

# **THE U.S. COMPUTER PROGRAMMING SERVICES AND COMPUTER INTEGRATED SYSTEMS DESIGN INDUSTRIES: NATIONAL TRENDS AND CHARACTERISTICS**

An Initial Report of the Center for Competitive Analysis  
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This report, prepared by the Center for Competitive Analysis (CCA) of the University of Missouri Outreach and Extension (UO/E), provides an overview of important aspects of the U.S. Computer Programming Services and Computer Integrated Systems Design industries. These two industries are assigned Standard Industrial Classification (SIC) codes 7371 and 7373, respectively.<sup>1</sup> The primary intended audiences for this report are trade organizations and individual firms in the industry, who will find the information useful in day-to-day as well as strategic planning activities; UO/E, which may consider educational programming designed to assist business owners and workers in the industry; and economic development policy makers, who can use the information contained herein to learn more about the industry and develop programs designed to attract or retain businesses in this industry. It is not an exhaustive survey of all aspects of the industry. The final section of the report identifies issues that will have to be studied in greater depth before educational or developmental programming can be designed. Information sources for this report include government publications and various trade journal articles.

Although each past CCA industry report has covered only a single SIC 4-digit industry, the two industries that are the topic of this report have sufficient complementarities and similarities to warrant discussing them jointly. Indeed, some publications discuss the “Computer Software and Networking” industry which includes SIC 7372 (prepackaged software) and SIC 3577 (computer peripheral equipment) in addition to the two industries considered in this report. When information is reported here for either of the two industries individually, they will be referred to by their SIC names or code numbers as given above, and they will be called the “computer services industry” (or “CS industry”) when treated jointly.

## **1. General Industry Information**

The Computer Programming Services industry (SIC 7371) contains firms providing specialized computer applications, not available on the mass market, to medium- and large-sized businesses and organizations. Growth in the industry slowed somewhat in the early 1990s as the availability of commercial business applications programs increased, but there continues to be a strong demand for proprietary software and specialized applications. Furthermore, many of the industry’s customers are increasingly turning to outside vendors of these services, rather than maintaining in-house capabilities, in an effort to cut costs. According to 1997 data, the Computer Programming Services industry

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<sup>1</sup>SIC 7371 corresponds to the new North American Industry Classification System (NAICS) code 541511, Custom Computer Programming Services. SIC 7373 firms are included in NAICS code 541512, Computer Systems Design Services, along with some firms from SIC 7379.

had 31,624 establishments in the U.S. with 318,198 total employees and \$38.3 billion in total revenues. There were 459 establishments in Missouri with 5,475 total employees and total revenues of about \$750 million. (There are fewer firms than there are establishments because some firms have more than one establishment.) The average annual payroll per employee in Missouri was \$55,455, slightly below the national average of \$57,879. The national average number of employees per establishment was 10.1, annual revenues per establishment were \$1.21 million, and revenues per employee were roughly \$120,000 annually. Corresponding figures for Missouri were 11.9 employees per establishment, \$1.63 million revenues per establishment, and \$137,000 revenues per employee. The employees per establishment data indicate that the proportion of small businesses is relatively high. Firms are primarily located in urban areas, which is not surprising given the service-oriented nature of this industry—most of its customers are in urban areas. An urban location is also likely to be an advantage with respect to finding workers because the labor pool is larger and there are more specialized educational opportunities. (See the “Production Issues” section for a more detailed discussion of the labor market issues facing CS firms.)

The Computer Integrated Systems Design industry (SIC code 7373) contains firms engaged in developing or modifying computer software and packaging or bundling the software with hardware (computers and peripheral equipment) to create an integrated system for specific applications. According to 1997 data, the Computer Integrated Systems Design industry had 30,804 establishments in the United States, with 337,526 total employees and \$51.2 billion in total revenues. There were 439 establishments in Missouri with 6,702 total employees and total revenues of approximately \$980 million. The average annual payroll per employee nationally was \$54,682, over 11% above the Missouri figure of \$49,069. The national average number of employees per establishment was 11.0, annual revenues per establishment were \$1.66 million, and revenues per employee were roughly \$152,000 annually. Corresponding figures for Missouri were 15.3 employees per establishment, \$2.23 million revenues per establishment, and \$146,000 revenues per employee. The employees per establishment data again indicate that the proportion of small businesses is relatively high, with Missouri firms being significantly (40%) larger based on this measure.

## **2. Sales, Marketing, and Customer Issues**

### ***Recent Sales Trends***

The industries that provide computer networking and data communications services have risen from near-obscurity several years ago to become one of the fastest growing and most technologically dynamic group within the information technology (IT) sector. Despite a slight slowdown in the growth rate of computer programming services in the mid-1990s, the industry is quite healthy, with increased use of programming services and information services such as electronic mail and networked computers being the primary drivers of strong demand. Total combined revenues for the CS industry were nearly \$90 billion in 1997. In comparison, the U.S. packaged software market (SIC 7372) had approximately \$70 billion of receipts in 1997.

### **Who Are the Customers?**

Custom programming and system design services are purchased by other businesses, nonprofit organizations, and governments at all levels. Generally, these customers are either moving to a more computer-intensive business model or have chosen to outsource such activities. The information technology talent shortage has increased the pressure on corporate information officers to use more outside professional services. The growth of information services is tied to the information technology product base—from microprocessors, to computers, to communications equipment, to multimedia—that makes up the infrastructure of many information services.

In addition, the explosive growth of electronic commerce (“e-commerce,” simply defined for our purposes here as transactions carried out over the Internet) has created the need for programmers with the specialized skills required for Internet operations. By one estimate, business-to-business commerce over the Web amounted to \$8 billion in 1997 and will grow to \$333 billion by 2002. Because electronic commerce provides a fundamentally new way of conducting commercial transactions, it will have far-reaching economic and social implications. The cost of doing business on new electronic networks is significantly lower than the cost of traditional methods. This advantage, along with the ability to offer high-value content-rich products and services, has led to exponential growth in the number of firms adopting e-commerce for purposes of buying from suppliers and selling to other firms, distributors, or the ultimate consumer. E-commerce skills are typically not present, even in companies with previously well-developed IT resources. Indeed, the area of e-commerce is likely to be the most important market driver for computer programming and systems design services, as firms expand their e-commerce activities and integrate them with other company IT processes.

Because of the growth in worldwide e-commerce and because foreign firms and governments are seeking to upgrade their computer capabilities generally, foreign markets for CS firms are expanding rapidly. By the mid-1990s, much of the work performed by U.S. custom programmers was for foreign clients. Companies in Europe and eastern Asia were turning increasingly to U.S.-based computer professional services companies to create software or computer systems to help them compete in the global economy. The largest U.S. networking firms have a vast global presence in the world's major and developing markets. At the same time, U.S. companies were outsourcing to take advantage of less expensive foreign programmers. Offshore outsourcing is a way to produce customized software less expensively and has therefore become a factor in the globalization of the programming and software industries.

Thus, developed and developing economies are both the largest source of demand for networking products and the home of the largest competitors of U.S. networking companies. Large multinationals such as Fujitsu, Hitachi, and Siemens, along with a variety of other foreign firms, are active in the networking equipment and software field, especially in servers, but U.S. firms are the unrivaled leaders. Cisco Systems, Bay Networks, 3Com, Cabletron, Ascend, and many others form the front lines of global competition in networking and data communications technology.

### ***New Product Technologies***

As noted above, a major growth market for the CS industries is Internet-related functions, and especially e-commerce. In addition, business functions within companies that are or will be clients of CS firms are increasingly being carried out using information technology. At the same time, the technology of the capital equipment used to implement IT-based business solutions—computers, servers, and other networking devices—becomes more advanced literally with each passing month. Indeed, it often seems to corporate information officers as though the new machine that was installed a few months ago is already two generations behind the newest equipment available.

In addition, since firms in the CS industries are selling a group of services, their personnel must be knowledgeable about the latest programming techniques and how they interact with the newest equipment. Thus, as client-server systems and networks gain popularity, programmers need traditional skills as well as familiarity with new IT technologies. Some industry firms have instituted team programming in which experienced programmers create application models and newer programmers create standards. One factor working against CS firms is that computer-aided software engineering has made it easier for in-house computer programmers to work without the help of outside firms.

This combination of rapid growth in demand for new IT capabilities and the speed of technological advance of the equipment used to achieve those capabilities represents both opportunities and challenges for CS firms. Rapid demand growth represents an opportunity in that there is quite a bit of work available for CS firms. It is simultaneously a challenge because the services being demanded are constantly changing, both in their nature and their level of sophistication. Firms in the CS industry must be able to foresee the next generation of services and understand the equipment that will be used to provide them before they are available, and then be able to explain all of that to their clients. In addition, customers have come to expect rapid developments in information technologies and services, and CS firms must learn to anticipate what customers will want to be able to do next. The CS firms that can meet those challenges will have the greatest opportunities not only to survive but also to seize increasing market shares.

## **3. Production Issues**

### ***Labor Market Issues***

The Economics and Statistics Administration of the U.S. Department of Commerce projects that employment in SIC industries 7371 and 7373 together will rise by nearly 50% to approximately 950,000 by 2006. Furthermore, CS workers in the U.S. are among the most productive in the world. This can be seen from the fact that U.S. companies now hold a two-thirds share of the global software market, yet only one-third of the world's programmers live in the U.S.

Personnel costs for the CS industry are significant, though perhaps not as large relative to overall costs as for many other industries. In the Computer Programming Services industry, payroll costs in 1997 were 48.1% of total industry receipts nationally and 40.5% for Missouri firms. The figures for the Computer Integrated Systems Design industry were 36.0% and 33.6%, respectively.

Demand for graduates with the latest training is very high. The high wages paid to workers in CS industries indicate the importance of human capital to the software industry and the growing scarcity of highly skilled workers. Professionals employed by computer programming firms received ongoing education and training in new technologies. More programmers are needed in software maintenance than in software development. Maintenance programmers are required to be familiar with many types of hardware and software and as a result gain broader training and experience.

Workers from a wide variety of occupational groups are employed in the CS industry. The ten leading occupations, listed here in descending order by number of workers, account for 57.5% of the workforce in this industry: computer programmers, systems analysts, computer engineers, sales and related workers, general managers, data entry keyers, secretaries, computer operators, engineering/science/math managers, and data processing equipment managers.

### ***Production Technology***

Given the rapid and continuous changes in both software and equipment in the entire IT sector of the economy, we will not attempt to provide an in-depth discussion of how the CS industry produces the services it sells. However, two important points should be made.

First, a recent technology shift involves the rise of switching technologies, as formerly isolated computers and subsystems are increasingly integrated. "Local Area Network" (LAN) traffic originates on one computer and is sent to another, as in e-mail and Internet-based e-commerce. While earlier LANs used a router to direct files and messages, the newest developments in the networking field concern the switched LAN. In the switched LAN approach, the network equipment is cheaper and the cost of administering the LAN can be reduced.

Another important factor that affects but is not directly controlled by CS firms is the state of the overall telecommunications system. The lack of adequate telecommunications infrastructure in much of the world is a significant barrier to future Internet development. Existing telecommunications systems have limited capacity to carry voice and data traffic. U.S. infrastructure needs for Internet use continue to increase at a dramatic rate, and Internet service providers (ISPs) are constantly increasing capacity. Thus, even if firms in the CS industry can find the required numbers of workers with the appropriate skills, their efforts to build the sorts of computer networks demanded by their clients are likely to be adversely affected if the requisite "external" telecommunications system is unavailable.

## **4. Industry Competitive Analysis**

### ***Conditions and Trends***

As increasing numbers of firms in virtually every sector of the economy use IT more extensively for internal management and integration as well as for external relationships with suppliers and customers, business opportunities for CS firms are plentiful. Generally speaking, such rapidly growing markets mean that competition among firms is not as intense as in stagnant or shrinking markets. That is, if a firm is not chosen by one

potential client, there are many others clamoring for service. Competition among firms is therefore most intense for vital inputs rather than for customers. In the CS industry, a skilled workforce is the most important input. With greater pressures to be able to fulfill a contract rather than to get it in the first place, CS firms must pay progressively higher salaries to attract and retain competent programmers and system designers. Of course, once increases in demand slow down (a development that does not yet appear to be imminent), competition for clients will intensify, but predicting when the CS industry will enter such a slow growth stage is risky at best.

Given the nature of the output produced by this industry, much interaction with clients can be carried out electronically. It is therefore not surprising that discussions of competitive issues in current industry publications emphasize the global nature of this market and the extent of international competition. Falling trade barriers allow greater opportunities for U.S. firms in foreign markets but simultaneously increase the threat from foreign firms in U.S. markets.

The United States has a sizable export trade surplus in information services. Although imports of information services rose at a compound rate of 24 percent a year between 1992 and 1996, the U.S. trade surplus in these activities continued to increase. With respect to U.S. firms, information services and computer services are traded primarily through foreign affiliates of U.S. companies in foreign markets ("majority U.S.-owned foreign affiliates," or MOFAs). U.S. sales of computer services by MOFAs reached \$22.7 billion in 1995, growing at a compound rate of 34% since 1993. Europe is the United States-largest market, followed by the Asia/Pacific region.

Computer professional services such as programming were encouraged by the passage of the North American Free Trade Agreement and the expansion of the General Agreement on Tariffs and Trade. The U.S.-Canada Free Trade Agreement of 1989 led some U.S. computer services companies to expand into other markets by buying Canadian firms. Some U.S. companies also have subsidiaries in South America and Europe. The European community encouraged mergers and acquisitions among Western Europe's computer professional services firms, thus increasing the strength and international competitiveness of those firms. The General Agreement on Trade in Services, or GATS, under the World Trade Organization, has the capacity to further reduce trade barriers internationally, which will open more of the world market to U.S. companies while also allowing more foreign firms into the U.S. market.

### ***Industry Structure***

**General.** A discussion of the level of market concentration is an important aspect of most industry studies, because concentration is an important feature of the likely degree of competition among firms in an industry. The purchasers of an industry's good or service prefer to see more rather than less competition, all else equal, because while more intense competition may not be good for individual firms, buyers in general benefit from the resulting greater incentives to improve quality and lower prices. Concentration is less likely to be important in industries experiencing dramatic growth, largely because rapid growth allows for relatively easy entry. As this report has discussed, the CS industry is growing rapidly, so that the concentration numbers presented here tend to overstate the

potential for the ill effects of industry concentration. In addition, these data are based on U.S. firms only, leading to further understatement of the probable level of competition.

Even without consideration of these factors, the concentration data indicate that sufficient competition exists in the two industries under consideration here. In SIC 7371 (Computer Programming Services), the largest fifty firms controlled only 36.6% of industry revenues in 1992 (the latest year for which data are available). In SIC 7373 (Computer Integrated Systems Design), the figure was considerably higher at 53.7%, but even that figure is not high enough to be concerned about the potential ill effects of concentration in such a rapidly growing industry.

On the other hand, there seems to be evidence that the industry is evolving to a structure consisting of a handful of very large “core” firms along with a large number of smaller firms that primarily serve narrow market niches. Much of this transformation is the result of consolidation activity (see below). If the industry is in fact evolving more toward an oligopoly structure, the level of competitiveness in the industry may very well suffer. At this point, rising concentration seems to be strongest in the packaged software (e.g., Microsoft) and equipment manufacturing (e.g., Cisco) segments of the overall IT sector; neither of these segments is the topic of this report. Nevertheless, the available concentration numbers are eight years old, virtually ancient for an industry experiencing such rapid change. Newer data is required in order to determine how concentration in the two CS industries under consideration here has changed through the 1990s.

***Trends in Consolidation and Outsourcing.*** According to *U.S. Industry and Trade Outlook '99*, “several networking companies have grown to become behemoths of the computer industry by acquiring numerous smaller software and hardware firms to shore up their product lines or add functionality to their existing products.” That publication covers Computer Programming Services and Computer Integrated Systems Design but also includes SIC 7372 (Prepackaged Software) and SIC 3577 (Computer Peripheral Equipment manufacturing). The definition of a “networking company” is not clearly stated, but the examples given (Cisco, 3Com, Lucent, and U.S. Robotics) indicate that that the above quote seems to apply mainly to equipment makers rather than CS firms. Because economies of scale are not likely to be as important in the two CS industries as in prepackaged software or equipment, consolidation would probably not be driven by cost reduction incentives. Other merger and acquisition motives would therefore be more important instead, including geographic market expansion and the desire for faster company revenue growth. Although this research has not uncovered strong evidence that consolidation is increasing in the two CS industries, there is likely to be at least some such activity simply because of the large amount of attention being paid by capital markets to the IT sector as a whole.

Outsourcing is having an impact on CS industries in two ways. First, on the demand (client) side of the market, the shortage of professionals with deep information technology skills as well as general cost control motives have increased the pressure on corporate information officers to use more outside services. Second, the same factors—a shortage of talent in the U.S. and the desire of CS firms to reduce costs—has caused offshore outsourcing to become a factor in the globalization of the software industry.

## 5. Business Strategies

### **General**

The profitability of a business depends upon both the overall degree of competition in an industry and the position of the business relative to its rivals. A business has little control over the general degree of competition in its industry, but can take strategic actions to position itself favorably relative to its rivals and thereby influence its profitability.

Businesses that earn profits above the industry average typically do so because they find a sustainable competitive advantage. This advantage allows such firms to position themselves relative to their rivals in ways that emphasize their relative strengths; and this in turn allows them to better cope with the various forces of competition.

It is common to distinguish between two broad strategies to achieve competitive advantage. The first is cost leadership and the second is product differentiation. Each of these strategies represents a different route to sustainable competitive advantage and above-average profitability. Moreover, no matter which of these approaches is adopted, a firm also needs to determine whether it will compete for all buyers in a particular market or focus on just a target segment of market. Successful firms will choose a strategy and target segment based upon their own individual strengths and weaknesses.

**Cost leadership** is a strategy of attempting to become the low cost supplier in the industry. Sources of cost leadership are varied but would include such things as pursuit of scale economies, use of proprietary technology, preferential access to raw materials and other inputs, and specific knowledge of customer needs. Firms pursuing this strategy must seek out all sources of cost advantage while at the same time produce a product that is perceived as comparable to that of rival firms.

In a **differentiation strategy** a business attempts to make itself and its products unique along dimensions that are considered valuable by buyers. The business needs to find attributes that buyers perceive as important and position itself to meet those needs. The attributes along which differentiation may be achieved are extremely broad including the product or service itself, the delivery system used, the marketing approach adopted, and so forth. To be successful in a differentiation strategy, a business must choose attributes to emphasize which will allow it to be perceived as distinct from its rivals. Differentiation is often a more promising strategy for products sold to consumers, rather than to firms processing them for later sale.

No matter whether cost leadership or product differentiation is pursued, a firm must also decide how broadly over the market it should compete. Most markets contain segments, which are distinct customer groups that possess a common set of characteristics or special needs. In consumer goods industries, for example, buyers may be segmented by income levels, frequency of purchase, knowledge of the product, and so forth. Industrial goods buyers may be segmented by size of buyer, willingness to trade price for quality, location, type of industry (e.g., a C.P.A. firm wants software to provide business accounting services to its clients), or special product needs. A firm needs to determine whether it will attempt to serve all of the market segments or focus upon target segments.

When a firm focuses it aims to better serve a single or small number of buyer segments in an industry. For some segments this will require a firm to be a low-cost producer. In other segments a firm may compete by offering a differentiated product.

Firms that become very narrowly focused (specializing perhaps in as few as one segment with a single product) are often said to be following a “niche strategy.”

By their very nature, small businesses typically must focus on only one or a few segments of an industry. Whether a strategy of low cost or product differentiation is appropriate depends upon the nature of the buyers in the segments being pursued and the positions of rival firms competing for those same buyers. Consider for example the following sets of questions in reference to a particular buyer segment:

1. Are other firms competing in this segment currently utilizing large-scale, low-cost production technologies? The existence of such firms may make it difficult to attract or maintain customers.
2. Are the products or services produced for this segment virtually standardized? Purchase of standardized goods and services are generally made on the basis of price alone.
3. Can the attributes of the product or service and its quality be ascertained by the buyer prior to purchase? Such products can be judged as to acceptability by buyers, and for a given quality a supplier must also offer the lowest price.
4. Are the buyers extremely price sensitive and unwilling to pay much of a premium for enhanced quality or image? In some cases nothing matters other than price. As a result, only firms able to offer the lowest prices are able to survive.
5. Is little post-sale service required for this product or service? Competition in segments in which post-sale service has little or no significance often will turn on price alone.

If each of these questions is answered affirmatively, then for this particular segment cost leadership is a dominant strategy. Segments displaying these characteristics offer little scope for creating value to buyers through differentiation efforts. Successful firms will be those who manage to achieve minimum cost in serving this type of target segment.

Product differentiation becomes a more viable strategy in segments where the conditions given in questions (2.) through (5.) above do not prevail. Under these circumstances firms have the opportunity to offer differentiated products or services with attributes that are especially desired by buyers. Firms successful in product differentiation benefit through the ability to obtain price premiums for their products.

In the next few subsections, a variety of strategic issues likely to be most relevant for CS firms are examined.

### ***Market Entry***

Barriers to entry do not seem to be great for firms considering doing business in CS markets. In particular, venture capitalists have (at least until very recently) been willing to fund even the most speculative startups in the IT sector. Also, one successfully

completed contract can lead to sufficient word-of-mouth promotion to aid the launch of a new firm. Nevertheless, more traditional approaches to market entry, particularly for firms with a strong record in other related industries, should also be considered. For example, Microsoft appears to have adopted a strategy of partnering with other firms in order to gain a foothold in the business-to-business e-commerce market. Microsoft needs partners because it has no product yet in business-to-business e-commerce, while smaller companies such as CommerceOne Inc. and Ariba Inc. have done better. The implication is two-fold. First, it may not be necessary for firms to build capabilities in a particular industry or market segment from scratch. Second, and perhaps more significant for small businesses, it is quite possible for smaller firms to successfully compete with large ones and ultimately turn that success into a profitable relationship with a larger firm.

### ***The Importance of Thinking Globally***

A very important feature of the market for programming and system design services is its increasingly global nature. Domestic CS firms find themselves facing opportunities in foreign markets as well as competitive threats from foreign firms. It will be difficult for a given CS firm to grow to its greatest potential (and perhaps even to survive) without recognizing the importance of foreign clients and competitors.

Developed economies are both the largest source of demand for networking products and the home of the largest competitors of U.S. networking companies. Large multinationals such as Fujitsu, Hitachi, and Siemens, along with a variety of other foreign firms, are active in the networking equipment and software field, especially in servers, but U.S. firms are the unrivaled leaders. Cisco Systems, Bay Networks, 3Com, Cabletron, Ascend, and a host of others form the front lines of global competition in networking and data communications technology. The largest U.S. networking firms also have a vast global presence in each of the world's major and developing markets.

### ***Product Differentiation and Market Segmentation***

The Internet will for the foreseeable future continue to be the most important factor considered as CS firms shape their near- and medium-term strategies. Its most obvious impact is on the client base. Buyers of computer services will be mainly interested in pursuing e-commerce solutions and in integrating those solutions with other aspects of their businesses, such as accounting and inventory control. In addition, CS firms must determine how to take advantage of the Internet for their own purposes, as the service they provide becomes easier to supply over telecommunications links without extensive face-to-face interactions with clients.

Computer service firms will need to adopt a business model with flexible approaches to service, pricing, and delivery in order to increase their share in the Internet services market. As discussed in an earlier section, they will also have to strengthen their efforts to acquire personnel with a varied skill set so that they will be able to deliver end-to-end Internet services quickly. Generally speaking, the trend in client preferences has been towards firms with a broad range of offerings.

One way to implement the strategy of broad offerings is through mergers and acquisitions. (See also the earlier section on industry consolidation.) Dataquest senior analyst Justin Behar points out that "most vendors moved to complete full-service

offerings last year [1999] through mergers and acquisitions to their core competencies.” Consulting and integration companies seeking to diversify from their core competencies include San Francisco-based Cotelligent, which targets the telecom and consumer packaged-goods industries, and Millennia, Redwood Shores, California, which has developed rapid-deployment methodologies for dot-coms, high-tech manufacturers, and Fortune 1000 companies. Affiliated Computer Services plans to significantly increase the amount of revenue it will generate from the financial services, healthcare, and telecommunications sectors. And NTT Data, a leading Japanese IT services vendor, is also well diversified, generating significant portions of its revenue from the government, financial services, insurance, and the telecommunications sectors. While there is clearly significant overlap in the skills needed to provide CS services to all of these sectors, each sector nevertheless has its unique aspects and each requires a different mix of services. Therefore, CS firms wishing to spread their client base across sectors of the economy must be able to provide a wide variety of services.

Despite the overall trend toward broadening CS service offerings, there are still many niche markets that small companies can concentrate on successfully. For example, when the American with Disabilities Act was signed into law, it changed the workplace and opened up a broad new set of sales opportunities for CS firms. Intended to make public and business facilities more accessible to people with disabilities, the current version of the Act requires businesses of more than 15 employees to make reasonable accommodations to disabled individuals. What this means, particularly for computer system design firms, is that if a job requires computer access, a business hiring a person with ability limitations may need hardware and software to accommodate that employee.

## **6. Challenges: Opportunities and Threats**

The preceding sections of this report have touched on aspects of the CS industry that represent challenges to its firms. Many of these market developments represent opportunities for growth in today's fast-moving CS industry, some represent threats, and still others could be either, depending on how well an individual firm reacts and adapts to these changes. In this section some of the more important challenges are highlighted.

Perhaps the most important challenge is finding (or training) and maintaining the highly skilled workforce that is needed. Rapid growth in an industry requiring specialized skills always leads to a shortage of qualified labor. One approach U.S. firms can use to find workers is to reach out to foreign countries where there are potential employees who either already have the skills or who have a background that makes them easily trainable. These foreign workers can be employed in their native countries, with the U.S. firm setting up a branch office there or perhaps simply communicating with them electronically. Another avenue for obtaining such workers is to bring them to the U.S., and the IT sector as a whole has been lobbying the U.S. Congress heavily for relief from immigration laws that make it difficult to bring in the required large number of skilled employees from other countries. Another approach is to pressure the U.S. educational establishment to train workers in the needed skill areas. This is especially important for small businesses (in either the CS industry or in other lines of business) who can often at best find workers capable of performing simple word processing or spreadsheet tasks, but

who do not possess the higher-level programming or hardware integration abilities needed to start a successful e-commerce effort. Small businesses, who cannot afford nationwide recruiting efforts, depend especially on the capabilities of their local educational systems. State and local governments can help by becoming more aware of these needs.

As noted in a previous section, the combination of rapid growth in demand for new IT capabilities and the speed of technological advance of the equipment used to achieve those capabilities represents both opportunities and challenges for CS firms. Rapid demand growth is both an opportunity and a challenge; there is considerable work available but it is becoming increasingly complex and technology changes rapidly. Firms in the CS industry must be able to foresee needs of their clients even before their clients see them while also understanding how the next generation of equipment can be used to meet those needs.

Another important challenge is recognizing and implementing a strategy consistent with the increasing global nature of the CS market. Possible approaches to this for CS firms are entering partnerships either with foreign firms directly or with domestic firms that have a foreign presence, beginning efforts to establish their own foreign affiliates, and engaging in marketing efforts, perhaps using the Internet, that increase their visibility in foreign markets.

A fourth challenge, particularly for small businesses, is in formulating and successfully implementing a business strategy that recognizes and focuses the firm's strengths. As discussed above, the initial choice may be between cost leadership and differentiation strategies. Given the nature of the service, cost leadership may be viable, but small firms will probably find more success through a differentiation strategy that concentrates on a narrow group of market segments.

## **7. Directions for Future Research**

This report has discussed a number of issues affecting the U.S. Computer Programming Services and Computer Integrated Systems Design industries. But except for providing a few broad statistics, the report gives no information that might allow for the identification of unique aspects of Missouri CS firms. Therefore, a logical next step in developing research outcomes to benefit Missouri CS firms in particular is to learn more about these firms. What market niches do they occupy? Do they face greater, lesser, or the same difficulties in finding skilled workers as compared to U.S. CS firms as a whole? To what extent have Missouri CS firms recognized the potential opportunities and threats posed by the rapid globalization of their industry? And finally, how can the resources of the University of Missouri and other agencies of the State be best utilized to ensure that Missouri CS firms obtain a significant share of this growing market? Policy makers in Missouri should consider these questions carefully in order to help make the state a leader in this industry and to bring these relatively high-paying computer services jobs to Missouri.