

Information Technology Sector Report

Technology Roadmap Project



For the

CENTER FOR ECONOMIC GROWTH

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INFORMATION TECHNOLOGY

Introduction

The Information Technology (IT) industry can be broadly segmented into hardware, software and services sub-sectors. The hardware sub-sector encompasses the manufacturing and distribution of computer and telecommunications equipment. The software sector encompasses a wide array of software products including systems software, infrastructure software, application software and software that power a host of end user devices such as cell phones, PDAs and other wireless devices. The IT services sector includes a variety of processing services including data processing and hosting services, IT-enabled process outsourcing and applications development, IT implementation and professional services and telecommunication services.

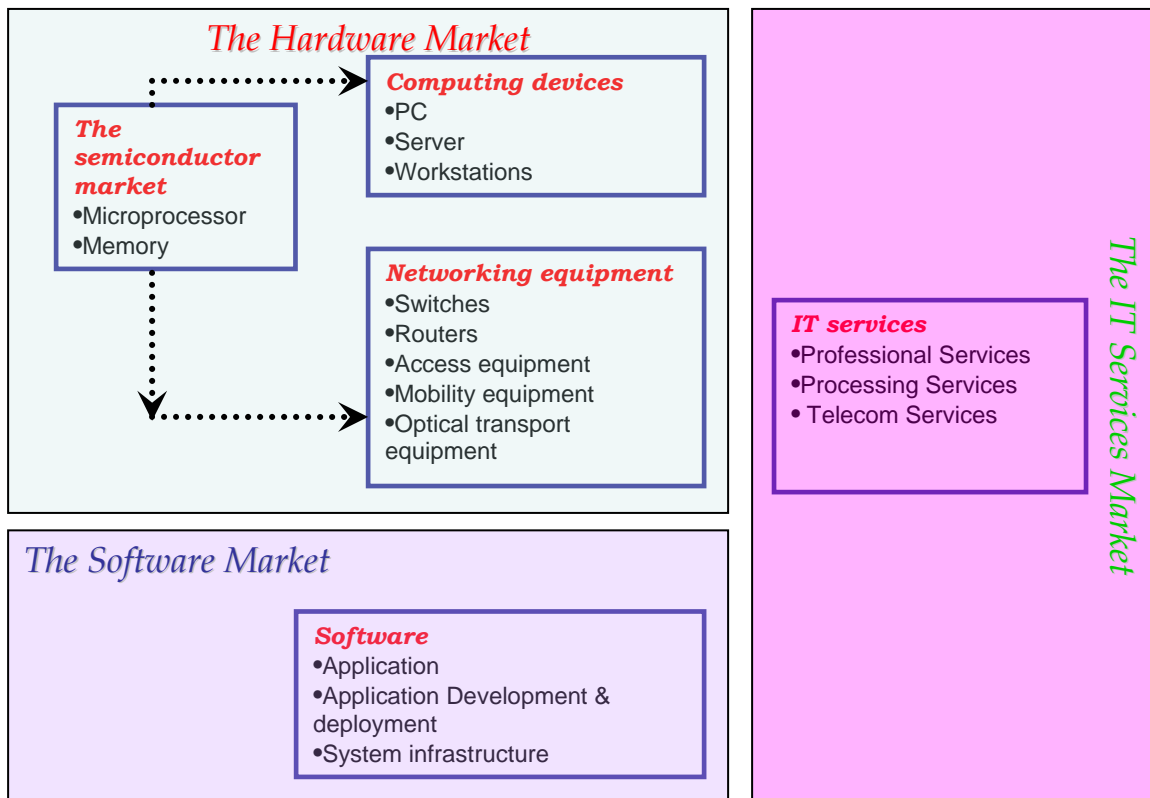


Figure 1: The IT Industry Value Web

The IT industry, which has witnessed rapid growth and change in the past, continues to exhibit the dynamism expected of this industry. The demand for IT products and services is primarily influenced by two factors: 1) corporate spending on information technology products and services and, 2) consumer spending on information technology, communication products and services and consumer electronics. During the recent economic downturn the IT sector witnessed a significant negative growth largely because of a slowdown in both corporate IT outlays and in consumer spending. As of 2004, the IT sector is again showing moderate growth.

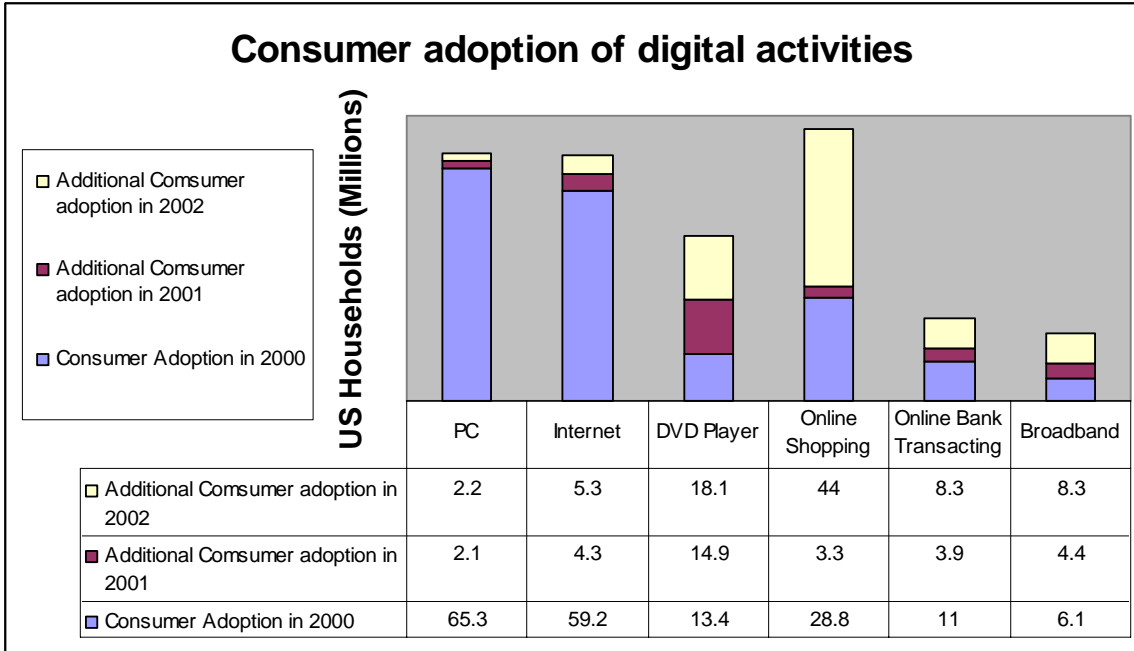


Figure 2: Consumer adoption of digital activities.
 Source: Forrester Brief Highlight: Consumer Tech Adoption Forecast; June 24, 2002

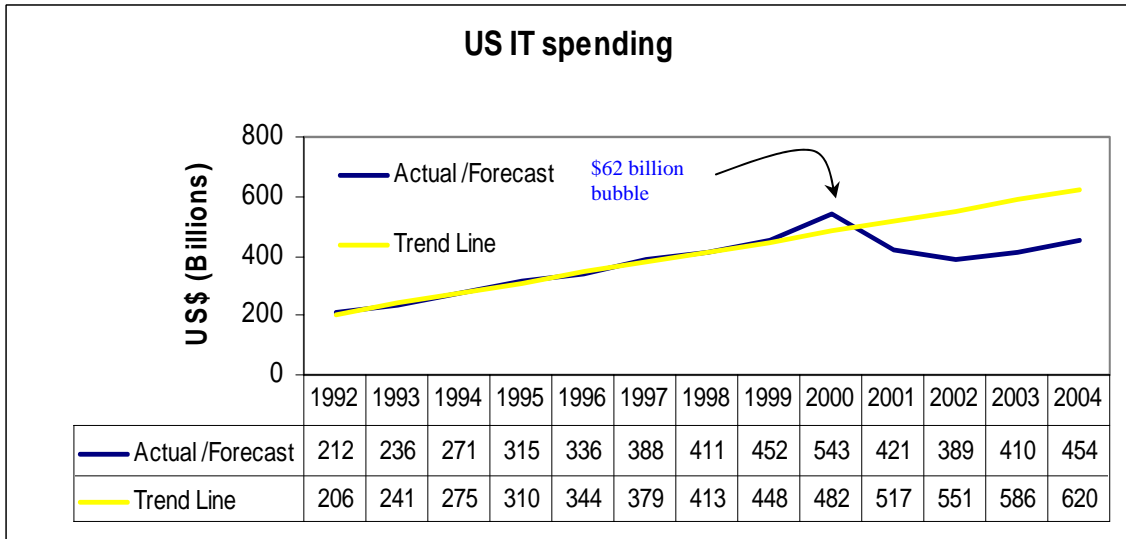


Figure 3: US spending on IT
 Source: Forrester Brief Highlight; June 24, 2002

1. IT segments and sub sectors

1.1 Hardware

This sector includes the manufacturers of workstations, servers, mainframe computers, the semiconductor industry including microprocessor and other chip manufacturers, networking infrastructure technologies such as routers, switches, storage devices, peripherals such as printers, display devices and a variety of gadgets such as PDAs, pagers and cell phones. The

convergence of computing and communications has broadened the scope of the hardware sector to include the manufacture of communication infrastructure technologies and end user devices. According to IDC, IT spending reached nearly \$1.0 trillion in 2001 and is expected to grow to roughly \$1.5 trillion in 2006.

- Based on data from IDC for the first quarter of 2003, worldwide PC shipments rose 2.1%, year-to-year, and is forecasted to touch US\$193 billion in 2004.
- Worldwide server shipments continued to show signs of stabilization in 2002 and are expected to touch US \$46 billion in 2004.
- The workstation market remained weak with revenues of \$14 billion in 2003.
- The semiconductor and microprocessor technologies remain an important part of the hardware sector, other than computing end products like PCs, and servers. After the sluggish sales during 2001-2002 following the boom of 2000, Standard & Poor’s estimates that sales have grown by almost 12% in 2003.
- Computer networking equipment forms another important part of the IT hardware infrastructure. According to the Dell’Oro group this industry can be divided into five market segments – Ethernet switches (\$12 billion, 2002), routers (\$8 billion, 2002), access equipment (\$4 billion, 2002), mobility equipment (\$28 billion, 2002), and optical transport equipment (\$7 billion, 2002).

Worldwide IT Industry Revenues

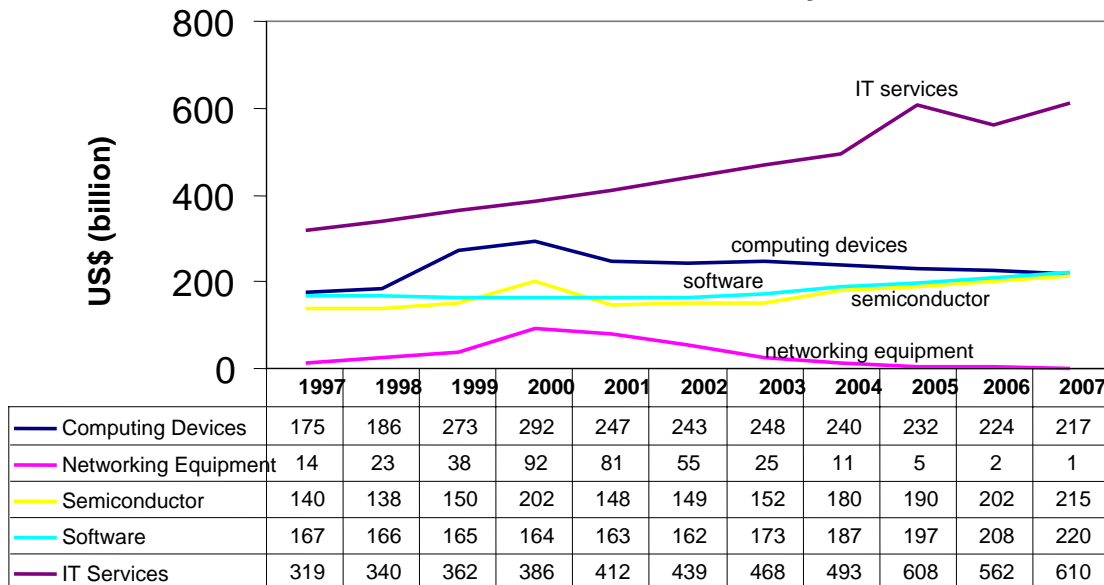


Figure 3: Worldwide IT revenues (all amounts in US\$ billions)

Source: S&P Industry Reports – 2003

1.2 Software

The packaged software market could be broadly categorized into applications software, applications development and deployment and system infrastructure software.

- Applications software comprises programs that perform specific functions, such as word processing, desktop publishing and enterprise application platforms to name a few. According to IDC, the worldwide market for packaged applications software totaled \$83 billion in 2002. This segment is expected to hit \$108 billion by 2007.

- Application development and deployment includes information and data management (IDM) software, application design and construction tools (AD&CT), application life-cycle management (ALM), application development platforms (ADP), and middleware (MW), according to IDC. The worldwide application development and deployment market was approximately \$31 billion in 2002. IDC forecasts this market will grow to approximately \$41 billion in 2007.
- System infrastructure software comprises operating systems, operating system enhancements, and data center management. Its worldwide market decreased about 1.1% to \$47 billion in 2002, down from \$48 billion in 2001, according to IDC. However, IDC forecasts this market will reach almost \$70 billion in 2007 which would indicate a CAGR of 8.0%.

1.3 IT Services

According to Standard & Poor's, IT services can be categorized into two major sectors: consumer services and the internet, and commercial services. The consumer services and the internet can be further categorized into web hosting service providers, and Internet access service providers. The commercial services are mainly offered under two modes – professional services and processing services.

- According to IDC web hosting and related service market is projected at \$10 billion in 2007 compared to \$5 billion in 2003.
- IDC also estimates that the consumer ISP market in the United States will grow from \$23 billion in 2000 to \$80 billion in 2005.
- The broad professional services segment includes technology consulting, education, training, custom programming, systems integration, and outsourcing. IDC groups these underlying categories together as follows: consulting/systems integration (\$125 billion in 2002), outsourcing (\$118 billion), and support and training (\$110 billion).
- Processing services comprises vendors that process their customers' transactions and data using their own computer systems (often with proprietary software). According to the latest available estimates from IDC, this group's revenues increased approximately 6.7% in 2002, to \$80 billion.

TABLE 1: NAICS CODES FOR IT INDUSTRY

NAICS Code	Industry Description
Hardware	
334111	Electronic Computer Manufacturing
334112	Computer Storage Device Manufacturing
334113	Computer Terminal Manufacturing
334119	Other Computer Peripheral Equipment Manufacturing
344210	Telecommunications and computer networking equipment manufacturing
Software	
511210	Software Publishers, includes applications, operating systems and utility software
IT Services	
541511	Custom Computer Programming Services
518111	Internet Service Providers
518210	Data Processing, Hosting, and Related Services
541512	Computer Systems Design Services
541513	Computer Facilities Management Services
541519	Other Computer Related Services
541614	Process, Physical Distribution, and Logistics Consulting Services

2. Key technological trends

There are some signs that the IT industry is maturing. So far the industry has thrived on exponentials such as rapid improvements in the price-performance ratio of computers driven by Moore's law and exponential growth in network connectivity and traffic. Now some of these trends might be reaching their limits and the consequences for the industry are significant. Several trends, such as the commoditization of hardware, the emergence of a service model for software and of a utility model of computing, and the shift in the industry focus in some sub-sectors from innovation to execution, suggest that at least the traditional sub-sectors of the IT industry are rapidly maturing. At the same time some sectors of the industry have seen significant new technological development which could pave the way for innovative products and services in the near future. The major technological and business trends driving the IT industry currently are 1) sensory computing, 2) web services and componentization of software, 3) utility computing, 4) business process outsourcing and globalization of the software development, and 4) resurgence of telecommunication services.

2.1 Sensory Computing

Devices that can be connected to the internet are proliferating. The availability of radio frequency devices combined with the miniaturization of sensors is creating opportunities for building systems with "ambient intelligence"; systems that can sense their environment and connect to a network through wireless means. It is expected that the processors that are embedded in smart sensors will be an order of magnitude more in number than the computers that are connected to the internet. New technology standards are being actively developed to enable these devices to communicate through wireless networks and to put them to productive use. The immediate business application of the sensory computing ideas can be seen in the adoption of RFID to track products across the supply chain. The cost of passive RFID tags has dropped significantly in the last five years reaching a point where it is cost-feasible to tag items. Several retailers such as Wal-Mart, Target and the US military have mandated their suppliers to start using RFID in the near future. This is expected to further drive down costs of the tags and thereby fuel rapid growth in the manufacture and use of these tags. It is also likely to fuel growth in the software needed to use these sensors effectively.

2.2 Utility Computing

Today's server technologies make building datacenters expensive and time-consuming -- and force firms to buy much more processing capacity than they actually use. Utility computing has emerged as a new model of providing computing resources that instead of forcing computing power into server-sized buckets, will allow datacenters to deliver fluid computing horsepower on demand. This is expected to bring in commodity economics to the running of data centers and the consumption of computing in organizations. The utility computing model has evolved over the last five years and has now resulted in commercial offerings by firms such as IBM and HP.

2.3 Web Services

The software industry is evolving to a pay per use model with the development of web services technology and increased componentization of software applications. Web services allow firms to use a specific functionality of software hosted on a server as service. The standards that allow data interchange between systems, for defining services and for locating them have evolved to an

extent that web services are actively being used now. All packaged software vendors including desktop software vendors such as Microsoft and enterprise software vendors are componentizing their packages and developing service offerings. The use of web services is likely to increase significantly in the next two years creating opportunities in the software and services sectors.

2.4 Business Process Outsourcing (BPO)

Process outsourcing though not new has become more widely used and has become a major business trend in recent years. The low cost of communications and the availability of cheap telecommunications infrastructure has led to off-shoring and near-shoring to capitalize on low labor costs in other parts of the world. BPO creates demand for IT products and services in countries investing to build their infrastructure for service delivery. It is also creating demand for infrastructure upgrades by firms in the US to enable them to effectively outsource processes without losing control of these processes.

2.5 Telecommunication Services

The telecommunications sector, though still saddled with excess capacity, is showing signs of renewal and growth, especially in the services area. New technologies in the wireless space such as Wi-Fi and Wi-Max are driving growth. Other technologies such as VoIP have become mainstream with start up firms offering technologies that provide good quality voice transmission over the Internet. This is likely to create significant price competition in the marketplace for voice services.

3. Summary

The IT industry after a significant downturn has recovered well in the last two years. The major trends identified above seem to be shaping this industry in the U.S and in the rest of the world. Overall, there is a shift in the geographical focus of innovation and technology creation in the IT industry. All major IT players are investing aggressively in creating R&D and business development capabilities outside of the U.S. Moreover, many venture capitalists seem to emphasize the need for an off-shore strategy in the business plans of start ups to take advantage of the cost differentials. Given these trends, the Capital region has to think hard as to how best to position itself to attract IT ventures to locate here. One interesting opportunity is to focus at the intersection of IT with other sectors where the region already has some traction such as biotechnology, nanotechnology and media and arts. IT is likely to be extensively used in all emerging sectors and development of appropriate hardware, software and IT services to support these sectors could be a natural choice for this region. Another potential opportunity could be to focus on services in niche areas that are seeing significant resource inflows such as the healthcare, homeland defense and power transmission to name a few.