

Measuring the Internet Economy

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Please Note:

With a tight deadline, we only compiled aggregate numbers for the Internet economy for the June 10, 1999, release. We are still analyzing details, and are also in the process of preparing a longer report.

We hope to have the detailed report posted on both [<http://www.InternetIndicators.com>](http://www.InternetIndicators.com) and [<http://crec.bus.utexas.edu>](http://crec.bus.utexas.edu) by the end of July or early August. When available, contents will be automatically updated with the same file name. Thank you very much for your interest in our study.

Measuring the Internet Economy: An Exploratory Study

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1. Measuring the Internet Economy: Motivation and Challenges

Rapid advances in Internet technologies and the subsequent proliferation of economic activity on the Internet have ushered in an information age where virtually every organization is trying to position itself to take advantage of this new phenomenon. These economic developments involving the use of the Internet as an important business driver are collectively being referred to as the digital or the Internet economy.

The Internet Economy is also compared today to the Industrial Revolution in potential scope and size. While the physical aspects of any economy are still based on raw materials like steel, oil and gas, the Internet Economy is fundamentally different. This new economy relies on high-speed networks based on the Internet Protocol (IP), Internet applications, new marketing and business tools, and electronic intermediaries to increase the efficiency of Internet-driven markets.

In spite of the excitement and optimism surrounding the Internet Economy, few comprehensive efforts have successfully measured the economic growth and jobs created by this emerging economy. Estimates of the dollar volume of Web-based business are often based on the consideration of fifty or one hundred pure Internet-based companies, and can seriously underestimate the size of Internet based transactions. Further, electronic transactions are only one component of the Internet Economy, which should also include infrastructure related activities. A foundation for metrics and measurement is the key to understanding and analyzing issues involving this Internet Economy. For example, what business sectors, products and services should be included in this Internet Economy? What methodologies are appropriate for measuring activities in this new world? How large is this Internet Economy? How fast is it growing?

The **Internet Economy Indicators**, developed at the Center for Research on Electronic Commerce at the Graduate School of Business, the University of Texas at Austin, and sponsored by Cisco Systems, seek to fill this void by providing a foundation for conceptualizing and measuring the various components of the Internet Economy. These indicators – the **Internet Economy Revenues Indicator** and the **Internet Economy Jobs Indicator** – are built on an analysis of four layers of the Internet Economy. In contrast to previous electronic commerce studies that focused on Web-based transactions, these Internet Economy Indicators are based on the premise that the level of Internet commerce activity hinges on the underlying Internet infrastructure and applications, as well as on the presence of electronic intermediaries to facilitate interactions between buyers and sellers. Accordingly, the Internet Economy Indicators divide the Internet Economy into four distinct but related layers: Internet infrastructure, Internet applications, Internet intermediaries and Internet-based transactions.

2. The Four Layers of the Internet Economy

From a conceptual standpoint, the Internet Economy can be divided into four layers. Each Layer is listed below with descriptions of the types of companies and names of some of the actual companies in each category.

Layer One: The Internet Infrastructure Layer

This layer includes companies with products and services that help create an IP based network infrastructure, a prerequisite for electronic commerce. The categories in this infrastructure layer include:

- Internet backbone providers (e.g., Qwest, MCI Worldcom)
- Internet service providers (e.g., Mindspring, AOL, Earthlink)
- Networking hardware and software companies (e.g., Cisco, Lucent, 3Com)
- PC and Server manufacturers (e.g., Dell, Compaq, HP)
- Security vendors (e.g., Axent, Checkpoint, Network Associates)
- Fiber optics makers (e.g., Corning)
- Line acceleration hardware manufacturers (e.g., Ciena, Tellabs, Pairgain)

Layer Two: The Internet Applications Layer

Products and services in this layer build upon the above IP network infrastructure and make it technologically feasible to perform business activities online. The categories in this applications layer include:

- Internet consultants (e.g., USWeb/CKS, Scient, etc)
- Internet commerce applications (e.g., Netscape, Microsoft, Sun, IBM)
- Multimedia applications (e.g., RealNetworks, Macromedia)
- Web development software (e.g., Adobe, NetObjects, Allaire, Vignette)
- Search engine software (e.g., Inktomi, Verity)
- Online training (e.g., Sylvan Prometric, Assymetrix)
- Web-enabled databases (e.g., Oracle, IBM DB2, Microsoft SQL Server, etc; only Internet/intranet related revenues are counted)

Layer Three: The Internet Intermediary Layer

Internet intermediaries increase the efficiency of electronic markets by facilitating the meeting and interaction of buyers and sellers over the Internet. They act as catalysts in the process through which investments in the infrastructure and applications layers are transformed into business transactions. The categories in this intermediary layer include:

- Market makers in vertical industries (e.g., VerticalNet, PCOrder)
- Online travel agents (e.g., TravelWeb.com, 1Travel.com)
- Online brokerages (e.g., E*Trade, Schwab.com, DLJDirect)
- Content aggregators (e.g., Cnet, ZDnet, Broadcast.com)
- Portals/Content providers (e.g., Yahoo, Excite, Geocities)
- Internet ad brokers (e.g., Doubleclick, 24/7 Media)
- Online advertising (e.g., Yahoo, ESPNsportszone)

Layer Four: The Internet Commerce Layer

Internet commerce involves the sales of products and services to consumers or businesses over the Internet. The categories in this Internet commerce layer include:

E-tailers (e.g., Amazon.com, eToys.com)
Manufacturers selling online (e.g., Cisco, Dell, IBM)
Fee/Subscription-based companies (e.g., thestreet.com, WSJ.com)
Airlines selling online tickets
Online entertainment and professional services

It is important to note that many companies operate at multiple layers. For instance, Microsoft and IBM are important players at the Internet infrastructure, applications, and Internet commerce layers, while AOL (before the acquisition of Netscape) is a key player in the infrastructure, intermediary and commerce layers. Similarly Cisco and Dell are important players at both the infrastructure and commerce layers. Even though the four-layer Internet Economy framework makes it difficult to separate revenues for multi-layer players, the framework presents a more realistic and insightful view of the Internet Economy than a monolithic conceptualization that does not distinguish between different types of activities. Further, the multi-layered approach lets us analyze how companies choose to enter one Internet layer, choosing later to extend their activities to the other layers.

3. Data Collection and Research Assumptions

One of the biggest challenges in a study of this magnitude and complexity involves the definition and enumeration of the universe of players in the Internet Economy. Multiple secondary sources were used to compile a master list of players at the Internet infrastructure and applications layers. For the intermediary and commerce layers, we used a database of all secure sites in the U.S. under the assumption that products or services sold directly over the Internet will involve secure communication. Telephone interviews were conducted with a sample of 2,830 companies from this four-layer universe, and over 100 in-depth interviews were conducted with the largest companies in the Internet Economy. In addition, we analyzed company annual reports, product literature and web sites for about 300 of the largest companies to develop a better understanding of how they fit into one or more of the four layers. In sum, in-depth research (either primary and/or secondary) was conducted on over 3,000 companies that participate in one or more of the four layers of the Internet economy.

Primary data collection from 2830 companies was conducted by MarketVision Research of Cincinnati, OH, which specializes in econometrics based market research. Industry research consultants conducted interviews with over 100 large companies.

The following conventions and assumptions were used for compiling the primary data:

- Companies studied were U.S.-based and generated all or part of their revenues from Internet or IP products and/or services.
- The scope of the research was limited to companies who had revenues associated directly with the Internet. The study did not include second or higher order impacts of the Internet Economy (e.g., an accounting firm generating revenues from pure Internet based companies).

- Revenues and jobs were based on worldwide estimates of U.S.-based companies.
- Revenues were calculated based upon companies' estimates of the percentage of their revenues that were Internet-related. For the largest 300 companies, we analyzed products and services and categorized them into one or more of the four layers and estimated revenues for each layer using phone interviews, annual reports, and other secondary data sources.
- Since most "bricks-and-mortar" companies were unable to estimate the percent of their total employees associated with Internet-related revenues, Internet Economy jobs for bricks-and-mortar companies were attributed using the ratio of Internet revenues to total revenues. At a first glance, this may appear to overestimate the number of jobs based on the intuition that an online business should be able to operate with fewer employees than its bricks-and-mortar counterpart. While such a conjecture may be true in the long run, it is unlikely to hold in the initial phases of a bricks-and-mortar company's foray into the online world.

For example, the online subsidiary of Barnes and Noble had \$61.8 million revenues and 654 employees in 1998 (according to www.hoovers.com). The corresponding figures for Barnes and Noble were \$3005.6 million and 29,500. The ratio of the online revenues to total revenues is .0199, while that of online employees to total employees is .021. The numbers are not only surprisingly close, but also suggest that the ratio of online to total employees is in fact slightly higher than that of online to total revenues. As a second example, consider eToys.com and Toys "R" Us. eToys, which started in 1996 as a pure Internet operation, had \$30 million revenues and 306 employees in 1998 according to www.hoovers.com. Toys "R" Us had total revenues of \$11,170 million and 117,392 employees in 1998. The ratio of eToys' revenues to the sum of revenues of eToys and Toys "R" Us is .0026, which is nearly identical to corresponding employee ratio.

We did the same calculation with several other online and bricks-and-mortar companies selling similar products or services, and found the assumption to be strongly supported. However, as electronic businesses mature over time, this approach to attributing jobs will prove to be risky and inaccurate. This calls for more elaborate research design to collect online employee data from bricks-and-mortar operations. For instance, it may be useful to categorize employees into online technology support, customer service, marketing, logistics, etc., and then contact appropriate personnel in bricks-and-mortar companies for such information.

4. The Internet Economy Estimates

Based on the data and the enumerated universe, the Internet Economy generated an estimated \$301.4 billion U.S. dollars in total revenue in 1998, and was responsible for 1.203 million jobs as of 1998. Worldwide sales of Internet-related products and services by U.S. based companies were considered in this measurement. The component indicators at each layer are shown in Table 1 below. The overall indicators were obtained by adding the corresponding indicators for the four layers, and then adjusting for double-counting across the layers.

	Estimated Internet Revenues	Attributed Internet Jobs
Internet Infrastructure Layer	\$114,982.8 M	372,462
Internet Applications Layer	\$56,277.6 M	230,629
Internet Intermediary Layer	\$58,240 M	252,473
Internet Commerce Layer	\$101,893.2 M	481,990
The Internet Economy Indicators	\$301,393 M	1,203,799

Table 1: Estimated revenues and attributed jobs for the four Internet Economy layers

The way in which Internet revenues and jobs are reported and how companies estimate them complicate the task of adding numbers across the four layers. A simple aggregation of the four layers yields \$331.39 billion in revenues and 1,337,554 jobs. Pragmatically estimating the double-counting of revenues between the Internet commerce layer and other layers to be between \$23.3 and \$31 billion, we found the total Internet Economy revenues to be \$301.4 billion. Similarly, we have revised downward the jobs figure to reflect the double-counting across the four layers.

It should be noted that the infrastructure and application layers reflect combined investments in the Internet, intranets and extranets. In other words, these two layers represent the revenues associated with the IP infrastructure and applications. The intermediary and commerce layers only capture Internet-based business activities. Extranet based business-to-business transactions are likely to become significant in the near future as more of the traditional EDI based transactions are moved over to extranets. However, given that less than 10% of companies were estimated to have intranets in 1998, the volume of extranet based business was likely to be relatively small.

5. Key Findings and Implications

5.1 Internet Commerce is much bigger today than any previous estimates

The Internet commerce layer revenue of \$101.89 billion is much larger than previously reported figures. This larger revenue estimate is attributable to the comprehensive nature of the universe of companies identified for this layer. For example, the universe of U.S. companies in this layer

consisted of close to 11,000 players, which is in sharp contrast to the top 50 or 100 companies often considered in Web-revenue measurement studies. In fact, our study suggests that the often-cited top 80 players at the Internet commerce layer contributed only a third of the layer's revenues. Sampling from a comprehensive database of secure sites enabled us to discover significant online activity across a variety of business sectors that have not received much attention in prior studies.

5.2 The Internet Economy is growing at an astounding rate.

As shown in Table 2, the U.S. Internet Economy revenues grew at an estimated compounded average growth rate (CAGR) of 174.5% from 1995 to 1998, compared to the overall world-wide average economic growth rate (which includes the U.S. Internet Economy) of 3.8% in the same period (see table below). While a direct comparison between worldwide GDP and the Internet Economy Revenue Indicators is unwarranted due to differences in what the measures stand for, it is evident that the Internet Economy is growing at an astounding rate. The 174.5% figure is highly sensitive to the initial figure of \$5.3 billion for 1995 estimated by Zona Research. However, it should be evident that in 1995, the Internet Economy was primarily made up of a small fraction of today's infrastructure layer.

A more convincing comparison underscoring the rapid growth in the Internet Economy involves a comparison with GDP growth in the U.S. economy. The U.S. GDP grew at a CAGR of 2.8% from \$6762 billion in 1995 to \$7552 in 1998. Admittedly much of this unparalleled initial growth in the Internet Economy could be attributed to a large substitution effect whereby economic activities conducted in the physical or non-Internet world are now being transferred to the Internet and IP-based networks.

WW Gross domestic product at purchasing power parity exchange rates

	95	96	97	98	99	CAGR to 98
GDP in \$ Billions	33,646	35,714	37,870	39,103	40,714	3.8%
Internet Economy in \$ Billions	5.3*			301**		174.5%
US Gross domestic product in \$ Billions	6,762	6,995	7,270	7,552	7,798	2.8%
US % of WW GDP	23%	24%	25%	26%	26%	

Table 2: Relative growth in GDP and Internet Economy revenues

Source: International Monetary Fund, *Zona Research, **The University of Texas at Austin

5.3 The Internet Economy already rivals century-old industries

In just five years (since the introduction of the World Wide Web), the Internet Economy already rivals century-old sectors like energy (\$223 billion), automobiles (\$350 billion), and telecommunications (\$270 billion) in size.

5.4 The Internet Economy has had a major impact on jobs and responsibilities

With 1.203 million Internet/IP-based jobs, the Internet Economy is reshaping the job market. Many of these jobs (e.g., Web design and development, Internet consulting) did not exist prior to 1994/1995, and companies have also re-designed existing jobs to meet the challenges and opportunities of the Internet Economy. An estimated 5.9 million Americans work in the broadly defined high-tech field, of which 20% were associated with the Internet Economy as of 1998. As pure Internet players flourish and as traditional businesses become more dependent on Internet related technologies for their daily business operations, new jobs will continue to be created and existing jobs will continue to be reshaped in the new economy.

5.5 Infrastructure and applications players make up over half of the Internet economy

Revenues of the Internet infrastructure and applications layers totaled \$171 billion, while the intermediary and Internet commerce layers contributed \$160 billion. This shows the nascent state of the Internet Economy, and suggests the need to foster rapid growth at the intermediary and commerce layers. As economic activity in virtually every business sector shifts to the Internet or IP based networks, the intermediary and commerce layers should ultimately turn out to be much larger than the infrastructure and applications layers. Of course, the infrastructure and applications layers are also likely to experience dramatic growth as the Internet keeps expanding globally and as companies commit themselves to building intranets and extranets. Given that less than 10% of companies had an intranet in 1998, there is ample room for sustained growth in the infrastructure and applications layers.

5.6 Internet intermediaries are critical to Internet Economy growth

While it is intuitive to think of “disintermediation” in an electronic world, this study provides evidence that Internet intermediaries are already playing an important role in shaping the Internet Economy. These intermediaries generated and estimated \$58 billion in 1998, nearly a third of the total revenues for Internet Commerce and intermediary based transactions. It is also important to note that only commissions (which typically account for less than 10% of the value of a transaction) were counted as revenues for intermediaries like online travel agents and auction houses. In other words, the total business associated with intermediaries was actually larger than the \$58 billion figure reported in Table 1.

7. Conclusions

Based on a broad conceptualization of the components that make up the Internet Economy, our empirical research yielded figures that exceed all prior estimates. Perhaps more importantly, this study clearly designates the roles and the relative magnitudes of four distinct but related layers of this Internet economy.

The first two layers (infrastructure and applications) provide the foundation for the conduct of Internet commerce, and accounted for more than half of the total revenues associated with the

digital economy. Estimated at \$58 billion, the third intermediary layer also is a significant contributor to the Internet economy, lending empirical support to the notion that electronic intermediaries or Internet middlemen will be crucial to the success of electronic commerce.

The fourth Internet commerce layer turned out to be much larger than previously reported estimates. The relatively large figure (\$101.89 billion) is attributable to the comprehensive nature of the universe (secure Web sites in the U.S.) from which the sample for this layer was drawn.

While any study of this complexity must rely on strong assumptions and the accuracy of responses from companies participating in the study, the above figures are based on in-depth research and interviews with more than 3,000 organizations, extensive analyses of financial statements, products and service descriptions as well as multiple secondary sources. To the best of our knowledge, this is the most elaborate study to date, measuring the size of the emerging Internet Economy, and should serve as a promising starting point for even more comprehensive and detailed measurements.