The Impact of Information Systems Investment Announcements on the Market Value of the Firm: Evidence from Australian Markets

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Abstract

As commercial technology use becomes more widespread, firms are becoming more interested in announcing their new information systems developments to the market. In extant studies, market reaction to information systems investment has been mixed. This paper conducts an initial test to examine whether the Australian market abnormally rewards information systems investment.

1. Introduction

The value of information systems investments has been a vexing topic for some time among those who wish to justify or assess IT acquisitions in organisations. Often, organisations may resort to the metric which is easiest to obtain (what the system cost to build) is drawn into question by the additional intangible costs and benefits, which are held by some to make up a larger part of IS investments than conventional assets (DeLone and McLean 1992).

The use of market reaction, has been mixed. Those systems with no direct revenue-building component have been found to be zero net-gain investments, based on market valuation. However, investments in e-commerce and e-markets have found more favour, with the market treating innovative and early-mover systems as positive net-gain investments. This study seeks to test whether a similar difference exists in the Australian market.

This paper describes the current pilot version of a future event study. Preliminary analysis on current data has been performed to ensure correct procedures are being followed in both data collection and data analysis. Conclusions from this part of the study should not be relied upon, given the sample size, but may serve as an indicator to the results of a future, more rigorous study. In particular, the number of announcements about "pure" information systems (those without e-commerce components) may guide future researchers in finding a more useful definition of such systems.

The following section of this paper reviews previous studies that have been done in this area. Section 3 describes the data gathering procedures that were followed for this pilot study. Section 4 details the analysis done on this data, with preliminary results. Section 5 lists the limitations with which this paper and the rest of this study will likely have to contend, and suggests future research areas. Section 6 gives the conclusion of the paper.

2.1 Literature Review

The two main articles on which this study is based are Dos Santos et al. (1993) and Ferguson et al. (2001).

Dos Santos et al. (1993) is an event study of information technology investment announcements to the New York Stock Exchange. It concluded that, overall, information technology investment was regarded as zero net-gain by the market. However, when the authors grouped announcements on the basis of innovative content, they discovered that the market rewarded the use of innovative technology. This is consistent with market economic theory, and with previous studies of non-information technology innovation (Chaney et al. 1991).

In contrast, Ferguson et al. (2001) examines the market effects of e-commerce system announcements to the Australian Stock Exchange, discovering that the market rewards investment in this technology. They review an American study (Subramani and Walden 1999) where this result was delivered, and combine tests around e-commerce announcements with a division on the basis of innovation. Although their paper is not yet published, the tentative result is that non-innovative e-commerce announcements are in fact valued *more* by the market than innovations. Their rationale is that once one company has shown that something can be done, the same improvement can be had by others for less cost by pursuing the same area of research with a known goal in mind. Therefore, second-movers should be rewarded more. This effect is increased by the inability of e-commerce innovators to use patents or copyright to safeguard their work (Dos Santos and Peffers 1995). The authors state that their research is incomplete, and needs expansion before this result can be confirmed.

There seems to be a fundamental difference in the results of the two studies. In the earlier, American paper, information technology investment was only valued at greater than zero gain when the investment was seen as innovative. In the later, Australian paper, e-commerce investment was rewarded regardless of its innovation status, and in fact innovation was not as well received as non-innovative announcements. Questions for future research include whether either of the two studies was flawed, whether the difference of markets is a factor, or whether the technology of e-commerce somehow makes it more valuable than other information technology investments. The fact that e-commerce is aimed at reducing the cost of every transaction the company makes, as opposed to some nebulous concept of granting better access to information, could have something to do with this greater valuation.

Mukhopadhyay and Kekre (1995) value an Electronic Data Interchange (EDI) investment from the point of view of transaction cost savings (rather than market reaction). The study highlights the significant gains that can be made through the consistent adoption of the EDI technology and "philosophy". The difference between EDI and e-commerce is not deeply discussed in any of the articles, although some distinction is made. EDI is described as occurring over private networks between business partners, whereas e-commerce is internet-based, and can happen between businesses or between a business and a private individual. By enabling the same electronic efficiencies with fewer network costs, e-commerce should be able to offer the similar benefits with less than the same investment. Awareness by the market of the very real gains to be made by investing in EDI and, by extension, its sister technology e-commerce, could mean that e-commerce is viewed significantly differently from other information technology investments.

However, many of the benefits from the Mukhopadhyay study came not only from the technology, but also from the consistent application of the discipline it enabled. It is unclear from the limited description in Ferguson et al. (2001) exactly what the difference is, and therefore no definitive statement can be made about the relative

gains or losses in e-commerce. The same factor that reduces the cost of e-commerce means that it can is similarly low-cost for imitators of innovation, and it is harder than previously for firms to gain any strategic advantage. Therefore, taking both Dos Santos and Ferguson at their word, and assuming for a moment that there is no inherent difference between e-commerce and any other technology investment[1] in terms of inherent value for the company, the comparability of the two markets should be examined.

This study is aimed at discovering whether there is any fundamental difference between the Australian and American markets in the reaction to information systems investment announcements. There are few possible reasons for this theory. Cultural and geographical factors are somewhat different between the two countries. Given the supposed technological and market trend lag[2], is there some basis for Australian investors expecting innovations to come from overseas, and only rewarding those local companies who successfully emulate American first movers? Is there any reason to believe in a uniformly greater conservatism in investment patterns? If this is the case, then investment in non-innovative, safe technologies should be rewarded in information systems as well.

2.2 Hypothesis Development

Null Hypothesis: A firm does not generate abnormal returns when it announces investment in information systems.

If this null hypothesis is rejected, then the Australian market may value investments in information technology, information systems or e-commerce as a group more highly than their American counterparts. If not, there may be a distinction in the minds of market participants between the members of this group. The reason for this distinction, and exactly where market participants draw the borders, cannot be judged from this study. The rejection condition for this hypothesis is that the cumulative abnormal returns around the announcement date are significantly different from 0. In the later version of this study, this test should be separated on the basis of innovation, to ensure that the effect of the market preference for innovation (should it exist) be captured. However, as is explained below, this is not yet possible.

3.1 Data Description and Gathering Procedures

In this event study, the two kinds of data were announcements of information systems investments, and daily closing share prices. The intent was to gauge the reaction of the market to the investment announcement by observing whether there was any abnormal activity in the share returns (adjusted for dividend effects) to investors.

Announcements were gained by performing searches of company announcements to the Australian Stock Exchange (ASX), as contained in the electronic archive of the f2.com.au website. This site was chosen because its search engine was always available, unlike that of the ASX website (asx.com.au) which was affected by heavy traffic on the site. While both were sometimes slow and unresponsive, the f2 website

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[1] It is not seriously suggested that e-commerce and information systems are the same. In order to avoid overlap, they have been identified as different types of information technology. It is simply in terms of the market's valuation of investment that they may be treated the same.

[2] Both in the public and private sectors, especially point D, as described in:

http://it.mycareer.com.au/columns/platform/20010205/A19452-2001Feb5.html

allowed search construction and modification even during these times, while the ASX restricted the use of this function. This meant that when a search on f2 timed out, it could be retried immediately, while the ASX user would have to retype all search terms and limits. Given that both access the same source documents, there should be no difference in the accuracy and completeness of data between the two archives.

The search itself was conducted using the Advanced Search section of the website, since the searches only returned 200 items at a time, and displayed the most recent relevant results first. This meant that even if one searched the last 5 years, only the first 200 results (which may only cover 3 years) are available to view. The Advanced Search allows the user to specify an end time for the search, and change the sort mechanism. The terms used were "information system", and the search was limited year by year. In the years 1998-2000 this combination resulted in many replies to the ASX's requests for information relating to the companies' Year 2000 remediation efforts. This stage of the study is concentrating on information systems announcements exclusively, rather than changes caused by the Year 2000 upgrade. The search was modified to read "information AND system NOT 2000" in those years, which was not a completely satisfactory solution. In any case, more than 200 results were found for each year, and each had to be evaluated on the basis of relevance.

Since this study is about assessing the market impact of information systems investments, efforts were made to minimise the impact of other events important to the company. Any announcement that accompanied the firm's scheduled financial reporting obligations, or resulted from a takeover or creation of a subsidiary, was excluded. Also excluded were companies who were in the business of creating such systems and selling them to others; where possible, their clients were examined, but in some cases there were joint venture or alliance issues which would have created too much noise to be acceptable. To avoid overlap between this study and Ferguson et al. (2001), and to concentrate on the effect of non-e-commerce investment, no system that actually sold products to the company's clients was included. Under all these criteria, approximately 30 candidate events remained.

In order to be able to study the market reaction, the company must have a measurable (and changeable) share price. Several of the announcements concerned companies buying systems from service providers, and further investigations into these client companies turned up several which were subsidiaries of others, government-owned corporations, foreign companies, or non-listed. This reduced the number of announcements to 12, all of which were from different companies that had been listed on the ASX at the time the announcement was made. As far as it was possible to ascertain the dates of financial reporting, no announcement formed a part of scheduled financial reporting, or coincided with such announcements.

The data on the daily closing share prices was obtained from DataStream. Again, this was not the only source of this information, but it was free and reasonably convenient. Price data was not available for all of the companies who had made announcements, even though all had been listed on the ASX at the time of the announcement. Mostly this occurred because of a company name change or trading suspension, which resulted in the company no longer being traded. As a result, the twelve candidate events were reduced to six. These announcements are shown in Table 3. Their number would seem to be viable only for the purposes of illustrating the statistical analysis to be done in future.

This table is a list of the announcements used in this study, consisting of the date, company name, and a summary of the announcement.

Date	Company Name	Announcement
25/11/97	Bendigo Bank	Pilot of new Systems Teller platform
09/12/98	Carter Holt Harvey Forests	New forest history/planning GIS
15/2/99	Powertel Ltd	Design of Operational Support System
22/6/99	Bank of Queensland Ltd	First phase of new IS completed
23/8/99	Coolgardie Gold NL	Purchase of new Geographical IS
19/1/00	Aneka Tambang (Persero)	Near completion of first phase of new IS

Table 3: List of announcements

Entering the date and company name as search terms into the Advanced Search engine on f2.com.au will reproduce the original announcements.

3.2 Equations

As in the Ferguson et al. (2001) study, a 61-day event was used (day –30 to day +30, centred around day 0). Cumulative Abnormal Returns for this period were calculated using a regression of that company's adjusted returns against those of the market. This regression was based on a 300-day period that excluded all of the events in the study, and the same period was used for each of the companies except Aneka Tambang. Price information was not available for this company during the 300-day period used for the other announcements, and the spacing of those other announcements prevented another regression that avoided all the announcement dates. This is another problem to be examined in greater depth in the rest of the study.

The regression itself was based on the Capital Asset Pricing Model, where

$$E(R_{it}) = \alpha + \beta \cdot E(R_{Mt}) + \varepsilon$$

This model brings with it some assumptions, most notably that the market is at least semi-strong efficient (that is, it has rational participants and impounds all publicly available information quickly into prices). This assumption may not be entirely reasonable given the Ferguson et al. (2001) result, but has been used frequently in event studies of this type (McWilliams and Siegel 1997).

The difference between the expected return and the actual return formed the abnormal return for that day, and the sum of all the abnormal returns over the 61-day event formed the cumulative abnormal returns. To control for any price effects, the natural logarithm of the change in price was taken, and this was the figure used to calculate abnormal returns.

$$\text{Actual } (R_{it}) = \ln (P_{it} - P_{it-1})$$

$$AR_{it} = E(R_{it}) - \text{Actual } (R_{it})$$

An 11-day window around the day of the announcement was examined for daily abnormal returns.

4. Analysis of Results

Day	Mean	Std dev	t-stat	Median	% positive	Minimum	Maximum	Skewness	Kurtosis
-30	-0.009	0.057	-0.07	0.000	0.50	-0.114	0.057	-1.444	3.433
-25	-0.021	0.047	-0.10	-0.007	0.33	-0.080	0.030	-0.556	-1.810
-20	-0.052	0.076	-0.04	-0.038	0.33	-0.157	0.021	-0.400	-2.019
-15	0.010	0.079	0.15	0.001	0.50	-0.078	0.145	0.992	1.104

-10	0.020	0.093	0.26	0.031	0.50	-0.121	0.119	-0.520	-1.203
-5	0.128	0.233	0.37	0.047	0.67	-0.122	0.509	0.970	0.068
0	0.129	0.286	0.37	0.045	0.33	-0.143	0.618	1.132	0.644
5	0.141	0.276	0.44	0.047	0.33	-0.156	0.483	0.539	-1.945
10	0.200	0.343	0.51	0.091	0.33	-0.140	0.781	1.115	0.510
15	0.224	0.330	0.54	0.111	0.33	-0.107	0.750	0.927	-0.507
20	0.214	0.307	0.62	0.116	0.33	-0.100	0.695	0.870	-0.632
25	0.192	0.323	0.51	0.077	0.50	-0.109	0.743	1.169	0.524
30	0.201	0.307	0.54	0.087	0.50	-0.062	0.701	1.057	-0.268

Table 1: Cumulative Abnormal Returns

The mean abnormal returns around the date of the announcement indicate that, some time before day –5, abnormal returns are boosted greatly. Only one announcement changes sign, indicating the power of each result in such a small sample. Over the period of the announcement itself, they don't seem to change much. Not one of the t-stats is above the required figure for significance at the 5 percent level.

Day	Mean	Std dev	t-stat	Median	% positive	Minimum	Maximum	Skewness	Kurtosis
-5	0.011	0.016	1.66	0.013	0.83	-0.014	0.029	-0.578	-0.522
-4	0.003	0.056	0.32	0.005	0.67	-0.081	0.092	0.199	1.864
-3	0.018	0.027	0.12	0.010	0.67	-0.007	0.057	0.743	-1.334
-2	0.026	0.080	-0.07	-0.002	0.50	-0.024	0.188	2.345	5.612
-1	-0.015	0.026	0.01	-0.003	0.33	-0.064	0.005	-1.704	2.678
0	-0.031	0.098	0.06	-0.002	0.50	-0.228	0.032	-2.314	5.509
1	-0.015	0.019	0.00	-0.012	0.17	-0.051	0.004	-1.679	3.748
2	0.004	0.049	-0.03	0.012	0.67	-0.082	0.068	-0.957	2.543
3	0.022	0.078	0.08	-0.001	0.50	-0.042	0.177	2.147	5.000
4	0.010	0.017	0.27	0.009	0.83	-0.017	0.036	-0.176	1.696
5	-0.008	0.043	0.42	-0.001	0.50	-0.086	0.045	-1.141	2.599

Table 2: Daily Abnormal Returns

The daily results demonstrate further the minimal overall change during the period of the announcement. The skewness and kurtosis measures swing up and down, manipulated by one large maximum or minimum, and yet the overall change between days –5 and 0 is only 0.001. It would appear that not enough has been done to moderate the size effects of some share price changes. None of the t-stats is significant at the 5 percent level (all are less than 1.96).

The overall result of the regression shows that the null fails to be rejected, as it is not possible to say with certainty that the cumulative abnormal returns for the announcements were significantly greater than 0. This means that the market does not value information systems as net positive gain investments. This is in keeping with results based on the American market, and, if the result can be relied upon, means there appears to be no fundamental difference between the Australian and American markets. This leads to the further research question of what has caused the difference in reaction between e-commerce investments and other types of information technology investments being announced to the market.

5.1 Limitations

This paper operates under a number of limitations, which restrict both its comparability to previous studies and its contribution to the literature. These are recognised and listed here, both for use in results interpretation and for future

reference. This paper was always envisioned as a pilot study for a greater effort, with the pilot identifying the research challenges that would be faced and laying the analytical groundwork (in terms of data source identification and formula refinement). The later study, cognisant of these challenges and able through greater resources to obviate them, would move efficiently towards answering the research question.

All assessment criteria and judgements with regard to these announcements have been the work of one person, which means that there is no way to check the results for bias. The criteria were based on previous studies, but there is no guarantee that they were correctly applied in each case. Independent result checking would benefit the study. The judgements of content (what should not be included because it related to e-commerce rather than to information systems) may have screened out more than was intended, and better rule construction on these grounds will be an issue for the main study. Likewise, judgements of which corporate dealings could cause noise in the market's reactions would also need greater examination. The timing of the announcements may have coincided with other significant events for the company. We would also need to take the size of the firm into account (e.g. Goode 2001) and their reputation for technology success among investors. Announcements were excluded if they were a part of earnings announcements and the like, but more work would be needed to assess the likelihood of other events creating market reaction.

The fact that DataStream did not contain the share prices for some companies, since they were suspended or delisted at some stage after the announcement was made, had a severe impact on the amount of data that could be gathered in a reasonable time. More complete sources of information, such as the new version of DataStream, other information service providers such as Huntleys, and the paper-based archives in the National Library, could all be investigated in a better-resourced study. Of course, the raw data gained from other sources would have to be adjusted in the same way as the DataStream information to allow comparability. At this stage, the sample is not large enough to distinguish meaningfully between innovative and non-innovative investments. This would have to be done to enable comparability with the Dos Santos results.

Sample size due to lack of numbers caused several problems. One solution would be to expand the years of announcement gathering; the f2 website stores announcements going back to 1990. Another would be to obtain announcements from other sources, such as newspapers and journal articles. However, the problems with determining when, exactly, information contained in non-daily publications became available to the writer (and thus the market) would eliminate most journals (as in Ferguson et al., 2001). Also, archives of newspapers are not likely to be available without either some significant amount of money (in the case of f2.com.au electronic copies of articles from such papers as the Australian Financial Review) or time (in the case of physical copies) being spent. None of these obstacles is insurmountable; they must simply be considered and planned for.

5.2 Further Research

It becomes more and more difficult to create an innovative information system the longer such systems have been around. Also, with the growing number of inter-organisational and jointly developed systems, some firms are choosing to create subsidiaries whose sole purpose is to manage these systems. The market is not given an opportunity to price the system directly, instead spreading its approval or lack thereof among the partners. To gain a greater appreciation of how the Australian

market is likely to react to information systems announcements, future research should focus on times when such announcements were more of a novelty.

It is also possible that, given the lag between American and Australian implementations of new technology, what would have been innovative in the Australian market is simply no longer worth announcing. A large number of more recent announcements came from companies announcing that they had won the deal to implement the information system, rather than the adopters themselves. The adopters did not often make a similar announcement of the same event, obviously feeling that either the market would draw their own conclusions, as all the information needed was already there, or there was nothing to be gained from drawing attention to their investment.

It is also an open question as to whether there is some feature of electronic commerce that makes every investment in it innovative, compared to other information systems investments. Is there a hype component to the market's valuation of e-commerce investment? Or is the technology as a whole still new enough that there is genuine innovation, even in second- and third- moving companies? Research into these questions will help explain the apparently paradoxical result of Ferguson et al. (2001), which states that the market values innovation less than non-innovation.

6. Conclusions

The evidence provided suggests that the Australian market does not appear to abnormally reward information systems investment. Current sample size problems prohibit this result from being conclusive. Also, since the experiment failed to reject the null hypothesis, which could lead to a number of conclusions, hypothesis development should be improved to the point where rejecting the null will lead to more definite evidence. There are sufficient announcements where the share price information was not immediately available to warrant further investigation. The future study would bring closer a conclusion as to whether higher rewards for non-innovative e-commerce investments in the Australian market are due to some Australian market preference for stable technology, or some feature of e-commerce itself.

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