1-1-1985

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American Institute of Certified Public Accountants. EDP Technology Research Subcommittee

Recommended Citation

American Institute of Certified Public Accountants. EDP Technology Research Subcommittee, "Response to the issue: Widespread computerization and automation of business operations" (1985). *Association Sections, Divisions, Boards, Teams*. 334.
https://egrove.olemiss.edu/aicpa_assoc/334

RESPONSE TO THE ISSUE:

WIDESPREAD COMPUTERIZATION AND AUTOMATION
OF BUSINESS OPERATIONS

PREPARED BY:

THE EDP TECHNOLOGY RESEARCH SUBCOMMITTEE

JULY 10, 1985

EXECUTIVE SUMMARY

One of the issues raised by the Future Issues Committee of the AICPA in its 1984 report, "Major Issues for The CPA Profession and The AICPA", was the following:

"The widespread use of computers is changing the traditional client-CPA relationship, expanding the scope of services, fostering competition, and creating changes in the operating structure of CPA firms and businesses generally. Within the next two decades, the increasingly rapid growth in computer and information technology is expected to revolutionize business practice in all areas and create a host of new products and services."

The EDP Technology Research Subcommittee believes that this issue requires the CPA profession to take advantage of the widespread computerization of business and the use of personal computers. Further, the subcommittee urges the Institute to provide leadership, develop technical and performance standards and identify new services for the benefit of its members.

In September 1984, the Chairman of the Board of Directors of the AICPA requested the EDP Technology Research Subcommittee address this issue. Since that time, the Subcommittee has met

four times and has prepared this report. The report consists of the following major sections:

I. New Developments in Computer Technology, the Business Committee and the Profession. In this section, we outline the major current trends in EDP and information technology.

II. Impact of New Developments on the Profession. In this section, we give our views on the impact that the new developments are having, and will continue to have, on each of our traditional service areas, as well as on the management of CPA firms.

III. A Framework for Response. In this section, we outline in broad terms the types of response that we believe are appropriate and available to the profession and its members.

IV. Suggested Specific Action Steps. In this section, we suggest specific action steps that we believe should be taken by the AICPA.

The subcommittee believes that many of the technological trends that will impact the profession are now well established. The views that the subcommittee has expressed in its report are based on the personal and professional observations of its members, all of whom are actively involved in EDP and information technology within their respective firms or universities. There is the opportunity for a research methodology and data analysis-based evaluation of the trends and their potential impact. But the principal need now is for farsighted action, rather than more analysis.

A compelling case for a significant response by the AICPA to changes in information technology can be made if one accepts one or more of the following propositions:

a. The rate of technological change, particularly the cost/benefit characteristics of such change, is currently high and will increase.

b. The changing technology has potential business and competitive implications which will impact some areas of current practice and the structure and economics of future practice.

c. Since the mid-1950s, the profession has been in a reactive, catch-up posture with the result that some professional mechanisms are badly in need of a major overhaul, not simply a minor tune-up. Consequently, many CPAs are now members of technology-based associations and the CPA exam no longer reflects what a CPA will encounter in practice.

The specific recommendations which are described in Section IV of this report have been organized to coincide with the organization of the Institute. We believe that the various groups within the Institute should be mandated to develop and implement immediate action plans to create a technological revolution within the profession which will bring its members, both current and future, up to date and fully competent to deal with current and emerging technologies.

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I. NEW DEVELOPMENTS IN COMPUTER TECHNOLOGY, THE BUSINESS
    COMMUNITY AND THE PROFESSION

The era we live in is being called the "information age".
In the next few years, the computer will become a uni-
versal machine much as the calculator is today. Journals
in fields outside of business and computers, as well as
those inside these fields, speak of the information
explosion, the information revolution, information as a
resource, etc. Organizations have information centers
and chief information officers. Millions of people are
using personal computers and terminals and mainframes in
their daily work at their desk. In 1980, Aetna Life and
Casualty had one terminal for every six employees, while
by 1985, they had one terminal for every two employees.
IBM estimates that there are 20 million terminals in use
today and that by 1990, the numbers will approximate 50
million. The principal users of these terminals will be
professionals and managers, not clerical personnel.

The computer has moved from just being in the data pro-
cessing shop to being in the office, the store, the
school and the home as well. With that outward move, a
drastic change has occurred in the nature of information
processing and communicating equipment. For centuries,
the processes of numeric calculation, test preparation,

storage information, communication and illustration had all required separate pieces of equipment.

Today, with the integration of personal computers, electronic mail, voice input/output, word processing, graphics, etc., one unit performs all of these tasks. In 1983, there were 2.4 million personal computers sold in the United States. It is estimated that 10 million will be sold in 1990. If that is true and the increase is constant per year, there will be 52 million personal computers in use in the United States by 1990. Further, there is every likelihood that many of them will become part of interconnected networks.

The computer's ever increasing power, coupled with declining costs of technology, have made it possible for even the smallest company to now have computer power that wasn't in existence 30 years ago. To demonstrate this explosive growth of the technologies, we need only consider that in 1972 an IBM System 370 Model 168 CPU sold for more than $4 million. In 1982, there were a number of minicomputers that offered the same computing power for approximately $15,000. This represents a 300 to 1 reduction in cost in only ten years. Today in 1985, this cost, for what is called a micro-computer, has declined further to only a few thousand dollars.

Today, in some manufacturing plants new computerized systems make is possible for a design engineer using computer aided design and manufacturing software (CAD/CAM) to develop a new product, test it, make a blue print, generate a program for computerized, numerically controlled machine tools to build tooling and enter a bill of material and route sheet into a database with only minimal human intervention. Further, automated retrieval storage systems have significantly reduced the need for material handlers. Similar improvements in white collar productivity are on the horizon and will impact the way CPAs see new business opportunities and manage their practice. The subcommittee has looked at current trends of emerging technologies in order to discuss what we foresee to be the impacts computer technology will have on the accounting profession.

The implications of the explosion of information technology are especially critical to the public accounting profession. Increasing competition within the profession and from outside the profession creates an essential need to operate more efficiently, to control the costs of services provided in the traditional audit and tax practices, and to expand the scope of services offered. This is especially true in those areas where clients are

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developing the ability to takeover, at a reasonable cost, some of the activities for which they previously relied on the public accounting firm - i.e., availability of economically feasible tax and financial analysis packages. In the tax area alone, inexpensive personal computers, tax software, and on the public-utility database services (i.e., PHINEP, LEXIS) make many clients more independent and/or cost conscience. This trend may be greatly accelerated as "expert systems" move into place, effectively providing an alternative for professional services and expertise.

A. Information Processing Environments

Data processing encompasses a great variety of processing environments, equipment configurations and software systems. Usually, large mainframe systems exist in organizations of sufficient size and scale of operations to justify a separate data processing department performing some degree of centralized processing. However, it must be remembered that mainframe installations can vary in size and scale from relatively small operations with very small DP staffs (sometimes no programmers) to very large organizations with large multiple operations geographically scattered and large specialized staffs, including programmers, analysts, database administrators, data communications specialists and computer operators.

The enormous growth in the use and availability of personal computers has significant implications for both the processes of organizational computing and of personal computing. Personal computers have also provided the tool for individual or personal computing tasks. The availability of the hardware and software (spread sheets, word processors, graphics, communication packages) systems for personal computers at sufficiently low costs, make it economically feasible to use these systems for individual workstations. Thus, analysis requiring multiple iterations or multi-demensional comparisons can be performed more rapidly and on a much larger scale than previously possible. Documents can be prepared, revised and illustrated with effective graphics much more rapidly and effectively.

Another impact of the growth in personal computers has been the significant reduction in the scale of operations for which in-house computerization of the accounting and management information systems is not only feasible, but advantageous. This means that virtually all clients - large and small - will have computerized functions requiring universal computer literacy within the profession.

B. Micro-Mainframe Interface

Until the advent of micro-computers and low cost
fixed storage devices, data stored on mini-computer
or mainframe hosts was relatively safe and not easily
transportable. Access to a tape drive was necessary,
and communications capabilities were severely limi-
ted. Today, this is no longer true. Whole files of
several megabytes can be transmitted between micro-
computers and large machines in a matter of minutes.
Thus, micro-mainframe interface technology has signi-
ficant potential for expansion of information net-
works and increased effectiveness in these networks.
This connection provides increased efficiencies for
the movement of data in both directions between data
sources and organizational databases.

Another important characteristic of the micro-main-
frame interface is the ability to provide individual
users effective access to organizational data for
timely analysis and flexible reporting needs. The
advantage of micros as a powerful individual tool for
analysis, simulation and report generation is often
limited by the availability of data, or where the
data are available, the practical problem of entering
very large volumes of data. A micro or personal
computer connected to a larger computer can provide

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users independent access to this existing data. Once the information has been accessed or down loaded, the user can perform analysis and generate individually tailored reports.

The micro is an extremely powerful and flexible tool for an information network. It can make data capture feasible at its source; can facilitate editing and processing of data close to the source for local use, even as the data are being transmitted to central files or being distributed to a network. A network using micros can use them as terminals or can allow them to be used independently as local processing facilities. While this design philosophy is not unique to micros, the small scale at which micros are feasible allows great latitude in designing networks.

Micro-mainframe interface technology has several implications for public accounting. It can enhance testing procedures and audit independence by giving auditors using micros direct access to client data. However, it increases the complexity of the system being evaluated and thus increases the technical competence required by the auditor.

C. New Software Tools

As the amount of technical expertise required by users of information technology has been reduced, thus encouraging its widespread use, the technology itself has become much more complex. User friendly software may make these systems "user transparent", but they encompass more sophisticated software and hardware components and much more complex system architecture. The advances in computer technology have resulted in computer users being able to access data stored throughout an organization's computer resources and format and tailor it to their own needs.

The new software tools make it possible for users without technical training in computer design or in programming techniques to effectively use the computer and thus benefit from the speed and flexibility it can provide. The computer has become a utility whose use is beneficial, even though the user does not fully understand how it works. Software tools can also be used to improve the productivity of technically qualified personnel in the application and systems development process.

Some software can be used to improve the efficiency of application development, while other kinds of software requiring no great expertise are being made available to users for reporting or analytical needs. A new organizational unit, called the information center, is evolving in which the EDP professional provides the basic data structure, and end users are performing the access and reporting functions. Thus, the productivity of an information system can be significantly enhanced by making information more available to a greater range of users and allowing developmental costs of a system to be better matched to the needs of the users. The implications for control of such an environment raise the need for an expanded set of access and processing controls. In this environment, inexperienced users can success-fully access and use organizational data. This eliminates a former protection previously available when lack of technical expertise provided an inherent protective barrier around the information system.

D. Availability of Public Databases
Data has always been the raw material from which decisions are made, and today's management decisions are becoming increasingly complex and time dependent and require a wide range of data to be available on

short notice. To meet this need, a new type of service has developed - the public database. A public database is a data source that can be accessed by means of a personal computer and a telephone. There are approximately 2,000 public databases in existence today covering a wide range of topics. Examples of the types of information available include financial data and reports, periodical references and abstracts covering most professional fields, credit reports, sports news and airline schedules. In other words, almost any type of information can be obtained from one of these sources. There are also service organizations which subscribe to hundreds of databases and perform research for a fee. Directories of these public databases are also available.

E. <u>Improved Telecommunications in Local Area Networks</u>
Faster and more versatile voice and data communications will be available for firms and their clients to use. The present inability to transfer data between computers will be eliminated either by computerized network interface protocol emulators or industry standardization. There will be an acceleration of integration occurring in businesses as they deal with the convergence of data, voice, image and word processing technologies in the office environment.

Improved local area networks for personal computers, which allow them to share resources and access other computers in an organization or outside database, are starting to appear. As organizations add more computers, there will be a need to link them so that data can be shared throughout the enterprise. The growth of local area networks and front-end communications devices will enable individually developed applications and data to be made available to other departments within a company or firm. Local area networks will accommodate both voice and data, enabling them to be switched throughout the computer-controlled local area and voice communication networks.

Local area networks are beginning to appear in "smart" buildings in Los Angeles, California (Grand Financial Plaza), Chicago, Illinois (One Financial Place), Arlington, Virginia (Crystal Gateway III), and Hartford, Connecticut (City Place). Others are under construction. In these smart buildings, desktop terminals or mini-computers are linked to centralized mainframe computers which offer access to public data bases and are available to perform other computing functions for the tennants. Because these LANs are interfaced with the telephone system, access could be allowed from any remote location.

For CPAs, this means they will be able to access their own or client databases without regard to present day equipment compatibility limitations. The merging of voice and data communication will reduce the need for redundant voice and data circuits, as well as allow communication of simultaneous voice-over-data transmission. This will allow CPAs and their clients to have integrated office networks without duplicate equipment and communication circuits.

F. Artificial Intelligence

Hardly a day passes without articles and meetings about the potential impact of artificial intelligence (AI) and expert systems on the job market. While these systems are, for the most part, still in the research and development phase, their development is occurring at an increasing rate.

International Data Corporation (IDC) provides a fairly good working definition of artificial intelligence: "The programming tools and techniques used in modeling human intelligence, as well as to the commercial products evolving from these tools and techniques." Defined as such, we can view AI not as a revolution, but as a part of an evolution towards more powerful and sophisticated computer systems.

Now that we have completed the first 20 years of research to develop computer systems which can emulate human thought, we've moved into a second stage where we have an emerging commercial market for AI-based products. The commercial market for AI software in 1984 was probably only $15 million, but by 1990 it is expected to grow to $700 million, with another $350 million to be spent on work stations and development hardware. A. D. Little believes we can expect an $11 billion market as ever increasing chip densities will allow additional AI applications to be made available. In fact, micro-processor and memory storage circuitry is becoming so complex that one of the first applications of AI is in the design of these new circuits. Three areas of AI are more advanced in terms of existing and potential commercial applications: natural language, expert systems and robotics. The first two of these will be of relevance to the profession as they offer the potential of allowing CPAs and their staffs to manage and process information more efficiently.

Natural language programs, for example, are used to improve the man-machine interface by analyzing a question posed by a person in his or her natural language and then converting it to a format a computer can understand. Expert systems seek to emulate

what the most knowledgeable persons in a particular area of knowledge know and transfer that knowledge via an AI program into a list of rules that can be recalled in order to replicate an expert's decision.

Although significant developmental efforts are ahead, the basic tools of AI are in the marketplace, enabling businesses to invest and fund further research and development. The profit potential is so great that it will encourage development by any organizations who have the capital and whose chief resources are people and information. One of the areas where we can expect the early impact of AI is in software engineering. Particularly in the systems design stage of software development, we already see tools which generate applications. Also, there are others which, by use of logic-based programming, render systems analysis so efficient that separate specifications and programs are not needed. Every tool and advantage that new information technologies can offer us to expedite, clarify and reliably engineer software will have a major impact on our MAS, tax and computer audit practices. The CPA will need to be on top of all these tools and technologies in order to deal with them appropriately when we encounter them in the client environment.

This leads to one of most promising applications of AI - Intelligent Computer-Aided Instruction (ICAI). It is more effective than conventional instruction. It could be an important aid to meeting our increased requirements for professional and technical knowledge.

Voice recognition technology is one of the most difficult problem area in the whole of AI research. Currently, progress is being reported from a variety of organizations. But the bottom line is that economics are currently prohibitive for anything near full language capabilities. (Now a system which can recognize 1,000 words costs $3,000 purchased in large quantities.) Although limited-function voice recognition is in its second generation development stage, what's now available is generally only a speaker-dependent capability with limited vocabulary. However, we must learn from history and expect the same dramatic cost reductions in voice recognition that have occurred in other areas of technology.

G. Image Processing

Digitized image processing is the technology for transforming text and images from a paper document into binary data, understood by a computer. The main appeal of this technology is the potential for eliminating many of the millions of paper documents pro-

duced by U.S. businesses each day. Image processing could offer significant economies to professional firms by permitting the entry of client data into the tax or financial processing system without any keyboarding through the use of low cost scanners that can recognize text. Further, a permanent file will be created at the same time.

By the end of the decade, optical laser disk storage systems will be a reality. These stable, low-cost devices, coupled with increased data address capacity and the capabilities of 32-bit micro-processors with improved graphics processing should allow for the integration of text (office) and normal data processing files. Whole documents will be able to be stored digitally, as well as be available for subsequent manipulation by programs. New methods of data entry will be practical and will eliminate much of the present transformation, i.e., re-keying of data. New software will be developed to enable selection of text in the computerized databases. Fiber optic links, capable of transmitting digitally encoded documents at speeds of millions of bits per second (compare this to existing computer networks which typically run at 9,600 bits per second), will be subject to continued price performance improvements. The recent introduction of low-cost laser prints and

scanners, coupled with improved read, write media, should enable CPAs to witness these developments in their clients' offices within the next few years and in their own CPA's office by the end of the decade.

II. IMPACT OF NEW DEVELOPMENTS ON THE PROFESSION

A. Auditing

The impact of all these new developments will probably be evolutionary, but which, at times, will seem almost revolutionary given the propensity of people to react slowly to change. As with most things, the impact of these new developments on future audits falls into a range of modest impact to dramatic impact. On the low end of the scale, we would expect to perform audits in the traditional way using a micro-computer as a super calculator. On the high end, we might expect to change what we audit, as well as how we audit.

More specifically, the impact can be viewed in the following ways:

1. Effectiveness -- Audits of the future will contain more analytical review because the micro-computer will allow the auditor to make more calculations and statistical analyses possible without being cost prohibitive, as might have been the case with manual methods. More industry

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and other economic data will be available through public databases. More projections of expected results for a company will be made which can then be compared to actual results.

2. Efficiency -- Micro-computers process vast amounts of data quickly and accurately. Most clerical tasks will be eliminated. Once the technology is widely available for down-loading of data from a client's mainframe to the auditor's micro-computer on an easy, routine basis, the data input problem will be solved and efficiency greatly enhanced. The efficiency on audits in terms of reduced hours will come without an offset in equipment cost as equipment cost continues to shrink. Storage of files and the space they occupy would no longer be a problem, particularly if laser discs, capable of storing several hundred thousand images, are utilized.

3. Portability -- Lap-size portables are already a reality, but their usefulness will increase as they take on more of the storage and computing capabilities of the current transportable machines. In short, the auditor will rely on his micro-computer in much the same way as he does his hand-held calculator today.

4. <u>Use of Expert Systems</u> -- Expert systems and artificial intelligence have potential for becoming household words in the profession in the future. Expert systems -- computer programs for making inferences about a set of facts comparable to the inferences an expert auditor would make -- hold great promise as an audit tool. But concerns about turning auditor judgment over to a machine and training new accountants the art of judgment when a machine can already do it are issues which will need to be addressed by the profession.

5. <u>Change in Staff Mix</u> -- Most likely there will be a change in the mix of audit staff as we know it today. In one scenario, the staff might consist of middle level personnel to perform an initial review of data generated by paraprofessionals. In another scenario, the staff might consist of lower level personnel generating computerized work papers to be reviewed by executives. This might be the case where expert systems are used. It is not yet clear what the typical staffing pattern will be, but most certainly it will be different from today and will cause a change in the way executives are trained and developed.

6. Complexity of Client Systems -- The complexity of client systems may conceivably grow to the point where they become impractical to audit using todays methodologies and techniques. The auditor may have to place greater reliance on built-in vendor security measures and control mechanisms and even **declare reliance** in his accountant's report on dominant vendors that have received independent, third party technical audits as an expert.

7. Audits of Client Databases and Systems for Shifting Financial Reporting -- Some notable members of the profession are already projecting that in the future the principal reporting vehicle of a corporation will be multi-layered databases instead of financial statements. As database reporting develops to supplant traditional reporting, dramatic changes would necessarily affect public accountants. A shifted emphasis in training will be required to help staff develop as information professionals rather than auditors of financial statements. An auditor's report may find him attesting to the reliability of the database system and controls attached thereto. Attestation may focus on a continuous system, rather than on specific outputs.

This migration from auditors of financial statements to auditors of databases could have a dramatic impact on opportunities for the profession. Besides auditing the database of information about a particular company, the profession could find that audits are demanded for public databases dealing with information broader than just a company. Another new audit opportunity which has recently arisen is in the certification of computer software and hardware systems. This audit function will certainly expand and be assumed by other than the accounting profession if we delay or defer.

B. <u>Tax</u>

The impact of technological developments may, at least in the near-term, have the greatest impact on the tax practice of the CPA firm. It can be said with virtual certainty that significant changes will, and already are, occurring in the tax practice. Further, the scenario can be outlined that without some dramatic action by the profession, the tax practice as presently known could be eliminated by the use of rapidly developing technology by non-CPA tax "experts".

The traditional areas of the tax practice can be divided into tax planning and tax compliance. In both of these areas, the computer and competition among hardware and software vendors is putting significant pressure on the fees CPAs are able to charge for their services. Frequently the client is asked to complete a lengthy questionnaire relating to income, expenses and other tax transactions. This information is then input to a computer and a computer generated return is given to the client. The client all to often asks the question, "Since I collected and organized the information and the computer prepared the returns, why is my fee so high?" With the increasing use of micro-computer tax planning software, the same questions are being asked concerning fees for tax planning services.

Personal financial planning, a rapidly growing area for many CPAs, has become micro-computer based almost from inception. The micro-computer generally made this service feasible for the less wealthy because of the computer's ability to allow several alternative calculations to be performed quickly once the basic data were input.

In the past several years, we have experienced frequent changes in the tax laws. This has created significant increased effort and expense for CPAs because of time required to read and analyze the changes and disseminate materials and provide training to staff members. Automated tax compliance and planning are greatly simplified by changing the computer program and distributing, if necessary, the altered programs to the office locations.

The current areas of technology which are driving the evolutionary changes in the tax practice include:

1. Micro-computers characterized by decreasing cost and increasing capabilities;

2. Increasingly user friendly and lower cost software being developed by competing vendors who recognize that the friendlier the software, the larger the market;

3. Decreasing cost and increasing speed of laser and other types of printers which are capable of printing forms acceptable to the IRS;

4. Decreasing cost and increasing speeds of telecom-
   munications which make feasible the rapid trans-
   mission of data to remote locations.

In the area of emerging technology are the expert
system and eventually the artificial intelligence
machines. Some expert systems are here today which
can out-perform professionals in some areas such as
mineral exploration. It is a matter of conjecture
as to the timing of the arrival of the expert tax
system, one to five years is clearly a good estimate.
It is not a matter of conjecture, however, that "it"
will arrive.

The fully evolved concept of artificial intelligence
would (will) be a computer-like machine that can
actually think, reason, make inferences, learn from
its mistakes and consult with other experts just as
other human beings do. It is again a matter of
conjecture as to whether the human thinking machine
can ever be constructed. However, too much time and
money are being devoted to this area by large cor-
porations, small think tanks and national governments
to pass AI off as science fiction. It is our predic-
tion that within the next 10 to 20 years, a machine
will be developed that will be better than the best

human tax professionals. This machine will be edu-
cated by some of the best human tax professionals.
It will have access and instant recall of all of the
IRS codes, regulations, court cases and rulings. By
following the rules of experts interviewed to program
the expert system, it will have access to an almost
infinite number of experiences from actual practice.
Further, a tax-based expert system will seek the
council of human tax professionals when an answer
cannot be given.

Already, the subcommittee is aware of attempts to
develop tax-based expert systems for the smaller
domain estate taxation area.

Concurrently with these advancing technologies is
an increase in competition for institutions not
previously included in the tax planning and tax
compliance practice. Generally speaking, our compe-
tition has come from attorneys and, to some degree at
the low income end, from specialized tax preparation
organizations.

With the advent of deregulation of financial institutions, several other competitors in the tax planning and tax preparation areas have appeared or increased their marketing efforts in the tax area. We now see banks, brokerage houses, certified financial planners, insurance companies and the so-called financial supermarkets actively entering the tax area. This new competition can be divided into two categories: low capital competitors and high capital competitors.

In the category of low capital competitors would be included the low cost micro-computer with both tax planning and preparation software and a printer capable of producing acceptable forms. The software will be user friendly and the software vendor might even add access to tax experts for more complex situations. Another low capital (actually low incremental capital) class of competitors would be the service/product linking competitor. Included in this category would be banks, brokerage houses, insurance companies, certified financial planners and financial supermarkets. With low cost tax preparation and tax planning software and micro-computers, all of these groups can enter or increase market penetration with relatively small incremental capital requirements.

In the area of high capital, competitors will be the expert system and ultimately the AI machine. The expert system will have the following characteristics:

1. Very high development costs
2. Very high volume capabilities
3. Very high potential return on investment
4. Low cost personnel
5. Low cost locations

The institutions most likely to develop such expert systems will be large banks, brokerage houses, insurance companies and financial supermarkets.

The low capital competitors are here and may continue to take business away from the CPA. The high capital competitors are being developed. When they will reach the market place is, at this time, not pre-dictable. Unless the profession develops specific action plans and begins immediately to implement those plans, the high capital competitors could take away a significant portion of the tax practice from the CPA. The impact could be very significant to the larger firm, but perhaps devastating to the smaller firms and individual practitioners.

C. Impact on Management Advisory Services

1. Small Systems

Numerous EDP/software consulting opportunities
will exist in the area of small systems and
financial management software. The party on the
front line, the professional who first hears of
the client's need, is either the auditor, the tax
specialist, or the small business services part-
ner. They should be fully equipped to advise
clients and implement micro-based financial man-
agement applications.

The traditional EDP/IS consultant is perceived as
a big system expert and, therefore, too expensive
for the small businessman. Also, the EDP/IS con-
sultant has been perceived as allied to the MIS
tradition which did not service the end-user suf-
ficiently and, in fact, was often autocratic,
technocratic and bureaucratic. Increasingly the
end-users have felt that they knew more about PCs
than did the "computer experts" of the CPA firms.
This is because the EDP/IS consultants did not
take the initiative on end-user computing advice
and were initially not well equipped to respond
to client queries. Finally, it became obvious
to organizations that massive training was the

perceived need; and client organizations have not viewed their EDP consultants as training specialists.

The business solution is the key to small systems consulting; therefore, the business person's trusted advisors, usually financial experts, are the ones being consulted. Thus, in some CPA firms the financial management consultants are sought out first; in others, the auditors alone handle the opportunities; another approach involves training a cadre of private business practitioners.

Beyond the large national firms, the local and regional firms have grasped the unique opportunities they finally have to generate new revenue, and bring new clients in the door through microcomputer consulting. Staff from these firms in large numbers are taking whatever training courses they can find. They emerge from these as a new generation, so to speak, of computer experts, although they may not be part of a formal MAS practice unit in these smaller firms. But, as they are already trusted by the client and have exposure to the business needs, they will get a great deal of this business.

In other cases, regional firms have acquired computer dealerships and have transformed their staff into implementers, trainers and software selection advisors.

There is clear indication that the large CPA firms as a group have lost some of the initiative in small systems consulting. In addition to the above discussion, we also see other cases where the business doesn't go to the CPA firm at all. If the auditors are too busy or are inadequately trained, it is difficult to engage the MAS consultants for a short-term, small fee project, and the private business advisor has limited exposure to the industry/client-specific application software market. The business may then go to a small independent consulting firm which packages sales and training attractively. Or the business may go to the local business school professors, to their students, or to CPA firm alumni, in private practice, doing what they couldn't get their big firms to do.

2. Large Systems

What's left for these specialist MAS consultants is plenty, however. In the first place, there will be large systems for a long time to come,

with their attendant problems, life cycle upgrade and replacement requirements, and the appropriate relationship between dollars invested and dollars available for specialized consulting. What must take place is a combined education and marketing effort so that the MAS consulting force is perceived as understanding the entire spectrum of a client's computing needs. Not that they will usually advise on the $500 micro-software decision. But they must forcefully deal with the new challenges presented by the information center, the development center, the chief information officer and redundant data collection/database development. These consultants must get even more attuned to overall business problem solution, and ultimately should gear themselves to provide strategic information management consulting at the top level. For that's where the trend is going. The most important near-term effort is to transform client perception of these consultants. This can be facilitated by strong commitments to publishing and speaking in the right settings (to executives, not specialists).

Where CPA firms can overcome their organizational and political constraints, they will find a huge market now for micro-computer systems consulting. As pointed out frequently, there are millions of small-to-medium sized firms facing their first conversion to computers now. Their need is for that unique blend of advanced computer and accounting skills which increasing numbers of our CPAs can provide. In fact, nationally-known financial recruiter Robert Half predicts that with computer literate personnel becoming indispensable, computer specialists will outrank the tax personnel in CPA practices. CPA firms need to take the lead as a 62% growth in micro-computer sales means that they will outsell TVs and offer unlimited opportunities for consulting and information management.

3. **Requirement for Personnel with EDP Related Technical Skills**

The pure technical specialist has probably reached the peak of demand, and that would apply to the telecommunications expert in particular. Now, as we migrate to the era where the technical information systems background will have to be blended with micro-computer applications exper-

tise, stronger communications skills and broader perspective to grasp the clients' systems from an information management perspective.

The office systems consulting specialists should be re-integrated with the IS specialists and telecommunications experts, because compartmentalization within organizations will begin to disappear and integration will prevail.

So, the MAS consultants will need more skills than before, and will need to be integrators rather than specialists in isolated clinical areas.

These requirements for professionals with hybrid background will, we believe, result in demand exceeding supply. The recent rapid growth of MAS activities within the profession appears to bear this out. Thus, we can expect a repeat of the phenomenon of the 60's and 70's, a seller's market, high salaries and high turnover. This can be remedied by major investments in continuing professional education and commitments to cross-training. Intelligent computer-aided instruction (ICAI) will certainly fill a need here and be an

important investment to be considered. Training requirements must be increased for these professionals; 120 hours/year might be more appropriate for them, given the rapid change in technological advances.

Thus the most significant trend we see in the impact of widespread computerization on the CPA profession, and MAS opportunities in particular, is the vastly enhanced competitive opportunity for the smaller firms to consult in micro-computer business applications. The smaller firms will continue to reap the benefits if they back their position with staff solidly trained at an adequate technical level to address clients' applications and hardware and software needs. The approach to training must incorporate: communications skills, consulting skills, marketing expertise and, of course, micro-computer hardware and software.

4. Computer Related Products and Services
   Changes in technology provide the opportunity for a variety of new services dealing with software development, OEM, turnkey systems and distribution

channels for hardware/software. Training of client's personnel, particularly to achieve high white collar productivity, is a service which many CPA firms are finding profitable.

5. Shifts in Practice Mix of Current Services

More consulting opportunities will appear on new emerging technologies in telecommunication, networking, office automation, data base management and personal productivity software.

6. Decision Support Services

More sophisticated advice will be rendered on decision support services through software tools. Examples are micro-computer based financial planning using spreadsheet software, inventory decision support, expert systems, routing of product, people or vehicles and others.

D. Impact on Management of an Accounting Practice

The advances in the computer and automation technologies have a significant impact on the way that accounting firms are managing their practices today and will manage their practices in the future. An objective in managing an accounting practice is the generation, control and communication of various

types of information in an efficient and cost-effective manner. Computerization and automation are vehicles which can be used to achieve this objective.

1. Economics of the Business

   Computerization and automation impact virtually every aspect of managing the accounting firm; from general accounting of firm activities to the quality of the services that is provided to clients. Because of this, management must carefully plan out the firm's use of these technologies.

   The technologies available to the accounting firm, in general, are word processing, data processing, electronic printing, local area networks, telecommunication, duplication and voice communication. Previous to the advances in these technologies, they were all being used as stand-alone functions of the accounting practice. Today, however, many of these have been integrated to the point where one piece of hardware can be used by many users to perform these different functions.

Though these technologies are available, use of all of them may not be necessary for a particular firm. Management must first decide what functions of the practice, such as client report generation, internal accounting and communication with other offices, should be performed using these technologies. The decision on which functions should be automated and/or computerized is beyond the scope of this report as it will be unique to each individual firm. However, once the functions have been identified, management can then assess the firm's technological needs.

The capabilities of micro-computers have increased considerably in recent years as the new generation of these computers can now perform all of the functions of a word processor. In addition to performing word processing, these machines can also execute data processing applications, store large files and support networks. When evaluating a micro-computer, management should take into account the flow of information within the firm and the structure and duties of the administrative support staff. These will dictate the capacity required in the computer in terms of the volume of text and the number of workstations.

The word processor should also be evaluated for the amount of training that will be required for administrative personnel to become proficient on it. Finally, management should consider the compatibility of the equipment with other automation equipment that the firm either has or is planning to acquire. Most word processing software will transmit files to other types of equipment; however very few are able to transmit files that are editable by the destination hardware and software.

The every increasing power of micro-computers should cause some firms to view micro-computers as more than just an auditing tool. Today, we have portable micro-computers that have up to 20 megabyte storage capacity and offer memory of 2.6 megabytes to process data. Desktop versions can offer scores of megabytes of storage in a single unit. Because of this, the micro-computer is becoming a far less expensive alternative to the mini-computer for many accounting practices.

There have been many advances in printing technology also. Laser printers are now available for use with micro-computers and word processing equipment for a relatively low cost. These printers provide a high-quality output for report preparation and are very fast, with some producing documents at a rate of between 8 and 20 pages per minute. Further, these versatile units with the proper software can produce any tax form. Impact printers are available which offer the same quality of output for still lower cost, however, their rate of document production is much lower.

Through local area networking, all of the functions mentioned above can be performed from the same or many different intelligent workstations. The key to this integration is the compatibility of the devices to be used. The compatibility of the hardware and software must be foremost in the planning process for the practice. Even without local area networking, the different functions can be integrated through the use of telecommunications. For example, a micro-computer can use a phone line to transmit documents to a word processor.

Duplication and voice communication are technologies that have remained "stand-alone" for the most part. However, the ability of data processing systems to support voice messaging and electronic mail is rivaling the duplication and voice communication technologies. Functions that historically have been performed using these technologies can now be performed with data processing equipment.

2. Security, Control and Integrity

With the advent of these technologies comes a whole new challenge to the CPA firm in terms of controlling both client and firm information. The protection of data, software and hardware is a prime concern in the management of the accounting practice, and it should be addressed in the same manner as control issues are addressed for clients.

An obvious concern is the physical protection of the hardware devices from theft and/or destruction. This is usually accomplished in much the same manner as any other capital asset of the firm. A control concern that is not so obvious, however, is the physical protection of the data medium. These are usually not treated with the

same priority as the hardware because of their relative insignificance in cost. The concern with medium such as data diskettes is not with their value but with the value of the contents. Often, the data contained on the medium can easily rival the hardware in terms of value to the firm. There are three major points to consider in the protection of data:

- Prevention of access to data by unauthorized individuals.

- Prevention and detection of unauthorized changes to data and software.

- Prevention of and recovery from the loss of data.

All of these points should be addressed in the firm's policy governing the use and protection of the equipment. Protection from unauthorized access can be accomplished in a variety of ways including:

- Keeping data medium secure and issuing them to authorized individuals only.

- Using password protection schemes for word processing and data processing equipment.

- Using key-lock devices to prevent access to equipment.

Prevention of unauthorized changes to data and software can be handled in the same manner as protection from unauthorized access. A key issue is the detection of changes that have been made.

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This is especially critical when providing client services. Firm management should set standards governing the use of computers and other equipment for performing engagement tasks. These standards should specifically address:

- Review requirements for applications used to generate workpapers. This should be further divided for applications prepared by firm personnel and applications prepared by client personnel.

- Documentation requirements for applications. This would include identification of assumptions, formulas, input, program logic, etc.

- Testing requirements for applications developed by firm personnel and data input by client personnel.

Prevention of and recovery from data loss is a very important concern that tends to be overlooked by many users of micro-computers and word processors. It is not uncommon for data diskettes to have bad sectors which will make data unusable nor is it uncommon for a disk to "crash" and make recovery impossible. It is therefore imperative for management to set policies for the backing-up of data and programs. Many users have procedures which require daily, weekly (or a combination of the two) backups of all data and programs. Prevention of data loss is indeed a virtually

impossible goal. However, the use of power-surge protection devices can help to reduce the risk of data loss due to irregularities in the electrical current.

3. Conclusion

The benefits of using these technologies in an accounting practice include: (1) reduced costs due to time savings; (2) the ability to make more informed audit decisions; (3) improved quality of reports and workpapers; and (4) staff competence by letting them have access to the automation equipment they will be encountering in the field. However, to ensure that these benefits are realized with the minimum amount of associated cost, firm management must properly plan for and control the use of them.

III. RESPONSE OF THE ACCOUNTING (CPA) PROFESSION TO CHANGING INFORMATION TECHNOLOGY AND OTHER RESULTANT CHANGES

A. The Need and Opportunity for Response

Changing information technology offers (demands) that the profession respond in several ways. The problems (opportunities) faced by the profession as a result of such changes can be described in several broad categories. Expertise and competence are one area of concern which must be addressed by the profession. Solving this concern will allow the profession to competently deliver services of the types already in its portfolio of services and to take advantage of significant future service opportunities. Changing methods and practices in the delivery of current and future services are another concern. New information technology will allow for or mandate shifts in staff composition as work methods change. In addition, information technology can have a substantial impact on work productivity. Standards for professional services is the final broad area of concern. As information technology changes and, as a result, methods of professional services delivery change, the old professional standards will need to be reviewed and new standards considered.

B. Differential Responses by the Accounting Profession

The "Accounting Profession" is a multi-layer concept composed of the following categories of participants:

Individuals - working for accounting firms , in the accounting or management function in organizations and as educators compose the individual's roles as CPAs.

Accounting Firms - ranging in size from the single professional person (sole practitioner) firm to the largest multi-office, international firm. Some smaller firms belong to associations of firms.

State Level Organizations - state societies of CPAs and state boards of public accounting.

National Organizations - AICPA

International Organizations - IASC

Each category is faced with a different set of plausible and appropriate responses. In general terms, individuals and firms can take direct, substantive actions to modify competency and make shifts in areas

and methods of practice as appropriate in response to changes in information technology, while the state, national and international level organizations can take indirect, facilitating and mandating actions to foster the appropriate changes.

C. Categories of Response

This section will review the four broad categories of response which will be dealt with individually in the sections which follow. The particular role of the AICPA in each response category is highlighted in those sections. The changing nature of the services offered as a result of developments in information technology by CPA firms is the driving force mandating a response. Both the nature of existing services and the existence of new service opportunities, as well as the demise of some existing services, should motivate the following categories of response.

Enhancing personnel competence is one of the most pervasive response categories. CPE offerings and practice aids are avenues for competence modification for existing personnel. University education guidelines and hiring practices of firms can have a major impact on the competency levels and mix of future staff.

Research on developments in information technology in a period of rapid and substantial change in information technology and the related changes induced in the ways that the information system function in organizations is operated is essential. Early identification of trends is fundamental to the ability to make a timely response.

Studies of new tools and services, including both technical studies and market studies, on new ways to offer old services, on possible new service areas, and on changing competition from other types of professional firms for clients, is an enabling step to allow practice units to engage in changing practice areas.

Certification and practice standards can be modified to respond to information technology shifts. In particular, the CPA examination coverage in the information technology area has been and is badly in need of revision.

D. Personnel Competence

Changes in information technology mandate that CPAs modify their abilities. Firms play a critical role in this area because they provide the resources to support the development of the vehicles for modifying competence through CPE courses, funding the participation by individuals in competence improvement and donating staff time to participate in state and national level accounting organizations which produce practice aids. The decision by firms to acquire, train in the use of, and encourage and/or require the use of information technology will be an important factor in the speed of response.

The hiring practices of firms have a strong impact on the type of product which university accounting programs produce. A shift in hiring by firms from accounting students trained in a traditional curriculum to a student primarily trained in "information technology" and only secondarily trained in the traditional accounting curriculum is already an observable trend in some universities. The AICPA can play a major role in the competence arena by developing university education guidelines which describe a curriculum with a proper balance of information technology topics to reflect the perceived importance

of the area by the profession. This step will help
to ensure the future competence of accounting re-
cruits. Current accounting professionals can be
assisted in modifying their existing competence
levels by the development and marketing of CPE offer-
ings. Competence can be modified by the preparation
of technical guidance for appropriate practice areas.

E. Monitoring of Information Technology Developments

A critical step which the accounting profession must
take is to monitor and forecast changes in informa-
tion technology through futures research. Large firms have
the resources to accomplish this task individually
but the AICPA is the most efficient locus of this
activity and an essential locus for most of the pro-
fession. The thrust of the monitoring activity is to
detect trends in information technology so that the
profession can be pro-active, rather than reactive.
A timely response to changes is possible only if the
changes are detected early in the change process.
Literature reviews, technology vendor presentations
and site visits are methodologies which are useful
here.

F. **Studies of Applications of New Information Technology and New Practice Opportunities**

A companion activity to the monitoring process is research which identifies the practice impacts of the new information technology. Two fundamentally different types of research are needed. One is creative in nature, centering on the discovery of uses of new technology. The second is empirical in nature, centering on the assessment of new and changing markets for services.

G. **Competence Certification and Practice Standards**

The content of the process by which the certification of professionals in accounting is accomplished is a major area in need of study and revision.

In a historical perspective, beginning in the mid 1950's and reaching substantial penetration by the late 1960's, most large and middle sized client firms had "computerized" their accounting information processing. This trend has major competence and certification of competence implications for the auditing and MAS practice areas. Yet, in 1984, perhaps twenty years after the fact, the CPA examination content does not reflect this change. Current CPA exams give only token coverage of information technology while the practice implications of information technology

have been substantial. Since 1970, the degree of computer based accounting has risen sharply and newer developments in personal computer technology, telecommunications and other areas have made the exam content even more seriously flawed. In fact, information processing has expanded from automated accounting applications, now focusing more on the strategic value of non-financial data. Future CPAs will need to understand the information flow throughout an enterprise just to comprehend how interconnected data networks are utilized to eventually arrive at the auditees financial statements.

It is not hard to make an argument that the profession has not only not been pro-active, it has not even been reactive. A major CPA exam content revision, transcending the addition of a few questions, is long overdue.

Standards for professional practice in all areas will be impacted by changing information technology. As client firms change their information technology utilization, standards for existing and new services need to be modified.

IV. RECOMMENDED AICPA ACTION STEPS

The simultaneous development of both new EDP hardware and software capabilities, coupled with the widespread computerization and automation of the world's businesses, will have a profound impact on how large and small CPA firms seek and deliver new services to their clients.

The AICPA can respond in several modes. Some changes can be mandated (e.g., establishing standards). Some changes can be facilitated (e.g., offering a CPE course). A third response mode is informational (e.g., an article in the JOA). We may need to consider a new approach -- joint professional effort, coordinated by the AICPA, that transcends individual firm activities.

Thus, our recommendations fall into two categories: action steps for existing AICPA divisions, and the suggestion of a new AICPA function.

A. Existing AICPA Department/Functions:

1. Information Dissemination - Publications Department -- The AICPA should be active in disseminating technical EDP-related information, both to specialists and general practitioners. The Journal of Accountancy and CPA letters are the natural place for information of interest to gen-

eral practitioners. Some of the articles that might appear there are:

- Product reviews (new integrated software packages, tax programs, accounting software)

- Educational articles (What is a database?)

- Current interest (security in micro-networks)

- Practitioners forum (questions, answers, letters)

There is no good journal for the EDP specialist in public accounting, and there is much duplication of materials between firms. We recommend that the AICPA study the feasibility of sponsoring a technical journal to be established for such specialists. Such articles would alleviate the need for individual firms to each research topics of interest. A technical journal of this type could attract international professional and academic interest.

2. Certification - Examination and Regulations:

a. Specialization Certification and Recertification-Information Technology is advancing rapidly. The ability of a CPA to provide appropriate service to a client depends in some cases on the level of understanding that

the CPA has of the technology. For example, an auditor needs a good degree of understanding in order to evaluate the internal accounting controls over a computer system (e.g., an on-line banking network).

Consideration should be given to requiring certification of new and existing practitioners who need such skills. The Institute could prepare technical examinations in the EDP area or investigate cooperative activities with organizations offering such certifications as the CDP and CISA.

b. CPA Exam - The present CPA exam does not, in our view, require sufficient EDP expertise of candidates. As a result, CPAs are released into the profession with an inadequate level of EDP knowledge. The exam, therefore, should be modified to include suitable questions relating to EDP.

3. Specialized Staffing - Industry and Practice Management -- The highly competitive environment of the professionals performing the special work associated with auditing complex applications that incorporate data base technology and com-

munications networks imposes great pressure on them. They generally command high salaries not commonly found amongst the audit staff and hence, the typical pay raise scales do not fit. Additionally, these professionals are under other social type pressures, since they do not "fit" the mold. Their career paths are not clearly defined, and they generally lack a mentor who recognizes and understands their needs. It is recommended that the Institute issue salary surveys for people with these skills in industry and also provide some insight into career counselling that can assist member firms in attracting and retaining those professionals.

4. <u>Strengthening Continuing Education - CPE Course Development</u> -- The development by the Institute of a more comprehensive CPE training program which will have "hands-on" courses in the following areas:

- In depth, hands-on technical training for the highly skilled professional on topics of current technologies such as data base, communications, security, operating systems, etc.

- In depth, hands-on training of the accounting/
audit staff in the application, interpretation
and use of various applied tools such as micro-
corporate tax return preparation, micro-part-
nership tax preparation, etc. Sample packages
would be used for these training sessions.

5. <u>New University Education Standards - Relations
With Educators</u> -- University education require-
ments in the information technology area should
include three categories of knowledge. First,
the information system concept as found in client
organizations must be understood. Computer
system hardware and software devices and archi-
tecture, application development and programming
methods, data base development and programming
methods, and data base concepts and controls all fall
in this category.

Second, the personal productivity tools which are
available (primarily on micro-computers), includ-
ing word processing, spread sheet, data base and
communication software should be experienced by
all accounting students.

Third, applications of information technology to accounting practice should be understood.

Current education pronouncements are outdated and should be reviewed and revised. The AICPA should strengthen and expand its relations and interactions with the American Assembly of Collegiate Schools of Business with particular emphasis on standards for Accreditation of Accounting Programs.

6. Monitoring Mechanism - Future Technology -- Continue the monitoring and tracking of new developments that will impact upon the accounting profession in the 3 to 5 year time frame; report these findings and their potential impact to the Institute; identify a mechanism/vehicle to communicate these results to the membership. These functions are currently performed by the EDP Technology Research Subcommittee and we feel should continue to be the function of this subcommittee. However, this subcommittee deals with technical issues whose implications affect all divisions of the AICPA and thus consideration should be given to its proper placement within the AICPA structure as a full committee or subcommittee reporting to the Board.

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B. Proposed New AICPA Function

1. Need for Pooling of Members/Firm Resources:

- One central point emerges from the committee's
  look at the future; the proliferation and
  availability of ever more powerful computers
  designed to support AI applications and expert
  systems will confront the profession in ways
  never before experienced.

- For the first time we foresee that the CPA pro-
  fession will be faced with the need to become
  more capital intensive harder to successfully
  embrace and react to these new technologies in
  order to continue to offer competitive services.

We believe that the present capitalization of
member firms, both large and small, precludes
the ability of the profession to react to these
trends effectively and thereby recommend that
the Institute seek out a vehicle, perhaps joint
development or research, to allow the profession
to profitably explore these technologies.

2. Research and Resources Staff -- The AICPA should
    establish a group of highly technical indivi-
    duals, not necessarily CPAs, who will be charged
    with the following responsibilities:

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- Identify areas where the availability of software would make the CPA's job easier. In many instances, the larger firms are already doing this identification and development themselves, but the smaller firms are "out-in-the-cold." An example of this could have been FASB-13. The research group would issue a functional specification to all interested parties, such as software houses who would develop the software for sale to accounting firms.

- Review and evaluate currently available audit, tax and accounting software identifying the vendor, product name, address, telephone number, price and functional capabilities.

- Review of new hardware developments (similar to above bullet).

- Provide a technical information hotline service.

- Assist in the development of technical CPE courses.