Does Superior Knowledge Management Increase Shareholder Value?

Mark L. DeFond
Yaniv Konchitchki
Jeff L. McMullin
Daniel E. O'Leary

Marshall School of Business, University of Southern California, Los Angeles, California 90089

January 2011

Abstract: In recent years firms have dramatically increased their expenditures on "knowledge management" (KM), where KM can be defined as the processes managers use to create new knowledge and leverage existing knowledge. Economic theory argues that knowledge is an important driver of firm value and anecdotal evidence suggests that firms with superior KM practices outperform their peers. But while proponents argue that KM increases shareholder value, critics label it a fad, arguing that KM does not benefit shareholders. Further, prior research that attempts to link KM to shareholder value has limitations that make it difficult to unambiguously interpret its findings. The purpose of this study is to provide more definitive evidence on this link by using short window event study methodology to investigate whether KM leads to increased shareholder value, as well as to provide insights into how capital market participants process KM-related information. Specifically, we examine the stock market reaction to companies receiving the "Most Admired Knowledge Enterprise" (MAKE) award, which recognizes companies that excel at KM. We find that MAKE winners experience positive abnormal returns around the award announcement, consistent with KM increasing shareholder value. We also find that MAKE winners report superior operating performance relative to their peers subsequent to the receipt of the award, and that analysts make significant upward revisions to winners' earnings forecasts during the month following the award. Taken together, our findings are consistent with KM enhancing firm value. These findings are consistent with economic theory that argues knowledge is a fundamental driver of firm value, and with KM literature in a variety of business disciplines that alleges superior KM practices provide firms with a competitive advantage.

Keywords: knowledge management; asset pricing; valuation; capital markets; information.

This study has benefited greatly from comments by Sandra Slaughter (editor) and an anonymous associate editor. We also thank Josef Aharony, Eli Amir, Divya Anantharaman, Eli Bartov, Phil Berger, Mary Billings, Alex Dontoh, Michael Eames, Eti Einhorn, Rich Frankel, Peter Gillett, Larry Harris, Mingyi Hung, Itay Kama, Yongtae Kim, Baruch Lev, Shai Levi, Siqi Li, Ken Merchant, Kayli Sanders, Tatiana Sandino, KR Subramanyam, Biqin Xie, Anastasia Zakolyukina, Paul Zarowin, and workshop participants at the California Polytechnic State University, Rutgers University, San Louis Obispo, New York University, The Hong Kong University of Science and Technology, National University of Singapore, The Ono Business School, Santa Clara University, Tel Aviv University, the Accounting Research Forum and the Finance, Business, and Economics workshops at the University of Southern California, the 2010 Annual Meeting of the American Accounting Association, and the 2009 Nick Dopuch Accounting Conference at Washington University. We thank Mathew McCubbins for helpful discussions about our statistical tests. We also thank Rory Chase, Director of Teleos, for helpful conversations.

Does Superior Knowledge Management Increase Shareholder Value?

"The economic problem of society is thus not merely a problem of how to allocate given resources…it is a problem of the utilization of knowledge not given to anyone in its totality."

- F. A. Hayek
  "The Use of Knowledge in Society"
  The American Economic Review, 1945.

1. Introduction

Economists have long recognized that knowledge plays a central role in creating firm value (e.g., Schumpeter, 1934; Hayek, 1945; Machlup, 1962). Recently, rapid advances in information technology have increased firms' ability to manage knowledge. At the same time, growth in intellectual capital and global competition have increased the benefits of "knowledge management" (KM). In response, expenditures on KM have grown dramatically, increasing from $400 million in 1994 to $34 billion in 2007, and are expected to exceed $150 billion in 2012 (GIA, 2008). However, prior research that attempts to link KM to shareholder value has limitations that make it difficult to unambiguously interpret its findings. Thus, the purpose of this study is to provide more definitive evidence on this link by using short window event study methodology to investigate the effect of KM on shareholder value, as well as to provide insights into how capital market participants process KM-related information. Specifically, we examine the stock market's consequences of companies receiving the "Most Admired Knowledge Enterprise" (MAKE) award.

MAKE awards are granted annually by Teleos (an independent international research organization of knowledge management professionals, in conjunction with The KNOW Network (a global organization of KM professionals) to acknowledge companies that excel in using KM (APO, 2007). While there is no single accepted definition for KM, a typical definition is "the

processes through which organizations generate value from their intellectual and knowledge-based assets" (Levinson, 2006). "Knowledge-based assets" in this context refer to knowledge within the firm about factors that create firm value (Boisot, 1999). In essence, KM addresses the comment by Hewlett Packard's Chairman that "I wish we knew what we know at HP" (O'Dell and Grayson, 1998). The notion underlying this quote is that companies contain reservoirs of valuable knowledge, and tapping into this knowledge can create substantial wealth. The objective of KM is to capture, leverage, and reuse this knowledge, as well as create new knowledge. To achieve this, KM activities commonly include sharing best practices, identifying internal experts, and facilitating the exchange of information among employees (Barclay and Murray, 1997; O'Leary, 2007).

Economists have recognized the importance of knowledge as early as Schumpeter (1934), who argues that knowledge creation, along with its application, is the cornerstone of economic growth. Hayek (1945) provides prescient insights into KM by observing that a major challenge in creating value is harnessing the disparate knowledge that resides within the heads of widely dispersed individuals. In addition, an extensive body of economics research, mainly theoretical or non-stock-price-based, investigates a variety of issues related to knowledge aggregation, management, communication, and its relation to productivity (e.g., Arrow, 1974; Adams, 1990; Garicano, 2000; Ofek and Sarvary, 2001; Espinosa, Slaughter, Kraut, and Herbsleb, 2007).

More recently, a large body of literature outside of economics, spanning many business disciplines, investigates the recent trend in managers adopting KM systems. Most of this research consists of case studies and surveys documenting how companies implement KM

systems and the benefits these systems produce (e.g., O'Leary, 2008).[1] These studies present numerous examples of successfully implemented KM across a wide variety of industries and in virtually all functional areas (e.g., sales, production, logistics, marketing, operations, human resources, and financial). For example, as discussed in Appendix 1, Siemens Corporation has a highly successful KM system for sharing best practices called ShareNet. Among other things, ShareNet is credited with dramatically reducing Siemens' costs of laying an underground communications cable in the Amazon jungle. Using ShareNet, Siemens' South American unit was able to discover what Siemens' African unit had learned a few years earlier while laying a similar cable in the jungles of Senegal.[2]

Despite its theoretical foundations and the anecdotal evidence, skeptics argue that KM does not benefit shareholders (McCune, 1999). These critics allege that KM is simply the latest fad created by management consultants to extract high fees from naive managers (Wah, 1999). Accordingly, this paper examines whether superior KM increases shareholder value, where superior KM is evidenced by the receipt of a MAKE award.

MAKE winners are selected by panels of KM experts using the Delphi research methodology, a process developed by Rand Corporation to improve decision-making by expert groups (Dalkey, 1969).[3] The panelists include KM experts from a balanced mix of public, private and, non-profit organizations, as well as executives from global corporations (including Chief Knowledge Officers, Chief Information Officers, and Chief Learning Officers). The experts' identities are not revealed to one another and their recommendations and are made anonymously.

---

[1] There are also a large number of articles in the popular press that provide management self-reports of large net benefits from instituting KM systems. According to a PwC survey of public company CEOs, ninety-seven percent believe that knowledge management is an "absolutely critical factor" for firm success (PwC, 1999).

[2] For additional examples, see Gladstone and Eccles (1991); Alavi (1997); Berzins, Podolny, and Roberts (1998); O'Leary (1998); O'Leary (2001); Schultz and Jobe (2001); Lee and Choi (2003); MacCormack (2002); Chuang (2004); Kim and Lee (2004); O'Leary (2008).

[3] Evidence suggests that the Delphi method results in group decisions that are superior to the decisions of the individual members (Dalkey, 1969).

The panel's objective is to identify firms that excel at KM. MAKE winners include public, non-public, and not-for-profit organizations.[4]

Because we expect superior KM to improve firm performance, we also expect managers to have incentives to independently inform market participants of their firms' superior KM abilities. However, managers are likely to find it difficult to make such assertions credible. Nearly all firms engage in KM activities of some kind, and while the firms with superior KM abilities are likely to experience superior performance, KM systems are not always successful (Malhotra, 2004). This poses a problem to market participants because it is difficult to predict, *ex-ante*, which firms' KM activities are likely to be successful in generating superior future performance. This suggests there is incomplete information in the market about the value of the KM activities of any given firm. We expect the MAKE awards to help resolve this problem by providing new information on firms' KM abilities based on the aggregate wisdom of a group of independent KM experts. Effectively, the MAKE awards can provide new, refined information to investors about which firms' KM initiatives are likely to succeed. Compared to information that is self-reported by firm managers, the KM experts can provide an unbiased assessment of the likelihood that a firm's KM activities are likely to improve firm performance. Thus, the MAKE awards are expected to "validate" the existence of an intangible asset that cannot be credibly established through management assertions (Penman, 2009).

Our primary tests use short window event study methodology to examine the abnormal stock returns of the MAKE winners during the five-day window surrounding the award announcement. Because superior KM practices are expected to result in superior operating performance, and because winning a MAKE provides new information to the stock market about

[4] Examples of public companies winning a MAKE award include Apple, Caterpillar, Google, Toyota, Siemens, and 3M. Examples of non-pubic and not-for-profit firms winning a MAKE award include the BBC, the Hong Kong Police Department, the Korean Water Resources Agency, KPMG, and the US Navy.

firms' KM abilities, we expect a positive stock market reaction to the announcement. Looking at changes in firm value during a short event window surrounding the award announcement provides strong evidence on whether firms' KM superiority *leads* to an increase in firm value.[5] This methodology contrasts with prior research (i.e., Tanriverdi, 2005), which examines the cross-sectional association between firm characteristics and the level of Tobin's q, and hence is more vulnerable to alternative interpretations (e.g., endogeneity; potential correlated omitted variables).

We perform our tests using a sample of all US publicly traded MAKE winners from 2001 through 2008 with available data, comprising 247 MAKE awards issued during the period. Our results are summarized as follows. First, event study tests find significantly positive mean abnormal returns of 1.25% during the five days surrounding the MAKE award announcement, consistent with the award providing new information to the market about firms' KM abilities, and with the market expecting superior KM practices to result in superior operating performance. Second, we find a positive association between the five-day abnormal stock returns and future accounting performance, consistent with the abnormal returns being a rational response to expected superior future operating performance. Third, we find that MAKE winners outperform their peers in terms of future accounting performance, consistent with superior KM resulting in superior future operating performance. Fourth, we find that analysts tend to make upward revisions to their earnings-per-share forecasts following the MAKE award announcements, consistent with the MAKE awards conveying new information about the winners' superior future performance. Finally, we find that abnormal returns are positive for the MAKE winners over the

[5] As reported later, we also perform tests that provide assurances that other (potentially confounding) news announcements during the event window are not responsible for the change in firm value.

year following the announcement of the award, consistent with the market still learning that the MAKE awards identify firms that excel at future performance.

Taken together, our results provide evidence that MAKE award winners experience an increase in shareholder value due to expected superior operating performance. To the extent that the MAKE awards provide market participants with new information about firms that excel at KM, our results are consistent with superior KM increasing shareholder value. These findings contribute to several streams of prior research. Importantly, our results are consistent with the long history of economics research that argues knowledge is a critical element in value creation. Our results are also consistent with an extensive body of literature that suggests superior KM practices improve firm performance.

Our findings also complement Tanriverdi (2005), which attempts to link KM to firm value, but which differs from our study in several important ways. Tanriverdi (2005) surveys executives of large multi-business firms regarding their KM capabilities in the areas of product, customer, and managerial knowledge. That study finds that these three dimensions of KM capabilities are positively associated with Tobin's q and return on assets. However, one difficulty in drawing inferences from the analysis in Tanriverdi (2005) is endogeneity. As acknowledged by Tanriverdi "…due to the study's cross sectional research design, which collected data at a single point in time, the possibility of endogeneity cannot be ruled out…" Our study largely overcomes endogeneity concerns by examining share value increases in *response* to the release of new information about firms' KM abilities. Thus, our research design and empirical setting allow us to make stronger conclusions regarding the causality of KM in impacting firm value.

Other important differences between our studies are that Tanriverdi (2005) uses Tobin's q to measure firm value, and survey methods to measure KM capabilities. Tobin's q captures a variety of intangibles, such as product R&D, advertising, brand name, managerial expertise, and

future growth options (Jose, Nichols, and Stevens, 1986; Bharadwaj, Bharadwaj, and Konsynski, 1999; Villalonga, 2004). The survey responses used in Tanriverdi (2005) infers firms' KM capabilities from self-reported information about R&D, marketing, and management skills. Thus, the higher levels of Tobin's q found to be associated with the survey responses are potentially related to intangibles unrelated to KM. By comparison, we examine the market response during a very short window surrounding an event that consists exclusively of new information about KM. Focusing on the change in share value around an event that unambiguously captures information about KM provides a high level of confidence that the increase in firm value we observe is related to KM. Finally, our analysis investigates several implications regarding the link between KM and firm value that are not addressed in Tanriverdi (2005). In particular, we link the stock price effects of KM to future accounting performance, we document that stock market analysts also care about and respond to KM-related news, and that market participants do not immediately impound the full implications of KM. In summary, compared to Tanriverdi (2005), our study examines a different setting and employs different research methods that allow us to draw stronger conclusions and gain greater insights into how market participants process KM-related information.

We also note that our tests include a variety of control variables, such as past accounting performance, analysts' expectations of future performance, and stock price momentum, designed to control for the possibility that the judges choose the KM award winners based on their past earnings or stock price performance, or the market's expectations of future performance. This gives us comfort that the panel of KM expert judges did indeed choose the winning firms based on their KM abilities, and not based solely on past or expected future performance.

We also emphasize that our findings are unlikely to result from the market's naïve mechanical reaction to firms that receive major awards. Prior research finds that the stock market

does not always react positively to award recipients, and firms that receive awards do not always outperform their peers. Several prior studies examine the stock market reaction and future performance of companies that receive awards such as the Malcolm Baldrige Award and the J. D. Power and Associates Award (e.g., Hendricks and Singhal, 1997; Przasnyski and Tai, 2002; Balasubramanian, Mathur, and Thakur, 2005). The results from this prior literature are mixed, with several studies finding no significant reaction to the awards. Not finding a stock market reaction to published news of awards examined in other studies suggests that our results are not likely to be explained simply by the award focusing the market's attention on the winners.

The next section discusses the motivation for the study, and Section 3 discusses the sample selection. Section 4 presents our analysis and results, Section 5 presents sensitivity analysis, and Section 6 summarizes our conclusions.

2. Motivation

2.1 Economic Foundations of Knowledge Management

Many economists have addressed issues related to knowledge, at least as far back as Schumpeter (1934). This literature has broadened into a large number of areas since Schumpeter (1934). Hayek (1945) identifies an issue that motivates much of the KM literature when he observes "the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bit of incomplete and frequently contradictory knowledge which all the separate individuals possess." This observation has been generalized to the firm, where coordinating knowledge that is widely distributed across individuals is a major challenge. Importantly, Hayek (1945) also makes a distinction between "scientific knowledge", defined as knowledge of facts, and "unscientific knowledge", defined as "…the knowledge of the particular circumstances of time and place…special knowledge of

circumstances of the fleeting moment, not known to others." Hayek (1945) notes that scientific knowledge, or "information," is a central concept in neoclassical economics, where agents often possess perfect and identical information. But focusing solely on information, Hayek argues, greatly oversimplifies the task of explaining economic behavior because it ignores the central importance of unscientific knowledge.

Hayek's dichotomy between scientific and unscientific knowledge is similar to the distinction between "explicit" and "tacit" knowledge made in Polanyi (1966). Explicit knowledge is defined as knowledge that is documented (or can be easily documented) and easily communicated and interpreted. An example is an owners' manual that accompanies the purchase of an electronic product (Alavi and Leidner, 2001). In contrast, tacit knowledge is obtained from experience and involvement in a specific context, and typically resides "in the heads" of individuals. This knowledge includes individuals' mental models, beliefs, and viewpoints, and is inherently difficult to communicate (Nonaka, 1991). A simple example of tacit knowledge is the best means of approaching a particular customer: such as through flattery or a hard sell approach (Alavi and Leidner, 2001). Such knowledge can be derived only from experience. Much of the KM literature focuses on creating and exploiting tacit knowledge. However, both tacit and explicit knowledge are related in that explicit knowledge can be used in the creation of tacit knowledge, and a primary objective of many KM systems is to turn tacit knowledge into explicit knowledge so that it can be shared and used to create tacit knowledge (Alavi and Leidner, 2001).[6]

[6] Similar to KM, there is no single accepted definition for "knowledge" as it is used in the context of KM. A commonly accepted definition is "…a state or fact of knowing, with knowing being a condition of understanding gained through experience or study" (Schubert et al., 1998). In this view, knowledge does not exist outside of individuals, and is the result of cognitive processing. Other definitions, however, suggest that knowledge is an object, which can be processed and stored (e.g., Carlsson, El Sawy, Eriksson, and Raven, 1996).

Machlup (1962) is another important influence on the growth in KM and KM research. Machlup coined the term "knowledge economy" and is credited with being the first to document that the US economy is in the process of transitioning from primarily industrial-based to primarily knowledge-based. Importantly, Machlup (1962) argues that the factors for business success are fundamentally different in an industrial-based economy than in a knowledge-based economy: while industrial-based firms rely primarily on factors such as land, labor and natural resources, knowledge-based firms rely more heavily on factors such as intellectual capital, expertise, and know-how.

A large body of theoretical research that examines issues related to knowledge has also developed (e.g., Arrow, 1974; Adams, 1990; Garicano, 2000; Ofek and Sarvary, 2001). For example, Ofek and Sarvary (2001) develop a theoretical model that predicts a number of recent market trends, including the increased emphasis on knowledge-creating activities in modern KM systems, the wave of mergers between consulting firms, and the general hype about KM and the vast resources that firms invest in building and marketing KM systems

2.2 Prior Research on Knowledge Management

KM researchers tend to adopt a knowledge-based perspective of the firm, which originates in the strategic management literature (e.g., Nonaka and Takeuchi, 1995). This perspective argues that firms create value primarily from combining and applying resources through the use of firm-specific knowledge, which are termed knowledge-based assets, and which reside primarily with the firm's employees. Knowledge-based assets are costly to imitate and therefore can provide the firm with a sustainable long-term competitive advantage. This literature also observes that the business environment is characterized by rapid shifts in product markets, high levels of competition, and fast changing technologies (Alavi and Leidner, 2001).

Successful companies are able to adapt by creating new products and embracing new technologies. A major implication of these arguments is that all business enterprises are primarily in the business of innovation, and success ultimately lies in a company's ability to manage knowledge.[7] Importantly, this means that a firm's survival does not just depend on its knowledge at a particular point in time, but on its ability to create new knowledge, with this new knowledge fueling innovation (Nonaka, 1991). This view suggests that knowledge is renewable and can be systematically managed within the firm.

KM research has flourished over the last two decades and permeates a wide variety of academic business disciplines. Using primarily case study and survey methodologies, this research presents strong anecdotal evidence that KM can significantly improve firm performance. Much of this literature attempts to identify the factors associated with successful KM initiatives (e.g., O'Leary, 2001; Schultz and Jobe, 2001; Lee and Choi, 2003; Chuang, 2004; Kim and Lee, 2004).[8] We summarize a KM case study in Appendix 1 that discusses Siemens Corporation's response to a dramatic increase in global competition and poor financial health in the late 1990's. Among other things, Siemens developed "knowledge communities" that allow globally dispersed business units to share best practices within the organization for solving customer problems. In particular, this system reuses customer solutions across different developing economies, and as these economies develop, it leverages solutions from more

[7] Nonaka (1991) argues that Honda, NEC, and Sharp are examples of such companies.

[8] We note that our study is distinct from the research that investigates the valuation implications of information technology (IT), such as enterprise resource planning (ERP) systems. Systems such as ERP are transaction-based and while they may facilitate KM activities they are fundamentally different from KM, as widely noted in prior literature (e.g., Borghoff and Pareschi, 1998; McDermott, 1999; Wah, 1999; Gao, Li, and Clarke, 2008). Importantly, KM is not transaction-oriented, focusing instead on issues related to knowledge creation, use, and reuse.

developed economies. Siemens management reports this KM system increased 2001 sales by $122 million at a cost of under $8 million.[9]

The KM literature essentially suggests that KM results in the creation of intangible assets that improve firm performance, and it is consistent with the notion that a substantial portion of firm value arises from intangible assets (Upton, 2001). While prior research focuses primarily on the valuation implications of intangibles such as R&D and brand names (e.g., Lev and Sougiannis, 1996; Barth, Clement, Foster, and Kasznik, 1998), we focus on an intangible that is conceptually different from R&D and brand names. While R&D pertains to a relatively well-defined activity within the firm (i.e., research), and brand name represents a relatively specific aspect of firm value (i.e., branding), knowledge-based intangibles are intrinsically related to all activities within the firm.[10]

In summary, the prior research in the area of KM is quite diverse and far reaching. We attempt to add to this prior research by empirically quantifying the performance and valuation implications of KM.

2.3 Information Conveyed by Winning a MAKE Award

If firms that excel at KM outperform their peers, managers of those firms have incentives to inform market participants of their superior KM abilities. Indeed, there is ample evidence that managers routinely provide market participants with information about their KM activities.[11] However, while anecdotal evidence suggests that KM helps many firms outperform their peers,

[9] Another example of successful KM is the "prediction markets" developed by Google. These markets have proven to be highly accurate in forecasting a variety of company developments, including product launch dates and product success rates (Sunstein, 2006).

[10] We note that KM is distinct from organization capital. While organization capital usually refers to the assets generated by information within the firm or to the accumulation of plant-specific knowledge (Prescott and Visscher, 1980; Lev and Radhakrishnan, 2004; Atkeson and Kehoe, 2005), KM refers more specifically to the processes through which organizations generate value from their intellectual and knowledge-based assets. Penman (2009) also notes that "knowledge capital" and "organization capital" are distinct internally generated intangible assets.

[11] For example, companies may include discussion of their knowledge management activities in presentations made to securities analysts (e.g., Carrig, 2005).

evidence also suggests that some firms are unsuccessful in implementing KM systems. For example, in a collection of case studies that attempt to learn why some firms do not benefit from their KM activities, Malhotra (2004) documents several cases of poorly conceived or designed KM systems that do not improve firm performance. If it is difficult for the market to discern, *ex ante*, which firms' KM initiatives are likely to succeed and which are likely to fail, the MAKE award, which summarizes the opinions of KM experts, can help the market identify the firms most likely to succeed. The MAKE award potentially plays the role of verifying a firm's KM activities are successful in improving firm performance. If so, the market should react positively to the MAKE award announcements.[12]

3. Sample Selection

The MAKE winners are chosen by expert panels using the Delphi method, a technique developed by the Rand Corporation to obtain consensus decisions from groups of experts (Dalkey, 1969). The panels comprise leading KM experts, Fortune 500 executives and organizational learning experts, from a balanced mix of publicly held, privately held, and not-for-profit organizations (APO, 2007; Chase 2007). There are no more than four panelists from any one organization and the panels range from 750 to 3,000 members. The objective of the Delphi method is to aggregate the divergent beliefs of the individual experts and converge on a collective decision. The selection process consists of three or four rounds of anonymously sharing the experts' views among themselves, where the experts' identities are not revealed to one another. In the first round, each panelist nominates one or more organizations (public, non-

[12] We also note that our study is distinct from the prior literature that examines intangible assets. While research on intangibles focuses primarily on the valuation implications of intangibles such as R&D and brand names, KM is conceptually different from R&D and brand names. Specifically, R&D pertains to a relatively well-defined activity within the firm (i.e., research), and brand name represents a relatively specific aspect of firm value (i.e., branding), while knowledge management relates to a much broader set of activities and aspects of firm value.

public, or not-for-profit) based on KM-related criteria that indicate superior KM, along with information to support their nominations. In the second round, the first round choices and supporting explanations are anonymously shared among the panelists and another set of nominations is made. Firms that are short-listed by 10% or more of the panelists are included in the third round and the panelists are asked to formally score each of the third round finalists on a Likert scale from one to ten based on eight criteria related to KM.[13] The scores are equally weighted across eight criteria, and the firms with the highest scores are selected as the winners.[14]

MAKE winners are announced through emails to the members of The KNOW Network, followed by the issuance of a public press release. Appendix 2 provides an example of a press release. The winners are announced by geographical region periodically throughout the year, with no pre-determined announcement dates.[15] Winners include a variety of organizations, including public corporations, government entities, non-public business enterprises, and not-for-profit organizations. We begin our data collection by searching the Factiva and Lexis-Nexis databases for news announcements of the MAKE winners. This search identifies 425 MAKE winners, with the earliest winners announced during 2001.[16] After excluding MAKE winners that

[13] The eight criteria are: success in establishing an enterprise knowledge culture; top management support for managing knowledge; ability to develop and deliver knowledge-based goods/services; success in maximizing the value of the enterprise's intellectual capital; effectiveness in creating an environment of knowledge sharing; success in establishing a culture of continuous learning; and effectiveness of managing customer knowledge to increase loyalty/value; and ability to manage knowledge to generate organizational wealth. The criteria upon which the MAKE winners are chosen include the judge's assessment of management's ability to use KM to generate organizational wealth. This is important for the purpose of our study because we test whether superior KM indeed leads to improved shareholder value. If superior KM does not lead to improved firm performance, we are unlikely to find a positive reaction to the MAKE winner announcements.

[14] We note that all of our tests include variables capturing past performance and expected future performance (accounting or stock performance, as appropriate). This controls for the possibility that the judges are choosing the winners based simply on these characteristics, as opposed to firms' ability to use KM to produce products and services that increase organizational wealth.

[15] MAKE awards are issued by various geographic regions (e.g., North America, Asia, and Europe), as well as an overall global award. Thus, firms may win more than one MAKE award per year if they win an award in their geographic region and a global award.

[16] The KNOW Network website reports that the first MAKE award was announced in 1998, but during our analysis we were only able to identify sporadic news announcements prior to 2001. Thus, we begin our sample with the 2001 awards.

do not have data in the CRSP database (primarily non-listed companies such as Ernst & Young and not-for-profit organizations such as NASA), we reduce our sample to 222 observations. We then obtain press release dates directly from Teleos for another 25 publicly traded MAKE winners that we cannot identify in the Factiva and Lexis-Nexis databases.[17] This process results in a final sample of 247 MAKE awards issued to 46 distinct companies from 2001 through 2008.

We obtain stock returns, prices, and shares outstanding data from the Center for Research in Security Prices (CRSP). We obtain analysts' earnings forecasts from the US Institutional Brokers Estimate System (I/B/E/S), Summary History – Summary Statistics (with Actuals) dataset. The accounting data are for all US firms, obtained from the annual and quarterly Compustat North America Merged Fundamentals, XPF Tables, datasets. We use the following accounting data items and variable definitions: Stockholders' Equity (Compustat item SEQQ), Net Income (Compustat item NIQ), Total Assets (Compustat item ATQ), Sales (Compustat item SALEQ), Cash Flows from Operations (Compustat item OANCFY), Book-to-Market (Compustat items SEQQ/(PRCCQ*CSHOQ)), Return on Assets (Compustat items NIQ/ATQ), Cash Flows from Operations over Total Assets (Compustat items OANCFY/ATQ), and Return on Equity (Compustat items NIQ/SEQQ). Our industry classification is based on the 12 industries in Campbell (1996).

Table 1 provides descriptive statistics of the MAKE awards by industry and year. Panel A presents the number of MAKE awards by industry. The Consumer Durables industry has the largest number of MAKEs, with 30%, followed by Services with 27%. The Capital Goods industry has the third largest number of MAKEs, with 21%, and the Petroleum industry has the

[17] Teleos issues a press release publicly announcing the MAKE winners. To establish the validity of the 25 press release dates obtained directly from Teleos, we compare the dates of the MAKE announcements of a sample of 97 Teleos press releases for which we also have news announcements and find that the Teleos dates match the news announcement dates in all but three cases, and in those cases the press release dates are within one day of the news announcement dates.

fourth largest number of MAKEs with 10%. The remaining industries receive 6% or less of the awards.[18] Panel B of Table 1 lists the number and percentage of MAKE winners in our sample by year, and indicates that the number of MAKE winners increases over time.

Table 2 lists descriptive statistics for our distinct MAKE winning firms using data from the Compustat database. We report quarterly statistics on each sample firm based on their average values over the period 2001-2008, equally-weighted by firm and winsorized at the first and ninety-ninth percentile. Table 2 reports that the sample firms tend to be reasonably large, with median assets of over $34 billion and median sales of over $8 billion. Our sample firms are also financially healthy, with median quarterly return on assets (ROA) of 1.9%, median quarterly return on equity (ROE) of 4.7%, and median quarterly cash flow from operations scaled by total assets (CFO) of 8.5%.[19]

4. Analyses and Results

4.1 Stock Market Reaction to Winning a MAKE Award

Our first test examines the abnormal stock returns of the MAKE winners during the five-day window surrounding the award announcement date.[20] Because superior KM is expected to result in superior operating performance, and because winning a MAKE is expected to provide new information to the stock market about firms' KM abilities, we expect a positive stock market reaction to the announcement. As in DeFond, Hann, and Hu (2005), we test our prediction using

[18] The distribution of distinct firms across industries is Capital Goods (28%), Services (20%), Consumer Durables (13%), Finance/Real Estate (17%), Construction (11%), Basic (4%), Petroleum (2%), Transportation (2%), and Utilities (2%) industries.

[19] Firm-level investments in KM are only sporadically available on a project-by-project basis. The estimates in GIA (2008) are industry-wide and include only sales revenues generated from sales of KM software and KM management services. KM impacts a wide variety of activities across many functional areas and total firm level expenditures are unavailable. Thus, we are unable to systematically examine KM dollar investments at the firm-level.

[20] While firm specific investments in KM are unavailable, our research design (i.e., using MAKE award winners), allows us to identify a set of firms with superior KM.

a standard event-study methodology with cumulative abnormal returns (CAR) computed over a five-day event window, beginning two days before the announcement through two days after the announcement (e.g., Binder, 1998). We employ a five-day window because the MAKE awards are announced to members of the KNOW Network via email one or two days prior to the official press release date, which suggests news of the awards may be leaked prior to the official announcement date. In addition, the MAKE awards are relatively new and the benefits of KM may be relatively unclear to market participants, suggesting that market participants may be slow to react to the announcements. Specifically, we compute CAR as follows:

$$CAR_{[-2,+2]} = \sum_{t=-2}^{t=+2} \overline{AR_t}\ , \tag{1}$$

where:

$\overline{AR_t} = \frac{1}{N_t}\sum_{i=1}^{i=N_t} AR_{it}$; $AR_{it} = R_{it} - E(R_{it})$; and t = (–2, –1, 0, +1, +2);
R_{it} is the return of the sample firm i on day t;
E(R_{it}) is the corresponding market return from CRSP on day t.

We report two t-statistics that test the statistical significance of the CAR, one using the time-series mean abnormal returns as in Brown and Warner (1980, 1985), and the other using the calendar-time abnormal returns as in Jaffe (1974) and Mandelker (1974). The t-statistics using the time-series approach are computed as follows:

$$t = \sum_{t=-2}^{t=+2} \overline{AR_t} \Bigg/ \left(\sum_{t=-2}^{t=+2} S^2[\overline{AR_t}] \right)^{1/2}\ , \tag{2}$$

where:

$$S^2[\overline{AR_t}] = \left(\sum_{t=-244}^{t=-6} \left[\overline{AR_t} - \overline{AAR} \right]^2 \right) \Bigg/ 238;\ \overline{AAR} = \sum_{t=-244}^{t=-6} \overline{AR_t} \Bigg/ 239\,.$$

We use 239 days (–244 through –6) in the estimation period to derive the standard deviation and restrict the analysis to firms with at least 120 daily returns in the estimation period.

Because a portfolio average abnormal return is used in the calculation of the standard deviation, the test statistic takes into account cross-sectional dependence in the abnormal returns.

To implement the calendar-time test we first sort all firms into portfolios by event calendar date. Next we estimate a portfolio standard deviation from the time series of portfolio abnormal returns in the estimation period, and use it to standardize the portfolio return. Our calendar-time p-value from this test is based on a cross-sectional t-test of the standardized portfolio abnormal return. We calculate the calendar-time t-statistic as follows:

$$t = CAAR_{[-2,+2]} \Big/ \left(S_{CAAR_{[-2,+2]}} \Big/ \sqrt{N} \right) \quad , \tag{3}$$

where:

$$S^2_{CAAR_{[-2,+2]}} = \frac{1}{N-1} \sum_{i=1}^{N} \left[\left(\sum_{t=-2}^{t=+2} \overline{AR_t} \right)_i - \frac{1}{N} \sum_{j=1}^{N} \left(\sum_{t=-2}^{t=+2} \overline{AR_t} \right)_j \right]^2 ; \; CAAR_{[-2,+2]} = \frac{1}{N} \sum_{j=1}^{N} \left(\sum_{t=-2}^{t=+2} \overline{AR_t} \right); \text{ and}$$

i, *j* are firm indices.

Table 3 reports the results of the stock market reaction analysis. Consistent with our prediction, we find a positive portfolio mean abnormal return for the MAKE winners of 1.25%, which is significant at p = 0.049 using the time-series abnormal return t-statistic from Brown and Warner (1980, 1985), and at p = 0.029 using the calendar-time abnormal return t-statistic from Jaffe (1974) and Mandelker (1974).[21] To assess the economic significance of our findings, we evaluate the impact of the market reaction on firms' equity value. Evaluated at the mean and median market value of equity for our sample firms of $72,066 and $50,191 million (see Table 2), our findings are consistent with an increase in market value of $900.8 and $627.4 million per sample firm, respectively. Overall, our findings are consistent with the MAKE awards providing

[21] P-values of 5% or less are considered statistically significant, and all significance levels are one-tailed where we have predictions and two-tailed otherwise.

new information about which firms excel at KM, and with market participants expecting firms that excel at KM to exhibit superior future operating performance.

4.2 The Association between the Market Reaction and Future Performance

Our second test analyzes whether the magnitude of the abnormal event returns found in our first test is associated with future operating performance. If the stock market reaction during the announcement window reflects market expectations that superior KM practices result in higher future operating performance, we expect a positive association between the MAKE announcement abnormal returns and future performance. We assess future performance using three performance measures: ROA, ROE, and CFO. Each measure is averaged over the four quarters following the quarter in which the MAKE award is received, with data obtained from the Compustat Quarterly database. We use the average of all available quarters for firms with less than four quarters of available data following the receipt of the award. We then regress each of the future performance measures on the cumulative abnormal stock returns during the five days surrounding the announcement of the award, using the following two models:

$$\textit{Model 1: } FuturePerformance_{if} = \alpha + \beta_1 CAR_{it} + \varepsilon_{if} \tag{4}$$

$$\textit{Model 2: } FuturePerformance_{if} = \alpha + \beta_1 CAR_{it} + \beta_2 ExpectedPerformance_{if} + \varepsilon_{if},$$

where:

CAR_{it} = Cumulative abnormal return for firm i over period t, which equals the five days surrounding the award announcement day (day –2 through day +2).

$FuturePerformance_{if}$ = ROA, ROE, or CFO, for firm i, over future period f. Period f refers to the average of the four quarters following the quarter in which the MAKE award is received.

$ExpectedPerformance_{if}$ = Analyst expectations of future ROA, ROE or CFO, for firm i over future period f.

Model 2 includes a control for market expectations of future performance and thereby tests whether the MAKE awards reflect information about future performance that is incremental to

the market's expectations immediately prior to the award announcement. We conservatively choose a one-year time horizon to capture future performance, consistent with prior accounting and finance studies that examine future performance in similar settings (e.g., Sloan, 1996). While KM may impact more than one year's future performance, it should impact at least one year.

We operationalize expected future ROA and ROE as the I/B/E/S consensus annual earnings per share forecast divided by four (because our dependent variable is average quarterly performance), scaled by total assets per share and by stockholders' equity per share, respectively. We operationalize expected future CFO as the I/B/E/S consensus analyst forecast of annual cash flows from operations per share divided by four (because our dependent variable is average quarterly performance), scaled by total assets per share. We measure total assets and stockholders' equity during the quarter in which the MAKE award is announced or, in the case of missing data, the quarter with data immediately before the MAKE winning quarter. To mitigate the effects of outliers, we winsorize the expected and future performance variables at the first and ninety-ninth percentile. Also, we cluster the regression residuals by firm and year to control for potential cross-sectional and time-series correlation (Petersen, 2009; Gow, Ormazabal, and Taylor, 2010). A significantly positive coefficient on β_1 is consistent with our expectation that the event period abnormal returns are associated with higher future performance.

Table 4 presents the results of estimating the two models for the three performance measures. The number of observations in this analysis drops to 202 (from the 247 in our event study test; see Table 1) for Model 1 because we lack future performance data for all the award observations. Because analyst forecast data are not available in I/B/E/S for all 202 observations, there is a slight loss of observations for estimating Model 2 (195 for ROA and ROE, and 170 for CFO). Consistent with our prediction, Table 4, Panel B, reports that for Model 1 the coefficient on CAR is significantly positive at p = 0.026 or less for all three future performance measures.

That is, all three regressions find a significantly positive association between future operating performance for the MAKE winners and abnormal stock returns around the announcement of the MAKE awards. Table 4, Panel B, also reports that for Model 2 the coefficient on CAR is significantly positive for future ROA ($p = 0.009$) and ROE ($p = 0.001$), but not for CFO ($p = 0.378$).

Taken together, our findings in Table 4 corroborate the findings in our first analysis by providing evidence that the positive stock market reaction to the MAKE award announcements is due to the market's expectation that the award winners will exhibit better-than-expected future performance. Because we expect the MAKE awards to identify firms with superior KM abilities, this is consistent with the market expecting firms that excel at KM to exhibit superior operating performance.

4.3 Future Performance of Award Winners Compared to their Peers

If KM impacts firm value through enhanced future performance, we expect the MAKE winners (who are firms with superior KM abilities) to outperform their peers, on average, subsequent to the receipt of the award. We investigate this by comparing the MAKE winners' performance with the performance of their peers, using three different tests. The first test uses a traditional ordinary least squares regression analysis to compare the MAKE winners with a set of peer firms that consist of the non-MAKE winners in the same industries during the quarters in which the MAKEs are awarded. The second test compares the MAKE winners with a more closely matched set of peers, consisting of the portfolios of all of the firms that are in both the same industry and one percentile of total assets as the MAKE winners during the winning quarter. The third test uses a technique referred to as "propensity score matching" to identify and compare the MAKE winners' performance with their peers. All three tests compare the

performance of the MAKE winners with their peers based on the three measures we use in Table 4 (ROA, ROE, and CFO). All three of our future performance tests include a measure of past performance in order to control for the so-called "halo" effect (Brown and Perry, 1994), which refers to the possibility that the MAKE winners are chosen simply because of their past superior performance. If the MAKE is chosen simply because the MAKE winners performed well in the past, the past performance variable, rather than the MAKE indicator variable will explain future performance.[22]

4.3.1 Performance Comparison with Peer Firms Matched on Industry

Because the first peer group is matched only on industry, we compare the MAKE winners with this group by estimating the following regression model that adds control variables capturing past performance, total assets, and the book-to-market ratio:

$$FuturePerformance_{it} = \alpha + \beta_1 Winner_{it} + \beta_2 PastPerformance_{it} + \beta_3 Assets_{it} + \beta_4 BTM_{it} + \varepsilon_{it}, \quad (5)$$

where:

$FuturePerformance_{it}$ = ROA, ROE, and CFO, for firm i over period t, which equals the average of the four quarters following the quarter in which the MAKE award is received. Where four quarters are not available we use all available quarters.

$Winner_{it}$ = An indicator variable indicating the observation is a MAKE winner.

$PastPerformance_{it}$ = ROA, ROE, and CFO, for firm i over period t, averaged over the four quarters prior to the quarter in which the MAKE is awarded. Where four quarters are not available we use all available quarters.

$Assets_{it}$ = Total Assets of firm i over period t, measured during the quarter in which the MAKE is awarded. When quarterly Compustat data is missing, we use the most recent quarterly or annual data prior to the quarter in which the MAKE is awarded.

BTM_{it} = Book-to-Market ratio of firm i over period t, measured during the quarter in which the MAKE is awarded. When quarterly Compustat data is missing, we use the

[22] Brown and Perry (1994) propose a method for extracting the halo effect from Fortune Magazine's ratings of the Most Admired Companies. However, unlike the Fortune Magazine ratings, which are ordinal rankings, the MAKE award is a binary variable. Therefore, we extract the effect in our analysis by including past performance as a control variable. We also perform sensitivity tests in Section 5 that control for the halo effect by first orthogonalizing our future performance measures to past performance, as suggested by Brown and Perry (1994), and then using in our tests the future performance measures that are purged out of past performance (i.e., the residuals from the first stage).

most recent quarterly or annual data prior to the quarter in which the MAKE is awarded.

We cluster the regression residuals by firm and year to control for potential correlations among the error terms. We include control variables for past performance, size, and the book-to-market ratio because these variables are potentially related to future operating performance. For the regression model in Equation (5), and the related univariate analysis described below, we winsorize the continuous variables at the first and ninety-ninth percentile. A significantly positive coefficient on the indicator variable capturing MAKE winners is consistent with the winning firms outperforming the matched peer firms over the quarters following the announcement of the MAKE award.

Table 5, Panels A through C, present the results of our first analysis. Panel A presents descriptive statistics for the 202 MAKE winning observations used in the analysis and Panel B presents descriptive statistics for the 51,030 peer firms matched on industry alone, and all descriptive statistics are based on quarterly data. Panel A indicates that mean future ROA, ROE, and CFO is 2.9%, 6.2%, and 10.1%, respectively, for the 202 MAKE winning observations. Panel B indicates that the peer firms matched on industry alone are smaller and perform more poorly, on average, when compared to the MAKE winners in Panel A. In addition, the book-to-market ratios of the peer firms tend to be larger than for the MAKE winners.

Table 5, Panel C, presents the results of the regression analysis and reports a positive coefficient on the indicator variable capturing MAKE winners in all three regressions, with a significance of $p < 0.001$. Thus, we find that when compared to the peers in their industry, the MAKE winners report significantly higher future performance, after controlling for past performance, size, and the book-to-market ratio as control variables.

4.3.2 Performance Comparison with Peer Firm Portfolios Matched on Industry and Percentile of Total Assets

Table 5, Panels D and E, present the results from comparisons with the portfolios of peer firms matched on industry and same percentile of total assets. Panel D presents descriptive statistics for the matched portfolios. This panel indicates that the peer firms in this test are much more closely matched to the MAKE winners than the firms in Panel B that are matched on industry alone. In particular, these matched firms are larger and more profitable than the peers matched on industry alone. Panel E presents a univariate analysis comparing the MAKE winners with the portfolio-matched firms. The results indicate that the mean and the median future performance, using all three performance measures, are significantly higher among the MAKE winners than among the portfolios of peer firms at $p < 0.001$.

4.3.3 Performance Comparison using Propensity Score Matching

Our propensity score matching analysis follows the approach outlined in Mithas and Krishnan (2009) (as originally suggested by Rosenbaum and Rubin, 1983). First, we identify the treatment, the outcome of interest, and the covariates. In our setting, the treatment is receiving the MAKE award, the outcome of interest is the firm's performance (measured as ROA, ROE and CFO), and the covariates are the firm's size, past performance, and book-to-market. Second, we define the parameter being estimated. Since we are interested in the performance of firms receiving a MAKE award relative to their peers that do not receive a MAKE award, the parameter we estimate is the difference in performance after the receipt of a MAKE award. Third, we identify the covariates associated with the parameter we estimate (i.e., winning a MAKE award). While we do not have a theory to help direct us in choosing these covariates, the descriptive information in Panels B and C of Table 5 indicate the MAKE winners tend to be

large, with lower values of book-to-market-to firm and higher past performance when compared with their peers. Thus, we use total assets, book-to-market, and past performance as covariates to make MAKE winners.[23]

Our fourth step is to obtain our propensity scores by estimating the following logit model:

$$MAKE = \alpha + \beta_1 Assets + \beta_2 BTM + \beta_3 PastPerformance + \varepsilon. \quad (6)$$

The dependent variable, *MAKE*, is an indicator variable which equals one if the firm wins a MAKE award, and zero otherwise. *Assets* and *BTM* (book-to-market) are measured during the quarter prior to the quarter in which the MAKE is awarded. *PastPerformance* is measured over the year prior to the quarter in which the MAKE is awarded. We define *PastPerformance* using three measures: past ROA, past ROE, and past CFO. The sample consists of the MAKE winners and all firms within the same industry and asset decile during the quarter prior to the quarter in which the MAKE is awarded. We estimate Equation (6) for each industry-quarter. The propensity scores are calculated for each observation, for each of the three *PastPerformance* measures, by obtaining the fitted values from Equation (6).[24]

Our fifth step is to use a caliper matching algorithm, without replacement, to identify one control firm for each MAKE firm. We require the propensity score for the control firm to be within plus-or-minus 0.001 of the MAKE firm, and are able to identify a control firm within this range for all MAKE winning firms. Table 5, Panel F, provides descriptive statistics for the MAKE winners and the control firms we identify, along with the differences between the treated firms and the propensity score matched firms. The panel reveals that the control sample

[23] We note that a limitation of this particular performance analysis is that there exists little theory to guide us in modeling MAKE winners. However, we do not rely solely on the propensity score matching test to draw inferences about MAKE winners' future performance. Rather, we look at the preponderance of evidence across all three of our tests of future performance.

[24] We check the overlap of the propensity score support for MAKE firms and control firms to determine if there are any MAKE winning firms which are outside of the support of the control firms. We find that the support for the MAKE firms is within the support for the control firms, thus we proceed without dropping any treatment cases.

identified by the propensity score matching is quite similar to the MAKE winning firms in terms of assets, book-to-market, and past performance. The sample size decreases from 202 observations in each test because of insufficient observations within some industry-quarters to estimate the logit propensity score model.[25]

Our final step compares the future performance of MAKE winning firms with the future performance of the propensity score matched sample, and is presented in Panel G of Table 5. Panel G indicates that MAKE winning firms experience significantly greater future performance—in terms of ROA, ROE, and CFO—than the propensity score matched sample, all at $p < 0.001$. Thus, findings from the propensity score matching procedure provide additional evidence that MAKE firms outperform their peers.

In summary, the three analyses of future performance presented in Table 5 provide consistent evidence that the MAKE awards identify firms that outperform their peers subsequent to receiving the award.

4.4 Analyst Earnings Forecast Revisions following Award Announcements

Equity analysts are financial intermediaries that are potentially interested in the valuation implications of the MAKE awards. Thus, in addition to investigating the stock market's reaction to the announcement of the MAKE awards, we also investigate the reaction of equity analysts. We predict that equity analysts make upward revisions to their annual earnings forecasts for the MAKE award winners during the month following the announcements. Finding that analysts make upward revisions to their forecasts in response to the awards is consistent with the awards providing analysts with new information about the award winners' expected future performance.

[25] We estimate the propensity score model for subsamples of industry-quarter combinations. A few of these subsamples are small or the model that uses them does not converge, which leads to a propensity score model not yielding reliable estimates (i.e., no propensity score) in such cases. This results in the decrease of the sample size from 202 observations.

We perform two analyses to test the reactions of analysts. Our first analysis tests whether the average number of upward earnings forecast revisions is larger than the average number of downward earnings forecast revisions for the MAKE winners during the month following the announcement of the award. If the MAKE awards provide new information about improved future performance, we expect to find significantly more upward revisions than downward revisions. Using the I/B/E/S database we compute the total number of upward and downward revisions for all observations with available data, divided by the number of MAKEs with available data. Specifically, we calculate the following two ratios, where time t is the award month:

$$\begin{aligned} Measure\ 1 &= \frac{Number\ of\ Upward\ Revisions_{t+1}}{Number\ of\ Awards} \\ Measure\ 2 &= \frac{Number\ of\ Downward\ Revisions_{t+1}}{Number\ of\ Awards}\ . \end{aligned} \tag{7}$$

Table 6, Panel A, reports the results of this test. This analysis restricts our sample to observations with consensus forecasts in the I/B/E/S database during the month after the award month, which reduces our sample to 190 observations. Panel A indicates that an average of 3.04 analysts per MAKE winner revise upwards (Measure 1), and an average of 1.90 analysts per MAKE winner revise downwards (Measure 2), and that the average number of upward revisions is significantly greater than the average number of downward revisions at p = 0.009. Thus, we find that the average number of upward forecast revisions is larger than the average number of downward forecast revisions for the MAKE award winners during the month following the announcement of the award.

Our second test investigates analyst EPS forecast revisions of MAKE firms relative to a control sample. We first match each MAKE award observation with a matched portfolio of firms in the same industry, year, quarter, and percentile of total assets, where each portfolio contains

an average of 6.4 matched peer firms. Next we calculate the revisions in analyst consensus EPS forecasts over the period month +1 relative to month –1 (–1, +1), where the award month is defined as month 0. We scale the analyst EPS forecast revisions by the analyst consensus EPS forecast from the first month of each period and winsorize at the first and ninety-ninth percentile for both the MAKE firms and the peer portfolios. We then compute the mean and median of the scaled revisions, and conduct a two-sample t-test and a two-sample Wilcoxon z-test to compare the means and medians, respectively, between the MAKE firms and the matched control portfolios.

Table 6, Panel B, reports the results of this test. The sample size for the test period is constrained by the availability of I/B/E/S data for both the treatment firm and the matched portfolios, and requires forecasts for both the month before and the month following the announcement. Thus, the sample size is reduced to 159 award observations.[26] The first row reports the mean and median revision for the award firm observations and indicates that both the mean and the median are significantly positive, with values of 0.033 ($p = 0.024$) and 0.004 ($p = 0.001$), respectively. The next row reports the mean and median revision for the control matched portfolios and indicates they are both insignificant at conventional levels. The last row in Panel B reports the differences in the mean and median revisions between the award firm observations and the matched portfolios. This analysis finds that the mean and median MAKE firms' revisions are significantly higher than the matched portfolios' revisions, with values of 0.033 ($p = 0.035$) and 0.013 ($p = 0.021$), respectively. Thus, Panel B indicates that equity analysts make significantly larger upward revisions to MAKE winners than to their peers during the months immediately surrounding the award announcement month.

[26] Note that the forecasted annual earnings during the month prior to the award announcement month must also be for the same year as the forecast during the month subsequent to the award announcement month. This restriction results in dropping seven observations.

In summary, for MAKE winners during the month following the award announcement the average number of upward analyst forecast revisions is larger than the average number of downward revisions; and analyst EPS forecast revisions for MAKE winners are significantly higher than for their peers. Taken together, these findings present evidence that the MAKE awards communicate information to equity analysts indicating the winners will exhibit higher future performance than previously anticipated. Because we expect the MAKE awards to identify firms with superior KM abilities, this is consistent with equity analysts expecting firms that excel at KM to exhibit superior operating performance.

4.5 Subsequent Abnormal Stock Returns of Award Winners

It is only recently that companies have begun to make large investments in KM, and the MAKE awards are relatively new. Therefore, the market may still be learning about the benefits of KM and the credibility of the MAKE awards. If so, the market may not impound all of the value relevant information about the award winners around the announcement date. If so, and if the MAKE winners outperform their peers, we expect abnormally high stock returns for the MAKE winners to persist subsequent to the announcement of the awards, as the market learns of their superior performance. Thus, our final analysis examines the risk-adjusted one-year-ahead returns of the MAKE winners.

We examine the subsequent stock market performance of the MAKE winners using an asset pricing test that examines the Fama-French intercepts (alphas) from a monthly time-series model of MAKE portfolios (e.g., Fama and French, 1993; Barth, Konchitchki, and Landsman, 2010; Konchitchki, 2010). Specifically, we form portfolios on July 1st of each year, where each portfolio consists of all MAKE winners during the preceding twelve months. Figure 1 presents a timeline for the construction of our portfolios relative to the announcement of the MAKE

winners. We then calculate the portfolio average return in excess of the risk-free rate for each month during the subsequent twelve months, and regress these monthly portfolio returns on the three Fama-French factors, excess return on the market (MKT), small-minus-big (SMB), high-minus-low (HML), and a momentum factor (MOM). Specifically, we estimate the following model:

$$(Ret - R_f)_{pm} = \alpha_p + \beta_1 MKT + \beta_2 SMB + \beta_3 HML + \beta_4 MOM + \varepsilon_{pm}, \qquad (8)$$

where:

$(Ret - R_f)_{pm}$ = Month *m* equally-weighted return in excess of the one month Treasury Bill, R_f, to portfolio *p* formed each July 1st and includes all MAKE winners in our sample during the preceding 12 months.

MKT= the monthly return on the stock market minus the return on the one month Treasury Bill.

SMB and *HML* = the respective monthly return to the size (Small-Minus-Big) and book-to-market (High-Minus-Low) factor mimicking portfolios as described in Fama and French (1993).

MOM = the monthly return to the momentum factor mimicking portfolio (Jegadeesh and Titman, 1993; Carhart, 1997).

A significantly positive intercept in this regression indicates the MAKE winners report abnormal stock returns over the year following the MAKE awards portfolio formation date.

Table 7 presents the results of this analysis. The sample size is 90 observations, corresponding to the number of months in the analysis (6 months of returns for 2001, and 12 months of returns for 2002-2008). We find that the coefficient on the intercept is significantly positive, with a value of 0.9% (p = 0.005). This finding indicates that MAKE winners continue to experience abnormal stock returns, on average, during the year following the MAKE awards portfolio formation date. This finding is consistent with market participants not fully impounding the information about the awards around the award announcement date.

5. Sensitivity Tests

5.1 Alternative Analysis of Abnormal Short Window Returns

We repeat the analysis in Table 3 using firm-level instead of portfolio-level returns. In untabulated tests we continue to find significantly positive abnormal returns during the short window centered on the MAKE announcement day. Thus, our interpretation from our analysis in Table 3 remains unchanged using this alternative measure of returns.

We also investigate the robustness of our inferences to the choice of the statistical tests we use to examine the stock market reaction in Table 3. Specifically, instead of the time-series and calendar-time t-tests we use to calculate the p-values, we use the standardized abnormal return Z-test following Patell (1976), which estimates a separate standard error for each security-event and assumes cross-sectional independence. In addition, we use a nonparametric generalized sign test that, instead of assuming a probability for a positive abnormal return of half, adjusts for the fraction of positive versus negative abnormal returns in the estimation period. In untabulated analysis we continue to find a significantly positive stock market reaction to the MAKE award. Thus, our inferences in Table 3 remain unchanged using these two alternative tests.

5.2 Alternative Analysis of Future Performance

Table 5, Panel E, reports an analysis using a univariate test. We test the robustness of this analysis by using a regression specification as in Table 5, Panel C, and using the 202 peer portfolios we use in Table 5, Panel E. Specifically, we regress future performance for our sample of MAKE winners and peer firm portfolios (matched on industry and same percentile of total assets), on an indicator variable for MAKE winners, past performance, total assets, and the book-to-market ratio. In untabulated analysis we find a significantly positive coefficient on the MAKE

winner indicator variable. Thus, our inferences in Table 5, Panel E, remain unchanged using a multivariate analysis.

We also test the sensitivity of our results in Table 5, Panel C, and the alternative regression specification of Table 5, Panel E (described above), to the inclusion of past performance by repeating the regression analyses after omitting the past performance variable. In untabulated results we find that the coefficient on the indicator variable for MAKE winners remains significantly positive in both specifications. Thus, our inferences regarding the multivariate analysis of Table 5, Panels C and E, are unchanged when we drop past performance from the analysis.

5.3 Alternative Specification for Future Returns

We repeat our future return tests in Table 7 using the Fama-French three-factor model (i.e. after dropping the momentum factor). In untabulated analysis we find that the coefficient on the intercept remains significantly positive. Thus, our interpretation from our analysis in Table 7 remains unchanged using this alternative specification.

5.4 Analysis of Winners with More than One Award

Because it is possible to win a MAKE award more than once, we investigate whether the market continues to react positively to firms that have previously won an award. We partition our sample into first-time winners (46) and non-first-time winners (201), and calculate portfolio-level CARs over the five-day window surrounding the award announcement. We find that the market reaction for the 201 non-first-time winners is significantly positive (0.89%), but significantly smaller (at $p = 0.01$) than the market reaction for the first-time winners (1.56%). This indicates that the market reacts positively to non-first-time winners, although not as strongly as to first-time winners. There are several reasons why the market reacts positively to firms that

have previously won an award. Winning multiple MAKE awards may indicate that the winning firm is continuing to make new investments in KM initiatives and that management is excelling at implementing these new initiatives. If the benefits from the new KM initiatives are incremental to the benefits from the prior KM initiatives, the market is expected to react favorably to multiple winners. In addition, over the period of our analysis the market is likely to still be learning that KM improves performance, and that the MAKE selection process reliably identifies firms that excel at KM. This is consistent with our analysis that finds that the winners continue to experience positive abnormal returns during the year following the award. This suggests that the market may not fully impound the benefits of superior KM performance during the initial winning of the award, but that subsequent wins reinforce the market's confidence that management indeed excels at KM. Finally, because KM is relatively new, it is likely to be improving over the period of our analysis, such that the benefits from KM, and the competition to win a MAKE award, are increasing over time. If so, the benefits from KM activities are likely to be relatively greater for the firms that win the award a subsequent time.

5.5 Potential Effects of the Post-Earnings-Announcement Drift

Prior research documents that post earnings announcement returns are positively associated with announcement returns for extreme portfolios constructed on the magnitude of the announcement surprise (e.g., Ball and Brown, 1968; Bernard and Thomas, 1989, 1990). Because our sample firms are relatively healthy and may perform well, we examine whether the abnormal event returns surrounding the MAKE award date are a potential manifestation of the post-earnings-announcement drift. To test this, we repeat the analysis in Table 3 using seven days prior to the MAKE award as our event date. We find a negative portfolio mean abnormal return of –0.36% with $p = 0.347$ using the Brown and Warner (1980, 1985)'s time-series t-statistic and

p = 0.425 using the calendar-time t-statistic from Jaffe (1974) and Mandelker (1974). This analysis suggests that the abnormal returns we observe in Table 3 are not from confounding post-earnings-announcement returns.

5.6 Potentially Confounding Events

To further investigate whether confounding events can explain our event analysis results, we conduct three analyses. In the first confounding event analysis, we hand collect material events data from the Securities and Exchange Commission EDGAR filings system for each company in our sample. We search for filings two days before and two days after each MAKE award announcement date in our sample. We identify 17 observations, out of the 247 sample observations that have an earnings announcement, annual financial statement filing, or quarterly financial statement filing events during the five-day window centered on the award date. Removing these 17 observations from our sample and repeating the event study analysis reveals that the Mean Portfolio Cumulative Abnormal Return is 1.28% and significant using all the statistical event tests (Patell Z, Calendar Time t, Portfolio Time-Series t, and Generalized Sign Z). These results further suggest that possible confounding events during the award event window are not driving our results.

In the second confounding events analysis we examine several types of news published during the five-day window centered on the award date. Specifically, we use the LexisNexis Academic database and, for each of our award observations, we identify all newswires and press releases announced during the five-day event window. We classify a MAKE award as confounded if during the five-day window there is any newswire or a press release, such as announcement that the firm repurchased shares, issued a dividend, won an award (other than the MAKE), received a ratings upgrade, or received a favorable change in stock recommendation. We find 25 MAKE award observations with at least one confounding event. Repeating the event

study analysis after removing these 25 observations reveals a significant Mean Portfolio Cumulative Abnormal Return of 1.37% (time-series p = 0.040; calendar time p = 0.034).

In the third confounding event analysis, we repeat the event study after excluding observations that are confounded by all the events in any one of the two sources we use to identify confounding events, i.e., EDGAR and LexisNexis Academic. Using a total sample of 206 MAKE awards that remain after excluding all award observations that are confounded by any of the potential confounding events, we find a significant Mean Portfolio Cumulative Abnormal Return of 1.43% (time-series p = 0.025; calendar time p = 0.043).[27]

Overall, these findings provide additional robust evidence that possible confounding events during the award event window are not driving our results.

5.7 Potential Selection based on Past Performance

Although the award selection process requires the judges to evaluate and select winners based on KM-related criteria, it may be possible that the judges simply select firms based on past earnings or stock price performance. First, we note that it is unclear why the judges (many of whom are chosen for their KM expertise) would have incentives to choose winners simply based on performance. Second, our tests throughout include variables that, depending on the context, control for past earnings performance, past stock price performance (momentum), or market expectations of future performance. Third, we repeat the future performance analysis in Table 5, Panel C, but after matching our MAKE sample by (1) industry and percentile of past ROA, (2) industry and percentile of past ROE, and (3) industry and percentile of past CFO. Untabulated results find that our inferences are unchanged relative to those currently reported in Table 5, Panel C, with MAKE firms significantly outperforming their matched peers (after matching on

[27] The 206 observations include the original 247 observations minus 41 observations that are potentially confounded (where 41 observations comprise the 17 from EDGAR plus 25 from LexisNexis Academic minus one observation that is identified from both sources).

past performance) when investigating future ROA, ROE, and CFO. Overall, these results indicate that the award winners are chosen based on their ability to use KM to create services and products that enhance organizational wealth, and not based solely on past or expected future performance.

5.8 Alternative Controls for Halo Effects from Past Performance

In our future performance tests in Section 4.3.1, we control for the halo effect by including a control variable for past performance. As an alternative control, we also repeat those three tests after orthogonalizing future performance to past performance. Specifically, we first regress future performance on past performance, and then use the residual from that regression as the dependent variable for future performance in the tests reported in Panels C and E, and G of Table 5 (after dropping past performance as an independent variable). Untabulated results find that our inferences are unchanged relative to those currently reported in Table 5, with MAKE firms significantly outperforming their peers based on future ROA, ROE, and CFO.

6. Summary and Conclusions

A long history of economic research suggests that knowledge plays a critical role in wealth creation. Recently, factors such as advances in technology and increased global competition have resulted in large increases in firms' expenditures on KM. In addition, a large body of literature across several business disciplines presents case study evidence that firms with superior KM abilities outperform their peers. However, prior research that attempts to link KM to increased shareholder value (i.e., Tanriverdi, 2005) suffers from empirical issues that make it difficult to unambiguously interpret its results. Our study attempts to overcome these empirical issues by examining the short window stock market reaction and future performance of

companies receiving the "Most Admired Knowledge Enterprise" (MAKE) award, which recognizes companies with superior KM abilities.

We perform analyses that examine the share price reaction to the announcement of the MAKE award, the link between the share price reaction and future performance, analysts' reaction to the announcement of the award, and the future operating and stock price performance of the award winners. We find that during the five days surrounding the award announcement, MAKE winners experience 1.25% abnormal stock returns, and that these returns are positively associated with MAKE winners' subsequent operating performance. We also find that equity analysts are relatively more likely to make significant upward revisions to MAKE winners' earnings forecasts during the month following the award, and that MAKE winners surpass their peers in terms of both operating performance and stock price performance during the year subsequent to winning the award. All told, our findings are consistent with firms that excel at KM improving shareholder wealth through superior future operating performance. These findings are consistent with economic theory that argues knowledge is a fundamental driver of firm value, and with the KM literature in a variety of business disciplines that alleges superior KM systems provide firms with a competitive advantage.

We acknowledge, however, that we cannot generalize our results beyond our sample of MAKE winners. While we find evidence that the KM activities of MAKE winners create value for shareholders, our evidence does not suggest that implementing KM systems, *per se*, necessarily leads to increased shareholder value. Whereas our sample firms excel at KM, firms with poorly implemented KM systems are less likely to benefit. A normative evaluation of the costs and benefits associated with implementing KM is beyond the scope of this study.

References

Adams, J. D. 1990. Fundamental stocks of knowledge and productivity growth. *Journal of Political Economy* 98 (4): 673–702.

Alavi, M. and D. E. Leidner. 2001. Review: knowledge management and knowledge management systems: conceptual foundations and research issues. *Management Information Systems Quarterly* (25): 107–136.

Arrow, K. J. 1974. The limits of organization. New York: W. Norton & Co.

Asian Productivity Organization (APO). 2007. Knowledge management: from brain to business. Hiakawacho, Chiyoda-ku, Japan.

Atkeson A. and P. J. Kehoe. 2005. Modeling and measuring organization capital. *Journal of Political Economy* (113): 1026–1053.

Balasubramanian, S., I. Mathur, and R. Thakur. 2005. The impact of high-quality firm achievements on shareholder value: focus on Malcolm Baldrige and J. D. Power and Associates awards. *Journal of the Academy of Marketing Science* (33): 413–422.

Ball, R. and P. Brown. 1968. An empirical evaluation of accounting income numbers. *Journal of Accounting Research* (6): 159–178.

Barclay, R. and P. Murray. 1997. What is knowledge management? Knowledge Praxis, Knowledge Management Associates.

Barth, M.E., M. Clement, G. Foster, and R. Kasznik, 1998. Brand values and capital market valuation. *Review of Accounting Studies* 3, 41–68.

Barth, M.E., Y. Konchitchki, and W.R. Landsman. 2010. Cost of capital and earnings transparency. *Stanford University Research Paper Number 2015*.

Bernard L.V. and J.K. Thomas. 1989. Post-earnings-announcement drift: delayed price response or risk premium? *Journal of Accounting Research* (27): 1–36.

Bernard L.V. and J.K. Thomas. 1990. Evidence that stock prices do not fully reflect the implications of current earnings for future earnings. *Journal of Accounting and Economics* (13): 305–340.

Berzins, A., J. Podolny, and J. Roberts. 1998. British Petroleum (B): focus on learning. S-1B-16B, *Graduate School of Business, Stanford University*.

Bharadwaj, A.S., S.G. Bharadwaj, and B.R. Konsynski. 1999. Information technology effects on firm performance as measured by Tobin's q. *Management Science* (45): 1008–1024.

Binder, J.J. 1998. The event study methodology since 1969. *Review of Quantitative Finance and Accounting* (11): 111–137.

Boisot, M. 1999. Knowledge assets. *Oxford University Press*, NY, NY.

Borghoff, U.M. and R. Pareschi. 1998. Information technology for knowledge management. Springer-Verlag Berlin Heidelberg, New York, NY.

Brown, S.J. and J.B. Warner. 1980. Measuring security price performance. *Journal of Financial Economics* (8): 205–258.

Brown, S.J. and J.B. Warner. 1985. Using daily stock returns: the case of event study. *Journal of Financial Economics* (14): 3–31.

Carhart, M.M. 1997. On persistence in mutual fund performance. *Journal of Finance* (52): 57–82.

Carlsson, S.A., O.A. El Sawy, I. Eriksson, and A. Raven. 1996. Gaining competitive advantage through shared knowledge creation: in search of a new design theory for strategic information systems. In *Proceedings of the Fourth European Conference on Information Systems*, J. Dias Coelho, T. Jelassi, W. Konig, H. Krcmar, R. O'Callaghan, and M. Saaksjarvi (eds.), Lisbon.

Campbell, J. 1996. Understanding risk and return. *Journal of Political Economy* (104): 298–345.

Carrig, K. 2005. Sysco corporation 2005 analyst field trip. Presentation by Sysco Corporation Executive Vice President and Chief Administrative Officer to securities analysts.

Chase, R. 2007. Speech by Rory Chase, Executive Director of Teleos and The KNOW Network.

Chuang, S. 2004. A Resource-based perspective on knowledge management capability and competitive advantage. *Expert Systems with Applications* 27: 459–465.

Dalkey, N. 1969. The Delphi Method: an experimental study of group opinion. *Rand Corporation*, Santa Monica, CA.

DeFond, M.L., R. Hann, and X. Hu. 2005. Does the stock market value financial expertise on audit committees of boards of directors? *Journal of Accounting Research* (43): 153–193.

Espinosa, J.A., S.A. Slaughter, R.E. Kraut, and J.D. Herbsleb. 2007. Team knowledge and coordination in geographically distributed software development. *Journal of Management Information Systems* (24): 135–169.

Fama, E.F. and K.R. French. 1993. Common risk factors in the returns of stocks and bonds. *Journal of Financial Economics* (33): 3–56.

Gao, F., M. Li, and S. Clarke. 2008. Knowledge, management, and knowledge management in business operations. *Journal of Knowledge Management* (2): 3–17

Garicano, L. 2000. Hierarchies and the organization of knowledge in production. *Journal of Political Economy* 108 (5): 874–904.

Gladstone, J. and R. Eccles. 1991. KPMG Peat Marwick: the shadow partner. *Harvard Business School*, 9-492-002, Revised 1995.

Global Industry Analysts, Inc. (GIA). 2008. Knowledge management: a global strategic business report.

Gow, I.D., G. Ormazabal, and D.J. Taylor. 2010. Correcting for both cross-sectional and time-series dependence in accounting research. *The Accounting Review* (85): 483–512.

Hayek, F. 1945. The use of knowledge in society. *The American Economic Review* (35): 519–530.

Hendricks, K.B. and V.R. Singhal. 1997. Does implementing an effective TQM program actually improve operating performance? Empirical evidence from firms that have won quality awards. *Management Science* (43): 1258–1274.

Jaffe, J.F. 1974. Special information and insider trading. *Journal of Business* (47): 410–428.

Jegadeesh, N. and S. Titman. 1993. Returns to buying winners and selling losers: implications for stock market efficiency. *Journal of Finance* (48): 65–91.

Jose, M., L. Nichols, and J. Stevens. 1986. Contributions of diversification, promotion and R&D to the value of multiproduct firms: a Tobin's q approach. *Financial Management* (15): 33–42.

Kim, S. and H. Lee. 2004. "Organizational factors affecting knowledge sharing capabilities in e-government." *Lecture Notes in Computer Science*, Springer – Verlag Issue 3035: 265–277.

Konchitchki, Y. 2010. Inflation and nominal financial reporting: implications for performance and stock prices. *The Accounting Review*, forthcoming.

Lee, H. and B. Choi. 2003. "Knowledge management enablers, processes, and organizational performance." *Journal of Management Information Systems* 20, No. 1: 179–228.

Lev, B. and S. Radhakrishnan. 2004. The valuation of organization capital. *New York University and University of Texas at Dallas working paper*.

Lev, B. and T. Sougiannis. 1996. The capitalization, amortization, and value-relevance of R&D. *Journal of Accounting and Economics* 21, 107–138.

Levinson, M. 2006. ABCs of knowledge management. CIO.com.

MacCormack, A. 2002. Siemens ShareNet: building a knowledge network. 9-603-036, *Harvard Business School*.

Machlup, F. 1962. The production and distribution of knowledge in the United States. Princeton: Princeton University Press.

Malhotra, Y. 2004. Why knowledge management systems fail? In E Knoenig and T Srikantiah (Eds.) Knowledge management lessons learned: what works and what doesn't. *Society for Information Science and Technology Monograph Series*: 87–112.

Mandelker, G. 1974. Risk and return: the case of merging firms. *Journal of Financial Economics* (1): 303–336.

McCune, J. 1999. Thirst for knowledge. *Management Review* (88): 10–12.

McDermott, R. 1999. Why information technology inspired but cannot deliver knowledge management. *California Management Review* (41): 103–117.

Mithas, S. and M.S. Krishnan. 2009. From association to causation via a potential outcomes approach. *Information Systems Research* (20): 295–313.

Nielsen, B. and F. Ciabuschi. 2003. Siemens ShareNet: knowledge management in practice. *Business Strategy Review* (14): 33–40.

Nonaka, I. 1991. The knowledge creating company. *Harvard Business Review* (69): 96–104.

Nonaka, I., and Takeuchi, H. 1995. The knowledge-creating company: how Japanese companies create the dynamics of innovation. *Oxford University Press*, New York.

O'Dell, C. and C. Grayson. 1998. If only we knew what we know. *California Management Review* (40): 154–174.

Ofek, E. and M. Sarvary. 2001. Leveraging the customer base: creating competitive advantage through knowledge management. *Management Science* 47 (11): 1441–1456.

O'Leary, D.E. 1998. Knowledge-management systems: converting and connecting. *Intelligent Systems and their Applications, IEEE*, 13, Issue 3: 30–33.

O'Leary, D.E. 2001. How knowledge reuse informs effective system design and implementation. *IEEE Intelligent Systems* (16): 44–49.

O'Leary, D.E. 2007. Empirical analysis of the evolution of a taxonomy for best practices. *Decision Support Systems* (43): 1650–1663.

O'Leary, D.E. 2008. Evolution of knowledge management towards enterprise decision support: the case of KPMG. In F. Bersein and C. Holsapple, Handbook on Decision Support Systems, Springer.

Patell, J.M. 1976. Corporate forecasts of earnings per share and stock price behavior: empirical tests. *Journal of Accounting Research* (14): 246–274.

Penman, S.H. 2009. Accounting for intangible assets: there is also an income statement. Center for Excellence in Accounting and Security Analysis, Columbia Business School.

Petersen, M. 2009. Estimating standard errors in finance panel data sets: comparing approaches. *Review of Financial Studies* (22): 435–480.

Polanyi, M. 1966. The tacit dimension. Routledge & Kegan Paul, London, UK.

Prescott, E.C. and M. Visscher. 1980. Organization Capital. *Journal of Political Economy* (88): 446–461.

PricewaterhouseCoopers (PwC). 1999. Inside the mind of the CEO. The 1999 Global CEO Survey: World Economic Forum 1999 Annual General Meeting. Davos, Switzerland, PwC, New York, NY.

Przasnyski, Z.H. and L.S. Tai. 2002. Stock performance of Malcolm Baldrige national quality award winning companies. *Total Quality Management and Business Excellence* (13): 475–488.

Rosenbaum, P.R. and D.B. Rubin. 1983. The central role of the propensity score in observational studies for causal effects. *Biometrika* (70): 41–55.

Schubert, P., D. Lincke, and B. Schmid. 1998. A global knowledge medium as a virtual community: the NetAcademy concept. In Proceedings of the 4th Americas Conference on Information Systems, Baltimore, MD, 618–620.

Schultz, M. and L. Jobe. 2001. Codification and tacitness as knowledge management strategies: an empirical exploration. *Journal of High Technology Management Research* (12): 139–165.

Schumpeter, J. 1934. The theory of economic development: an inquiry into profits, capital, credit, interest and the business cycle. Cambridge, MA: *Harvard University Press*.

Sloan, R.G. 1996. Do stock prices fully reflect information in accruals and cash flows about future earnings? *The Accounting Review* (71): 289–315.

Sunstein, C. 2006. Infotopia: how many minds produce knowledge. *Oxford University Press*.

Tanriverdi, H. 2005. Information technology relatedness, knowledge management capability, and performance of multi-business firms. *MIS Quarterly* (29): 311–334.

Upton, W. 2001. Business and financial reporting, challenges from the new economy. Financial Accounting Standards Board, Special Report, Norwalk, CN.

Villalonga, B. 2004. Intangible resources, Tobin's q, and sustainability of performance differences. *Journal of Economic Behavior and Organization* (54): 205–230.

Wah, L. 1999. Behind the buzz. *Management Review* (88): 16–26.

TABLE 1
MAKE Award Distribution by Year and Industry

This table reports the number of MAKE awards awarded between 2001 and 2008 by industry (Panel A) and by year (Panel B) for firms with available CRSP data. Industries are based on the 12 Campbell (1996) industry classifications.

Panel A: MAKE Awards by Industry		
Industry	N	%
Consumer Durables	75	30
Services	66	27
Capital Goods	52	21
Petroleum	24	10
Basic	16	6
Construction	7	3
Finance/Real Estate	5	2
Transportation	1	<1
Utilities	1	<1
Total	247	100

Panel B: MAKE Awards by Year		
Year	N	%
2001	12	5
2002	9	4
2003	22	9
2004	41	13
2005	41	17
2006	47	19
2007	38	15
2008	37	15
Total	247	100

TABLE 2
Descriptive Statistics

Descriptive statistics for distinct MAKE award winning firms with available Compustat data. Statistics are quarterly average values for each of the 46 distinct MAKE firms over the period 2001-2008, equally-weighted by firm in millions of dollars. Variable definitions: Stockholders' Equity (Compustat item SEQQ), Net Income (Compustat item NIQ), Total Assets (Compustat item ATQ), Sales (Compustat item SALEQ), Cash Flows from Operations (Compustat item OANCFY), Book-to-Market (Compustat items SEQQ/(PRCCQ*CSHOQ)), Return on Assets (Compustat items NIQ/ATQ), Cash Flows from Operations over Total Assets (Compustat items OANCFY/ATQ), and Return on Equity (Compustat items NIQ/SEQQ).

	Mean	Median	Standard Deviation	25th Percentile	75th Percentile
Stockholders' Equity ($MM)	24,032	16,620	25,769	5,650	33,066
Net Income ($MM)	1,080	706	1,117	229	1,361
Total Assets ($MM)	121,925	34,396	271,851	14,367	95,482
Sales ($MM)	15,613	8,574	17,553	3,890	22,958
Cash Flows from Operations ($MM)	4,830	2,706	7,207	882	5,995
Market Value of Equity ($MM)	72,066	50,191	71,853	21,214	85,663
Book-to-Market	0.379	0.291	0.245	0.215	0.494
Return on Assets	0.024	0.019	0.020	0.009	0.038
Cash Flows from Operations/Assets	0.092	0.085	0.054	0.050	0.130
Return on Equity	0.065	0.047	0.084	0.028	0.075

TABLE 3
Market Reaction to Announcement for 247 MAKE Award Winners

This table reports abnormal return around the announcement of news for firms that excel at KM. Portfolio abnormal returns are the five-day cumulative abnormal returns surrounding the announcement day for 247 MAKE award winners using standard event study methodology (Binder, 1998). The CARs are computed as follows: $CAR_{[-2,+2]} = \sum_{t=-2}^{t=+2} \overline{AR_t}$, where: $\overline{AR_t} = \frac{1}{N_t} \sum_{i=1}^{i=N_t} AR_{it}$; $AR_{it} = R_{it} - E(R_{it})$; and t = (–2, –1,0,+1,+2); R_{it} is the return of the sample firm i on day t; and E(R_{it}) is the corresponding market return from CRSP on day t.

P-values are based on t-statistics computed using the time-series mean abnormal returns as in Brown and Warner (1980, 1985), and the calendar-time abnormal returns as in Jaffe (1974) and Mandelker (1974). We calculate the time-series t-statistic as follows:

$$t = \sum_{t=-2}^{t=+2} \overline{AR_t} \Big/ \left(\sum_{t=-2}^{t=+2} S^2[\overline{AR_t}] \right)^{1/2} \text{, where: } S^2[\overline{AR_t}] = \left(\sum_{t=-244}^{t=-6} \left[\overline{AR_t} - \overline{AAR} \right]^2 \right) \Big/ 238 \text{ ; } \overline{AAR} = \sum_{t=-244}^{t=-6} \overline{AR_t} \Big/ 239 .$$

We calculate the calendar-time t-statistic as follows:

$$t = CAAR_{[-2,+2]} \Big/ \left(S_{CAAR_{[-2,+2]}} \Big/ \sqrt{N} \right) \text{, where: } S^2_{CAAR_{[-2,+2]}} = \frac{1}{N-1} \sum_{i=1}^{N} \left[\left(\sum_{t=-2}^{t=+2} \overline{AR_t} \right)_i - \frac{1}{N} \sum_{j=1}^{N} \left(\sum_{t=-2}^{t=+2} \overline{AR_t} \right)_j \right]^2 ;$$

$$CAAR_{[-2,+2]} = \frac{1}{N} \sum_{j=1}^{N} \left(\sum_{t=-2}^{t=+2} \overline{AR_t} \right) \text{; and } i, j \text{ are firm indices.}$$

Portfolio-Level Abnormal Returns	1.25%
p-value (time-series)	(0.049)
p-value (calendar-time)	(0.029)

TABLE 4
Relation Between Future Performance and Abnormal Returns around the MAKE Announcement

Panel A reports descriptive statistics for the future performance of MAKE winning firms over the average of the four quarters following the quarter in which the MAKE is awarded and the expected future performance of MAKE winning firms as of the day the MAKE award is announced. Panel B reports results from estimating a model of $FuturePerformance_{if}$, defined as ROA, ROE, and CFO for firm *i* over future period *f*, regressed on firm-level cumulative abnormal return, CAR, during the five days surrounding the MAKE award announcement (-2,+2). Period *f* refers to the average of the future four quarters following the quarter in which the MAKE award is received. When less than four quarters of data are available, we use all available quarters. CAR is computed as follows:

$CAR_{[-2,+2]} = \sum_{t=-2}^{t=+2} \overline{AR_t}$, where: $\overline{AR_t} = \frac{1}{N_t} \sum_{i=1}^{i=N_t} AR_{it}$; $AR_{it} = R_{it} - E(R_{it})$; and t = (–2, –1,0,+1,+2); R_{it} is the return of the sample firm *i* on day *t*; and $E(R_{it})$ is the corresponding market return from CRSP on day *t*. The expected performance variable, $ExpectedPerformance_{if}$, is expected ROA, ROE, and CFO for firm *i* over future period *f*, calculated as the I/B/E/S consensus analyst annual earnings per share forecast divided by four (because our dependent variable is average quarterly performance), scaled by total assets per share or by stockholders' equity per share for expected ROA or expected ROE, respectively. Expected CFO is the I/B/E/S consensus analyst forecast of annual cash flows from operations per share divided by four (because our dependent variable is average quarterly performance), scaled by total assets per share. Total assets and stockholders' equity are measured during the quarter in which the MAKE award is announced or, in the case of missing data, the quarter with data immediately before the MAKE winning quarter. P-values are in parentheses. Regression residuals are clustered by firm and year to control for potential cross-sectional and time-series correlation.

$$\textbf{Model 1: } FuturePerformance_{if} = \alpha + \beta_1 CAR_{it} + \varepsilon_{if}$$

$$\textbf{Model 2: } FuturePerformance_{if} = \alpha + \beta_1 CAR_{it} + \beta_2 ExpectedPerformance_{if} + \varepsilon_{if}$$

Panel A: Descriptive Statistics

	Mean	Median	Standard Deviation	25th Percentile	75th Percentile	N
Future Return on Assets	0.029	0.025	0.024	0.011	0.044	202
Future Return on Equity	0.062	0.056	0.046	0.034	0.086	202
Future Cash Flows from Operations over Assets	0.101	0.097	0.057	0.061	0.138	202
Expected Return on Assets	0.025	0.020	0.017	0.012	0.039	195
Expected Return on Equity	0.056	0.046	0.041	0.029	0.071	195
Expected Cash Flows from Operations over Assets	0.034	0.031	0.019	0.018	0.046	170

Panel B: Regression of Future Performance on Abnormal Returns around the MAKE Award Announcement Date

	Predicted Sign	Dependent Variable					
		Future Return on Assets		Future Return on Equity		Future Cash Flows from Operations over Assets	
		Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
α		0.029 (<0.001)	0.004 (0.042)	0.062 (<0.001)	0.013 (0.001)	0.101 (<0.001)	0.042 (<0.001)
CAR	+	0.108 (0.004)	0.069 (0.009)	0.169 (0.026)	0.151 (0.001)	0.211 (0.013)	0.031 (0.378)
Expected Performance	+		1.034 (<0.001)		0.873 (<0.001)		1.809 (<0.001)
N		202	195	202	195	202	170
Adj. R^2		0.030	0.561	0.020	0.625	0.021	0.392

TABLE 5
Future Performance Tests

The table reports results from four-quarters-ahead performance of MAKE winners compared to two matched samples: one based on industry only and the second based on industry and same percentile of total assets, both measured during the MAKE winning quarter. Panel A presents descriptive statistics of variables included in the analysis for the 202 MAKE winners with available Compustat data during the MAKE winning quarter. Panel B presents descriptive statistics for 51,030 MAKE peer firms matched on industry only. Panel C reports results from comparing future performance of the MAKE winners with that of the MAKE peer firms matched on industry only. This analysis regresses *FuturePerformance* on an indicator variable (*Winner*) which is equal to 1 when the observation is a MAKE winner and zero otherwise, and control variables for past performance (*PastPerformance*), total assets (*Assets*), measured in billions of dollars, and the book-to-market (*BTM*) ratio. Panel D presents descriptive statistics for 202 MAKE peer portfolios matched on industry and same percentile of total assets. Panel E reports results from comparing future performance of the MAKE winners with the MAKE peer firms matched on industry and same percentile of total assets. This analysis performs a univariate comparison of ROA, ROE, and CFO across the two samples. Panels F and G report results from the propensity score matching procedure. *FuturePerformance* is ROA, ROE, and CFO averaged over the four quarters subsequent to the winning quarter, and *PastPerformance* is the related performance measure averaged over the four quarters prior to the quarter in which a MAKE is awarded. When less than four quarters of data are available, we use all available quarters. Regression residuals are clustered by firm and year to control for potential cross-sectional and time-series correlation. P-values are in parentheses.

Panel A: MAKE winners (N = 202)

	Mean	Median	Std Dev	25th Percentile	75th Percentile
Future Return on Assets	0.029	0.025	0.024	0.011	0.044
Future Return on Equity	0.062	0.056	0.046	0.034	0.086
Future Cash Flows from Operations over Assets	0.101	0.097	0.057	0.061	0.138
Past Return on Assets	0.029	0.022	0.023	0.011	0.043
Past Return on Equity	0.059	0.053	0.043	0.036	0.080
Past Cash Flows from Operations over Assets	0.102	0.099	0.056	0.060	0.138
Total Assets	113,442	48,516	239,654	14,746	98,008
Book-to-Market	0.311	0.244	0.199	0.143	0.479

Panel B: MAKE Peer Firms Matched on Industry Only (N = 51,030 peer firms)

	Mean	Median	Std Dev	25th Percentile	75th Percentile
Future Return on Assets	–0.025	0.004	0.094	–0.028	0.018
Future Return on Equity	–0.100	0.011	0.424	–0.053	0.035
Future Cash Flows from Operations over Assets	–0.015	0.022	0.163	–0.032	0.065
Past Return on Assets	–0.024	0.003	0.091	–0.029	0.018
Past Return on Equity	–0.057	0.011	0.253	–0.052	0.035
Past Cash Flows from Operations over Assets	–0.013	0.021	0.149	–0.034	0.064
Total Assets	3,776	145	40,713	31	752
Book-to-Market	0.595	0.455	0.552	0.263	0.734

TABLE 5
Continued

Panel C: Regression of Future Performance for MAKE winners (N = 202) and MAKE Peer Firms Matched on Industry Only (N = 51,030 peer firms)

$$\boldsymbol{FuturePerformance_{it}} = \alpha + \beta_1 \boldsymbol{Winner} + \beta_2 \boldsymbol{PastPerformance_{it}} + \beta_3 \boldsymbol{Assets_{it}} + \beta_4 \boldsymbol{BTM} + \varepsilon_{it}$$

	Dependent Variable		
	Future Return on Assets	Future Return on Equity	Future Cash Flows from Operations over Assets
A	–0.006 (<0.001)	–0.059 (<0.001)	–0.004 (<0.001)
Winner	0.015 (<0.001)	0.066 (<0.001)	0.020 (<0.001)
PastPerformance	0.678 (<0.001)	0.723 (<0.001)	0.814 (<0.001)
Assets	2.010E–05 (<0.001)	1.134E–04 (<0.001)	1.430E–05 (<0.001)
BTM	–5.205E–03 (<0.001)	3.663E–04 (0.936)	–7.786E–04 (0.502)
N	51,232	51,232	51,232
Adj. R^2	0.432	0.187	0.561

Panel D: Portfolios of MAKE Peer Firms Matched on Industry and Asset Percentile (N = 202 peer portfolios)

	Mean	Median	Std Dev	25th Percentile	75th Percentile
Future Return on Assets	0.015	0.014	0.011	0.008	0.020
Future Return on Equity	0.031	0.037	0.040	0.019	0.049
Future Cash Flows from Operations over Assets	0.065	0.062	0.027	0.049	0.077
Total Assets	95,152	39,363	173,375	13,489	129,801
Book-to-Market	0.816	0.443	2.061	0.352	0.578

Panel E: Univariate Analysis of Future Performance MAKE Winners (N =202) Compared with MAKE Peer Portfolios Matched on Industry and Percentile of Total Assets (N = 202)

	Knowledge Management Firms		Knowledge Management Peer Portfolios		Difference in Means	Wilcoxon Sign Ranked Test
FuturePerformance	mean	median	mean	median	p-value	p-value
Future Return on Assets	0.029	0.025	0.015	0.014	(<0.001)	(<0.001)
Future Return on Equity	0.062	0.056	0.031	0.037	(<0.001)	(<0.001)
Future Cash Flows from Operations over Assets	0.101	0.097	0.065	0.062	(<0.001)	(<0.001)

TABLE 5
Continued

Panel F: Propensity Score Matching Analysis - Covariate Balance

Variable	MAKE Firms Mean	MAKE Firms Median	Propensity Matched Control Sample Mean	Propensity Matched Control Sample Median	Difference in Means (p-value)	Wilcoxon Sign Ranked Test (p-value)
Performance - Return on Assets (N = 183)						
Assets	95,186	48,672	102,851	3,991	(0.800)	(<0.001)
Book-to-Market	0.323	0.241	0.367	0.312	(0.017)	(0.301)
Past Return on Assets	0.028	0.022	0.023	0.014	(0.418)	(0.005)
Performance - Return on Equity (N = 185)						
Assets	90,937	47,143	70,679	4,012	(0.386)	(<0.001)
Book-to-Market	0.321	0.241	0.371	0.334	(0.004)	(0.186)
Past Return on Equity	0.056	0.053	0.088	0.040	(0.308)	(0.039)
Performance - Cash Flow from Operations over Assets (N = 179)						
Assets	103,980	48,516	65,238	2,806	(0.128)	(<0.001)
Book-to-Market	0.323	0.241	0.329	0.276	(0.731)	(0.550)
Past Cash Flow from Operations over Assets	0.102	0.097	0.084	0.079	(0.004)	(0.073)

Panel G: Propensity Score Matching Analysis - Comparison of Future Performance

Performance Variable	MAKE Firms Mean	MAKE Firms Median	Propensity Matched Control Sample Mean	Propensity Matched Control Sample Median	Difference in Means (p-value)	Wilcoxon Sign Ranked Test (p-value)
Return on Assets	0.028	0.024	0.018	0.013	(<0.001)	(<0.001)
Return on Equity	0.063	0.053	0.034	0.038	(0.001)	(<0.001)
Cash Flow from Operations over Assets	0.099	0.096	0.078	0.073	(0.000)	(0.004)

TABLE 6
Analyst Forecast Revisions Following MAKE award

This table reports results from analyses of analyst forecasts. Panel A reports the average of each firm's proportion of revising analysts who revise their annual EPS forecast upward during month *t+1*. Panel B reports a comparison in the change of the mean consensus annual EPS forecast from month *t*–1 to month *t*+1 between MAKE winning firms and a control group of peer firms matched on same industry, year, quarter, and one percentile of total assets.

Panel A: The Direction of Analyst Forecast Revisions (N =190)

$$\textbf{Measure 1} = \frac{\textbf{Number of Upward Revisions}_{t+1}}{\textbf{Number of Awards}}$$

$$\textbf{Measure 2} = \frac{\textbf{Number of Downward Revisions}_{t+1}}{\textbf{Number of Awards}}$$

Mean number of analysts per MAKE winner that revise upward (Measure 1)	3.037
Mean number of analysts per MAKE winner that revise downward (Measure 2)	1.900
P-value for difference in means	(0.009)

Panel B: Comparison of the Magnitude of Analyst Forecast Revisions Surrounding the Award Month for MAKE Winners versus a Control Sample of Matched Peer Firms (N = 159)

	Mean	P-value from a two-sample t-test for comparison of means	Median	P-value from a two-sample Wilcoxon z-test for comparison of medians
Test Sample: MAKE Winners	0.033	(0.024)	0.004	(<0.001)
Control Sample: Matched Peers	<0.001	(0.472)	0.000	(0.918)
Difference (Test – Control)	0.033	(0.035)	0.013	(0.021)

TABLE 7
Future Abnormal Returns for Portfolios Constructed on MAKE Winners

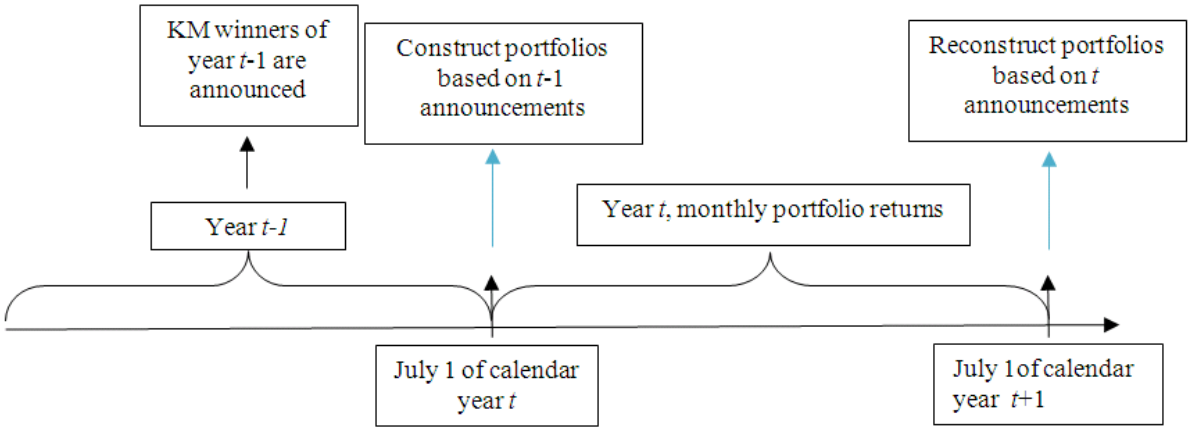
This table reports results from estimating future abnormal returns for portfolios constructed on MAKE winners during 2001-2008. Portfolios are constructed on July 1st of each year, and include all MAKE winners during the preceding 12 months. Monthly return data are obtained from CRSP, and portfolio monthly returns are calculated each month as the equally-weighted monthly returns for all firms in the portfolio. Portfolios are rebalanced every year, and portfolio monthly returns in excess of the monthly risk-free rate, $(Ret - R_f)_{pm}$, are regressed on the four Fama-French and Momentum factors: Excess Return on the Market (MKT), Small-Minus-Big Return (SMB), High-Minus-Low Return (HML), and Momentum (MOM). The monthly risk-free rate is the return on the one month Treasury Bill.

$$(Ret - R_f)_{pm} = \alpha_p + \beta_1 MKT + \beta_2 SMB + \beta_3 HML + \beta_4 MOM + \varepsilon_{pm}$$

Variable	Coefficient	t-statistic	p-value
α	0.009	2.870	0.005
MKT	1.292	14.880	(<0.001)
SMB	0.012	0.100	0.921
HML	–0.663	–4.830	(<0.001)
MOM	0.007	0.090	0.926
N	90		
Adj. R^2	0.813		

FIGURE 1
Timeline for Test of Future Risk-Adjusted Returns for Portfolios Constructed on MAKE Winners

The figure plots the timeline for the analysis of one-year ahead abnormal returns for portfolios constructed on MAKE winners. The first portfolio, constructed on July 1, 2001, includes all firms that receive a MAKE award during the prior 6 months. Portfolios are reconstructed on July 1 of each year *t* based on KM award winners during the prior 12 months. Our sample includes the monthly observations from July 2001 through December 2008 (N = 90). Each firm's monthly returns are obtained from the CRSP Monthly Stock File, and the monthly portfolio returns are obtained by averaging all firms' returns in each month during the test period. The monthly portfolio returns are regressed on the four Fama-French and Momentum factors: excess return on the market (MKT), Small-Minus-Big Return (SMB), High-Minus-Low Return (HML), and Momentum Factor (MOM).



APPENDIX 1

Siemens ShareNet

In the late 1990's Siemens began implementing knowledge management as a means of responding to increasing competition and deregulation.[28] Siemens had recognized that so-called "knowledge islands" had developed within their organization based on organizational and hierarchical barriers; business, process, project, and functional barriers; and local time, culture, and language barriers. As a result, Siemens had "poor reuse" of solutions generated for customers and there was "limited" best practice sharing in sales. In order to mitigate these limitations, Siemens took the approach of generating support for "knowledge communities" that cut across and integrated those many knowledge islands. In addition, they set out to capture and disseminate their best practices across Siemens world-wide organization.

The core idea was that knowledge management initially would focus on sales and marketing. Siemens saw that countries in similar stages of economic development and regulatory environments would have similar needs. They also noted that as markets developed, solutions could be leveraged from more economically developed countries to developing countries. As a result, they developed ShareNet, a system that allowed users to enter best practices in the form of "solutions objects" and "environmental objects." In addition, the system permitted "urgent requests" that allowed sales people to ask other sales people if they had a solution for a specific problem. For example, ShareNet is credited with dramatically reducing Siemens' costs of laying an underground communications cable in the Amazon jungle. Using ShareNet, Siemens' South American unit was able to discover what Siemens' African unit had learned a few years earlier while laying a similar cable in the jungles of Senegal.

[28] See, for example, Nielsen and Ciabuschi (2003).

The resulting system allowed Siemens to address questions such as “What sales deals have we lost or won recently?” “Why and how did we win them?” and “Who in Siemens is the expert on a specific topic?” Ultimately, in the fiscal year 2000-2001, the system resulted in an incremental $122 million in revenue at a system cost of $7.8 million.

APPENDIX 2

An Example of a MAKE Award Press Release Announcement

BusinessWire

HD Teleos **Announces 2006 World's Most Admired** Knowledge **Enterprises**

WC 455 words
PD 27 June 2006
ET 01:05 AM
SN Business Wire
SC BWR
LA English
CY (c) 2006 Business Wire. All Rights Reserved.

LP LONDON - (BUSINESS WIRE) - June 27, 2006 - Teleos has announced the winners of the 9th annual Global Most Admired Knowledge Enterprises (MAKE) study. Toyota is the overall Global MAKE Winner for the second year in a row.

The winners of the 2006 Global MAKE study, conducted by Teleos in association with The KNOW Network, are (in alphabetical order):

TD -- Accenture

-- Apple Computer

-- BHP Billiton

-- Buckman Laboratories

-- Dell

-- Ernst & Young

-- Fluor

-- Google

-- Hewlett-Packard

-- Honda Motor

-- McKinsey

-- Microsoft

-- Novo Nordisk

-- PricewaterhouseCoopers

-- Samsung Group

-- Sony

-- Tata Group

-- 3M

-- Toyota Motor Corporation

-- Unilever