What Determines IT Investment Priorities?[1]

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Information technology (IT) continues to account for a large portion of firm investment. While many researchers have attempted to model the value and drivers of IT investment, little work has examined the factors that determine how firms allocate IT expenditures across business functions (e.g., administration; production and distribution; customer relationship management (CRM); research and design (R&D); managerial decision-making; and security). In an effort to address this issue, a survey of 1,495 business leaders in Alabama, Arizona, Colorado, and Texas was conducted during 4th Quarter of 2005 that examined their IT investment priorities. Empirical analysis of this survey data shows that the highest IT expenditure priorities of the respondents are in the areas of *administration* and *production and distribution* while the lowest priorities are in the areas of *R&D* and *security*. In addition, the analysis shows that factors such as industry type, firm size, and perceptions of the impact of past IT investments on product quality and revenue may differentially affect the allocation of IT expenditures across business function categories. For example, the results show that:

- *Service firms* are more likely to rank IT investments in support of *R&D* and *security* as their highest priority.
- *Small firms* are more likely to rank IT investments in support of *security* as their lowest priority.
- Firms that have leveraged past IT expenditures to increase product/service *quality* are more likely to rank *CRM* as their highest IT priority.

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- Firms that have leveraged past IT expenditures to increase *revenues* are more likely to rank *managerial decision-making* as their highest IT priority.

This study will help IT managers better understand which factors do and which factors do not affect IT investment decisions for each business function.

The Survey Instrument and Description of Respondents

The *Compass on Business* initiative is a collaboration between Compass Bank and four universities: University of Alabama (Center for Business and Economic Research), University of Arizona (Eller College of Management), University of Colorado (Leeds School of Business, Business Research Division), and University of Texas at Austin (IC2 Institute). Compass on Business provides business leaders with insight into topical economic news and business trends on local, regional, and national levels. One component of this initiative is the quarterly Business Leadership Confidence Index® (BLCI) panel survey. The BLCI is an online survey (accessed via www.blci.com) that asks business leaders in four states (Alabama, Arizona, Colorado, and Texas) six questions about next-quarter expectations on sales, profits, hiring, expenditures, and state/national economic outlook. In addition, the survey asks respondents for firm information such as industry type, annual sales, and number of employees. Each quarter the BLCI survey contains a set of additional questions on a topical issue. Examples include questions about the impact of employee compensation, energy prices, and hurricane Katrina on firm performance. The topical questions on the BLCI survey for the 4th Quarter of 2005 asked respondents about their future IT investment spending priorities and about their perceptions of the economic impact of past IT investments (see Figure 1).

1. The IT expenditures planned by your company in 2006 may support a variety of activities. Please rank, according to size, your company's planned IT expenses for 2006 in the following categories (where 1 is the largest planned expenditure, 2 is the second largest planned expenditure, etc.).

___ Product/service research, design, and development	___ Product/service production and distribution
___ Managerial decision-making	___ Customer relationship management
___ Administrative functions (e.g., back office, accounting, payroll, etc.)	___ Security

2. To what extent have your company's total IT expenditures over the past 3 years changed the cost of producing your product or service? (choose 1-5)

Large decrease in cost		No change in cost		Large increase in cost
1	2	3	4	5

3. To what extent have your company's total IT expenditures over the past 3 years changed the quality of producing your product or service? (choose 1-5)

Large decrease in quality		No change in quality		Large increase in quality
1	2	3	4	5

4. To what extent have your company's total IT expenditures over the past 3 years changed the revenues of producing your product or service? (choose 1-5)

Large decrease in revenues		No change in revenues		Large increase in revenues
1	2	3	4	5

Figure 1. BLCI Topical Questions for 4th Quarter of 2005

Of the panelists registered for the BLCI panel, 1,637 responded to the survey in the 4th Quarter of 2005. After eliminating observations with missing data 1,495 observations were used in our analysis. The distribution of these observations across industry categories, based on the North American Industry Classification System (NAICS) is presented in Table 1. For purposes

of analysis we further classify the first 8 NAICS categories (1-8) as non-service industries and the last 12 NAICS categories (9 -20) as service industries.

Index	NAICS code (first 2 digits)	Industry Group	Frequency	Percent
1	11	Agriculture, Forestry, Fishing and Hunting	6	.4
2	21	Mining	15	1.0
3	22	Utilities	19	1.3
4	23	Construction	154	10.3
5	31-33	Manufacturing	169	11.3
6	42	Wholesale Trade	101	6.8
7	44-45	Retail Trade	87	5.8
8	48-49	Transportation and Warehousing	33	2.2
		Non-Service Industries (Sub-Total)	**584**	**39.1**
9	51	Information	49	3.3
10	52	Finance and Insurance	175	11.7
11	53	Real Estate and Rental and Leasing	142	9.5
12	54	Professional, Scientific, and Technical Services	227	15.2
13	55	Management of Companies and Enterprises	29	1.9
14	56	Admin., Support, Waste Mgmt., and Remediation Services	2	.1
15	61	Educational Services	23	1.5
16	62	Health Care and Social Assistance	74	4.9
17	71	Arts, Entertainment, and Recreation	20	1.3
18	72	Accommodation and Food Services	11	.7
19	81	Other Services (except Public Administration)	133	8.9
20	92	Public Administration	26	1.7
		Service Industries (Sub-Total)	**911**	**60.9**
		Total	**1495**	**100.0**

Table 1. Classification of Survey Respondents by Industry Type

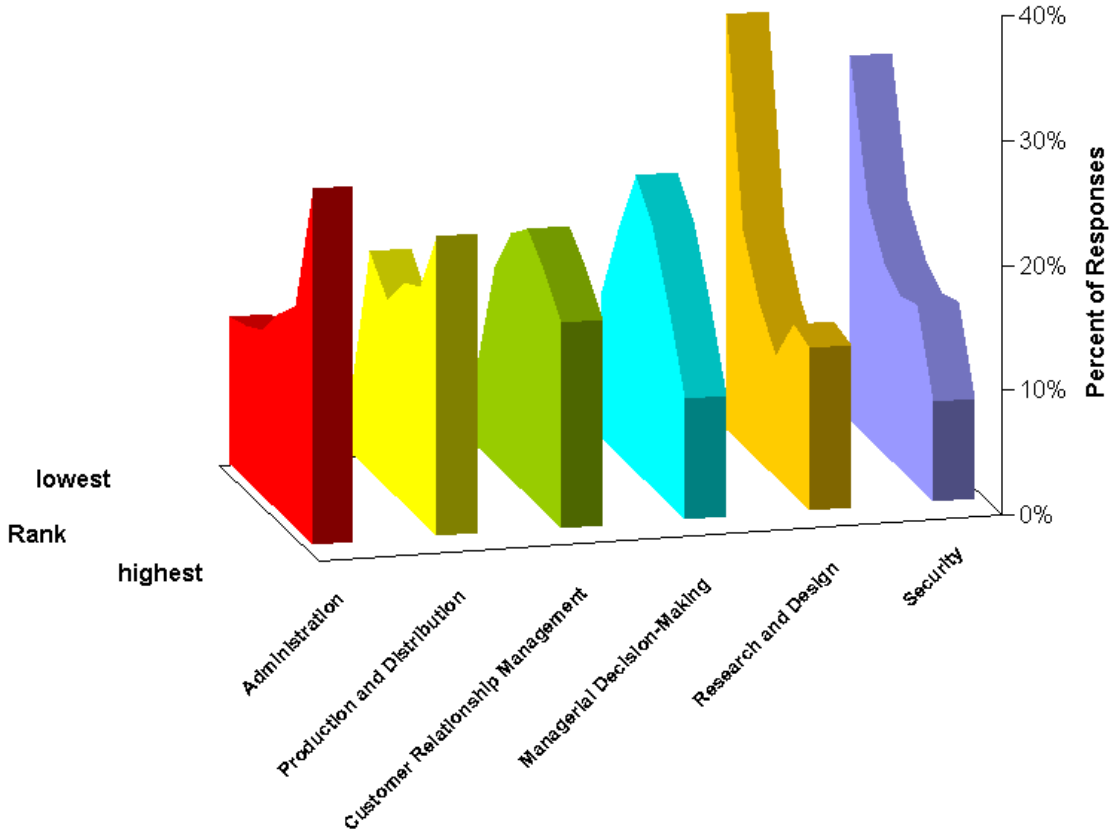
We also classify firms as either small (fewer than 100 employees), mid-size (between 100 to 1,000 employees), or large (1,000 or more employees). Sales data was excluded from our analysis due to its high correlation with *number of employees* ($\rho = 0.72$, p-value =.000). Table 2 presents a cross tabulation of the respondents by firm size and industry type.

	Service Firms	Non-Service Firms	*Total*
Small	649	380	*1029*
Mid-size	180	147	*327*
Large	82	57	*139*
Total	*911*	*584*	*1495*

Table 2. Classification of the Survey Respondents by Firm Size and Industry Type

Data Description

In topical question 1 each respondent ranked the firm's planned IT expenditures (from first to sixth, according to the size of expenditure) for 2006 over six business function categories. Figure 2 presents a graphical view of the rankings distribution and a tabular view of the overall rank of IT expenditures (based on each category's average rank) and the percentage of respondents that ranked each business function first and last.



Business Function	*Average Ranking*	*% Rank First*	*% Rank Last*
Administration	2.98 (1)	29%	12%
Production and Distribution	3.03 (2)	24%	7%
CRM	3.20 (3)	17%	7%
Managerial Decision-Making	3.60 (4)	10%	12%
R&D	4.08 (5)	13%	33%
Security	4.10 (6)	8%	29%

Figure 2. Ranking IT Expenditures Planned for 2006

Based on a series of paired t-tests, we confirm that the average rank of each category is significantly different from the category ranked below it. *Administration* ranks as the highest planned IT expenditure (see Figure 2). New regulatory requirements on firm operations may be one important reason that firms rank *administration* as their highest IT expenditure. For

example, the Sarbanes-Oxley Act requires all public companies to substantiate financial statements with proof of the procedures and controls in place. As another example, Basel II, an accord among bank supervisors and central bankers from 13 countries, specifies international standards for measuring the adequacy of a bank's capital. Firms must make significant IT investments in *administration* in order to comply with these and other regulations. In fact, according to an AMR Research study firms spent an estimated $6.1 billion on compliance-related activities in 2005 and will spend another estimated $6 billion in 2006 [Reilly(2005)].

Security ranks as the lowest planned IT expenditure (see Figure 2). This result may concern consumers and regulators given recent corporate security failures. For example, in late 2004 Bank of America lost unencrypted computer backup tapes containing personal information (including credit card information and social security numbers) belonging to 1.2 million federal employees [Allen(2005)]. In addition, in October 2004 ChoicePoint, a commercial data broker, inadvertently sold personal and financial records of 145,000 consumers to fraud artists [Allen(2005)]. Despite these and other security failures, Figure 2 suggests that firms plan to spend the least (relative to other business functions) on protecting company investments, assets, and customer information. While some firms may argue that spending on security is limited due to budget constraints and uncertain market conditions, one might expect that security would have a higher priority given the disastrous consequences associated with security failures.

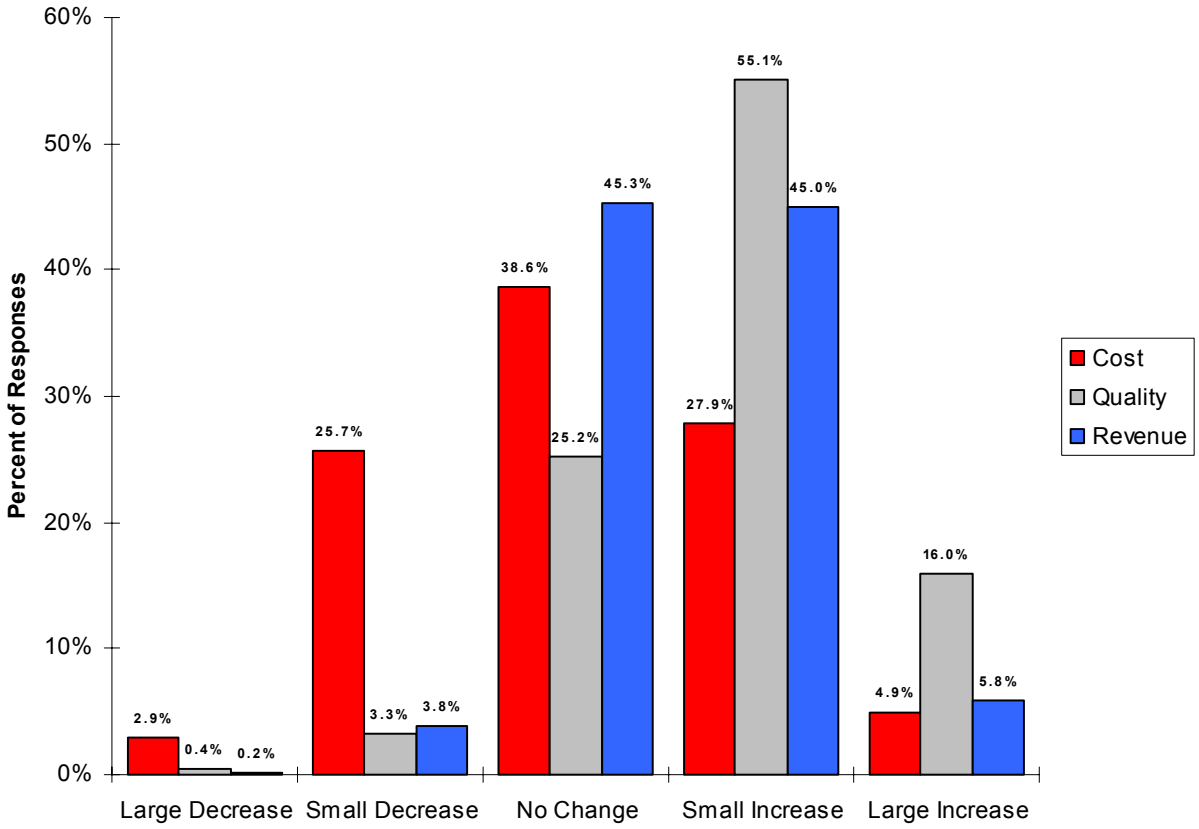


Figure 3. Impact of Past IT Investments on Costs, Quality, and Revenues

In addition to prioritizing IT expenditures, respondents were asked to what extent their company's total IT expenditures over the past 3 years changed the cost and quality of their products/services and the revenues of the firm (see Figure 3).

- 39% reported that IT expenditures have not changed their product/service costs. However, almost equal numbers reported that IT expenditures have either increased (32%) or decreased (29%) their costs.
- 71% reported that IT expenditures led to improvements in product and service quality while 25% reported no change in quality.

- 51% reported that IT expenditures resulted in higher revenues while 45% reported no change in revenues.

These results taken together may suggest that firms are leveraging many of their IT expenditures not simply to reduce product costs, but also to improve revenues through product quality enhancements, sometimes at the expense of higher total costs, as argued in Thatcher and Pingry (forthcoming, 2004a, 2004b), Thatcher and Oliver(2001).

Data Analysis

Having discussed the descriptive statistics, we now examine the impact of firm characteristics and perceptions of past IT performance on the ranking of IT expenditure priorities. Multinomial logistic regression is used to model the probability of discrete outcomes [e.g., selecting the best software to acquire (Nelson et al.(1996)]. We use this method to measure the impact of a change in each independent variable, firm characteristics and perceptions of past IT performance, on the probability a firm ranks a particular business function first or last. The statistically significant results of this analysis are presented in Table 3. We interpret these results below.

Independent Variables		Cost		Quality		Revenue		Small Firm		Mid-size Firm		Service	
Rank		First	Last	First	Last	First	Last	First	Last	First	Last	First	Last
Business Functions	Administration			↓				↑	↓	↑	↓		↑
	Production and Distribution							↓					↑
	CRM			↑									
	Managerial Decision-Making					↑							↑
	R&D										↑	↑	
	Security					↓			↑			↑	↓

An up arrow indicates an increase in the independent variable will increase the probability that the business function will be ranked first (last).
A down arrow indicates a decrease in the independent variable will decrease the probability that the business function will be ranked first (last).
Blue indicates that an increase in the independent variable increases the business function's priority.
Orange indicates that an increase in the independent variable decreases the business function's priority.

Table 3: Statistically Significant Results

Quality and Revenue (Aligning IT with Firm Strategy)

Earlier we noted that the majority of survey respondents believe that their firms' portfolio of IT investments over the past three years has led to improvements in product quality and firm revenues. This suggests that firms may be aligning their IT investments with business strategy to improve consumer value and firm performance. Interestingly, firms that have leveraged past IT investments to improve product quality are more likely to rank *CRM* and less likely to rank *administration* as their highest planned IT expenditure. IT investments in support of *administration* do little to improve product quality. However, CRM software manages how a firm interacts with its customers. Firms may use CRM software to analyze customer data, collected from call centers or sales force interactions, to improve customer.

In addition, firms that have leveraged past IT investments to improve firm revenues are more likely to rank *managerial decision-making* and less likely to rank *security* as their highest

planned IT expenditure. IT investments in support of *security* are typically not considered strategic and do little to improve firm revenues. However, decision support systems, data mining tools, and other business analytic software help firms analyze business data to forecast market trends, identify patterns, and make better business decisions. Firms may use these business analytic tools to more effectively segment customers and engage in targeted marketing strategies, leading to more revenues.

Firm size

Table 3 suggests that small- and mid-size firms rank *administration* as a higher priority than large firms, while they rank *R&D* and *production and distribution*, which are important strategic business functions, as relatively lower priorities. In small and mid-size firms, IT departments are still often recognized as cost centers. Only one-third of IT spending in these firms is strategic and aimed at improving business performance [Pettey(2005)]. Instead of allocating their limited IT resources to strategic business functions, these firms spend most of their IT budget on the fundamental administration (e.g., payroll, email, compliance, and other back-office solutions) or on supporting infrastructure (e.g., network and servers). This observation is consistent with our results and suggests that small- and mid-size firms may be under-investing in strategic IT, failing to align IT and business strategy, and, therefore, not realizing the quality and revenue improvements enabled by such alignment.

In addition, small firms tend to rank *security* as a lower priority than large firms. Some argue that small firms often ignore data security issues. One reason may be that developing effective security measures is very costly for small firms with limited budgets. Another reason is that some small firms wrongly believe that hackers are only interested in large, high profile firms.

However, hackers often target small firms as testing grounds or launching pads for larger attacks. Therefore, small firms may be more vulnerable to security beaches than they think, leading to under-investment in security applications (relative to other functions).

Service Firms

Six of the seventeen significant results presented in Table 3 lie in the service column. Here we summarize two important results derived from this analysis. Earlier we noted that, on average, *security* was ranked as the lowest planned IT expenditure by respondents (see Figure 2). Interestingly, Table 3 shows that service firms are more (less) likely to rank IT investments in *security* as the highest (lowest) IT expenditure. This result may be due to recent regulation that increasingly requires firms, especially those in the areas of health care, banking, and financial services, to protect customer data. For example, the Gramm-Leach-Bliley Act (GLBA) requires banks and financial services firms to protect customer data while the Health Insurance Portability Act (HIPPA) requires health providers to secure electronic patient information. These regulatory requirements may lead to an increase in IT expenditures by service firms in support of *security*. However, we note that despite these marginal effects service firms still only rank *security* as the fifth priority compared to non-service firms which rank it last.

In addition, the service industry has been a hotbed of product customization based on research using data gathering and data mining tools. This focus on customization to support changing customer needs may be one reason that service firms are more likely to rank R&D first.

State Differences

In three cases, the state in which a firm operates significantly affects the firm's IT expenditure priorities. Specifically, when compared to Texas firms, firms in Alabama, Arizona, and Colorado are all more likely to rank *administration* as their highest IT expenditure. On the other hand, when compared to Texas firms in these same states are less likely to rank *production and distribution* as their highest IT expenditure. A final interesting observation is that firms in Arizona are less likely to rank *security* as their highest IT expenditure when compared to the other states. Although it is difficult to determine the source of these state differences based on this survey data, it may reflect state-specific differences in the business environment (e.g., regulation). A more extensive survey may to shed more light on these and other results reported above.

Conclusions

Based on survey results from 1,495 business leaders we have derived some important insights into how factors such as industry type, firm size, state location, and past IT performance affect a firm's allocation of IT expenditures across business functions. However, we note that the size of IT expenditures may not be the only indicator of a firm's investment priorities. A more extensive survey will help tease out the relationships among a firm's characteristics, portfolio of IT expenditures, strategic focus, and economic performance.

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