

Impacts of Effective Data on Business Innovation and Growth

Chapter Two of a Three-Part Study

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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, definitively 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 series of reports, we 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 improvement¹. 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.

Impacts of Effective Data on Business Innovation and Growth: Summary

While our first report on this study established a strong linkage between effective data and the financial performance of a company, this report complements those results in demonstrating some of the ways that financial performance can be achieved: superior innovation and growth.

Business attributable to new products and services and new customers are critical indicators of the competitiveness of a firm. Revenue due to new products and services is an indicator of a firm's innovativeness, while revenue from new customers shows the ability of a firm to grow its market penetration and customer base. In a comprehensive study of more than 150 Fortune 1000 firms from every major vertical, we found that an improvement in two of five attributes of data attributes used in our study – intelligence and accessibility – can have a dramatic impact on a firm's ability to innovate and grow:

Business innovation can be considerably impacted by effective data. An increase of 10% in both the accessibility and intelligence of data within a business will lead to .81% increase in revenue due to new products, or \$17 million in revenue from new products annually based on the median revenue of Fortune 1000 firms in the study. Innovation can vary widely between verticals however, as some industries can see more than eight times that impact (\$150+ million annually from new products).

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Business growth can also be positively impacted by effective data. An increase of 10% in both the accessibility and intelligence of business data will lead to .7% increase in revenue due to new customers, or \$14.7 million based on the median firm in our sample. Similar to innovation, results can vary widely between verticals with many industries averaging at least \$50 million in new customer revenue annually as a result of improving data's effectiveness.

The results show that while major investments have already been made to improve data quality, there is still a lot of headroom to improve the innovativeness and growth potential of an enterprise through further improvements in data attributes.

The Conceptual Model

Figure 1 below posits that attributes of data have a positive effect on three customer oriented performance metrics: Revenue due to new products/services, revenue due to new customers, and specialty products and services.

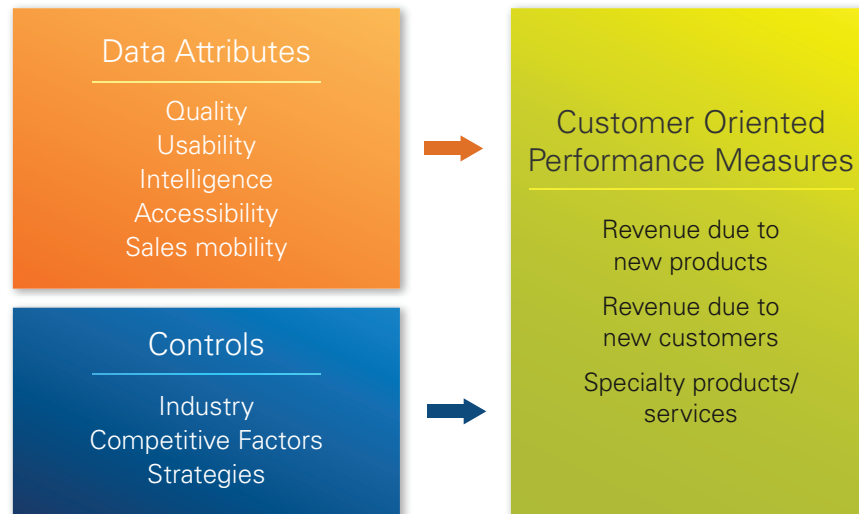


Figure 1: Customer-oriented impacts of data attributes

Each of these criteria is discussed further below.

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

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 Customer-oriented performance measures

Revenue due to new products and services

According to Mark Deck, lead director of product development practice at PRTM, a management consulting firm from Waltham, MA, revenue from new products is a “fundamental measure of organic growth. It’s also a measure of renewal and innovation, and relates to market leadership.” Indeed, in a hyper-competitive

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business environment, continuous product innovation is often considered a key, strategic weapon for remaining profitable. Better data may have a positive impact on this measure of performance in a variety of ways. Increased data accessibility enables different groups in an organization, such as new product development, to obtain data from functions like sales and services, which provide important information on customer preferences and demand

patterns. Along similar lines, business intelligence applications can reveal unique patterns and relationships in various types of customer and operational data, which can provide insights critical for the creation and marketing of new products and services.

² <http://www.highbeam.com/doc/1G1-118597468.html>

Specialty products and services

One of the major outcomes of the proliferation of the Internet is the “long tail”³, which implies that products and services outside the dominant mainstream will be offered through both online and offline channels, and which will contribute significantly to a firm’s revenues. While a particular specialty, unique, or hard-to-find product may be sold in small quantities, collectively such products may make up a significant chunk of a firm’s revenues. Specialty products and services are therefore likely to be increasingly important to a firm’s product mix, and will lead to increased business from both existing and new customers.

Revenue due to new customers

Unless a firm is lucky to have locked in a large customer base with high switching costs, new customers are essential for the growth and sustainability of a firm operating in a dynamic, competitive environment. Data attributes such as intelligence and sales mobility are likely to contribute to revenue from new customers through remote access to relevant data, trends and profiles that enable a firm to attract new customers and also to increase the amount of business with such customers.

“New customers are essential for the growth and sustainability of a firm operating in a dynamic, competitive environment.”

The above discussion does not suggest that sales due to new customers and new products are independent phenomena. In addition to existing customers purchasing new products and services, new customers also buy new products and services, implying that they may be attracted by new offerings. Such new customers may also buy existing products and services, further boosting sales⁴.

³“The Long Tail: Why the Future of Business Is Selling Less of More” by Chris Anderson

⁴ <http://ezinearticles.com/?Increase-Business-Revenue-With-an-Innovation-Strategy&cid=4146281>

The Main Results

The customer-oriented measures described above are widely held as a solid basis for measuring innovation and growth between businesses. We tested if better data attributes lead to superior customer-oriented performance.

Measuring effective data's impact on business innovation

Revenue due to a company's ability to innovate new products and services increases with data accessibility and specialty products and services, which, in turn, is positively affected by data intelligence. Improving accessibility of data so that more authorized employees can make use of information remotely, and improving intelligence of data to better spot trends, demand patterns, improve recommendations for decision-making, and profile match, can impact a business's ability to innovate. An increase of 10% in both the accessibility and intelligence of data within a business will lead to .81% increase in revenue due to new products. The median revenue of Fortune 1000 firms in our sample is \$16.82 billion, while the revenue due to new products for this median firm is \$2.10 billion. If we increase data accessibility and intelligence by 10%, the corresponding annual increase in revenue from new products and services will be approximately \$17 million. If a project involving improvement in data attributes has a 5-year horizon for benefits, the present value of \$17 million in revenue for 5 years at 10% discount rate is \$64.44 million.

The chart below in Figure 2 shows ten verticals in our sample with the highest impact on revenue from new products due to a 10% improvement in data accessibility and intelligence. The first interesting

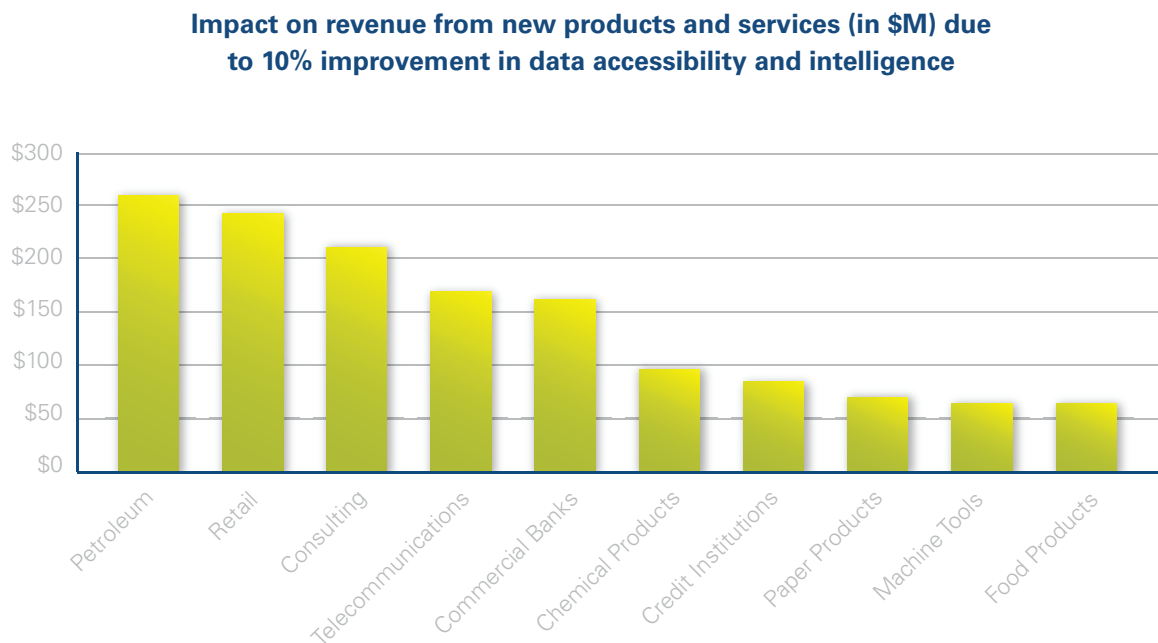


Figure 2: Impact of increasing data attributes on revenue due to new products/services

observation is the large impact in the “top 10” list relative to the median impact (which itself is quite large). Business in vertical industries such as petroleum, retail, consulting, telecom, and commercial banking see dramatic impacts on their ability to innovate when effectiveness of data is slightly improved, at least eight times more than the median business in our study, and as much as 14 times more, equivalent to \$255 million in additional revenue from new products and services annually. Another important fact is that while IT-savvy verticals like retail, financial services, and consulting are a part of the “top 10” list, diverse verticals such as petroleum, machine tools, and chemical and paper products also show a high impact of improving data attributes.

Beyond driving revenue from new products and services, the ability of a company to innovate with specialty products and services that serve important niches is also impacted by effective data. The share of specialty product and services in the product/service mix is positively affected by intelligence. An increase in 10% in intelligence will lead to 1.51% increase in offerings of specialty products and services. As noted above, specialty products and services are a key factor in both the development of new products and generation of new customers, lending support to the “long tail” hypothesis.

“An increase in 10% in intelligence will lead to 1.51% increase in offerings of specialty products and services.”

Measuring effective data’s impact on business growth

As with revenue due to new products, revenue due to new customers increases with data accessibility and specialty products and services. An increase of 10% in both the accessibility and intelligence of business data will lead to .7% increase in revenue due to new customers. For the median firm in our sample, this translates into \$14.7 million additional revenue due to new customers. Thus for a 5-year horizon at 10% discount rate, the median firm will enjoy a present value of \$56 million from increased revenue due to new customers.

“An increase of 10% in both the accessibility and intelligence of business data will lead to .7% increase in revenue due to new customers, which translates into \$14.7 million additional revenue.”

Figure 3 (page 9) shows the ten verticals with the highest increase in revenue from new customers due to data attribute improvement. As in the case of new products, we again observe the presence of a range of verticals, which is indicative of the widespread impact of data attributes on this performance measure.

Impact on revenue from new customers (in \$M) due to 10% improvement in data accessibility and intelligence

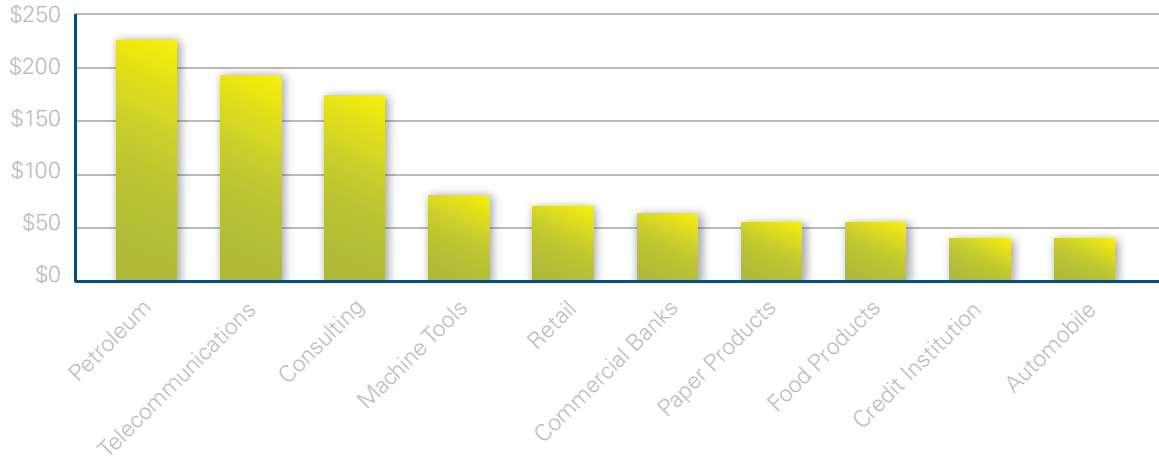


Figure 3: Impact of increasing data attributes on revenue due to new customers

Earlier we noted that both existing and new customers may buy new products and services, while new customers may buy both existing and new products. Thus the increase in revenue due to new products and services may be attributed to both existing and new customers, while revenue from new customers can be attributed to both existing and new products, as shown in Figure 4 below:

	Existing Products/Services	New Products/Services	Increase in revenue due to new customers after 10%
Existing Customers	Not relevant to our study	Existing customers buy new products/services	Not applicable to our study
New Customers	New customers buy existing products/services	New customers buy new products/services	\$14.6 million annually or \$56 million present value over 5 years
Increase in revenue due to new products after 10% increase in data attributes	Not applicable to our study	\$17 million annually or \$64.44 million present value over 5 years	

Figure 4: Median increase in revenue due to new products/services and new customers

Conclusions

Revenue due to new products and services, new customers, and the presence of specialty products in the mix indicate the ability of a business to innovate and grow in an increasingly competitive environment. Our study demonstrates that increasing effective data has a large positive impact on these performance measures. Our first report on financial metrics established a strong linkage between data attributes and financial performance. This report complements those results by showing that one of the ways in which effective data may affect financial performance is through superior innovation and growth. Our third and final report on this study will focus on operational measures and demonstrate that superior financial performance from better data is also attributable to a corresponding improvement in operational performance.

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

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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.

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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.

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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.

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