

## Does Media Exposure of Firm IT Practices Matter To Firm Market Value?

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**ABSTRACT:** Extant literature on information technology business value has proposed firm market value as a better measure than traditional firm performance measures, such as return on investment (ROI). Interestingly, however, it solely focuses on the tangible effects of IT investments and overlooks a simple fact that firm market value is a type of perceived performance, which is significantly influenced by intangible effects of firm IT practices (such as IT investments, changes of IT leadership, and reports of IT implementation) on attitude of investors towards and reputation of the focal firm. In this study we extend existing research by focusing on IT media exposure, defined as the extent to which firm IT practices are reported by media within a prescribed period, and argue that IT media exposure is positively related to firm market value. We suggest that this is because IT media exposure can facilitate three mechanisms – improving attitude of investors, building firm reputation and signaling firm IT capability. To test our conjecture, we collected data of 26 companies among S&P 500 under the health care section over a period of 1991-2012 (22 years) and conducted a multilevel analysis (MLM). The results of data analysis support our hypothesis.

**Keywords:** Firm market value, IT media exposure, Tobin's q.

### I. INTRODUCTION

Exploring and manifesting business value of information technology (IT) is one of the fundamental tasks of the IS community [1-3]. Because of the lag-effects of IT investments, scholars have argued that traditional measures of firm performance, such as return on investment (ROI), may not capture the effects of IT investments appropriately and proposed firm market value (measured by Tobin's q) as a better measure [4, 5], which has been adopted widely in a number of IS studies [e.g., 6, 7-10]. This wide adoption has been justified in that firm market value is forward-based and can be used to predict firm future performance [5].

Interestingly, however, extant IS literature has overlooked a simple fact that in nature, firm market value is a type of perceived performance. The path from IT investments to firm market value in extant literature has been limited in a perspective of tangible effects of IT investments, such as reduced operating cost and/or enhanced differentiation of products and services [11]. Since firm market value is based on the perceptions of investors, intangible effects of firm IT practices (such as IT investments, changes of IT leadership, and reports of IT implementation) on attitude of investors towards and reputation of the focal firm should be taken into account for the purpose of exploring the business value of information technology.

In addition, a number of studies have confirmed that IT investments, by themselves, do not guarantee improvement on firm performance [e.g., 12, 13, 14]. IS scholars have pointed out that other intangible factors, such as IT capability (the ability of a firm to deploy and mobilize its IT investments) [15], are sources of superior firm performance [16, 17]. Thus, besides the tangible influences, there exist intangible factors that should be considered to help explain the relationship between IT practices of a firm and its market value.

In this study we extend existing research by focusing on IT media exposure, defined as 'the extent to which firm IT practices are reported by media within a prescribed period,' and argue that IT media exposure is positively related to firm market value. We suggest that this is because IT media exposure can facilitate three mechanisms – improving attitude of investors, building firm reputation, and signaling firm IT capability – which can represent the effects of intangible factors on firm performance. To test our conjecture, we collected data of 26 companies among S&P 500 in the healthcare section over a period of 22 years (1991-2012) and conducted a multilevel analysis (MLM). The results of data analysis support our proposed hypothesis.

We claim three contributions. First, to our knowledge, this study is among the first ones examining the impact of 'IT media exposure' on 'firm market value'. Second, even though some terms related to IT media

exposure, such as IT investment announcements and IT rankings, have been used in past studies, these terms only cover partial information of firm IT practices and are not comprehensive to represent the complete concept of IT media exposure. We believe that our conceptualization of 'IT media exposure' is creative in capturing the relationship between firm IT practices and firm market value. Finally, we suggest three reasonable mechanisms to help explain the proposed relationship between IT media exposure and firm market value from the lens of intangible factors.

## II. THEORETICAL BACKGROUND AND HYPOTHESIS

### 2.1 IT Media Exposure

The concept of IT media exposure is derived from the term 'media exposure'<sup>1</sup>, which is widely used in communication and business studies and defined as "the aggregated news reports relating to a specific company within a prescribed period [19, p.34]." Based on information processing theory, Wartick [19] suggested three most salient characteristics of media exposure: amount, tone, and recency. However, in extant studies media exposure has typically been measured by counting the number of articles published about a given firm in a particular period of time within a certain set of media outlets [18]. Empirical studies have found that media exposure has a positive effect on firm reputation [20-22] and a strong positive association with firm market value [23].

While IT media exposure is conceptually related to prior constructs in existing IS literature, such as IT investment announcements, IT leaders, IT initiative announcements, and IT rankings, it is more comprehensive than these constructs and has not been investigated accordingly. This distinction is mainly rooted in the difference on how they are operationalized. For example, in one of the pioneer studies [24], the percentage of valid IT investment announcements to all IT media reports is only 1.93%. It means that more than 98% of IT media reports on all kind of firm IT practices are excluded. Moreover, IT leaders and IT rankings are mostly derived from subjective opinions of IT journal editors and IT professionals but are not based on objective IT media reports at all. While the percentage of valid IT initiative announcements to all IT media reports is slightly higher (about 7.5%) in Liu et al. [25], an important difference on these operationalizations is that IT media reports are repeatable in the operationalization of IT media exposure (this characteristic is never true in the operationalizations of IT investment announcements, IT leaders, and IT rankings as adopted in extant literature). It means that the same IT investment, IT initiative, or IT implementation announcement could be published in different media, combined with other news to be published again, or just simply re-mentioned later in review reports so that the "extent" of IT media exposure can be captured. This distinction on operationalization also reflects the difference between our intangible benefit-focused approach (i.e., IT media exposure) and the tangible benefit-focused approach (e.g., IT investment and IT initiative announcements).

### 2.2 IT Media Exposure and Attitude of Investors

We conjecture that IT media exposure can generate intangible benefits which influence firm market value with three basic mechanisms: improving attitude of investors, building firm reputation, and signaling firm IT capability. The first mechanism is derived from the field of human-computer interaction (HCI), where the link between attitude of individuals and perceived usage of technology is well-established (so-called technology acceptance research stream). Further studies have extended this research stream and included other perceived measures, such as perceived performance. Some research has showed that attitude of individuals to IT has influence on their perceived performance with these technologies [26]. At the same time, a number of studies from the field of communication have demonstrated that individual attitudes can be influenced by media reports [27, 28]. Thus, combining these two research streams together, we believe that media reports can affect individuals' attitude to IT and further affect their perceived performance with technologies.

In the case of IT media exposure, attitude to IT has been extended to attitude to the focal firms and perceived performance with technologies extended to perceived firm performance. We believe that such extensions are reasonable. A difference between general media reports and IT media reports is that IT media reports are hardly negative. Media reports on firm IT practices, such as IT investments or IT implementations, should always give individual investors positive impression (such as IT leaders) and improve their attitude to the focal firm. In the same vein, the extension from perceived performance with technology to perceived firm performance is natural since media reports cover all kind of firm IT practices and their effects should be presented as a whole on firm performance. Therefore, we expect that media reports on firm IT practices can affect attitude of investors towards the focal firm and improve their perceptions of firm future performance.

### 2.3 IT Media Exposure and IT Reputation

<sup>1</sup> In existing literature, terms such as media visibility, media coverage, media awareness and/or media attention were used as synonyms [18]. Following this tradition, we treat these terms interchangeable in this study.

Under the second mechanism, investors routinely rely on the reputations of firms in making investment decisions [29] and the aggregated judgements of major investors on firm reputations determine firm market value, which in turn indicates investors' expectations on firm future performance [30]. Existing literature has identified a set of firm reputation attributes and subattributes, such as products and services, financial performance, social responsibility, emotional appeal and so on [31, 32]. Among them, IT media exposure can significantly influence perceptions of investors on firm reputation subattributes such as firm market opportunities, leadership, quality products and services, innovative products and services, superior financial performance, and growth prospects.

The logic underlying the argument is that if there are plenty of evidences that IT can significantly contribute to these firm reputation attributes/subattributes mentioned above, media reports of firm IT practices can bring up investors' expectations that firms with similar IT practices will achieve alike success. Narratively, such evidences are adequate in existing literature. For example, Bhatt and his colleagues [33] collected data from 105 manufacturing and service firms and found that IT enhances the ability to respond quickly to market opportunities. Based on data collected from customers of a leading financial services company, Krishnan et al. [34] conducted a full Bayesian analysis and confirmed that IT-enabled call centers significantly improved quality of customer service. Within network environments, Liu et al. [25] conducted a longitudinal study over a period of 15 years and revealed that IT initiatives are related up to seven major measures of financial performance, including return on asset (ROA), return on sales (ROS), and others. Pavlou and Sawy[35] collected data from 180 managers and found that IT plays an indispensable role in new product development. Since the evidences of how IT contributes to firm reputation attributes are extensive, it can be argued that IT media reports can influence firm reputation.

#### 2.4 IT Media Exposure and IT Capability

Under the third mechanism, IT media exposure signals firm IT capability, which has been widely argued as a source of superior firm performance [15-17]. The perspective of IT capability is rooted in resource-based view (RBV), which argues that competitive advantage comes from resources that are valuable, rare, inimitable, and nonsubstitutable (so called VRIN) [36]. Based on RBV, the IT capability perspective acknowledges that IT is accessible to most firms and IT investments by themselves cannot be a source of competitive advantage, but argues that the ability to use IT to create VRIN resources, such as customer orientation, knowledge assets, and synergy (the sharing of resources and capabilities across organizational divisions), can be a source of competitive advantage [15]. The IT capability perspective has obtained significant empirical supports [e.g., 16, 17, 37].

The argument that IT media exposure signals IT capability is well supported by the fact that existing studies have frequently used IT media reports to measure IT capability. For example, two pioneer studies on IT capability used IT leader, a type of IT media report, to indicate IT capability [15,38]. Other studies used IT initiative announcements [39] or IT ranking [17] from IT major media to measure IT capability. While it can be argued that IT media reports are not really equal to IT capability [15], using media reports as proxy of IT capability has become a feasible practice in IS studies [39].

In general, there are four categories of IT media reports that constitute IT media exposure: IT initiative announcements, IT officer appointments, opinions on new version of existing or emerging technologies, and reviews of past IT implementations. More or less, all these media reports are pointing to firm IT capability. For example, IT initiative announcements exposure the major IT practices of the focal firms, which constitute the essential part of IT capability; IT officer appointments reveal their IT managerial skills, a crucial element of IT capability; Being sought for opinions on technologies indicates firm reputation on IT. Since we have demonstrated firm reputation on IT (such as IT leader) has been used as an indicator of firm IT capability, being sought for opinions on technologies also indicates firm IT capability; Reviews of past IT implementations point out that the firms have successfully used their IT capability to implement and deploy IT applications. Thus, we feel confident to argue that IT media exposure signals IT capability through different types of media reports.

#### 2.5 IT Media Exposure and Firm Market Value

While there may be multiple paths through which IT media exposure can influence firm market value, it may be less parsimonious and too micro-focused to argue specific mediators between IT media exposure and firm market value. Thus, in this study we focus on the direct relationship between IT media exposure and firm market value as the first step and call future study for examining the possible mediated effects of factors (such as attitude, IT reputation and IT capability) on the proposed relationship. To sum up, we argue that IT media exposure can influence firm market value. Therefore, we propose:

*Hypothesis: IT media exposure is positively related to firm market value.*

### III. METHODOLOGY

#### 3.1 Operationalization of IT Media Exposure

In communication and business studies, media exposure has typically been measured by counting the number of articles published about a given firm in a particular period of time within a certain set of media outlets [18]. Another common adopted practice is using natural logarithmic transformation of the counted number of media reports in data analysis for reducing data skewness [e.g., 20, 21, 40]. Therefore, following these practices, in this study we used the natural logarithmic transformation of the counted number of media reports from three major computer journals (detailed below) in a period of one year to measure a firm's IT media exposure.

#### 3.2 Dependent Variable

Firm market value measured by Tobin's q serves as the dependent variable in this study. There are multiple methods to calculate the q ratio but results are very similar [5]. We adopted the method suggested by Chung and Pruitt [41], which has been used in IS literature [5], to calculate q value. Specifically,

$$\text{Tobin's } q = (\text{MVE} + \text{PS} + \text{DEBT}) / \text{TA}$$

where MVE = (Closing price of share at the end of the financial year) × (Number of common shares outstanding); PS = Liquidating value of the firm's outstanding preferred stock; DEBT = (Current liabilities - Current assets) + (Book value of inventories) + (Long term debt); and TA = Book value of total assets.

#### 3.3 Sample Selection

There are two general criteria for selecting sample companies in research related to current study. First, companies have to be selected from industries where intensive IT adoption is common. Second, they are generally comparable with each other. To satisfy the first criterion, we selected sample companies from the healthcare industry, which is well-known as having intensive IT adoption. Following the second criterion, we selected companies among S&P 500 where these companies are included based on given criteria so that they are comparable. As a result, we obtained 26 sample companies<sup>2</sup>. For the purpose of obtaining adequate observations, we adopted a longitudinal design and collected data of these companies during a 22-year period (1991-2012).

While the sample size of 26 companies might seem to be small, it is comparable with similar studies. For example, Chi et al. [42] adopted a sample size of 12 companies over 16 years and Chi et al. [43] used a sample size of 20 companies over 7 years. These examples suggest that the effect size for statistical power is big enough to adopt fairly small sample size in similar studies and this study. At the same time, while choosing the sample companies from only one industry (healthcare) may limit the generalization of findings to other industries, it is a trade-off between generalization and comparability. Companies from different industries may not be comparable based on their media reports. Moreover, it is our intention for this exploratory study to limit the scope to industries with intensive IT adoption.

#### 3.4 Control Variables

Studies related to firm performance usually need to control firm size, as large firms can enjoy advantage such as economies of scale and scope that might not be available for smaller firms [33]. Firm size can be indicated by the number of employees, which is widely used as an important control variable in firm performance-related studies [e.g., 15, 38]. For a longitudinal study, time factor should be carefully observed since firm performance may be influenced by some events occurred in specific years, such as an economic crisis. Thus, we included firm size and year as control variables in this study.

#### 3.5 Data Collection

Most studies focusing on media exposure collected data either from one of the two major databases: Lexis/Nexis and Factiva, or from one or several major journals, such as The New York Times, Wall Street Journal, and BusinessWeek. In this study we adopted three major computer journals listed in Lexis/Nexis, namely InformationWeek (IW), ComputerWorld (CW), and eWeek. Among them, IW and CW together cover 80%-90% of news of various IT practices in the U.S. [15, 39]. Data of firm market value (calculated by Tobin's q) and the number of employees in a firm (firm size) were obtained from COMPUSTAT.

#### 3.6 Data Analysis

Longitudinal data with multiple companies are usually clustered or nested because observations within companies are typically more similar than observations between companies. To address this concern caused by

<sup>2</sup> A list of these companies is presented in appendix.

nested data, we adopted multilevel modeling (MLM) [44] for data analysis. Compared with other methods, MLM treats clusters as if they are sampled from a larger population of clusters and thus enhances the generalizability of results. To justify the use of multilevel analysis, we first calculated the intra-class correlation (ICC), which is the proportion of observed variance that is between units (the between- and within-cluster variances sum to the observed variance) and similar to  $R^2$  in regression. The resulted ICC is 0.70, which indicates that MLM is appropriate for our data analysis [44].

At the same time, it is not our intention to test how year, firm size, and IT media exposure influence the market value of each company separately. Thus, our data analysis model is expressed as:

First level:

$$y_{ij} = \beta_{0j} + \beta_{1j}Year_{ij} + \beta_{2j}FirmSize_{ij} + \beta_{3j}ITMediaExposure_{ij} + e_{ij}$$

Second level:

$$\beta_{0j} = \gamma_{00} + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20}$$

$$\beta_{3j} = \gamma_{30} \quad e_{ij} \sim N(0, \sigma_e^2) \quad \mu_{0j} \sim N(0, \tau_{00})$$

Subscript i represents firms (i = 1 to 26) and j represents years (j =1 to 22), respectively.  $\beta$  is the coefficient (slope) of the independent variables and  $\beta_0$  is the intercept at the level-one.  $\mu$  is the coefficient (slope) and  $\gamma$  is the intercept at the level-two.  $\sigma$  is the variance at the level-one and  $\tau$  is the covariance at the level-two.

With this model, we first tested the effects of the control variables on the dependent variable without including IT media exposure (Model 1 – control model). After that, we added IT media exposure and tested its effects on the dependent variable after controlling the effects of control variables (Model 2 – proposed model). The main purpose of including two models is for comparing data fit.

#### IV. RESULTS

Table 1 illustrates the descriptive statistics and correlation matrix of all variables included in the analysis. Year is significantly related to all other variables. It means that firm size, IT media exposure, and Tobin’s q all varied over years. IT media exposure is related to firm size, which indicates bigger firms may obtain more IT media exposure. Unexpectedly, IT media exposure is not significantly related to Tobin’s q. Since this correlation analysis does not take the influences of nested observations and the effects of control variables into consideration, it actually implies that the relationship between IT media exposure and Tobin’s q would not be captured without using MLM, which controls the influences of nested observations and the effects of control variables (i.e., year and firm size).

**Table 1.** Descriptive Statistics and Correlation Matrix

	Variables	N <sup>#</sup>	Mean	Std Dev	1	2	3
1	Year	526					
2	Firm Size	514	23.85	25.09	0.12**		
3	IT Media Exposure	496	0.91	1.25	-2.0***	0.67***	
4	Tobin’s q	488	2.36	1.82	-2.0***	-0.05	0.08
** Significant at 0.01; *** significant at 0.001.							
#: the number of observations varies for difference variables due to missing data.							

Table 2 shows the estimates of the coefficients and standard errors of the models. The coefficient of firm size is negative and statistically significant ( $\gamma=0.014$ ;  $p<0.05$ ), which indicates that bigger firms actually had smaller Tobin’s q. The coefficient of year is negative and statistically significant ( $\gamma=0.044$ ;  $p<0.001$ ), which means that firms’ Tobin’s q decreased over years. Finally, the coefficient of IT media exposure is positive and statistically significant ( $\gamma=0.228$ ;  $p<0.05$ ), which indicates that IT media exposure positively contributed to Tobin’s q. In addition, compared with the control Model 1, the proposed Model 2 has smaller deviance, which indicates better data fit.

**Table 2.** Estimates of coefficients and standard errors of models

Variables	Tobin' q	
	Model 1	Model 2
Firm Size	-0.00731 (0.0059)	-0.01436 (0.00688)*
Year	-0.05471 (0.01099)***	-0.04363 (0.01320)***
IT Media Exposure		0.22730 (0.10277)*
Intercept	112.17298 (21.96918)***	89.97294 (26.398)***
Deviance -2Loglikelihood	1764.098	1675.257
Level 1 Units	485	457
Level 2 Units	26	26
Standard errors are in parentheses. *Significant at 0.05; *** significant at 0.001		

## V. DISCUSSION

From Table 2, we can see that the results of data analysis provide empirical support for our hypothesis that IT media exposure is positively related to firm market value measured by Tobin's q. That is, IT media exposure can significantly improve investors' expectations of firm future performance, indicated by firm market value. Thus, findings of this study provide evidence that firms can utilize IT media exposure as a competition weapon for stimulating potential future performance, namely increasing media reports on firm IT practices.

At the same time, it is worth noticing that the two control variables (firm size and year) have negative influence on firms' Tobin's q. It indicates that (1) bigger firms may need more efforts to provoke investors' expectations for their future performance and (2) it is becoming more difficult to obtain high market value over more recent years.

While the results of data analysis show that IT media exposure is positively related to firm market value, it is possible that firms with higher market value get reported more on IT media, rather than more IT media reports cause higher market value (i.e., a reverse causality concern). Our empirical finding suggests that IT media exposure is a sufficient condition for better firm market value, rather than a necessary condition. It means that while more IT media exposure can lead to higher firm market value, higher firm market value does not imply more IT media exposure. Indeed, companies have many options to increase their market value, such as through advertising and introduction of new products and services. Thus, there is no clear evidence to argue that companies with higher market value need more IT media exposure and the reverse causality concern can be avoided theoretically.

Since firm market value is based on perception of investors and the intangible effects should occur shortly (rather than long) after the media reports are released, it might not make sense to simply introduce a lag between the independent variable and the dependent variable (e.g., using IT media exposure in the current period with firm market value in the next time period) in our model, an approach widely used in capturing tangible IT effects.

## VI. IMPLICATIONS AND FUTURE RESEARCH

How IT contributes to firm performance (such as market value) has been argued as a core in the IS field (so called IT business value research stream) and a complex issue involving social action that can extend over a period of time and should be studied in a more comprehensive fashion [2]. IS scholars have conducted many studies on this issue and provided a variety of perspectives, such as IT and organizational complementary resources [1], IT-strategy alignment [45], and IT-based capabilities [15]. But existing literature mainly focuses on the tangible benefits of IT and ignore the intangible effects of IT practices on important factors, such as attitude of investors and firm reputation, that can contribute to firm performance. Therefore, the results of this study provide significant implications on both IT theories and practices.

Theoretically, our findings suggest a new dimension, namely focusing on intangible effects of IT, for IT business value research. Such dimension is important in that intangible resources, such as firm reputation, can be a source of competitive advantage if they are valuable, rare, inimitable, and nonsubstitutable [29, 30]. In addition, intangible benefits of IT can be shared not only by the focal companies, but also by other companies in the same or related industries. For example, the focal companies act as pioneers on developing/using IT innovations; in turn, their success, or even failure, can provide valuable experience for follow-up companies. Thus, future studies may follow this dimension and provide more comprehensive perspectives beyond firm level.

In practice, our findings suggest that by investing in IT, companies can not only acquire tangible benefits of IT, such as reduced cost and enhanced product differentiation, but also gain intangible benefits, such as reputation. We believe that understanding the intangible benefits is especially important under current situation where capturing the direct, tangible benefits of IT is still a challenge [4]. For companies that struggle

for identifying tangible benefits from their IT investments, our findings direct them to pay more attention to intangible benefits of IT investments and encourage them to continuously use IT as a competition weapon.

For future studies, we strongly encourage scholars to examine potential mediating variables, especially intangible factors such as attitude of investors, firm reputation, and IT capability, between IT (e.g., IT media exposure) and firm performance (e.g., firm market value). In addition, effects of these mediating variables can be multifaceted. For example, firm reputation might influence not only on firm market value but also on other consequences, such as attracting better applicants, enhancing access to capital markets, and attracting investors [30]. Therefore, future research on IT media exposure can also investigate corresponding effects on other important areas beyond firm market value.

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## Appendix

Agilent Technologies Inc

Amerisourcebergen Corp

Abbott Laboratories

Baxter International Inc

Bard (C.R.) Inc

Becton Dickinson & Co

Bristol-Myers Squibb Co

Boston Scientific Corp

Cardinal Health Inc

Medtronic Inc

Perkinelmer Inc

St Jude Medical Inc

Stryker Corp

Thermo Fisher Scientific Inc

Varian Medical Systems Inc

Waters Corp

Zimmer Holdings Inc

Cerner Corp

Carefusion Corp

Covidien Plc

Express Scripts Holding Co

Edwards Lifesciences Corp

Hospira Inc

Intuitive Surgical Inc

Johnson & Johnson

Mckesson Corp