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ABSTRACT

Complementary investment in information technology (IT) and organizational work practices enable a firm to respond strategically to competitive challenges. Specific combinations of these investments, as called for in organizational programs, are implemented in a coordinated manner to bring about a change more consistent with the external environment, resulting in improved firm performance. While a plethora of existing research examines the value generated from each factor individually, there is a need for research that examines the performance implications of complementary investments in organizational programs and IT across a broad set of firms. In this research-in-progress, we examine the performance impacts of Employee Involvement and Total Quality Management; two participative management programs selected specifically to involve employees in daily decision making. Preliminary empirical results indicate that IT is a key enabler of select work practices of these participative programs and that together, these complementary investments can positively contribute to firm performance.

Keywords (Required)

Business value of IT, organizational change, organizational complements, participative management programs

INTRODUCTION

While early research investigating the impact of information technology (IT) presented paradoxical results, later examinations have provided consistent and positive evidence that IT investment benefits firm performance (Brynjolfsson and Hitt 2003, 1996, 1995; Brynjolfsson, Hitt, and Yang 2002). A line of inquiry is this research stream is the investigation of organizational factors that complement IT (Bresnahan et al. 2002; Devaraj and Kohli 2000; Hitt and Brynjolfsson 1997). These factors take advantage of IT's information economic characteristics and when combined with IT, these co-investments make positive contributions to firm performance. Unfortunately, research investigating the impacts of these complementary factors is limited.

In this research-in-progress, we investigate the complementary impacts of IT and organizational work practices associated with Employee Involvement (EI) and Total Quality Management (TQM). We focus on EI and TQM as these programs are chosen by firms in response to competitive challenges, in order to achieve distinct operational and process goals (Lawler et al. 2001). We examine if IT is associated with the organization practices of these two programs and whether or not a coordinated adoption of these complements has a significant affect on firm output.

While existing research informs us of different types of organizational practices that can benefit from co-investment in IT, there is a lack of research examining the complementary impacts of IT and organizational programs across a wide set of firms. Investigating specific combinations of organizational practices is needed as firms respond to challenges by choosing and investing in programs of practices rather than adopting a random selection of practices individually. Our research helps to close this knowledge gap and will help to inform future management and strategic decision making.

Our preliminary results indicate that IT is a key enabler of the organizational work practices of EI and TQM. When combined with IT, the practices of these two organizational programs positively contribute to firm output. The results are particularly strong for IT enabled TQM in manufacturing firms and are consistent to situations where EI and TQM are implemented jointly. Our preliminary results demonstrate that IT is an important component of planned organizational change, enabling organizational programs that target specific change characteristics. In our case, change to a decentralized organizational structure that calls for information technology to support employee participation in daily decision making. While it is possible to implement such organizational change without IT, the utilization of technology and its performance improvement characteristics make it an attractive co-investment choice for corporate change agents.

THEORY

Improvements in quality and reduction in prices of technology motivate firm investment in IT. The lower cost of more powerful IT helps to reduce information related transaction, agency, and operational costs, and make possible a new optimal organizational structure (Gurbaxani and Whang 1991). These new structures, enabled through new IT, minimize both internal (agency, information processing) and external (transaction, inter-organizational) organizational costs. In addition, lower cost for IT inputs motivates the replacement of IT for other more costly inputs such as labor (Dewan and Min 1997). At the same time, firms are motivated to bring about organizational change to better respond to current environmental challenges (Mendelson and Pillai 1998; Galbraith 1973). Firms look to create new organizational structures that bring about a higher level of performance through improved flexibility, faster decision making, and customer responsiveness. Organizational programs using specific organizational practices are chosen and implemented to bring about desired reporting structures, changes in decision authority, employee capabilities etc. These organizational innovations motivate investment in IT as technology plays an enabling role for many of the organizational practices that makeup these programs (Lawler et al. 2001). In short, IT and organizational practices are complementary components used by firms to move the organization to a new performance maximizing structure (Bresnahan et al. 2002).

Participative management approaches bring about a targeted change in the organization to implement various styles of employee decision making (Lawler 1986). Participative management approaches call for the adoption of organizational practices that support the increased involvement of lower level employees in the day-to-day decisions of firms. These programs involve the decentralization of an organization, implementation of teams, and the empowerment of workers with new decision authority and process responsibility. The new structure is said to be more responsive to today's information intensive environment, enabling better and more timely decision making by taking advantage of the knowledge of line employees who work directly with external information sources (i.e. customers, business partners). For example, allowing a call center representative to make a controlled decision regarding credit card limits can help to improve the satisfaction of a customer who needs a credit increase authorization for an immediate retail purchase. Enabling the call center representative to make an informed decision helps the company meet its customer's needs when it's required (time of purchase) and reduces the chance of that customer switching to a another credit card company. Participative management approaches are complex and require changes in the organization across multiple dimensions. These include employee behavior motivation, efficient information flow, knowledge development, and organizational structure.

IT plays an important enabling role in participative management. This includes creation of an infrastructure to support self managing teams, mini business units, and other decentralized structures (Clemons, et al. 1993, Gurbaxani and Whang 1991). Indeed, empirical research demonstrates a positive association between IT use and these types of decentralized structures, and demonstrates that IT and such work practices can have a positive influence on firm output (Bresnahan et al. 2002; Hitt and Brynjolfsson 1997). We expect a similar impact from the use of IT and participative management approaches. First, IT's characteristics enable the multiple dimensions of participative management. For example, IT enables efficient monitoring of employees (agents) improving the overall monitoring process and its costs. IT can also be used in the form of websites, databases, and networks to capture relevant customer information, storage and analysis of the data, and dissemination of the knowledge to empowered decision makers throughout the company. Second, these complementary factors (IT enabled participative management) impact firm performance through improvements in operationally flexible and better response to changing competitive environments. This is accomplished by taking advantage of the local knowledge of employees who, supported by IT, can make informed, value added decisions at a reduced cost. In addition, improved information flow can lead to improvements in business processes through knowledge sharing, decisions support, and process redesign resulting from IT's informating capabilities. In short, we hypothesize that a complementary relationship exists between participative management approaches and information technology, and that these two factors, when combined, benefit firms. We test this hypothesis by examining the relationship between these two factors and examining the impact of the integrated combination of these two factors on firm performance.

H1: A positive relationship exists between the work practices of participative management approaches and information technology inputs.

H2: The interaction of investments in information technology and participative management approaches positively impacts firm performance.

DATA

We test our hypothesis using data on two related participative management programs; Employee Involvement (EI) and Total Quality Management (TQM). Employee Involvement closely matches the dimensions of participative management. EI is implemented with work practices along the dimensions of information sharing, knowledge development, rewards, and organizational structure (power). TQM incorporates the participation of employees but does so with the focus on improving quality and the customer focus of firms. In TQM, employees assume responsibility for identifying quality issues and finding appropriate solutions. In both EI and TQM, IT is used as an enabler for multiple work practices associated with each of the programs. TQM can also be a natural extension of EI due to the call for empowered employees, indicating a need to test the individual and combined use of these organizational programs (Lawler, et al. 2001).

We create a firm level dataset that matches financial data from Compustat, IT investment data from Computer Intelligence (CI), and organizational practice usage data from a dataset created by the Center for Effective Organizations (CEO) at the University of Southern California. While the IT and the EI and TQM work practice datasets are secondary data used in existing research, these unique data sources have yet to be combined until this research project. The final matched dataset contains data for nearly 300 individual Fortune 1000 firms in the 1987-1999 time period. Firms in the study are large with approximately $7 billion in sales and 37 thousand employees. We find that the dataset is evenly split between manufacturing (SIC=4) and service (SIC>4) sector firms however, there are slight descriptive differences (Table 1).

The CI data is based on site surveys that catalog IT hardware quantities within Fortune 1000 firms. Current market values are assigned to each type of hardware and an IT capital stock value is determined (CPURCH). A 1995 definition change in CPURCH and new price indexes motivated the adaptation of CPURCH utilizing the methods of Chwelos et al. (2002). Specifically, OLS regression is used to decompose the 1987-1994 IT stock value into its major components and the estimated prices are used to impute a new estimate of IT stock value for all years. High correlation estimates between the imputed and original IT stock values indicates that the majority of the variation between the new and original observations has been retained. We utilize the new 1987-1999 IT stock value estimates within our analysis.

The CEO data were generated through surveys of Fortune 1000 firms once every three years between 1987 and 1999. Each questionnaire was completed by a senior manager, with a majority of the respondents coming from the HR department. The CEO dataset contains detailed data on the utilization of EI and TQM organizational work practices. EI work practices were measured in five survey years, while TQM practices were measured in four survey years beginning in 1990. The usage of each work practice was measured using a 7 point scale representing the percentage of employees affected by each practice.

	Full Sample	**Manufacturing**	**Services**
Sales	$6,933M	$8,369	$5,397M
Labor	$1, 533M	$1,881M	$1,156M
Non-IT Capital	$3,573M	$3,572M	$3,574M
IT Capital	$60M	$64M	$56M
Employees	37K	40K	34K
% IT of Total Capital	5.9%	4.5%	7.3%
Mainframe / 1000 Emp	0.4	0.4	0.5
Total MIPS / 1000 Emp	108	156	53
Minicomputer / 1000 Emp	7	10	3
PC / 1000 Emp	206	192	220
LAN Nodes / 1000 Emp	191	188	195
N	859	444	415

Table 1: Descriptive Statistics

ANALYSIS

Adopting a model used in previous research (Bresnahan et al. 2002), we utilize a Cobb Douglas production function with an interactive component between IT and the organizational program in question (Org). Non-IT capital and labor inputs are also included. The log transformed model is shown below. Controls for time (t), industry (i), and union (u) are used and an error (ε) term is added when estimating the equation.

$$Log(VA) = \alpha(t, i, u) + \beta_1 Log(IT) + \beta_2 Log(K) + \beta_3 Log(L) + \beta_4 Org_1 + \beta_5 Org_1 * Log(IT) + \varepsilon$$

Lawler et al. (2001) argue that there are situations when EI and TQM programs are adopted as one cohesive program. This is motivated by TQM's need for employees who have responsibility for decisions that affect both production and customer service processes. In addition, firms that have successfully implemented EI have the capability to adopt TQM due to the qualification of their workforce and their decentralized structure. To control for such situations, we also analyze the effect of an ORG component that combines both programs. The ORG variable, whether representative of an individual or combined organizational program, is introduced into the equation in levels. The ORG variable is created by combining the z-scores of the organizational practices involved in the program(s), a method used in earlier research (Bresnahan et al. 2002).

RESULTS

Preliminary correlations results are shown in Tables 2 and 3. Consistent with expectations, Tables 2 and 3 demonstrate that IT is correlated with multiple work practices of Employee Involvement and TQM, the two participative management approaches under investigation. However, these positive relationships occur with only select work practices. Preliminary regression results demonstrate a similar pattern. Using ordinary least squares, manufacturing firms appear to achieve incremental output benefits from the interaction of IT and participative management practices, especially those of TQM. These results are consistent in situations where manufacturing firms use a joint EI and TQM program enabled by IT and are consistent when controlling for potential endogeneity using two stage least squares techniques. The incremental impacts of IT enabled EI and TQM programs in service firms are still under investigation. All regression results will be displayed at the AMCIS conference.

Category	Work Practice	IT Capital Stock	Mainframes	PCs	LAN Nodes
U	Overall program utilization	-0.123**	0.062	-0.175**	-0.208***
I	Corporate overall operating results	0.030	0.010	0.129**	0.138**
	Unit operating results	0.009	0.019	-0.018	0.015
	Advance info on new technologies	0.319***	0.169***	0.154**	0.152**
	Info on business plan-goals	0.027	-0.069	0.032	0.018
	Info on competitor relative performance	0.085	-0.037	0.075	0.066
K	Group decision making-problem solving	0.077	-0.022	0.045	0.038
	Leadership	0.073	-0.028	0.101*	0.067
	Understanding business	0.090	0.009	0.098*	0.066
	Qualitative-statistical analysis	0.080	-0.030	0.132**	0.106*
	Team building	0.066	-0.027	0.087	0.103*
	Job training	0.127**	0.078	0.115**	0.121**
	Cross training	0.109*	0.048	0.066	0.050
R	All salaried pay systems	0.186***	0.090	0.208***	0.125**
	Knowledge skill based pay	0.092*	-0.007	0.096*	0.118**
	Profit sharing	0.039	-0.129**	0.062	0.013
	Gainsharing	-0.138**	-0.049	-0.066	-0.044
	Individual incentives	0.068	0.130**	0.062	0.068
	Non monetary recognition awards	0.129**	0.047	0.126**	0.109*
	Employee stock ownership plan	0.111*	0.022	0.085	0.095*
	Flexible cafeteria style benefits	0.121**	0.036	0.136**	0.117**
	Employee security	0.137**	0.016	0.129**	0.109*
	Open pay information	0.031	0.073	0.105*	0.087
	Stock option plan	0.127**	0.052	0.216***	0.241***

Table 2: Correlation Analysis – Employee Involvement Utilization, Work Practices and IT

U – Overall Program Utilization; I – Information Sharing; K – Knowledge Building; R – Rewards; P – Power

Pearson Correlation Estimates; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Category	Work Practice	IT Capital Stock	Mainframes	PCs	LAN Nodes
P	Suggestion system	0.057	0.009	0.043	0.077
	Survey feedback	0.103*	-0.086	0.143**	0.096*
	Job enrichment or redesign	0.188***	0.030	0.174***	0.141**
	Quality circles	0.209***	0.080	0.251***	0.229***
	Non-quality circle participation groups	0.100*	0.004	0.098*	0.096*
	Union quality work life committees	0.038	-0.003	0.110*	0.110*
	Mini business units	0.109*	0.026	0.163***	0.135**
	Self managing work teams	0.223***	0.080	0.205***	0.254***
	Employee policy/strategy committees	0.152**	-0.025	0.133**	0.118**

Table 2: Correlation Analysis – Employee Involvement Utilization, Work Practices and IT (cont.)

P – Power, Pearson Correlation Estimates; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Category	Work Practice	IT Capital Stock	Mainframes	PCs	LAN Nodes
U	Overall program utilization	0.126*	-0.027	0.202***	0.202***
C	Quality improvement teams	-0.071	-0.109	0.008	-0.008
	Quality councils	0.150*	-0.012	0.178**	0.141
	Cross functional planning	0.085	-0.055	0.152*	0.202**
	Direct employee exposure to customers	0.284**	0.088	0.138*	0.070
	Work simplification	0.080	-0.037	0.132	0.157*
	Customer satisfaction monitoring	0.219**	0.132	0.231***	0.165*
P	Self inspection	0.015	-0.128	0.016	0.041
	Just in time deliveries	0.142	-0.047	0.165*	0.164*
	Work cells or manufacturing cells	0.128	-0.076	0.222**	0.212**
	Employee statistical control methods	0.069	-0.086	0.139	0.098
O	Cost quality monitoring	0.105	-0.053	0.199**	0.167*
	Collaboration with supplier	0.109	-0.030	0.154*	0.125

Table 3: Correlation Analysis – TQM Utilization, Work Practices and IT

U – Overall Program Utilization; C – Core; P – Production; O – Other

Pearson Correlation Estimates; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

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