Quality assurance in a large commercial data processing installation

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ABSTRACT

Quality assurance (QA) is one of the most misunderstood, highly desired, yet inconsistently defined, organizational entities in the data processing industry today. There is an increasing number of articles and literature available on the subject. Senior management finds it very attractive. In spite of this, however, few commercial data processing organizations have successfully assimilated effective QA programs into their organizations. This paper describes such a program by the Information Services Group (ISG) of Chemical Bank. Particular emphasis will be placed on the organizational definition of QA and the philosophy of its operation.
INTRODUCTION

Quality assurance suffers from a lack of standard definition. When discussing QA with different companies, it is very important to begin the discussion with a carefully worded description of what you mean when you refer to QA. What are the component parts? Where does the function report? What is the management philosophy behind the organization and how does it know that it is satisfying the objectives as viewed by senior management, middle management, and technical personnel? Anyone faced with the challenge of establishing a QA organization has been faced with these questions. They are not easy questions to answer. In light of the lack of standardization and of the general lack of understanding by management and technical personnel regarding the function itself, QA becomes a most difficult organizational unit to create and manage. In this paper the Chemical Bank QA organization and the organizational structure, goals, and philosophies are discussed.

THE CHEMICAL ENVIRONMENT

Chemical Bank is the sixth largest bank in the United States. It has the second largest retail branch system in New York City. There are many offices overseas and throughout the United States, with over 18,000 employees. Chemical's assets are in excess of $40 billion.

Most data processing within Chemical falls under the management of the Information Services Group (ISG). ISG has responsibility for all of the general purpose computing for the bank, as well as most of the special purpose computing. Special purpose computing outside the management concern of ISG includes check processing, the processing requirements of several subsidiaries throughout the country, and data processing for our international branches. ISG has responsibility for the operation of three computer sites: one in New York City, a second in New Jersey, and a third on Long Island. ISG operates multiple IBM 3033s and 3032s as well as a significant number of smaller mini systems. An extensive, standard communications facility is available, providing the Bank with a worldwide communications capability.

The quality assurance organization is one of the units reporting to the senior vice-president in charge of ISG (see Figure 1). There are two Systems Development Groups with a total staff of over 400 programmers and analysts. The 1982 ISG staff includes more than 1,000 people, with a budget in the range of 100 million dollars. Systems Development (SDD) develops and maintains business application systems in a matrix-like fashion, working very closely with both user groups as well as database and communications technical support groups (represented in the organization chart as Information Systems Integration [ISI]). In most cases, the user groups are surrogate users (not the end user) and are formed into what we call Automation Groups. This relationship of SDD to users and technical staff becomes very important when understanding the role that QA plays in the development process.

QUALITY ASSURANCE ORIGINS

The quality assurance function was established in late 1978/early 1979. It started as a staff of four. There were four start-up activities: systems assurance, change control, project accounting, and standards and procedures.

It was created by consolidating existing functions which were placed in other parts of the organization. For example, at that time, ISG had a standards and procedures group as well as a systems assurance function reporting to the database group. Change control was in the computer operations area.

The ISG budget was about $24 million. At that time, ISG was experiencing the problems that many people consider typical of commercial data processing: all too frequent delays and cost overruns in Systems Development; general instability in the computer operations environment; and an apparent lack of acceptable administrative, developmental, and operational standards and guidelines that were used by the personnel in the organization. This is not to suggest that the introduction of QA solved all the problems nor is it to suggest that it was introduced in response to a specific crisis. Our budgets were growing rapidly, and change was being introduced into ISG at an accelerated rate. This accelerated rate of change, coupled with dramatic personnel growth and increasing complexity (from both a technological and organizational perspective), caused severe strains on management. It became evident that we needed to standardize and institutionalize many management and technical functions if we were to be successful. QA was but one of several management improvements that were introduced to help us manage better the data processing and communications enterprise. In establishing QA, however, several specific objectives were identified.

We wanted to establish a quality environment and to reduce the tendency for crisis management through problem avoidance. We wanted to be able to provide rules and consistency in terms of the way we worked and the products that are produced.

We also wanted to provide consistency in terms of the way we conducted business with our clients. Our final objective was to raise the level of productivity and productivity awareness. For ISG to be successful we had to have a disciplined development process, provide for continuing integrity of our production systems, increase our organizational productivity, and raise our level of organizational effectiveness. These overall objectives, as expressed above, were translated into a QA
A DIFFERENT APPROACH

I would like to suggest a different approach to QA, one of active and positive management participation. QA must play a leading role in the management of the organization and must have processes and check points in place that facilitate the identification of problems before they occur. QA should be able to identify and understand the technical issues, while applying management judgments in terms of recommendations for resolution. Managing a large data processing organization is indeed a challenging and demanding job. Data processing management is constantly dealing with large, complex issues, and there exists a need for third party objectivity to current issues and problems. This would suggest that QA must be in a position to address a technical issue and help interpret the issue in management terms in such a way that management can take timely, corrective action. In my view, one of the worst things that a QA organization can do is to determine that a situation is out of control when it is too late to take corrective action. The anticipation of problems, being in a position of knowing and anticipating a problem, is a key to having senior management support for the QA activity.

Assuming a positive management stance provides many benefits. One favorable result of functioning this way is that...
QUALITY ASSURANCE
CHARTER AND RESPONSIBILITIES

The primary purpose of Quality Assurance (QA) is to foster a uniformly high level of quality in EDP Systems developed and installed on behalf of the Information Services Group. This purpose is achieved by means of provisions which have been set up:

1) for assuming active and coordinated participation in considerations leading to the establishment, revision, evaluation and dissemination of standards, management guidelines, and procedures;

2) for research into definition, establishment, enhancement, and maintenance of a systems development methodology(ies);

3) for consultation, review and evaluation of computer projects at significant milestones in their development;

4) for establishment, enhancement, and maintenance of a methodology to facilitate the orderly introduction of change into the operational environment; to manage the process of introducing such change into the environment;

5) for research into definition, establishment, and maintenance of a standard, consistent, and well-defined testing methodology;

6) for implementation and maintenance of an automated project control and project planning system that facilitates planning and project accounting;

7) for providing the impetus and focal point for the successful and timely introduction of new technology to ISG's computing environment.

Figure 2—QA organization charter

information becomes more readily available to the QA staff. Managers, project managers, and programmers are less reluctant to discuss their problems. Certainly there is a lot to learn from looking at a document, and a lot can be gained by working in isolation. However, the key to QA effectiveness, the key to producing a positive effect on the company and the data processing organization, is being able to assimilate all that information, including what you learn in the hallways; exercising good judgment; and making timely recommendations to management in such a way that no one is embarrassed. A lot of work must be accomplished behind closed doors, and a lot of persuasion takes place. QA should become part of the management process, have a positive influence on events, and become involved in organizational decision-making. Much of this involves the availability of information. If QA is considered by the organization to be a help rather than a hindrance (and a bureaucratic hindrance at that), it starts to flourish. Like a snowball rolling down a hill, it gains momentum. In this kind of a situation, people will look for QA's help as a third party. This is fundamental to the way we have approached the introduction of QA at Chemical Bank.

Philosophically there are essentially two ways to approach QA. One is to stop people from doing things incorrectly. The other is to help people do things correctly. There is a great deal to be gained by choosing the latter approach.

ORGANIZATIONAL COMPONENTS

The QA organization at Chemical Bank is composed of approximately 35 people and is organized into eight (8) units (see Figure 3). There is a high ratio of experienced people in the organization. This is not only a result of the need for quality analytical work but also a reflection of the need for management oriented interpretation of technical issues and information. The remainder of this paper discusses the component parts of QA and provides some insights into how the organizational units interrelate and reinforce each other.

Figure 3—QA organization

DEVELOPMENT METHODOLOGY AND EDUCATION

One of the key requirements for effective QA is to provide the organization (ISG) with well-defined methods of work as it relates to systems development. This means having a well understood systems development methodology. I will put everything from breadboarding (prototyping) to structured techniques under the umbrella of development methodologies. To be effective, systems development methodologies must be simple to use, simple to understand, and flexible. They must also be adaptable to changing technologies, changing organizational environments, and changing needs. This unit of QA is concerned that the methodologies in use for systems development and maintenance are effective for ISG and the Bank. In a sense, this unit provides the cornerstone for work accomplished by the other units of QA and ISG. Chemical Bank uses a project life cycle (PLC) as defined in Figure 4. This PLC provides the overall framework for most other QA activity. The PLC is straightforward and very easy to understand. It provides standardization in terms of the way we develop and maintain our computer systems. The PLC is occasionally modified, as necessary, to meet the needs of the organization. It is the responsibility of this group to define and properly coordinate PLC changes and to provide education

From the collection of the Computer History Museum (www.computerhistory.org)
regarding the nature of the change to affected groups. There are four major users of the PLC from a QA perspective:

1. Systems Assurance
2. Project Planning and Control
3. Systems Management
4. Test Management

SYSTEMS ASSURANCE

The cornerstone of our development process concerns project reviews (Table I). Systems Assurance is responsible for reviewing and monitoring all PLC projects while they are under development. It holds reviews on these projects at defined milestone points in the development process. We have found formal project reviews to be very effective. These meetings are always chaired by Systems Assurance and are held at predetermined points within the life cycle (see Figure 5). For example, once requirements are established, there is a formal requirements review. It is at this point that we ensure that all parties are brought into the process. All groups must either sign off on the requirements definition or express their reservations. A management report of review is drafted by Systems Assurance and delivered to the director of data processing for comment and/or signature. The signed report is then sent to all project and management personnel, including senior user management. Most reviews result in the creation of action items (things to be done by the project team). These action items are listed in the management report. Systems Assurance will track action items to ensure their completion. Other reviews in the life cycle follow the same basic process.

People from EDP Auditing, Data Security, Information Systems Integration, Computer Operations, Systems Development, and the user areas are present at every review (Table II). Other participants at the reviews vary, depending upon the nature of the project and the PLC phase in question. Information Systems Integration is responsible for all architectural questions and, as such, they are with the project from the very inception. This is also true of computer operations people. They attend all reviews.

The Systems Assurance Group is composed of project managers drawn from other ISG groups (usually Systems Development). It is considered a positive move in terms of their career development. There is every attempt to ensure that they have organizational credibility and exceptional communication skills. They must exercise good judgment and tact in dealing with people. They are asked to be helpful in their approach. Most development project managers, when approached that way, are receptive and will take advice.
Competence, good judgment, and a positive attitude of Systems Assurance personnel are fundamental to the success of the project review process. Systems Assurance people must exercise good judgment and understand when a problem needs escalation. Tom West of Data General once said, “Not everything worth doing is worth doing well.” These are very appropriate words for Systems Assurance Personnel to heed when reviewing projects. Our objective is to help get systems out the door, systems that can be operated and maintained cost-effectively by ISG. Knowing what is important and understanding when to take a firm stand is critical. It is sometimes counterproductive to require compliance to the letter of the law in striving for the last 10% of perfection.

The role of Systems Assurance at Chemical Bank can perhaps best be described by the following excerpts of a letter from the head of ISG to a senior user manager at the Bank:

“Attached is the Requirements Document and supporting Approval Package for the . . . System. As a part of the project management procedures specified in the Project Life Cycle, ISG, through its Quality Assurance organization, conducts a series of reviews at critical points throughout the life of a project. One such review is conducted immediately prior to the submission of a proposal. It is called the Proposal Review and was conducted for this system on April 17th. A follow-up was conducted on May 6th to resolve the action items generated at the reviews.

Quality Assurance representatives concluded that although the requirements are well documented and the project is sound from a technical viewpoint, the completed system may be cumbersome and expensive to operate. (More detailed comments by Quality Assurance are included in the last Tab of the proposal package.)

I want to emphasize that Quality Assurance exists to protect the Corporation and the user as well as to assure proper ISG performance. I am very well aware of the fact that any time a Quality Assurance organization reaches a conclusion other than “all is well,” it is often viewed as being a roadblock to progress or supporting a vested interest of one of the players. I am also aware that the Quality Assurance finding in the extant instance can be viewed as “covering ISG”—if the system turns out to be a failure (however defined), ISG is vindicated; if on the other hand the system is successful, ISG can say that it was only through dint of ISG effort that success was achieved. Finally, I don’t doubt but that at some levels in both your office and mine, this project is being viewed as a series of tedious confrontations on both sides—a “we vs. they.” Only reasonable and strong management is going to overcome or at least negate such feelings.

I have been involved in many projects such as this and a reasonable share of them have turned out to be unsatisfactory. I think that the Quality Assurance finding on this project deserves your special attention and I highly recommend an independent assessment of the Requirements by a third party. This should not reflect on your staff but should help to assure that you are going to get the system you need and one which the Corporation can afford.”

It is also perhaps obvious that such senior DP management support is also critical to the success of Systems Assurance.

### PROJECT PLANNING AND CONTROL

Another QA organizational unit at Chemical Bank is Project Planning and Control. This unit is responsible for providing support and automated capabilities in the following areas:

1. Project planning
2. Project accounting
3. Project monitoring

We currently use PAC II® for these purposes. Once again, the project life cycle provides the overall framework for the products and activities of this area. In terms of project planning, standard PLC activities and deliverables are defined in the planning model. This proves to be a great aid in terms of the standardization of development work. It is also an aid to Systems Assurance in monitoring development activity.

In 1979, ISG established a budgeting and project accounting methodology that categorizes ISG activities into three major groups for management purposes:

1. Minimum maintenance
2. Discretionary enhancements
3. Development work

**Minimum maintenance** is defined as that expense level necessary to continue to operate and maintain the current portfolio of computer application systems. In addition to programming staff, it includes the systems support infrastructure necessary to operate the computer complex. In this sense, technical support personnel, equipment, and supplies needed to keep the computer applications running are included in the minimum maintenance category. This is a baseline component.

Unlike baseline, expense levels for discretionary enhancements and development are largely controlled by the user community. The identification and justification of new work and the decisions to add functions to existing systems are user driven. However, once the bank commits itself to the development of a new system and after implementation of that system, the ISG baseline will be driven upward to accommodate the continuing maintenance requirements. There is,
therefore, a direct correlation between ISG baseline and the impact of past decisions. The identification of ISG work in such a manner offers management an opportunity to assess ISG workload characteristics in terms of spending patterns and work type trends. The objective of ISG management is, of course, to reduce the amount of resources (in a relative sense) required to maintain its portfolio of business application systems. This, in turn, provides the Bank greater opportunity to devote more resources to new automation. While accounting for the fact that past decisions cause baseline increase, ISG strives to control the rate of increase in maintenance work, thereby maintaining a favorable ratio of development to maintenance activity.

SYSTEMS MANAGEMENT

Another aspect of quality assurance concerns the operational environment. This is the concept of Systems Management. Systems Management is composed of two functions, Change Management and Problem Management.

The objective of Change Management is to minimize the risk of making applications and systems changes in our operational environment. This is much easier to do in a large, centralized computer operations area operating mainframes than in a distributed systems environment where the hardware and software are operated within the user area. Change Management is responsible for the establishment and maintenance of a process to accommodate the planned, orderly introduction of all application and software changes. As such, all work being requested of ISG is sent to a work request desk, managed by Change Management. When the work in question is completed, the request to make the change to the computer system must also be sent to the work request desk. This process affords ISG an opportunity to closely monitor and analyze all changes taking place in the operational environment.

One method to help reduce the risk of change is to reduce the frequency of such change. All users are requested to adhere to a planned change cycle for their business applications. The cycle frequency is determined by them, in concert with ISG Systems Development. Once-a-month change cycles are not uncommon. The checks and balances implied in this process provide ISG an opportunity to reduce the risk of introducing software change.

Another way of providing for more operational stability is through the process of problem management. Problem Management provides for a systematic way of identifying, categorizing, assigning and tracking problems that occur in the operational environment. We currently use an IBM product "Information Systems" for automated support. There are terminals strategically located in the data centers. As problems are encountered, information concerning the problem is keyed into the system (we are in the process of building automated interfaces to SMF, RMF, etc. to reduce the manual intervention). The group in Problem Management monitors all this activity and ensures that the problems are being properly identified and assigned. They also monitor the process to ensure that follow-up action is being taken and that the problems are being resolved.

TEST MANAGEMENT

Software testing is one of the most critical tasks performed by a large data processing organization. Testing is important in the development of new systems, but it may have an even greater effect on the maintenance of production systems. In spite of this, testing is rarely approached in the same disciplined manner as other software production activities. This neglect of software testing is not, however, a result of the lack of available technology. Over the last several years, software testing has been the subject of intense activity in the research community, and many books and articles can be found on the subject. An organization can often achieve significant improvements in both software testing effectiveness and efficiency through a relatively low-cost investment in testing methodologies, tools, and techniques.

The Test Management staff of QA is responsible for providing ISG with a standard methodology for testing. This standard testing methodology is closely integrated with the PLC framework (see Figure 6). As a project moves through the various phases of the development or maintenance life cycles, the program guides and identifies testing activities to be performed and possibly documented. The review points established in the PLC provide the opportunity for QA to evaluate testing plans and progress at critical life cycle milestones.

Test Management has defined three progressive levels of increasing involvement with the testing of individual systems in development or maintenance:

1. Testing program review
2. Testing coverage audit
3. Independent testing

Referred to as certification levels, these procedures provide increasing organizational assurance of system reliability through third-party review.

Testing Program Review

This is the certification level for most systems at Chemical. It uses the project life cycle review points to verify adherence to the standard testing program. These reviews are handled by Systems Assurance in the development cycle and by Change Management in the maintenance cycle. Test Management provides technical assistance to both project teams and the QA review teams in preparing for these reviews.

Testing Coverage Audit

At this certification Level, QA Test Management uses the TRAILBLAZER tool (including its change analysis feature for systems in maintenance) to assess independently the thoroughness of test data provided by the systems developers. Standards of thoroughness ranging from 75% to 95% coverage of (changed) program logic are established as part of a system's testing strategy or regression test manual and agreed to by QA, the developers, and the user(s). If these standards are met, QA certifies the system; otherwise, the detailed reports showing unexecuted logic are returned to the project team for additional testing.
STANDARD TESTING METHODOLOGY

![Diagram of testing methodology](image)

**Independent Testing**

This highest certification level transfers system testing responsibility from the development organization to QA. It is relatively costly, since QA analysts must understand the applications area of the system under test in order to do an effective job. In an organization with a high volume and diversity of applications being developed and maintained simultaneously, this approach can be justified for only a few, extremely critical systems.

**TEST SERVICES**

The success of the Test Management program is, to a large extent, dependent upon a reliable test environment. Chemical Bank has significant resources devoted to testing and, as such, is concerned that testing services are consistently available and that performance is reliable. A Test Services Group was established in QA to monitor the ISG test environment, seek new tools and methods to improve the service, and to follow up on performance problems.

The group is responsible for:

1. Establishing and maintaining all management reporting functions as they relate to the performance and availability of the testing environment.

2. Performing liaison with all appropriate areas of ISG in providing a consistent and cost-effective level of testing service.

3. Performing liaison with the users of the testing environment to ensure proper education and training in the utilization of the test environment.

4. Establishing and communicating appropriate policies and procedures in the use of TSO and other test systems (CICS, IMS, etc.).

**FUNCTIONAL INTERACTION**

Testing, Systems Assurance, Systems Management (Change and Problem) and other facets of quality assurance bring individual benefit to the company. However, it is important to remember that the real payback is when these functions begin to interact and support each other. Accept for a moment that there are two ways a system can be changed: (1) through problem correction and (2) through a user-generated change (see Figure 7). Also accept that there are two outputs of that process. One is a product of some nature (a report, CRT screen, etc.); and the other is another problem. This could be conceptualized as the normal processing cycle.

One of our objectives is to institutionalize procedures whereby the various groups reinforce each other. Organiza-
tional payback is greatly increased when the units begin working together as seen in Figure 8 and described below.

In the Problem Management organization, we establish a threshold of problems for each production system and keep track of the problems encountered with that system. Once the threshold is reached, the Problem Management group notifies Change Management. The Change Management Group places it on a key problem list. As long as the problem threshold on the application in question is being exceeded, any new changes for that application must be rerouted to Test Management. The Test Group has two options. They can start doing third-party independent testing on those changes or they can start reviewing, through the use of their test tools, the program coverage of those changes until the problem level falls below the threshold. Through such interaction, the organization begins to get significant payback from QA.

STANDARDS AND PROCEDURES

I will briefly cover Standards and Procedures. It has been said that data processing people do not believe in standards. We all are aware of manuals gathering dust on the tops of desks. Standards is traditionally a paper-driven process.

When the creation of standards is a unilateral process accomplished by a Standards and Procedures Group, the users of the material have a tendency to ignore them. Often Standards and Procedures Groups are not responsive, taking months and months to get new material out the door. Often times the standards are partially outdated by the time they are distributed. We developed a program to overcome these problems by focusing on three things:

1. Introduce the idea of ownership. Foster the thought that Standards and Guidelines belong to the area most directly affected by the Standards and Guidelines in question. Give the users of Standards and Guidelines a piece of the action.
2. Move from a paper-driven process to utilization of office technology. Create, update, and deliver material electronically. Cut down the lead time required to deliver material.
3. Create standards, guidelines, and requirements that reflect minimal needs (a standard is not a standard unless it is machine enforceable). One area that needs most attention in this regard is Systems Maintenance documentation requirements. Requiring extensive narratives that describe systems applications functions are usually counterproductive (the use of structured analysis and design is helping to overcome this problematic area). Require only that which is necessary.

In our view, Standards and Procedures is an internal service organization. It is staffed with professional technical writers.

PRODUCTIVITY

Data processing (DP) and communications are playing an ever-increasing role at Chemical in helping the Bank meet the competitive challenges of the marketplace. To meet the demands being placed on EDP, ISG must be constantly seeking new tools, techniques and methods to assist in keeping cost and service at cost-effective levels.

ISG established a management unit with the responsibility to identify, assess, and, where appropriate, help implement new productivity-oriented products and procedures within ISG. Another aspect of this productivity program is to provide concise, meaningful, and easily understood measurements of ISG productivity. Quantifying data processing organizational productivity has been an elusive target of the industry for years. There is a great deal of theory written in journals and publications; but few, if any, organizations have arrived at satisfactory measurement techniques.

One key to understanding or discussing a productivity measurement program lies in obtaining a working definition of productivity that most people in the organization can accept. We define productivity as the ratio of an output produced by an activity to an input used by the activity. Our reference to productivity and productivity measures refers to this rather simple, working definition. ISG has taken steps to better understand the DP productivity issues, and we have begun to apply measurement techniques to our activities.
There are two fundamental objectives that were established in the measurement of ISG productivity:

1. To better understand and measure the effectiveness of the products and services that we provide to the Corporation. This "external" view is briefly discussed below and is undoubtedly the greater of the challenges in the area of productivity measurement.

2. To measure the efficiency with which we provide these products and services. This could be thought of as the internal view of ISG productivity.

**Effectiveness**

Measuring ISG effectiveness is undoubtedly the more difficult. The activity of an organization like ISG, as seen by senior bank management, is to provide appropriate services to the user divisions and, where appropriate, directly to bank customers (i.e., ATMs).

The measure of our success is how well the users are served in relation to the cost of the service. Thus, increasing the productivity of ISG is defined as: (a) increasing the service levels provided to the divisions and customers while consuming no more resources or (b) providing equal services while consuming fewer resources. Assuming the resources can be measured and the services provided are measurable, then either (a) or (b) results in an increased productivity ratio.

**Efficiency**

We view the measurement of ISG efficiency as having two dimensions: (1) a measure of the operations or productions set of activities and (2) a measure of the factors relating to the systems development process. Productivity, and the measurement of our productivity, is viewed as one of the key issues for ISG in the 1980’s.

**QUALITY ASSURANCE IMPERATIVES**

Quality Assurance is like motherhood and apple pie. Everyone believes in it, but most are not sure how to define it in terms of its role in the organization. This paper has presented QA at Chemical Bank. In the process of implementing the function, certain needs and requirements for successful implementation have been identified.

**Functionally Complete**

To get maximum payback out of a QA function, the QA organization should evolve to the point where it has sufficient function whereby units can mutually support each other. In a sense, this creates the potential for making the whole stronger than the sum of the component parts.

**Technical Competence**

It is probably obvious that QA must be staffed with technically competent personnel. Historically, QA has been viewed by DP professionals as a dead-end road. Some DP organizations have, in some instances, moved incompetent people aside (to QA) to minimize their visibility and lessen the potential impact of their “mistakes.” This view of QA is changing, and must change if an organization is serious about the function. There is a school of thought that DP will see the emergence of QA professionals and that QA will soon be considered a productive and meaningful career in and of itself. The DP industry (unlike manufacturing) has not yet matured to this point. I believe such will be the case, but in the meantime, we must attract (by providing visible career paths) well qualified and respected developers and other DP specialists to the QA area.

**Management Orientation**

A good technical decision is sometimes not the best management decision. Quality assurance must never lose sight of organizational objectives and not consider their work as a series of technical challenges.

**Third-Party Objectivity**

In the course of their work, QA can and must assume the role of an objective third party. This is particularly important to senior DP management. QA should not become a part of the problem. It is possible to work closely with a problem solver and be so closely associated with a proposed solution that, as viewed by senior management, QA becomes part of the problem. In that sense, QA can offer no alternatives or proposed remedies to senior management.

**Information Source**

To effectively anticipate problems, QA must establish itself as a fertile source of information for the organization and for senior management. The degree of success in this area is due, in large part, to the perception of QA by the rest of the organization. Formal reporting structures are important. The informal communications process is equally important.

**Senior Management Peer Level**

Quality Assurance must actively participate in the decision-making process of the DP organization and should be in a position to influence direction and strategy. There is great variation in data processing organizations in terms of the reporting level of QA. Groups producing papers on QA (GUIDE et al.) seem to begin with a discussion of reporting levels. We believe it is important for QA to report at the highest organizational level if management wants to realize maximum benefit.
Positive Contributor Towards Organizational Goals

This is the bottom line. Success in this regard is a reflection of the attitudes, philosophies, and posture of the QA organization. It is a function of the technical competence and orientation of QA. If QA is considered a hindrance to progress, i.e., a group that gets in the way and fails to provide added value, then the QA organization will not be able to make a positive contribution and will eventually fail. Quality assurance must thoroughly understand the goals, objectives, and problems of the corporation and the data processing organization. These concerns must be considered in daily activities.

REFERENCES

PERSONAL COMPUTING