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INVESTIGATING THE IMPACT OF 'GREEN' INFORMATION TECHNOLOGY INNOVATORS ON FIRM PERFORMANCE

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ABSTRACT

The purpose of our study is to test the robustness of innovation theory. Today, many companies are 'going green' to respond to the demand from government, consumers, and general public and also to improve competitiveness. To investigate if information technology (IT) innovators achieve competitive advantage even after going green, we first selected IT innovators using the most recent Information Week 500 annual data sets and then selected companies that are environmentally conscientious (green).

Using 'matched sample comparison group' methodology, we compared green IT innovators' performance against their industry average performance and also with performance of green IT followers that are going green but not IT innovators. We found that performance of green IT innovators was significantly better than their industry benchmark firms and also green IT followers.

Keywords: IT innovation, firm performance, green, environmental consciousness, and match sample comparison group

INTRODUCTION

Organizations have continuously increased their investments in information technology (IT), hoping to create value [25, 18]. However, researchers [43, 52] have reported that IT investments alone do not add value to the organization. Instead, emphasis should be placed on how the IT investment is used within the organization in order to create unique IT capabilities [21, 41]. For example, the *InformationWeek (IW) 500* annual survey selects the top 500 most innovative U.S. firms based on innovation in business technology, rather than on the biggest IT investments. IT investment is considered innovative if it represents the first use of a technology among firms in the same industry, or if it results in a new product or service [12]. Daft [9] defined organizational innovation as "the adoption of an idea or behavior that is new to the organization adopting it" (p.197). Organizational innovative use of technology leads to organizational changes, which become

a driving force for improving organizational performance and achieving competitive advantage [45, 10, 47]. Thus, innovation in IT is an important contributor to organizational success. However, organizations that invest in innovative technology are faced with increasing cost and complexity associated with a decreased technology life cycle [51]. If they invest in the technology, costs and complexity increase. Yet, if they do not invest in the technology, they run the risk of losing out to the companies that do invest [15].

Although using IT is important to organizational success, IT has significantly contributed to environmental problems from its production, its usage, and its disposal [35]. According to Gartner's recent research, the information and communication technology (ICT) industry is responsible for approximately 2% of global CO_2 emissions from using PCs, servers, phones, network and telecom, etc. and "going green" becomes an essential activity for IT leaders [14]. Accordingly, environmental issues have received increased attention at the firm level in recent years. The demand for environmental management from government regulators, consumers, and the general public is continuously growing [30]. Consumers tend to associate terms such as "environmentally friendly" with product quality [7], pay a relatively high price for green products [5] or measure the company's concern for the consumer and society [22]. Thus, many firms have devoted time and resources toward protecting the environment. They have implemented environmental management strategies to minimize firms' impact on environment and make efforts to reduce energy consumption and waste generation [33, 2]. Bansal and Roth [2] investigated motivations for companies to 'go green' and found that improved competitiveness is one of the motivations. Accordingly, the number of companies attempting to achieve higher profits with a greener corporate image has increased [29]. However, up to date research on this topic provides inconclusive results. Some researchers indicate that there is no relationship between "going green" and organizational performance [48, 31, 13] while others indicate that either a positive [6, 24, 23], or a negative relationship [20, 49]. This lack of conclusive empirical evidence provides motivation for our study.

Previous studies found that IT innovation has a positive impact on organizational performance. When firms not only spend their resources in innovative use of technology but also spend in "going green," can they still be achieving competitive advantage over those that do not? In this study, we link technology innovation with "going green" to firm performance and empirically examine this relationship. Thus, our study tries to answer a research question, "Can IT innovators gain competitive advantage even after they are 'going green'?

The remainder of the paper is organized as follows. First, we present a review of the literature in the field of organizational innovation and environmental consciousness ('going green'). Next, we describe financial performance indicators. Then we present the research hypotheses along with the research model. This is followed by our research methodology, which includes data sources and sample selection. Fifth, we discuss our results and their implications. Finally, we conclude our study by discussing limitations and grounds for future research.

LITERATURE REVIEW

Organizational Innovation Theory

Innovation can be characterized as either administrative or technical [10, 11, 50]. Although there is no clear-cut difference between the two [53], administrative innovation is primarily based on the needs of management and indirectly influences the process of producing products or services and enhances organizational coordination and organizational efficiency. Conversely, technical innovation has a direct influence on the firm's product or service, makes an organization more competitive in the market, and is an important factor for organizational effectiveness [10, 11, 44].

Based on the premise that organizational innovation is increasingly important to stay competitive and become successful [45], previous studies have investigated the relationship between technology innovation and firm performance. To measure IT innovation, Shin [43] developed a second-order construct from technology strategy, e-business strategy, business practices, and customer knowledge. He found that IT innovation had a significant positive role on firm performance, as measured by Tobin's q and revenue per employee. However, his study did not show any significance on return on assets (ROA). Zhuang [52] examined the relationship between IT innovation in electronic business and firm performance using a matched sample methodology. The author concluded that e-business innovativeness has a positive impact on firm performance and thus, innovative firms gained competitive advantage.

In line with Schumpeter's Innovation Theory that focuses on value creation, the resource-based view (RBV) of IT suggests that a firm's specific resources and capabilities lead to value creation [1]. Based on the RBV framework, Bharadwaj [3] investigated the relationship between superior IT capability and firm performance us-

ing a matched sample comparison and found that firm performance of the IT leaders was significantly higher than that of the matching sample firms. Later, Santhanam and Hartono [40] replicated Bharadwaj [3]'s study and found that firms with superior IT capability had better performance. The authors also used the matched sample comparison methodology in their study.

Environmental Consciousness ("Going Green")

International regulations of environmental protection, such as the Montreal Convention and Kyoto Protocol (Chen, 2008) play an important role in corporate awareness of the need to address environmental issues. Release of the *International Organization for Standardization* (ISO) 14001 'standard for environmental management' in 1996 (later revised in 2004) is evidence of global consciousness of environmental issues [34, 38]. The ISO 14001 standard was initiated to help organizations take a more pro-active approach toward protecting the environment while reducing the negative impact that their business activities have on the environment. Its aim is to help reduce and minimize an organization's impact on the environment. This is often referred to as environmental performance [28, 24] and many firms implemented environmental management systems (EMS) that monitor and evaluate an organization's environmental performance and use it as a tool to promote continual improvement of environmental condition [33]. The impact of ISO 14001 is substantial to organizations. In contrast to the traditional economic argument, Porter [36] and Porter and Van der Linde [37] view "going green" as a win-win proposition for both the environment and the firm. While the environment improves because of regulated and/or self-regulated efforts, the organization also improves. If the environmental standards are properly designed, firms find innovative ways to use materials more productively and thus enhance or maintain competition [37, 24, 16].

Using an event methodology, Klassen and McLaughlin [24] investigated the impact of the public announcements of firms that won environmental awards or experienced environmental crises on a firm's stock market returns. The authors found that the firm's strong environmental management, as indicated by environmental performance awards, is associated with significant positive returns in market value and the firm's weak environmental management, as indicated by environmental crises, is associated with significant negative returns. Using a survey method, Melnyk et al. [32] investigated the impact of environmental management systems (EMSs) on organizational performance and found that EMSs have a strong positive impact on operational performance. As with previous studies, Montabon et al. [34] explored the relationships between environmental management practices (EMPs) and firm performance measures and also found that EMPs were positively associated with firm performance.

However, other researchers argue otherwise. Using static and dynamic panel data, Elsayed and Paton [13] found that environmental performance has a neutral impact on firm performance. Some argue that improving environmental performance leads to a drastic increase in cost without any economic payback. This leads to reduced profits, decreased returns to stockholders, and thus, hindered organizational competitiveness [49]. Although profit remains the primary reason for most firms' existence, they are increasingly more conscious of their corporate social responsibilities. Firms that intentionally disregard environmental issues face the risk of decreased profits due to such factors as governmental fines and lack of consumer confidence. Although it is expected that environmental consciousness pays off in the long run, environmental management is an expensive process. How much firms are willing to expend in this effort and if they receive a return on their effort are concerns that still need to address.

FIRM PERFORMANCE INDICATORS

In investigating firm performance, financial ratios are the most commonly used performance indicators in many empirical studies [3, 17, 40, 52, 19]. We also used ratios in this study in measuring firm performance. For the profitability ratios, Return on Assets (ROA) is an indicator showing the ability of a firm using its own assets to generate sales. Return on Sales (ROS) is a commonly used indicator in evaluating a firm's operational efficiency. Operating Income to Assets (OI/A) and Operating Income to Sales (OI/S) evaluate how much net profit is derived from every dollar of total asset (or sales). The high profitability ratio means the organization is profitable. For the cost ratio, we used one ratio, Cost of Goods Sold to Sales (COGS/S) and it measures the percentage of sales used to pay for expenses. Thus, the higher the cost ratio is, the less profitable the organization is. Table 1 includes description of the ratios.

Table 1: Description of Financial Performance Indicators

Profit Ratio	**Formula**
Return on Assets (ROA)	Net Income / Total Assets
Return on Sales (ROS)	Net Income / Net Sales
Operating Income to Assets (OI/A)	Operating Income before Depreciation / Total Assets
Operating Income to Sales (OI/S)	Operating Income before Depreciation / Net Sales
Cost Ratio	**Formula**
Cost of Goods Sold to Sales (COGS/S)	Cost of Goods Sold / Net Sales

HYPOTHESES AND RESEARCH MODEL

Industry Benchmark Firms

Prior research argues that a firm with superior IT capabilities (or innovative firms) demonstrated higher firm performance when compared to average industry performance [40, 52]. By the same token, these innovative firms can go green to even lower overall costs and gain competitive advantages [37]. Therefore, based on innovation theory, we propose that *green IT innovators* use technologies efficiently to attain technical and administrative innovation while addressing environmental issues. Thus, we propose following hypotheses:

H1a: Green IT innovators have higher profit ratios than the average profit ratios of all other firms in the industry (average industry performance).

H1b: Green IT innovators have a lower cost ratio than the average cost ratio of all other firms in the industry (average industry performance).

IT Innovation

As noted in a prior study, firms with high IT capabilities (or innovative firms) outperform the control firms [3]. If innovation theory holds, both going green and IT innovative firms (Green IT Innovators) outperform the control firms that are green but non-innovators (Green IT Followers). The control companies represent the firms that have invested in green efforts but not being selected as innovative firms. Thus, the following hypotheses are proposed.

H2a: Green IT innovators have higher profit ratios than green IT followers.

H2b: Green IT innovators have a lower cost ratio than green IT followers.

The research model is shown in Figure 1.

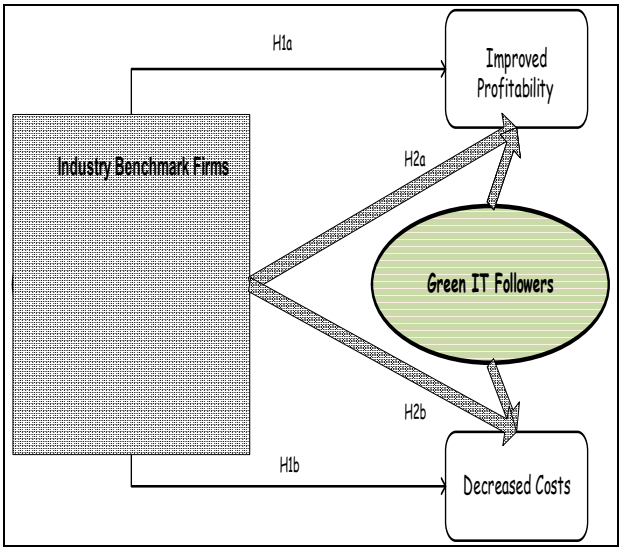

Figure 1: Research Model

RESEARCH METHODOLOGY

We employed the "matched sample comparison group" methodology to empirically investigate the impact of Green IT innovators on firm performance. This methodology has been used in several IT valuation studies [3, 40, 52] and is a technique commonly used to compare the performance of treatment sample with that of control firms matched by either industry or size or both.

As such, we used paired samples (a treatment sample and a control sample) and compared the differences of measurements between two matching samples. For the comparison purpose, we investigated the impact using both the paired samples t-test (parametric) and the paired samples non-parametric Wilcoxon test although non-parametric test might be more appropriate here due to the violation of the normality. Compared to the t-tests that require normality assumption, the non-parametric Wilcoxon test is less sensitive to the outliers and known to be more powerful when the underlying distribution is not normal. The treatment sample represents a set of firms that are green IT innovators. The matching control sample selection is dependent upon the hypothesis to be

tested. Following is discussion of data sources and sample selection.

Data Sources and Sample Selection

Treatment Sample (Green IT Innovators)

Our initial data source was *Information Week (IW) 500* annual survey reports. Since 1998, *IW* has provided an annual report on the top 500 most innovative U.S. organizations of information technologies. This report focuses on innovative use of IT, rather than simply the amount spent on IT. The actual criteria for defining IT innovative company changes from year to year, based on input from the technology innovative candidates. For example, the selected IT innovative firms in the IW 2005 annual survey improved organizational performance by using IT to accomplish tasks such as increasing automation, improving data integration between systems or departments, and/or reengineering existing applications [8]. Conversely, the leading 2006 technology innovators focused on operations and improved communication and access to employees, customers, and suppliers [4]. To get financial data for the selected innovative companies, we also used *Compustat*. Both *IW 500 reports* and *Compustat* have been used in numerous studies [3, 27, 26, 42] and the validity of data has been tested by previous researchers [43, 27]. Detailed selection procedures for our sample are as follows:

From the IW 500 report for the years 2001 to 2006, we selected all firms that were identified as IT innovators for five or more years in those six years. Of these, 100 firms were identified each of the six years, and 97 were identified in five of the six years, yielding an initial sample size of 197 firms. From the list, we excluded private firms and firms with too many missing data. This step ended up with 138 IT innovative firms. Then we checked if the company is environmentally conscious. No known entities record an organization's environmental consciousness on a large scale. Although ISO 14001 is designed to address this, certification is neither required nor monitored by ISO [38]. When reviewing ISO certification of the firms, we could find no evidence of some firms' participation in certification. In addition, some firms were certified, but not within the United States. Thus, we had to omit these firms. We also used another potential measure, organization's web site, which demonstrates their environmental management (or green) initiatives. Some organizations went to great lengths to express environmental consciousness, along with their "green" activities, while others expressed little or no concern for green activities. Accordingly, we reviewed each of the firms' websites to determine the organizational environmental consciousness as the surrogate measures for environmental consciousness. Only those firms that are both certified under ISO 14001 and demonstrated green initiatives in their websites are selected as "Green IT innovators" and thus, the sample size reduced to 45.

Control Sample to Test Hypotheses 1a and 1b (Industry Benchmark Firms)

The control sample represents a set of industry benchmark firms using a four-digit standard industrial classification (SIC) code of the treatment firm to identify all the firms operating in the same industry. The first two-digit SIC code provides a general identification of a major industry or business, while the last two-digit code provides a more specific classification of a product or service within the industry. As a result, for each green IT innovator, a control sample includes all firms operating in the four-digit industry, excluding the treatment firm. The financial data were extracted from *Compustat.* We used the average performance of the matching control firms (industry benchmark firms) as the performance of the control sample and compared it to the performance of the green IT innovator. Since all treatment firms could be matched, the sample size of the control firms is 45.

Control Sample to Test Hypotheses 2a and 2b (Green IT Followers)

The control sample represents "Green IT Followers" that are not selected as IT innovators. Firms that are both matched by firm size using total assets of the treatment firm and by industry using two-digit SIC code are selected for potential control firms. After that, we determined if the selected firms were environmentally consciousness (green). We reviewed each of the potential control firm's websites to determine whether the company demonstrated green initiatives (or efforts) in its website and selected a firm with strong evidence of environmental consciousness as a matching control firm. Three treatment firms were dropped from the sample because no matching control firms were available and one firm was matched by one-digit SIC code for the industry matching. Thus, the sample size reduced to 42.

RESULTS AND DISCUSSION OF FINDINGS

Comparison of Industry Benchmark Firms (Hypotheses 1a and 1b)

Table 2: Six-Year Average Performance of Green Innovators and Their Control Firms

Ratio	Group	Mean	Median	T	Z
ROA	Green Innovator	0.027	0.036	-6.863[a]	-5.232[a]
	Control	-0.222	-0.217		
ROS	Green Innovator	0.020	0.039	-3.552[a]	-5.300[a]
	Control	-2.570	-0.485		
OI/A	Green Innovator	0.125	0.128	-4.833[a]	-5.164[a]
	Control	-0.144	-0.078		
OI/S	Green Innovator	0.160	0.147	-3.415[a]	-5.548[a]
	Control	-2.375	-0.323		
COG S/S	Green Innovator	0.641	0.627	2.782[a]	4.701[a]
	Control	2.511	0.873		

a: 1 % level

Table 3: Six-Year Average Performance of Green IT Innovators and Green IT Followers

Ratio	Group	Mean	Median	T	Z
ROA	Green Innovator	0.024	0.038	-2.596[b]	-3.307[a]
	Control	-0.006	0.003		
ROS	Green Innovator	0.015	0.040	-2.090[b]	-3.195[a]
	Control	-0.045	-0.001		
OI/A	Green Innovator	0.123	0.116	-3.238[a]	-2.907[a]
	Control	0.090	0.090		
OI/S	Green Innovator	0.155	0.138	-2.973[a]	-2.995[a]
	Control	0.084	0.100		
COG S/S	Green Innovator	0.654	0.687	2.658[b]	2.582[a]
	Control	0.744	0.762		

a: 1 % level, b: 5 % level

We ran tests to evaluate if firm performance of Green IT Innovators was better than the average performance of industry benchmark firms using a six-year average, as reported in Table 2. The year by year results from 2000 to 2005 (due to the timing difference of the reports) are shown in Appendix A, Table A-1. Following the convention of previous research, a negative sign before the test statistic of profit ratios and a positive sign of cost ratios indicate the better performance of the treatment sample (Green IT Innovators) than the control sample.

The results, based on a six-year average performance, indicated that all profit ratios (ROA, ROS, OI/A, and OI/S) were significantly higher and the cost ratio, COGS/S was significantly lower for the Green IT Innovators than their control firms (P-values < 0.01) for both paired t test and non-parametric Wilcoxon test. Annual comparisons for each of six years shown in the Table A-1 in the Appendix also indicate that Green IT Innovators perform significantly better than their control firms, which were similar to the results of the six-year average performance. Thus, hypotheses 1a and 1b are strongly supported.

Comparison between Green IT Innovators and Green IT Followers (Hypotheses 2a and 2b)

When we compare the difference in performance between Green IT Innovators and Green IT Followers, evaluating the innovative impact on firm performance, the results, based on a six-year average performance, indicated that all of the profit ratios (ROA, ROS, OI/A, and OI/S) are significantly higher and the cost ratio, COGS/S, is significantly lower for the Green IT Innovators than the Green IT Followers (P-values < 0.05) for both paired t test and non-parametric Wilcoxon test. Annual comparisons for each of six years shown in the Table A-2 in the Appendix A also indicate that performance of the Green IT Innovators is significantly better than their control firms. Thus, hypotheses 2a and 2b are strongly supported.

Summary of Results and Discussion

The results of our empirical study are summarized in Table 4. As shown, green IT innovators perform significantly better than average industry performance (H1a and H1b) for all financial performance indicators. Thus, this study supports that innovative use of technologies for the technical, administrative, and environmental innovations improves overall firm performance showing higher profit ratios and lower cost ratio. For the evaluation if technology innovation has a positive impact on firm performance in case of Green Firms (H2a and H2b), our results indicate that Green IT Innovators significantly outperformed the Green IT Followers. Thus, our result supports innovative theory.

Table 4: Summary of Results

Hypothesis		Results
H1a	Green IT Innovators have higher profit ratios than the average profit ratios of all other firms in the industry (average industry performance).	Strongly supported
H1b	Green IT Innovators have a lower cost ratio than the average cost ratio of all other firms in the industry (average industry performance).	Strongly supported
H2a	Green IT Innovators have higher profit ratios than Green IT Followers.	Strongly supported
H2b	Green IT Innovators have a lower cost ratio than Green IT Followers.	Strongly supported

CONCLUSIONS

With growing awareness of environmental issues, many organizations have actively participated in the green effort. The recent Gulf of Mexico oil spill by British Petroleum [46] is an environmental catastrophe that drew everyone's attention. Such environmental disasters have provoked various stakeholders to pressure organizations to be actively engaged in environmental management or environmental protection. Going green is no longer an option for organizations without running the risk of losing credibility by being environmentally damaging [35].

Using a more recent dataset, this study has attempted to provide empirical evidence in understanding the impact of IT innovation on firm performance in the case of going green firms. We found that green IT innovators have competitive advantage over other companies in the industry and also over other green non-IT innovators (IT followers). The basic assumption of the study is that firm performance of green IT innovators will be higher because these innovators will also use technology in an innovative way as they are going green and thus, this facilitates organizations to gain competitive advantage in the market.

Our paper makes several contributions to research. Our research links innovation theory to going green on firm performance and empirically tests the relationship. Thus, it adds additional insight to the innovation theory. The results of our study validate that going green does not increase costs for firms but still helps gain competitive advantage even in the case of innovative firms.

Our results have important implications for top managers who need to make a strategic decision if "going green" pays off or increase costs. Although going green is an expensive project to implement, the managers should also consider cost reduction from implementing environmental management initiative, partially due to being efficient and partially due to avoiding any taxes and penalties from regulators although empirical study is needed to support this. Recently, consumers are increasingly attracted to firms with better environmental performance. For firms, going green is imperative to meet the demands of various stakeholders and thus, top manager's decision should be how soon going green pays off, not if going green pays off.

LIMITATIONS AND FUTURE RESEARCH

All firms in our study were "large" due to the fact that only firms with at least $500 million in revenue are invited to participate in the *Information Week* survey. Although one could argue that firm size impacts performance, smaller firms are often able to act more quickly to innovative opportunities [39]. Thus, they may actually exhibit greater performance than large firms. In this study, we used accounting measures, which might not be the best measures although they are the most commonly used financial performance measures in the previous studies. Another issue is that we used firm's website to determine firm's green initiatives. There would be a case where the company might making green efforts but if they do not mention it in their website, we could omit it from the sample although we do not expect the outcome of our study could change from it.

Further research using longitudinal data including firms with a broader range of firm size could provide further insight on this research topic. Also, very little IT innovation or investment research has been conducted outside the United States at either firm [39] or national levels. We encourage researchers to focus more on global settings. What does, or does not, work in the United States does not necessarily apply to other countries with different demographics, goals, and economies. Finally, further research investigating the impact of environmental performance on performance based on industry may be interesting since some industry sectors (i.e. mining) produce more waste than others (i.e. service) and thus, it might suggest additional insight on this topic.

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APPENDIX A

Table A-1: Year to Year Performance of Industry Benchmark Comparison (H1a and H1b)

Ratio	Group	Year 2000				Year 2001			
		Mean	Median	T	Z	Mean	Median	T	Z
ROA	Innovator	0.054	0.060	-6.069[a]	-5.030[a]	-0.016	0.025	-4.267[a]	-4.430[a]
	Control	-0.145	-0.074			-0.232	-0.176		
ROS	Innovator	0.059	0.057	-2.924[a]	-4.656[a]	-0.035	0.023	-3.110[a]	-4.476[a]
	Control	-1.936	-0.440			-1.895	-0.301		
OI/A	Innovator	0.157	0.167	-5.853[a]	-4.878[a]	0.118	0.116	-3.906[a]	-5.220[a]
	Control	-0.060	0.0136			-0.153	0.010		
OI/S	Innovator	0.189	0.191	-3.259[a]	-4.901[a]	0.149	0.132	-3.318[a]	-5.503[a]
	Control	-2.432	-0.156			-1.803	-0.260		
COGS/S	Innovator	0.626	0.675	2.322[b]	3.408[a]	0.646	0.680	2.517[b]	3.335[a]
	Control	2.376	0.729			1.903	0.747		
Ratio	**Group**	**Year 2002**				**Year 2003**			
		Mean	**Median**	**T**	**Z**	**Mean**	**Median**	**T**	**Z**
ROA	Innovator	0.015	0.023	-4,360[a]	-5.164[a]	0.012	0.026	-5.001[a]	-4.577[a]
	Control	-0.279	-0.169			-0.174	-0.136		
ROS	Innovator	0.002	0.023	-1.874[c]	-5.187[a]	0.001	0.033	-2.709[a]	-4.961[a]
	Control	-4.626	-0.274			-2.030	-0.332		
OI/A	Innovator	0.111	0.104	-4.836[a]	-5.017[a]	0.108	0.988	-2.214[b]	-5.096[a]
	Control	-0.193	-0.055			-0.261	-0.096		
OI/S	Innovator	0.149	0.133	-1.777[c]	-5.311[a]	0.147	0.132	-2.777[a]	-5.379[a]
	Control	-4.182	-138			-1.673	-0.264		
COGS/S	Innovator	0.644	0.626	1.463[c]	3.561[a]	0.649	0.649	2.113[b]	3.787[a]
	Control	4.143	0.771			2.020	0.786		
Ratio	**Group**	**Year 2004**				**Year 2005**			
		Mean	**Median**	**T**	**Z**	**Mean**	**Median**	**T**	**Z**
ROA	Innovator	0.042	0.045	-4.709[a]	-4.859[a]	0.053	0.056	-4.057[a]	-4.983[a]
	Control	-0.211	-0.145			-0.281	-0.146		
ROS	Innovator	0.046	0.049	-2.595[b]	-5.119[a]	0.051	0.058	-2.480[b]	-4.691[a]
	Control	-2.364	-0.393			-2.501	-0.621		
OI/A	Innovator	0.123	0.114	-5.152[a]	-4.983[a]	0.129	0.118	-5.009[a]	-4.726[a]
	Control	-0.080	-0.034			-0.113	0.049		
OI/S	Innovator	0.165	0.144	-2.585[b]	-5.424[a]	0.161	0.148	-2.477[b]	-5.077[a]
	Control	-2.000	-0.340			-2.181	-0.469		
COGS/S	Innovator	0.638	0.642	2.120[b]	3.493[a]	0.646	0.671	2.175[b]	3.606[a]
	Control	2.245	0.777			2.414	0.755		

a: 1 % level, b: 5% level, c: 10% level

Table A-2: Year to Year Performance Comparison (H2a and H2b)

Ratio	Group	Year 2000				Year 2001			
		Mean	Median	T	Z	Mean	Median	T	Z
ROA	Innovator	0.049	0.057	-1.944[c]	-2.570[b]	-0.022	0.024	-0.153	-1.782[c]
	Control	0.021	0.019			-0.027	-0.002		
ROS	Innovator	0.051	0.053	-2.184[b]	-2.920[a]	-0.046	0.023	-0.468	-2.019[b]
	Control	0.011	0.020			-0.067	-0.006		
OI/A	Innovator	0.154	0.164	-2.656[b]	-3.170[a]	0.114	0.115	-2.745[a]	-2.770[a]
	Control	0.107	0.104			0.073	0.082		
OI/S	Innovator	0.183	0.184	-2.406[b]	-2.932[a]	0.140	0.125	-3.089[a]	-3.145[a]
	Control	0.128	0.108			0.071	0.082		
COGS/S	Innovator	0.639	0.691	2.615[b]	2.332[b]	0.662	0.722	3.064[a]	2.720[a]
	Control	0.713	0.737			0.753	0.775		
Ratio	**Group**	**Year 2002**				**Year 2003**			
		Mean	**Median**	**T**	**Z**	**Mean**	**Median**	**T**	**Z**
ROA	Innovator	0.015	0.022	-3.672[a]	-3.132[a]	0.008	0.026	-1.687[c]	-2.987[a]
	Control	-0.039	-0.025			-0.032	0.006		
ROS	Innovator	0.001	0.022	-2.357[b]	-3.432[a]	-0.009	0.033	-1.367	-3.052[a]
	Control	-0.136	-0.036			-0.066	0.003		
OI/A	Innovator	0.108	0.101	-2.401[b]	-2.144[b]	0.106	0.093	-1.779[c]	-1.860[b]
	Control	0.078	0.087			0.084	0.081		
OI/S	Innovator	0.143	0.127	-2.020[b]	-2.544[b]	0.139	0.123	-2.170[b]	-2.443[b]
	Control	0.046	0.097			0.083	0.091		
COGS/S	Innovator	0.658	0.692	2.216[b]	2.207[b]	0.672	0.674	2.402[b]	2.145[b]
	Control	0.770	0.761			0.755	0.770		
Ratio	**Group**	**Year 2004**				**Year 2005**			
		Mean	**Median**	**T**	**Z**	**Mean**	**Median**	**T**	**Z**
ROA	Innovator	0.041	0.049	-2.355[b]	-2.372[b]	0.052	0.056	-1.609	-2.074[b]
	Control	0.014	0.028			0.031	0.020		
ROS	Innovator	0.043	0.049	-1.506	-2.428[b]	0.044	0.056	-0.882	-1.607
	Control	-0.043	0.023			0.027	0.026		
OI/A	Innovator	0.123	0.110	-2.204[b]	-1.954[c]	0.126	0.115	-2.299[b]	-1.833[c]
	Control	0.097	0.091			0.096	0.094		
OI/S	Innovator	0.163	0.144	-1.956[c]	-2.679[a]	0.152	0.135	-2.390[b]	-1.939[c]
	Control	0.061	0.115			0.110	0.117		
COGS/S	Innovator	0.656	0.657	2.360[b]	2.568[a]	0.677	0.719	1.673	1.561
	Control	0.782	0.753			0.731	0.738		

a: 1 % level, b: 5% level, c: 10% level