs reporting structure is reciprocal with the organization’s orientation towards IT.
    - In a strategic orientation, the CIO is a member of the TMT (Reich & Nelson, 2003)
    - In an operational orientation, the CIO is only responsible for leading the IT function, offering IT support and managing less risky, non-strategic projects (Ives & Olson, 1981).
The CIO’s importance - Positioning

- The inclusion of a CIO in the TMT is an indication of an IT strategy.
  - Without a clear IT strategy, the actual contribution of IT to performance is most probably the result of serendipity (Galliers, 2011; Leider, Lo, & Preston, 2011)
  - Alignment of IT to the strategic alignment of the organization has focused on the degree IT is strategic and structural (Reich & Benbasat, 1996; Venkatraman, Henderson & Oldach, 1993) or even more recently, informationally (Chan, 2002), aligned with the organization.
The CIO’s importance - Alignment

The alignment-fit view (Mintzberg, 1990)

• The importance of aligning the organization’s IT strategy with the organization’s strategic view and structure has been established (Govindarajan, 1989; Hambrick & Mason, 1984).

• Chen et al (2010) adopts Mintzberg’s 5th definition – perspective – and defines IT strategy as the “Organizations perspective on the investment in, deployment, use, and management of information systems” (p.237).
The CIO’s importance - Alignment

• The clearly articulated role of the CIO and the resulting integration of a shared view among the organization’s TMT helps ensure that all members of the organization have a similar orientation (Tai & Phelps, 2000).
  – Leads to a general consensus among the TMT regarding the role of IT (Pyburn, 1983)
  – The conception and implementation whereby IT is inextricably incorporated in the organization’s overall business strategy (Galliers, 2011; Leidner et al, 2011).
Postulate
The existence of a CIO or similar role within the organization will enhance organizational performance.

• The presence of a CIO exemplifies the significance of IT
  – By extension the existence of an IT strategy and IT’s impact on organizational level performance outcomes.

• Given the percentage of an organization’s capital expenditures
  – Presence of a CIO suggests the pursuing of activities and innovations supporting the businesses innovations.
Method

Standard & Poor’s Capital I.Q. Database

• Dataset utilized 20,762 companies classified as Industrial capital goods broken out by sales volume
  – 19,846 had sales between $10 million and $100 million
  – 593 had sales between $101 million and $250 million
  – 156 had sales between $251 million and $500 million
  – 167 had sales greater than $501 million
Method

Firms in the same or similar industries display significant heterogeneity in terms of productivity

• To account for the effect of organizational size
  – Divided organizational total revenue by number of employees
  – Ratio served as a measure of success thus refining the performance measure
  – Served as a proxy for labor productivity
    • Mahmood & Mann (2009) – Canonical correlation
Findings

• Dependent Variable – Presence of a CIO or similar position

• Independent Variable – Organizational Performance

• One-way Analysis of Variance (ANOVA)

<table>
<thead>
<tr>
<th>Size $ (000,000)</th>
<th>Sum of Square</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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<td>$0 - $50</td>
<td>Between Group</td>
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<td>8525</td>
<td>.0006</td>
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<tr>
<td></td>
<td>Within Group</td>
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<td>10327</td>
<td>.004</td>
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<td></td>
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<td>89,570</td>
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<tr>
<td>$51 - $100</td>
<td>Between Group</td>
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<td></td>
<td>Within Group</td>
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<td>49</td>
<td>.020</td>
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<td></td>
<td>Total</td>
<td>32,732</td>
<td>911</td>
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<tr>
<td>$101 - $250</td>
<td>Between Group</td>
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<td>Within Group</td>
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<td></td>
<td>Total</td>
<td>40,415</td>
<td>539</td>
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<tr>
<td>$251 - $500</td>
<td>Between Group</td>
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<td>155</td>
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<td></td>
<td>Within Group</td>
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<td>1</td>
<td>0.0</td>
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<tr>
<td></td>
<td>Total</td>
<td>18,191</td>
<td>156</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$500 +</td>
<td>Between Group</td>
<td>25,905</td>
<td>166</td>
<td>.156</td>
<td></td>
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<tr>
<td></td>
<td>Within Group</td>
<td>0.0</td>
<td>1</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>25,905</td>
<td>167</td>
<td></td>
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</tr>
</tbody>
</table>
Findings

• Organizations with $50 million or less the presence of a CIO has a significant impact on performance
  – F(90,, 18853) = 1.17, p=.000

• The presence of a CIO was also significant for organizations with $50 million to $100 million
  – F(49,, 1011) = 1.804, p=.005

• At an annual sales volume of $101 million and more the presence or lack of a CIO has no significance on company performance.
Discussion

• The productivity paradox (Brynjolfsson, 1993) remain unresolved

• Carr’s (2003) argument still have credence

• However, when size is taken into account there does appear to be significance with smaller organizations
Discussion

• IT within larger organizations is in-grained in the organization thus becoming ubiquitous
  – IT resources and their management become disseminated throughout the vary DNA of the organization
  – The CIO, while remaining a part of the TMT, becomes more integrated into the entire organization
  – As a result, the impact becomes more difficult to measure
    • While an important member of the TMT, does not necessarily have a lead role in facilitating strategic orientation and operation
Discussion

• Smaller organizations have a tendency to isolate and focus on specific resources such as IT

• The CIO’s role and visibility is much greater

• These firms more frequently and aggressively reconfigure resources to adapt to changing environments
  – Dynamic capabilities (Eisenhardt & Martin, 2000; Teece, 2007)
Discussion

• The CIO in this process may well be analogues, if not the conductor of a symphony orchestra, the first seat in the string or woodwind section of the orchestra.

• In such a position, they play a significant role in the overall quality of the organization’s output.
Thank you