Measuring the Business Impacts of Effective Data

Chapter One of a Three-Part Study

Anitesh Barua, University of Texas at Austin
Deepa Mani, Indian School of Business
Rajiv Mukherjee, University of Texas at Austin

THE UNIVERSITY OF TEXAS AT AUSTIN

Sponsored by SYBASE® An SAP® Company

Introduction

Despite the incredible sums of money that businesses around the world have invested in Information Technology, the direct correlation between those investments and the financial performance of the business, the productivity of employees, the ability to grow and innovate, and the ability to more accurately plan and forecast, have all eluded senior decision-makers. The University of Texas at Austin in conjunction with the Indian School of Business, and sponsored by Sybase, Inc., set out to address these and related questions.

In a study of over 150 Fortune 1000 firms from every major industry or vertical, we explored issues associated entirely with the lifeblood of today's enterprises: data. The quality of data, the ability for that data to be accessed wherever and whenever it's needed, and the relevance of that data in addressing a specific problem were areas of focus in the study – in essence, effective data, and the business implications of greater access to effective data.

The findings, being publicized now for the first time, definitely demonstrate the often dramatic impacts that even marginal investments in information technology can have when that technology addresses data quality, usability, and intelligence, whether it be using mobility or remote access solutions, analytics or business intelligence solutions, or a combination of the two.

Throughout this report and two subsequent reports, we will explore the study findings in detail across three series of performance measures:

- **Financial impacts of effective data** on areas such as productivity of employees, return on equity, return on invested capital, and return on assets
- **Customer-focused impacts of effective data** on areas such as the ability to innovate to derive revenue from new products, and the ability to expand the existing customer base
- **Operational impacts of effective data** on areas such as asset utilization, the accuracy of planning and forecasting, and on-time delivery of products or provisioning of services

The significance of this research is that to the best of our knowledge it is the first study that has quantified the relationship between improvements in data and key performance metrics of businesses today. Most studies focusing on the benefits of data quality report the percentage of firms that have seen a specific type of benefit after investing in data improvement[1]. They tell us neither the magnitude of the effect on performance nor what it takes to improve the attributes of data.

While large-scale investments in Information Technology have certainly helped improve basic data access and quality, our findings suggest that there is still room for major performance gains through additional investments in better data.

[1] Effectively these studies are taking a binary (0/1) view of effects of data improvement rather than focusing on how big or small such improvements may be.

Financial Impacts of Effective Data: Summary

In a study of over 150 Fortune 1000 firms from every major industry or vertical, we found that five attributes of data (quality, usability, intelligence, remote accessibility and sales mobility) have a dramatically positive effect on key financial measures. Our results show that relatively small improvements in these attributes can pay off with big financial returns. Here are the highlights:

Productivity of employees can be dramatically affected by increasing the usability of data within an organization, that is, presenting data more concisely and consistently across platforms such as corporate laptops and mobile devices, and allowing it to be more easily manipulated. If the median Fortune 1000 business in our sample (36,000 employees and $388,000 in sales per employee) increased the usability of its data by just 10%, it would translate to an increase in $2.01 billion in total revenue every year, or $55,900 in additional sales per employee annually.

Return on Equity (ROE), defined as net income/ shareholder equity, and an important indicator of a business's ability to grow, can be tremendously impacted by slight investments in IT. Increasing both the quality of data and the ability of sales people to access it by just 10% more than existing levels in the business, the average Fortune 1000 company can increase ROE by 16%.

> "If the median Fortune 1000 business…increased the usability of its data by just 10%, it would translate to an increase in $2.01 billion in total revenue every year."

Return on Invested Capital (ROIC), a measure of a business's efficiency of allocating capital to profitable investments, also increases noticeably with greater mobility of data. If the average Fortune 1000 business were to increase the mobility of its sales organization's data by just 10%, ROIC would increase by 1.4% as a result of net income increasing by $5.4 million.

Return on Assets (ROA), a measure of a business's ability to efficiently use the resources at its disposal to drive income, is positively affected by intelligence and remote accessibility. If the average Fortune 1000 company were to increase both intelligence and accessibility of data by 10%, ROA increases by 0.7%. That is the equivalent of squeezing $2.87 million of additional income out of the average Fortune 1000 business's assets, assuming assets remain fixed.

In an era of hyper-competition where every enterprise is jockeying for position to remain competitive and profitable, investing in better data still appears to be a low-hanging fruit.

The Conceptual Model

Figure 1 shows the conceptual model we developed to assess the impact of data attributes on organizational performance measures. The components of the model are (i) data attributes, (ii) controls and (iii) performance measures.

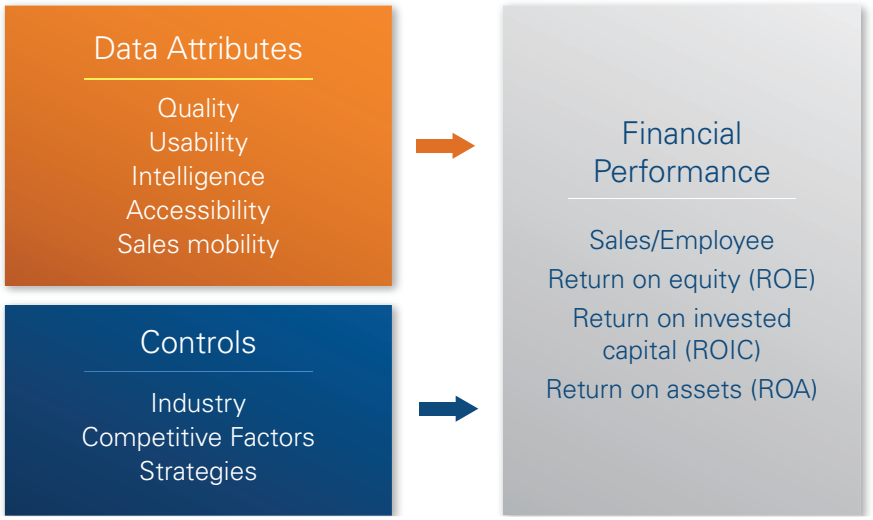

Figure 1: Financial performance Impacts of Data Attributes

3.1 Data attributes

Five attributes of data were considered: Quality, intelligence, usability, remote accessibility and sales mobility. Each attribute is multi-dimensional in nature and includes distinct but related facets that may be important to users or decision makers who have to use data.

The **quality** attribute incorporates the following dimensions:

Accuracy: The extent to which there are no errors in the data
Scope: The extent to which the breadth and depth of the data provide sufficient coverage of the event(s) of interest.
Timeliness: The extent to which data is received on time to take suitable actions and decisions.
Recency: The extent to which data is up to date relative to the event(s) of interest.

Usability includes the following dimensions:

- The extent to which data is concisely presented.
- The ease with which data can be manipulated or processed
- The extent to which data is consistent across multiple sources

Intelligence includes:

- Trends on data items of interest (e.g., price)
- Demand patterns (e.g., variation by the day of the week)
- Recommendations for better decision or actions
- Profile matching

Remote accessibility includes:

- The extent to which data can be accessed remotely by authorized users
- The extent to which applications can be run remotely by authorized users – which applications

Sales mobility includes the ability of salespersons to:

- Exchange price quotes information with customers through portable systems – for all items
- Exchange order information with customers through portable systems
- Exchange delivery information with customers through portable systems

3.2 Financial performance measures

To assess the impact of data attributes on performance, we chose a broad, multi-faceted representation of performance in the spirit of the balanced scorecard (BSC) approach. BSC includes financial, customer oriented and operational measures to assess performance. In this report, we only describe the financial impacts of better data, and will discuss the equally significant effects of data attributes on customer and operational measures in subsequent reports. In measuring the financial impacts of effective data, we use four distinct but related financial measures: Sales per employee, return on equity (ROE), return on invested capital (ROIC), and return on assets (ROA).

Defining financial performance measures

(from Investopedia and other sites)

Investopedia notes that the sales per employee ratio "gives investors some sense of a company's productivity and financial health… The sales-per-employee ratio provides a broad indication of how expensive a company is to run. A higher sales-per-employee ratio indicates that the company can operate on low overhead costs, and therefore do more with less employees, which often translates into healthy profits." Investopedia further notes that higher sales per employee may translate into higher market valuations.

ROE (net income / shareholder equity) is an important profitability metric relative to shareholder equity. The Bull notes that "a business that has a high return on equity is more likely to be one that is capable of generating cash internally… The higher the ROE, the more easily the company will be able to raise money for growth."

ROIC ([net income – dividends] / total capital) is used to measure the efficiency of allocating capital to profitable investments. By comparing ROIC against a firm's cost of capital, we can tell whether the invested capital was used productively.

ROA (net income / total assets) is an indicator of how profitable a company is relative to its total assets. Thus ROA gives an idea as to how efficient management is at using its assets to generate earnings. ■

The Main Results[2]

Financial measures are widely reported as a basis of performance comparison between firms. We tested if better data attributes lead to superior financial performance. As reported below, there is a strong association between data attributes and various measures of financial performance.

Measuring effective data's impact on employee productivity

Sales per employee, which is widely used in practice as a measure of productivity, is positively influenced by the usability of data. Usability of data involves presenting data more concisely and consistently across platforms such as corporate laptops and mobile devices, and allowing it to be more easily manipulated. We find that an increase of 10% in usability increases sales per employee by 14.4%. The median sales per employee in our sample is $388,000, implying that the median firm could increase its sales per employee figure by $55,900. Given that this annual benefit would be realized every year for, say, 5 years[3], after the undertaking of a project aimed at better usability of data, at 10% cost of capital, we obtain a present value of $233,095 of higher sales per employee.

> "An increase of 10% in usability of data increases sales per employee by 14.4% or $55,900."

The average rating for data usability in our sample of Fortune 1000 firms was a moderate 4.21 on a 1-7 scale, which means that a rating of 5 would represent an 11.28% increase over status quo. Increasing data usability involves improving the presentation of data, the ease with which data can be manipulated or processed, and the extent to which data is consistent across multiple databases. Shortcomings in presentation, ease of data manipulation and consistency result in additional time and effort to process the data into a meaningful form, which then results in productivity loss. It is also possible that many users or decision makers do not undertake such effort, which results in poor decisions or actions that may lead to poor interactions with customers with serious revenue implications.

In understanding the connection between data usability and financial performance, we can consider the additional processing time that would be required to make the data valuable for the user's context. The result above suggests that a 10% reduction in such effort or time would result in a significant increase in the productivity of the firm. For example, consider financial advisors who

> "A 10% reduction in effort and time required to make data valuable for the user's context would result in a significant increase in the productivity of the firm."

[2] All reported values are statistically significant at 10% or lower.

[3] Most Net Present Value (NPV) or Return on Investment (ROI) assessments of IT investments consider 5 years of benefits.

have to observe raw data streams on multiple screens and manually extract pieces of information from large research documents while advising clients on the phone. The lack of usability of data is likely to slow them down, make their judgment error prone, and be an impediment for them to serve a sufficient number of clients in a satisfactory manner in a given amount of time.

Figure 2 below shows the top-10 verticals in our sample with highest increase in sales per employee resulting from a 10% improvement in usability. The retail industry reported the maximum average increase of nearly 50% in sales per employee for a 10% improvement in data usability. Indeed consistency and conciseness of organizational data across multiple platforms will help with more accurate sales forecasts, improved inventory management across manufacturers and distributors, and greater efficiency of the sales force. All of these contribute to greater sales efficiency. The information intensive services industry reported an average increase of nearly 40% in sales per employee for a 10% improvement in usability, while the other verticals averaged an equivalent increase of nearly 20% in their sales per employee.

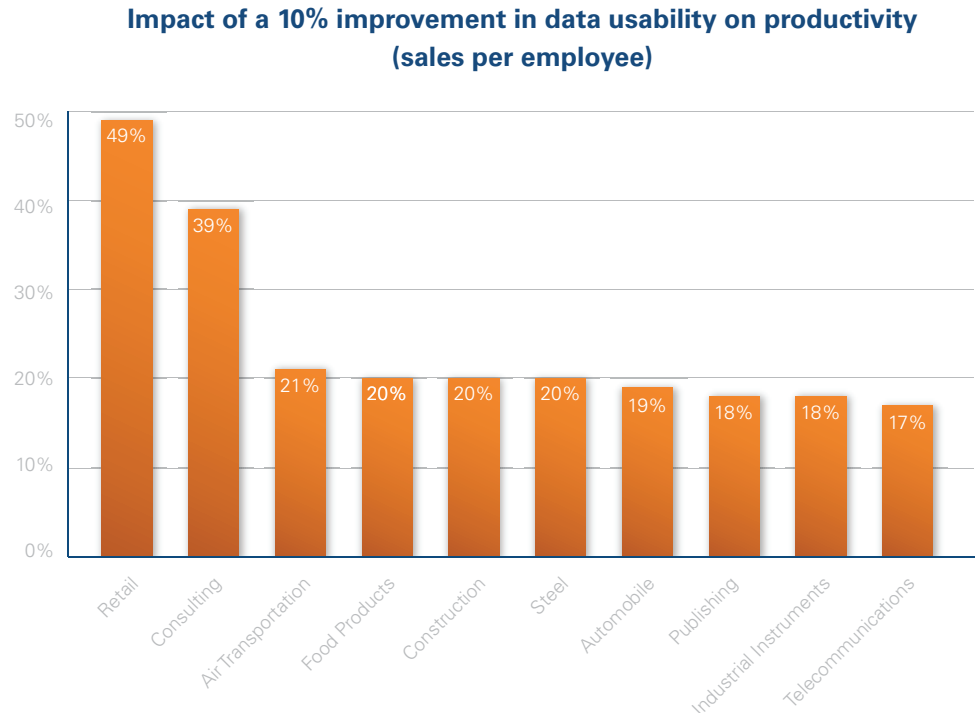

Figure 2: Average impact of data attributes on sales per employee

Figure 3 (page 8) shows the increase in sales due to a 10% improvement in usability for the 10 verticals identified in Figure 2. The rankings of the verticals are different in Figures 2 and 3 due to the representation of the data as a percentage in Figure 2 and an absolute value in Figure 3.

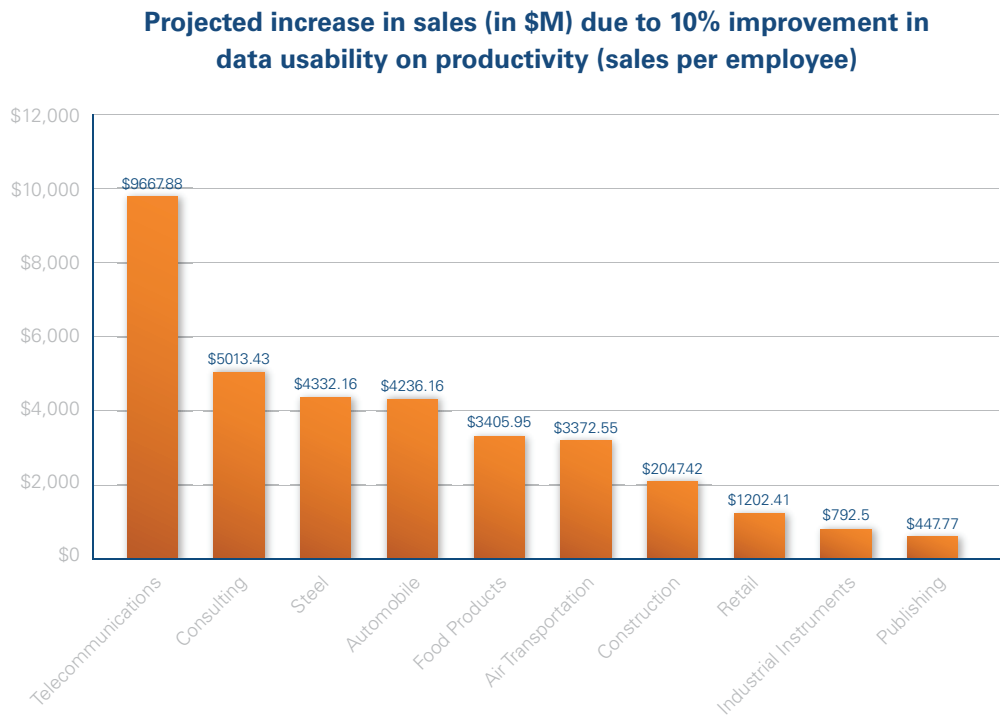

Figure 3: Average impact of data attributes on increase in sales (in millions of $)

Measuring effective data's impact on a business's ability to grow

Return on Equity (ROE), which is defined as net income / shareholder equity, and an important indicator of a business's ability to grow, is positively affected by data quality and sales mobility. As sales forces become increasingly mobile, it is imperative for competitiveness that they have high quality data and IT systems that enable rich interactions with customers. We find that for a 10% increase in both data quality and sales mobility, ROE increases by 16%. Given that the median ROE in our sample is 21%, this increase due to data attributes is extremely large and impressive. As an illustration, the median net income in our sample is $410.47 million. If we hold shareholder equity constant, a 16% increase in ROE would mean an increase of $65.67 million in net income per year.

> "We find that for a 10% increase in both data quality and sales mobility, Return on Equity (ROE) increases by 16%."

Improvements in data quality are likely to affect both top and bottom lines (and hence net income). Improvements in performance may come through better and timely decisions (which may increase customer satisfaction, loyalty and hence revenues), as well as fewer errors and rework, lower working capital requirements, faster receivables, etc. (which will lower costs). Sales mobility enables salespersons to efficiently configure customized products and add value by providing customers with relevant and timely information on all aspects of a transaction. These enabling capabilities are expected to increase the profitability of the firm.

What does it take to increase data quality and sales mobility? The average data quality was rated in our sample at 4.66, indicating significant room for improvement. For example, a rating of 5.36 would represent a 10% improvement over the average data quality in our sample. Data quality increases with reduction in errors, and improvements in scope, timeliness, and recency. Data errors are often caused by manual entry or reentry, which also results in delays in reporting. Implementation of "touchless" processes throughout the value chain simultaneously increases the accuracy and timeliness of data. Such processes also improve the recency of the data by making it more real-time. As noted earlier, scope of data refers to the level of aggregation. For example, if item-level or daily data is needed, and if only monthly data aggregated by product category level is available, the scope of the data is less than ideal for the specific context. Given that data on a large number of items may be required, even if the highest quality is available for some items, it may not be possible to simultaneously improve the quality of the entire set due to various financial, organizational and technological constraints.

"Data errors are often caused by manual entry or reentry, which also results in delays in reporting. Implementation of 'touchless' processes throughout the value chain simultaneously increases the accuracy and timeliness of data."

Sales mobility involves the ability of sales persons to use portable devices and applications to exchange information related to all aspects of a deal or transaction with a customer. At an average level of 4.63 in our sample, improvements in sales mobility can lead to handsome returns. Such mobility not only involves empowering sales persons with secure, mobile devices, but also with mobile applications that enable customized pricing, order placement, tracking and delivery capabilities. There may be high variance in sales mobility applications, which may only cater to certain types of customers and products, and which may provide only a subset of features and capabilities that salespersons need to add value to customer interactions.

Figure 3 below shows the verticals in our sample with highest impact on ROE due to 10% improvement in information quality and sales mobility. An increase of 10% in information quality and mobility yields a median[4] increase of over 200% in the return on equity for half the verticals and over 100% for the others. Thus, profitability is significantly impacted across all verticals by an improvement in information attributes.

Measuring effective data's impact on invested capital

Return on invested capital (ROIC), which is ((net income – dividends) / invested capital) and a measure of a business's efficiency of allocating capital to profitable investments, is positively affected by sales mobility. For a 10% increase in sales mobility, ROIC increases by 1.4%. As an example, the median value of ROIC is 18% in our sample, and a 10% improvement in sales mobility would enable the firm to increase its ROIC to 19.4%. Further, the median case corresponds to net income – dividends = $386 million and capital = $2.144 billion. To understand the implications of the increase in performance, if the median

[4] Given the skewness in measures of ROE, we report median estimates instead of the mean increase in ROE.

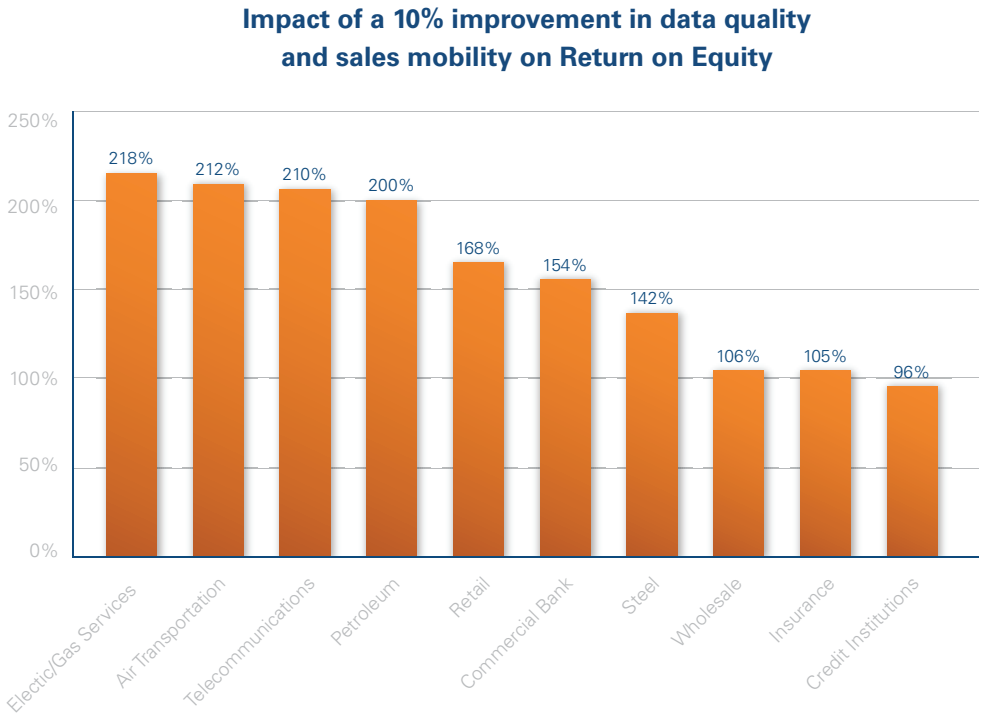

Figure 4: Median impact of data attributes on ROE

Fortune 1000 business were to increase the mobility of its sales organization's data by just 10% and the amount of capital is held constant, net income would increase by $5.4 million each year. Taking the 5-year horizon for benefits at 10% cost of capital, we have a present value of $22.52 million in additional net income. The intuition behind this finding is that sales mobility makes a firm's capital more productive by enabling salespersons conduct business with customers when, where and how the latter want it.

Measuring effective data's impact on efficient use of company assets

Return on Assets (ROA), an indicator of a company's ability to efficiently use its resources to generate income, is positively affected by intelligence and remote accessibility. For a 10% increase in both intelligence and accessibility, ROA increases by 0.7%. For example, the median ROA was 10.25%,which implies that a 10% improvement in intelligence and remote accessibility will push the median ROA to 10.95%. The corresponding net income and assets were $410.47 million and $4 billion respectively. For the sake of comparison, if we hold net income constant, the corresponding reduction in assets would be $28 million. Alternatively, if the median Fortune 1000 company in

> "If the median Fortune 1000 business were to increase the mobility of its sales organization's data by just 10% …net income would increase by $5.4 million each year."

our sample were to increase both intelligence and accessibility of data by 10%, and assets were held fixed, it would result in the equivalent of squeezing $2.87 million of additional income out of the business's assets, or a present value for a 5-year horizon of $11.97 million.

Data intelligence shows a firm how to make the best use of its assets by arming with the knowledge of what is important to customers. Such knowledge is not only critical to salespersons, but also to other functions in the value chain and span a wide range of decisions related to inventory, scheduling and production decisions. In a similar vein, remote accessibility enables access to data anytime, anywhere, and helps improve decisions in all functions.

Intelligence of data[5] can be improved through the accuracy of the prediction, trends analysis, recommendations and profile matching/associations made by the associated applications. For example, what percentage of recommendations made by a business intelligence application results in cross-selling? How much more revenue can a better recommender system bring? Similarly, what percentage of credit applicants are correctly

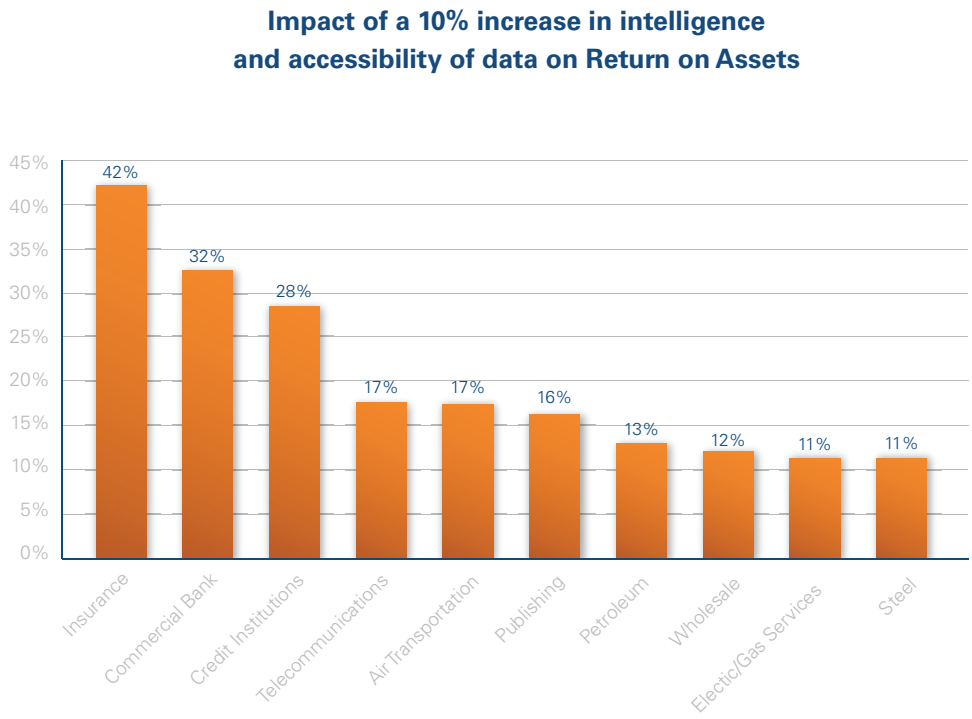

Figure 5: Mean Impact of Data Attributes on ROA

classified by a business intelligence application? At a mean value of 3.76, intelligence is the least developed data attribute in our sample, which, coupled with the above result, suggests major performance gains from investments in insights from data. As with the case of other data attributes, an IT system that helps increase intelligence may perform well with some aspects of intelligence but not others. Our analysis suggests that a holistic improvement in prediction, trends, recommendations and profile matching can lead to overall increase in data intelligence.

Remote access to data and applications is gaining in importance important to an increasingly mobile workforce. For example, service technicians without remote access to relevant data cannot perform productively, which will increase the cost of doing business and reduce customer satisfaction from delayed or poor quality service. Remote accessibility scores a healthy 5.45 for our sample relative to other data attributes, but still shows potential for significant gains from further improvements.

Figure 5 (page 11) shows the ten verticals in our sample with the highest impact on ROA due to 10% im-provement in intelligence and remote accessibility. The financial services industry reports the maximal increase in ROA for an improvement in intelligence and remote accessibility. On average, the latter results in an increase of nearly 42% in the insurance sector, 32% in commercial banks, and 28% in credit institutions. The other verticals report an average increase of between 10 and 17% in their ROA for an improvement in information attributes.

[5] Intelligence may be interpreted broadly to imply meaningful insights from data for any function in a business. In this study, for the intelligence dimension, we have mainly concentrated on the customer facing side of a business.

Conclusions

Our study based on over 150 Fortune 1000 firms shows that there are major positive financial impacts of effective data as described by our data attributes. While previous studies of "better" data focused on the fraction of firms that reported improvements in financial metrics, this study actually quantifies the effect of improving data attributes on financial ratios that are key indicators of a firm's competitiveness and profitability.

Even though our sample consisted of Fortune 1000 firms, the average values for quality, usability, intelligence, remote accessibility and sales mobility (on a 1-7 point scale) were 4.66, 4.21, 3.76, 5.45 and 4.63 respectively, which represent relatively modest values, and which suggest a lot of headroom for improvement. It should be noted that these organizations have all undergone major initiatives involving data quality and access improvements over long periods of time. Perhaps even larger gains await smaller organizations that did not have the opportunity to improve effective data due to a variety of constraints and impediments. The cost of increasing effective data is relatively minor compared to the resulting substantial returns.

Appendix: Methodology and Analysis

The methodology of the study involved three steps – (i) Operationalization of data attributes, survey design and testing, (ii) data collection, and (iii) analysis.

A.1 Operationalization of data attributes

To test the conceptual model, we operationalized the data attributes into a measurable form by developing a questionnaire based on an extensive review of the academic and business press literature. Respondents would be asked a series of questions related to the above dimensions of data and asked to rate data attributes on a 7-point scale, where an increase of 1 point represents a 14.28% increase in the perceived level of a data attribute. The survey also collected information on certain customer and operational efficiency related performance measures.

A.2 Data collection

Our objective was to collect data from a variety of industries and functions. The questionnaire was tested for clarity and face validity and refined with the help of inputs from Fortune 1000 employees in functions who need accurate and timely information to make decisions or take actions (e.g., sales, forecasting, etc.). The final survey instrument was completed by over 150 respondents from Fortune 1000 firms. Not all questions were answered by all respondents, and hence in some parts of the analysis, the number of data points drops to about 100. Financial and some operational performance data on the firms represented by the survey respondents was collected from archived sources.

A.3 Analysis

The empirical analysis involved two steps: Factor analysis to determine distinct attributes of data, and multiple regression analysis to test the relationships between data attributes, controls and performance measures.

Initially four attributes of data were considered: Quality, intelligence, usability, and mobility. We broadly defined mobility to include all aspects of work away from the stationary desktop. However, our empirical analysis revealed the emergence of two distinct factors, one involving the ability to access data from outside office premises and run applications remotely, and the other dealing with the ability of salespersons to interact with customers regarding price quotes, order processing and delivery through portable systems. Since the first factor is not specific to a function, we labeled it as remote accessibility, and since the second factor is specific to the sales function, we described it as sales mobility.

Once the factors for data attributes were obtained, regression techniques were used (along with well-established methodologies for statistical rigor to address common problems such as heteroskedasticity and multicollinearity) to establish relationships between data attributes, control variables and performance measures.

A.4 A note on controls

Industry and competitive factors serve as controls in our analysis. The relationship between data attributes and performance may depend on the type of industry and the competitive forces that shape dynamics within an industry. For example, in a highly competitive industry or sector, where every firm may already be operating with high values of data attributes, the effect of better data on performance may be smaller than in a sector where there is a lack of general awareness of the role of data quality. In a similar vein, some verticals may have higher average performance measures such as sales per employee or return on equity (e.g., if asset requirements are low). Hence controlling for industry effects allow us to compare the impacts of data attributes on various performance measures.

The Research Team

Dr. Anitesh Barua

Anitesh Barua is the William F. Wright Centennial Professor of Information Technology, Stevens Piper Foundation Professor, Distinguished Teaching Professor, Director of the MBA Information Management program, and Associate Director of the Center for Research in Electronic Commerce at the McCombs School of Business, the University of Texas at Austin. He received his Ph.D from Carnegie Mellon University. Dr. Barua's research has been sponsored by the National Science Foundation, Cisco Systems, Dell Inc., Ernst & Young, IBM Research, Intel Corporation and Sprint. 75 of his research articles have appeared (or are forthcoming) in academic journals, refereed conference proceedings and edited book chapters. He serves as a Senior Editor at Information Systems Research.

Dr. Barua's research on electronic commerce (sponsored by Cisco Systems), and e-business value assessment (sponsored by Dell Inc.) have been featured in the Associated Press, Atlanta Journal – Constitution, BBC, Bloomberg, BusinessWeek, Chicago Tribune, CNNfn, Fortune, Industry Standard, Investor's Business Daily, Knight Ridder/Tribune Business News, LA Times, National Public Radio, Philadelphia Daily News, Reuters, San Francisco Chronicle, San Jose Mercury News, Seattle Times, USA Today, Washington Post, and the Wall Street Journal.

Dr. Barua has appeared on multiple occasions as an electronic commerce expert on television and radio programs including CNN, CNBC, and Jim Lehrer News Hour. He has appeared as an expert witness before the House Ways and Means Committee, and has briefed the staff of the Joint Economic Committee on issues in electronic commerce.

Contact information: anitesh.barua@mccombs.utexas.edu

Dr. Deepa Mani

Dr. Deepa Mani is an Assistant Professor at the Indian School of Business. Her research interests are at the intersection of technology, organization and firm value, including the nature of technological advances, the organizational capabilities created and management interventions required of these advances, and the ultimate impact of these emergent organizational capabilities on firm performance. Her papers have been published or are forthcoming in leading journals such as MIS Quarterly, Information Systems Research and Sloan Management Review.

Contact Information:
Deepa Mani, Indian School of Business, Hyderabad 500032, India.
Email: Deepa_Mani@isb.edu

Rajiv Mukherjee

Rajiv Mukherjee is a doctoral student in the Information, Risk and Operations Management (IROM) department in the McCombs School of Business at the University of Texas at Austin. His research interests involve the intersection of information economics, game theory and pattern recognition. His industry experience includes media technologies and authentication systems.

Contact Information:
Rajiv Mukherjee, IROM department, McCombs School of Business, CBA 5.202. University of Texas at Austin.
Email: rajiv.mukherjee@phd.mccombs.utexas.edu.

About the Center for Research in Electronic Commerce at the McCombs School of Business, The University of Texas at Austin

The Center for Research in Electronic Commerce (CREC) at the McCombs School of Business is recognized today as a thought leader in Information Systems research. The Center's vision is to assure that electronic commerce processes and applications achieve their efficient outcomes promised for the digital age. That vision is implemented through interdisciplinary research focused on identifying structures, processes and technologies that increase business productivity, consumer satisfaction, market efficiency, society's welfare and the effectiveness of government policies. The Center's research covers a broad range of topics that are pertinent to contemporary businesses including, but not limited to, business value of IT, social media and viral marketing, online search and advertising, online auctions, and other innovations in digital processes and products. Faculty and researchers from diverse disciplines including computer science, economics, information systems, marketing and statistics work together to advance the Center's research agenda.

About the Indian School of Business

The Indian School of Business (ISB) was ranked # 12 in the global B-school rankings released by the Financial Times, London, in 2010. This is the third successive year that the ISB has featured among the top 20, in the list of top 100 B-schools in the world. Previously, ISB was ranked 15th in 2009 and 20th in 2008 by the Financial Times.

About Sybase

Sybase, an SAP company, is an industry leader in delivering enterprise and mobile software to manage, analyze and mobilize information. We are recognized globally as a performance leader, proven in the most data-intensive industries and across all major systems, networks and devices. Our information management, analytics and enterprise mobility solutions have powered the world's most mission-critical systems in financial services, telecommunications, manufacturing and government. For more information: www.sybase.com. Read Sybase blogs: blogs.sybase.com. Follow us on Twitter at @Sybase.

[i] A "touchless" business process is one where data items are captured automatically and where there is no manual reentry of the same data items in the value chain.