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IT's Impact on Organizational Performance: A Meta-Analysis

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ABSTRACT

Despite the constant stream of research investigating IT business value, IT capabilities, and competitive advantage, researchers are calling for a more coherent understanding of the firm-level impacts of IT, and how those firm-level impacts can be measured. The purpose of this study is to investigate the multitude of organization-level studies of the impact of information technology. A meta-analysis approach was used spanning five years (2003-2008) and 60 articles concerning the impact of information technology at the organizational level. The findings are synthesized into an overarching framework of the impact of IT at the organization level. The study finds that IS research on organizational impacts of IT is diverse, with a multitude of variables and constructs as antecedents and measures of the impact of IT. The framework categorizes measures of the impact of IT into organizational productivity, financial performance, and intangible benefits, while the antecedents of IT impact are categorized into business alignment, IT resources, IT capabilities, and external forces.

Keywords

IT Value, organizational impact, productivity, profitability, financial performance

INTRODUCTION

During the 1990's, many questioned the ability for information technology (IT) to substantially contribute to the firm's bottom-line, a phenomenon referred to as the "productivity paradox" (Brynjolfsson 1993). However, subsequent studies revealed significant effects of IT investments on both productivity and profitability of the firm (Brynjolfsson et al. 1996). More studies have demonstrated the continual importance of IT to the creation of business value and competitive advantage (Melville et al. 2004). However, common issues regarding the nature of the dependent variable (IT Impact) and how to measure it (productivity, profitability, etc.) remain prevalent. For example, Tallon and Kraemer (2007) lament the lack of robust, firm level measures of IT's impact and propose the use of *perceptual* measures in the absence of *objective* measures. Despite the constant stream of research on IT business value, IT capabilities, and competitive advantage, researchers are calling for a more coherent understanding of the firm-level impacts of IT, and their measurement.

The purpose of this study is to investigate the multitude of organization-level studies of the impact of information technology. A meta-analysis approach was used (Rosenthal et al. 2001). Specifically, we extend the work of Kohli and Devaraj (2003) on the firm-level impacts of information technology. Their meta-analysis covered 66 articles from the period 1990 - 2000. King and He (2005) make a call for future research where any meta-analysis would follow the design strategy of Kohli and Devaraj (2003). In order to build on cumulative tradition, this study captures similar data points. The meta-analysis spans five years (2003-2008) and 60 articles concerning the impact of IT at the firm or organizational level. The findings are synthesized into an overarching framework. Specifically, the study addresses the following research questions:

1. What are the dominant firm-level, dependent variables in organizational-IT literature?
2. What are the dominant antecedents (IT process- or firm-level, independent variables) that impact firm-level performance?

THEORETICAL FRAMEWORK

The term "meta-analysis" was first coined in Glass (1976) in the field of psychology as simply an "analysis of analyses." Rosenthal and DiMatteo (2001) elaborate that "the quantitative procedures of meta-analysis help to address some of the

challenges introduced by the existence of multiple answers to a given research question." Meta-analysis has become an accepted way of synthesizing a large body of work into something more manageable. A broader view of research that shows the emerging "landscape" can sometimes be of greater value than the individual results (Rosenthal et al. 2001), allowing researchers to see the forest rather than just the trees.

Many theoretical frameworks have sought to explain how business and organizations leverage valuable resources and transform these into competitive advantage or cost leadership. The model by DeLone and McLean (1992) has seen many extensions. Theory addresses the significant role of IT in supporting and even enabling competitive business processes. One theory permeating this meta-analysis is the Resource-Based View. Resource-based View (RBV) is a broad perspective of the firm, where organizations are amalgams of physical, human and knowledge *resources* (Melville et al. 2004) that are scarce and valuable to competing firms. These resources confer competitive advantage for the firm that are able to control and leverage the unique characteristics of the resource. Specifically, the RBV holds that a resource must have four criteria. It must be (1) valuable, (2) rare, (3) hard to copy and (4) non-substitutable (Wernerfelt 1984, Barney 1991). It is with the RBV in mind that all independent variables in this meta-analysis were ultimately examined. The expectation that the majority of all independent variables in this analysis would meet the four criteria of the RBV as a source of competitive advantage proved to be a useful theoretical framework. While there are other popular theories, Porter's (1985) "value chain" is an example that has evolved into the area of competitive dynamics, RBV was a consistent theme in the articles examined in this meta-analysis.

METHODOLOGY

The methodology for this meta-analysis was a systematic selection of articles that fit the research questions. The target pool of articles included seven top tier journals covering a five-year period from 2003 to 2008. The journals were (1) *MIS Quarterly*, (2) *Information Systems Research*, (3) *Journal of MIS*, (4) *Decision Sciences*, (5) *Management Science*, (6) *Information & Management*, and (7) *Journal of Global Information Technology Management*. Journals were selected based on their ranking as top tier journals. JGITM was selected as the premier journal for global IS studies. The authors met many times to compare candidate articles until all were satisfied that the selection criteria were being interpreted consistently. The initial search resulted in 72 articles. Twelve of these were ultimately excluded after group discussion since the selected article did not meet the selection criteria. The resulting 60 articles provided the basis for this meta-analysis. The selection criteria covered three main points:

1) The articles had to be at the organizational level or higher. Typically this meant firm-level, but could also extend to industry-level or even society. Articles that studied the lower levels at the departmental level, project team level, or individual level were excluded due to the focus of the study.
2) Organizational success had to be one of the main constructs. While there are many ways that IS can indirectly affect firm performance, studies were limited to ones that addressed firm performance (or higher) directly. In other words, an article that identified how IS knowledge management led to higher productivity of individuals, was excluded even though a case could be made that the aggregate of individuals ultimately affects organizational performance.
3) The articles had to include an empirical study. If the article was theoretical only, it was excluded.

These criteria mirror what Kohli and Devaraj (2003) used for their selection process. Articles were identified by both keyword search in library databases and manually reading all abstracts in each issue of the targeted journals. The specific keywords used were operationalized using the keyword classification developed by (Barki et al. 1993). The number of useful and appropriate keywords developed into a considerably lengthy list; therefore, keywords were divided into primary (Table 1) and secondary (Table 2) keywords; the primary keywords being the primary search criteria for large database searches.

Table 1. Primary key words used during the selection process

Primary key words
Value, valuable
Impact
Performance
Success, succeed
Effective, effectiveness
Productivity
Profit, profitability

Table 2. Secondary keywords used during the selection process

Secondary Keywords	
Accomplish, accomplishment	Improve, Improving, Improved
Achieve, achievement	Increase, Increasing
Advance	Market share
Assess, assessment, assessing	Measure, measurement, measuring
Benefits	Objective
Collaboration	Organizational
Competitive	Output
Contribute, Contribution	Progress
Cost reduction	Providing
Delivering	Rating
Effect	ROI
Elevate	Scorecard, scoring
Enhance	Stock price
Evaluate, evaluation, evaluating	Synergy
Goal	Teamwork

The complete list of keywords is provided as an additional contribution for future researchers. The primary keywords in Table 1 were considered the most targeted, however the secondary keywords were important considerations in the early stages of research. The list of possible keywords was built after several discussions among the research team based on readings and experience.

The first round of selection found the researchers with a low agreement rate on the articles selected (well below 0.50, where coefficients greater than 0.90 are necessary). The low inter-rated reliability can be accounted for by (a) poor initial formulation of the problem, particularly level of analysis, (b) non-empirical research on the impact of IT *management practices*, and not IT *itself*, and (c) ambiguity of terms, particularly variable and construct names. Two additional selection rounds were conducted not only to improve the inter-rated reliability, but also address issues in research design and selection.

Dependent Variable

The dependent variable was deliberately interpreted broadly initially for the article selection. The goal was to find all kinds of success, not just financial success. After reviewing the articles, the authors identified three broad categories of organizational

success. Initially these were informally identified as "good", "fast", and "cheap", then more formally as "Quality", "Efficiency", and "Financial". This corresponds roughly with the binary categorization that Kohli and Devaraj (2003) used (Productivity or Profitability). Therefore "Efficiency" was renamed "Productivity" and "Financial" renamed "Profitability" for ease of comparison, while the third category was labeled "Intangible".

Coding process

A coding scheme was used for the structure of the Access database for recording and coding all articles. Fields were created for the following: keywords, research questions, key findings, methodology and model using dropdown boxes based on the lists provided in Palvia et al. (2006), variables and their type, hypotheses and whether they were supported or unsupported, topic areas, whether the data was primary or secondary, sample size and level, whether the data was cross-sectional or longitudinal, and any global issues. The complete coding scheme is included in Table 3.

Table 3. List of Coding Criteria

Coding Criteria	Definition
Keywords	All keywords defined by the authors or journal as presented on the article
Research questions	The explicit or implicit research question that drives the research design and methodology.
Key Findings / Main results	Summary of supported hypotheses and their implications, and in particular, whether the study addresses the research questions.
Methodology	The primary and secondary methodologies used in the study.
Research Model	Inclusion of any explicit research model and the type of research model used.
Variables	A list of all variables and their type, i.e. dependent, independent, moderating, mediating or control.
Hypotheses	Includes all main and sub hypotheses examined in the study, and whether the hypothesis was supported or unsupported.
Topic Areas	Broad areas of inquiry (similar to keywords) provided by the researchers of this study.
Origin of Data Source	Whether the data source was primary of secondary.
Sample Size and Type	The sample size of the study, prefixed to indicate whether the sample referred to firms, individuals, or other.
Type of study	The type of study could be either cross-sectional or longitudinal.
Dependent variable type	Based on logical grouping: productivity, profitability, and other..
Global issues	A description of any global or international issue related to the study.

ANALYSIS AND RESULTS

The analysis resulted in a number of interesting findings. Table 4 shows the results of the distribution of journal articles, ranked by count. The table indicates that the *Journal of MIS*, *Information & Management*, and *MISQ* had the highest content in the area of organizational performance.

Table 4. Distribution of Articles by Journal

Journal	# of articles	Rank
JMIS	16	1
I&M	12	2.5
MISQ	12	2.5
MS	9	4
ISR	7	5
JGITM	3	6
DS	1	7
Total	**60**	

Figure 1 shows the frequencies of journal articles on organizational impact for the five-year period: 2003- 2008. The result shows that the trend is increasing dramatically. The graph demonstrates a steady and significant increase in the frequency of IT-impact studies. The frequency of articles for 2008 is lower only because the selection was conducted in Fall 2008 and did not include the entire year.

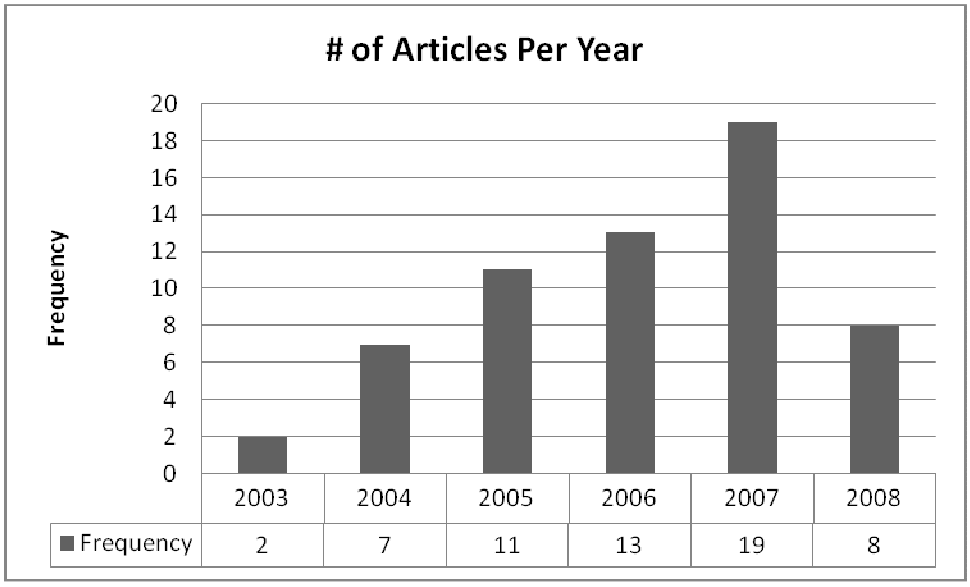

Figure 1. Distribution of Articles by Year

Tables 5 and 6 show the top models and the top methodologies by count and rank. The list of possible models and methodologies came from Palvia, Midha and Pinjani (2006). The totals are greater than the number of articles because several articles were coded with two models and/or methodologies. The top methodology type, as expected, was survey followed by mathematical analysis. The top model type was multi-tier influence diagram. These findings validate the rankings found in Palvia et al. (2006).

Table 5. Frequency and Rank of Primary Model Types

Model	# of Articles	Rank
Multi-tier influence diagram	29	1
Mathematical model	14	2.5
Temporal influence diagram	14	2.5
Combination	1	5
Listing of variables	1	5
Listing of variables and implicit relationships	1	5

Table 6. Frequency and Rank of Primary Methodology Types

Methodology Type	# of Articles	Rank
Survey	37	1
Mathematical analysis	12	2
Case study	5	3
Field study	3	4.5
Literature analysis	3	4.5
Secondary data	3	6
Interview	2	7

Dependent Variables

The dependent variable was initially coded as either "Profitability", "Productivity", or "Other". This builds on the prior binary coding scheme (Kohli & Devaraj, 2003) while preserving their nomenclature. *Profitability* may be better termed "financial performance" as items such as market share and sales were coded as Profitability. Technically, it is certainly possible to increase market share and sales while profitability decreases. *Productivity* is another broad term where technically production as output is distinct from improving the internal process that generates that output. Productivity includes both output improvement and process improvement. The Other category captured items that were neither profit-related nor production-related. It was then determined that a more precise name would be "Intangible Benefits". Table 7 shows a complete list of all the dependent variables that were used in the literature in the period of analysis. Figure 2 shows the breakdown of articles by the three categories of the dependent variable.

Table 7. List of All Dependent Variables

Productivity	Financial Performance	Intangible Benefits
Agility	Bank profitability	Online commitment through downloads
Bank productivity	Business unit performance (sales growth, profits, financial performance, return on investment)	Public image / client loyalty
Business effects of IT	Client extra costs	Perceived Improvement
Business process outcomes	Competitive advantage	
Competitive Flexibility	Competitive cost advantage	
Firm productivity	Corporate performance	
Information effectiveness	Earning Variability	
IT business value	Financial benefits (revenue and profit)	

Labor productivity	Financial performance	
Net benefits	Firm performance	
Operational efficiency	Firm performance (market value)	
Operational impact of IT use	Impact on procurement	
Organization business process performance	Impact on sales	
Organizational performance	Liquidity and investment capacity	
Output productivity	Long term profitability	
Performance	Market value	
Plant performance	Net financial benefits	
Process efficiency	Net sales or revenue	
Process performance (operational)	Online performance	
Production output	Performance Sales	
Service performance	Process performance (economic)	
Sourcing leverage	Profit margins	
Strategic benefits and competitive performance	Profits (first mover)	
Strategic impact of IT use	Sales growth	
Systems performance	Stock price returns	
Tactical impact of IT use	Stock return variability	
Value added	Supply channel performance	

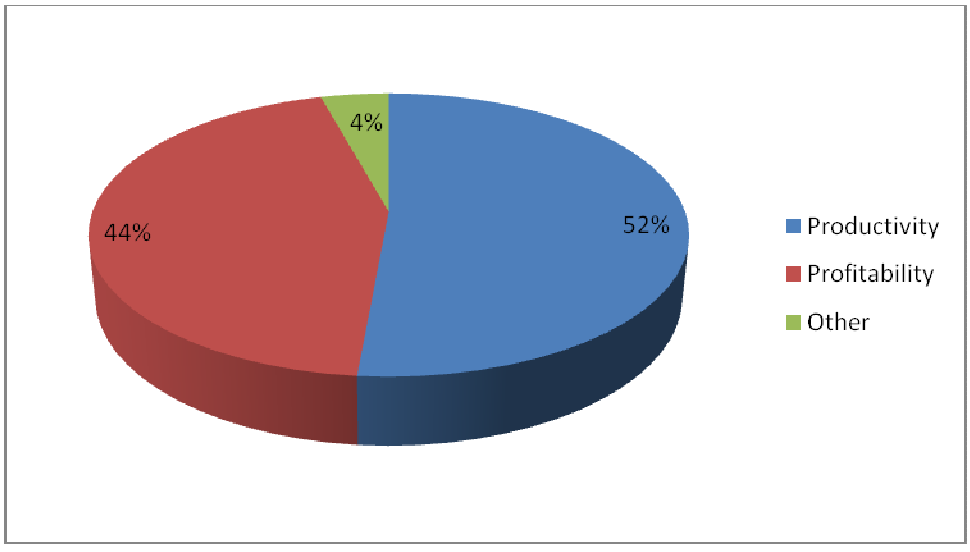

Figure 2. Articles Distribution by Dependent Variable

PROPOSED FRAMEWORK

Some recurring themes emerged during the meta-analysis. The dependent variables fell naturally into three logical buckets. IS makes an organization successful either by making the organization more profitable, more productive, or by an intangible benefit. The "intangible" category included three items: number of downloads, public image and client loyalty, and perceived performance improvement. While this category is small, it seemed important to show that not all measures are financial or production-related.

The independent variables took more thought. Categorizing 147 independent variables from the meta-analysis was challenging. As it is important to have a parsimonious model and still capture the landscape of IS success, the categories must be broad. The first facet focused on was frequent references to business variables, strategy, and alignment. Because business alignment has received so much attention (Luftman & Kempaiah, 2007), it made intuitive sense as a category. Examples of business alignment included Top Executive Support and Expense Controls. The next category came from the trend in many theoretical frameworks. The Resource Based View (RBV) holds that resources can bring competitive advantage to an organization if they are 1) valuable, 2) rare, 3) hard to copy, and 4) non-substitutable. So the next category is simply Resources. A wide variety of resources was captured in the meta-analysis and included items like infrastructure, specialized knowledge of managers and users, and system quality. Most resources met the criteria of being valuable, rare, hard to copy and non-substitutable, such as an ERP system. The third category arises from the second. Resources by themselves do not create value unless they are used properly. So the final category is Capabilities. An example of a capability would be integration with a supply chain partner. Many articles covered all three variables: business alignment, resources, and capabilities, but most seemed to address at least one.

There were a few variables that did not fit easily into the three categories. These included geographic scope, international scope, lowered cost of infrastructure, market characteristics, supply chain demand uncertainty, and supply chain demand volatility. After reflection, they were found to be external to the organization. Business Alignment, Resources, and Capabilities are all internal. It does seem obvious that sometimes external factors, outside the organization's control, can impact IS success. So the final category included in the model is External Factors.

The breakdown of variables according to these four categories of antecedents is shown in Table 8.

Table 8. Four antecedent categories

	# of Variables	Percentage
Business Alignment	**29**	**20%**
Resources	**69**	**47%**
Capabilities	**43**	**29%**
External factors	**6**	**4%**
Total	**147**	

Based on the above discussion, the following framework in Figure 3 is proposed to describe, in very general terms, the recent landscape of IS success literature. It has face validity in terms of being intuitive as well as empirical support from the meta-analysis. This framework may serve to assist future research in IS success to form new hypotheses.

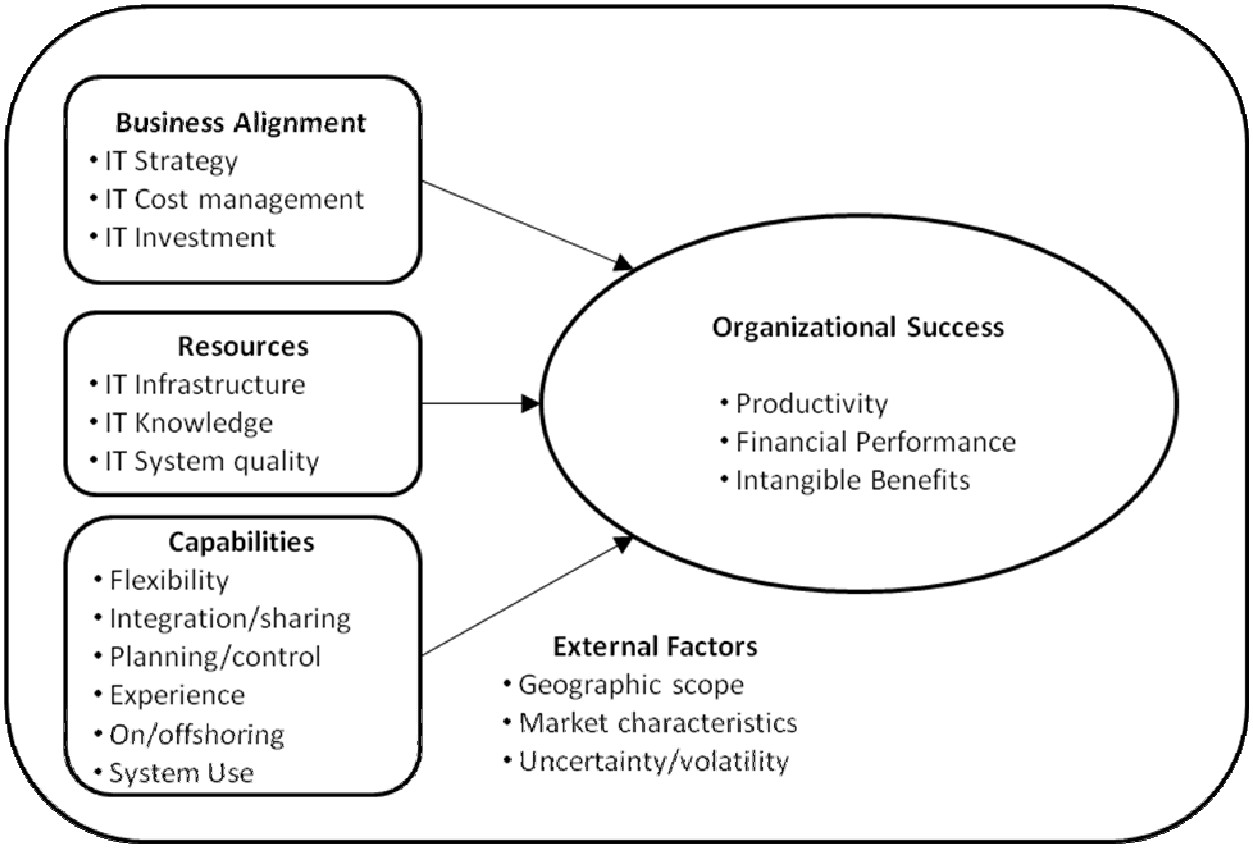

Figure 3. Proposed IT Impact Framework

Hypotheses

The study also captured the various hypotheses for each of the three types of dependent variables. Scores of hypotheses were captured under each category. Representative hypotheses are shown in Table 9.

Table 9. IS Success Hypotheses

Productivity Hypotheses	Supported?
1. Given fixed product quality, investments in IT infrastructure will increase productivity. (Thatcher, 2004)	Yes
2. The extent to which the IOS is initiated by the buyer firm is positively related to process efficiency. (Saeed, 2005)	Yes
3. There is a positive relationship between information quality and organizational agility. (Zain, 2005)	Yes
4. IT investments have a positive effect on a company's productivity through better coordination between the agency network and the technical core. (Neirotti, 2007	Yes
5. There is a positive relationship between alignment and IT business value at the process level, with the relationship being strongest when alignment and IT business value are considered within the same process. (Tallon, 2007)	Yes
Financial Performance Hypotheses	
1. There is a positive association between shareholder value and Y2K spending. (Anderson, 2006)	Yes

2. There is a positive relationship between IT use and bank productivity and profitability. (Swierczek, 2005)	Yes
3. Higher levels of customer-side digitization will be positively associated with greater gains in financial performance attributable to NBT. (Barua, 2004)	Yes
4. We posit that the manufacturer engages in information-integration efforts to ultimately increase profitability. (Kulp, 2004)	Yes
5. Knowledge sharing with customers positively affects BU performance. Knowledge sharing with channel partners positively affects BU performance. (Saraf, 2007)	Yes
Intangible Benefits Hypotheses	
1. The likelihood that project embeddedness positively influences project commercial success increases as the number of page views increases. (Grewal, 2006)	No
2. The likelihood that project manager embeddedness positively influences project commercial success will increase as the number of page views increases. (Grewal, 2006)	No
3. ERP success as measured by user satisfaction, is positively associated with the perceived performance of organizations. (Law, 2007)	Yes
4. There is a difference in the perceived level of organization performance, as measured by the mean organizational performance indices, across firms with different strategic intents for ERP. (Law, 2007)	No
5. Firms that have matched their AIS capacity with their perceived AIS requirements perform better than firms which have not. (Ismail, 2006)	Yes

DISCUSSION

In general, there was wide support for the impact that IS has on organizational performance and the idea *that* IS has an impact on organizational performance does not seem to be an issue as much as *how*. This meta-analysis shows that IS impacts the organization in three main ways: financial performance, productivity, and other intangible benefits. It has also been shown that the main ways in which IS impacts the organization are through business alignment, resources, capabilities and external factors.

Another interesting finding is the dependent variable used to measure firm-level impact of IT varied widely across multiple dimensions. First, dependent variables were measured in broad productivity and performance terms. Productivity measures of the impact of IT included corporate, organization or firm performance and productivity (broad), plant and labor performance and productivity (specific), online and systems performance (technical), and business process and operation efficiency and performance (process). Second, dependent variables were highly contextual to the nature of the study, further indicating a need for a cohesive framework on the "IT dependent variable." Some dependent variables did not fit into the major categories of productivity or financial performance, such as number of downloads, improved image, and perceived improvements, and were put into a category by themselves as "Intangible benefits".

This study echoes the need for more research into the dependent variable of information systems and information technology research. The sheer number of dependent variables used to study the impact of IT underscores the complex nature of IT impacts and the difficulty of measuring firm- and organization-level phenomena. As the field of information technology evolves, the nature of the question changes and what was the "gold standard" of one decade may have to be replaced. Many researchers have laid claim to *the* dependent variable of information systems, such as the original DeLone and McLean IS Success Model (Delone et al. 1992), but the success of IS is more complicated than first expected, as evident in the inevitable reformulation of the concept (Delone et al. 2003).

Concerning the coding criteria inspired by Kohli and Devaraj (2003), the results of this meta-analysis are not particularly surprising. The generally large, firm-level sample sizes and emphasis on primary source data collection is consistent with the vast majority of articles employing survey methodologies to large groups of contacts from many different firms. The bias toward large surveys to firm-level contacts is indicative of the phenomenon being studied (the organizational impact of IT) and the statistical power necessary to find firm-level effects, which have often been elusive to researchers (Brynjolfsson 1993; Brynjolfsson et al. 1996).

Despite the constant drive of globalization and the subsequent importance of IS research in multi-national firms, the study found surprising few studies that explored the impact IT has on multi-national firms. There may be several explanations for this finding. First, as evidenced by the "productivity paradox" (Brynjolfsson 1993) and the general difficulty of conducting firm-level studies, these issues are further exacerbated on an international scale in multi-national firms. Additionally, political, regulatory, and cultural variables as external forces may confound the organizational level findings. Second, due to the large sample sizes necessary to find significant effects of IT at the organizational level (Kohli et al. 2003), researchers may find difficulty in global comparative studies due to insufficient population sizes of some smaller or developing nations, for example.

CONTRIBUTIONS

The study contributes to research in several ways. First, it brings attention to the need for further research on *the* dependent variable of information systems and information technology in organizations. Many have been proposed, including such broad constructs as "success," but few singlehandedly capture the phenomena. A multi-dimensional construct is necessary to fully capture the complex, multi-faceted impact IT has on organizations. Second, a framework for the organization-level impacts of IT and its antecedents is proposed. The research framework combines independent variables into three broad categories, business alignment, resources and capabilities, and their impact through IS/IT success as embodied in organizational productivity, financial performance and intangible benefits. This study also demonstrates the increasing, not decreasing, interest in this area of research and provides an effective snapshot of the landscape.

LIMITATIONS AND FUTURE RESEARCH

Although individual hypotheses and the support (or lack of support) was captured, this data has not been fully analyzed due to the relative complexity of the data (dependent and independent variables) to the number of articles and hypotheses coded. Some variables, such as firm performance or financial benefits, had several hypotheses associated with them, however, the multitude of independent and dependent variables without replication exacerbates further analysis. A second categorization of variables (for example, consistent with the proposed research framework) or an expansion of the selection domain including more journals and more years may alleviate this issue.

In terms of other limiting factors, while the sample size seems adequate compared to other meta-analysis studies, the data gleaned from the analysis is purely observation and not randomized in any way. Therefore any causal inference to a larger population would be risky, just as with any other empirical study. While no statistical generalizability is being claimed, the generalizations of the literary landscape in this framework are fairly representative.

A final limitation is the lack of statistical analysis common in modern meta-analysis (King et al. 2005; King et al. 2006; Kohli et al. 2003; Rosenthal et al. 2001). Some descriptive statistics are given, in terms of percentages and average sample sizes; however, more complex analysis would prove useful in the future. Future work will address this issue and expand the analysis to investigate relationships between dependent variable operationalization and hypotheses support, for example.

One interesting issue that arises through both the selection, coding and analysis process of the study was the sheer inconsistency of how firm-level studies of IT impact operationalized both independent and (primarily) dependent constructs. On one hand, this posed a severe roadblock and limitation to the coding and analysis process. However, the inconsistent operation of firm-level constructs and variables offers abundant opportunity to synthesize and operationalize robust firm-level constructs of the impacts of IT.

While global issues were coded and captured for each of the 60 articles in the meta-analysis, few studies had any resemblance of global or international issues. Even considering that the *Journal of Global Information Technology Management*, a journal that focuses exclusively on the global application of information technology, few firm- or organizational-level studies were found. As mentioned before, this may be due to the difficulty of conducting firm-level studies in multi-national corporations. Certainly, the global context will be a rich area for future empirical studies and we would call on researchers to examine more global issues in their work.

META-ANALYSIS ARTICLES: AVAILABLE ON REQUEST

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