

Ten Common Mistakes Companies Make Setting Up and Managing Software Quality Assurance Departments

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In the late 70s and early 80's, when the Japanese were teaching the world about manufacturing quality, I was establishing a software quality program and managing a software Quality Assurance (QA) department. My department was very successful. We significantly increased the profitability of our projects, improved customer satisfaction, and gave the company a significant competitive advantage. With hindsight and experience, I now understand the key factors that made our QA department so effective. Since that time, I have seen dozens of Software Quality Assurance departments come and go. Some were successful. Most, however, had limited success and were eventually abandoned. The purpose of this article is to describe common mistakes companies make when setting up and managing a Quality Assurance department.

Let me add up front that by QA, I do *not* mean testing. Rather, I am describing a function with the responsibility to ensure that software will meet its intended requirements – functional, date, budget, etc. Testing is important, but it is different. Testing can prove that a system does not meet its requirements. It cannot ensure that a system will meet its requirements. Testing is quality control; it is not quality assurance.

If you do not have a QA department, you are probably trying to improve software quality by some other means – advancing to the next CMMI (Capability Maturity Model[®] Integration) level, with an SEPG (Software Engineering Process Group), a PMO (Project Management Office), IT Governance, or a similar effort. As you read this article, I think you will find that most, if not all, of the same issues are relevant to these efforts.

Mistake 1: Not properly defining objectives.

The primary objective of a QA department should be to ensure successful projects. While this may seem obvious, I have rarely seen this objective stated or followed.

Most QA departments are established without a well-defined objective or with an objective something like:

- Improving quality
- Achieving CMM level X
- Implementing a new methodology
- Process improvement

These are good secondary objectives, but they are not the same as ensuring successful projects. There are many situations where overemphasis on a single laudable goal is counterproductive. Focus too much on any one goal (e.g., date, budget, user requirements, etc.) and you will likely meet that goal at the expense of the success of the project. For example, IBM had a better operating system with OS/2, but lost the marketing battle to Microsoft's Windows because IBM was too late getting to market. On the other hand, many software companies have caused themselves significant problems by rushing new product releases to market before they were ready.

What is a successful project? Defining success is not always easy. It can also be very situational. When I was managing a QA department, my company was a medium-sized consulting firm that would take project responsibility for developing systems. My firm's definition of a successful project meant that the project must meet two criteria:

- The client must be satisfied: The client would pay their bills, would allow us to use them as a reference and, budgets permitting, there would be repeat business.
- The business would be profitable: This objective could easily conflict with the first. This objective meant we could not keep the client happy by doing work for free.

Ensuring an organization's success can also conflict with ensuring an individual project's success. This is very common and usually occurs when there are limited resources that must be allocated – staff, budget, user time, senior management time, QA time, etc. There are several strategies my firm used to address this problem:

- We would avoid projects where success would be in doubt because adequate resources could not be provided. (This can be very hard to do in practice.)
- We would allocate resources where they would have the most impact. The QA department, for example, would rank projects by risk. QA resources would be allocated first to high-risk projects, then to lower risk projects. QA activity on low-risk projects would be deferred if necessary.
- We would communicate the risks and issues to Senior Management. When appropriate, the issues would be resolved and key decisions would be made by senior management.

The tradeoff between cost, target dates, quality, and user satisfaction can differ significantly from organization to organization and even from project to project. Success may be very target date driven on one project (e.g., tax software), quality driven on another project (e.g., life critical software), cost (e.g., most projects), or user satisfaction. Success is usually some combination of these factors and other factors. Achieving success may require different strategies depending on a number of factors including: the size and experience of the project team, the nature of the requirements, the technology, user involvement, etc. In some cases success may mean minimizing financial loss – e.g., killing a project before too much money has been spent.

Mistake 2: Not properly defining a Quality Assurance department's responsibilities and staffing to meet these responsibilities.

Ensuring successful projects requires a QA department to work with project managers to ensure that:

- A process is defined that if followed will result in the success of the project and
- The process is followed.

This view of a QA department's responsibilities goes beyond defining the responsibilities of the QA group to be just defining process and conducting reviews. Ensuring project success requires QA staff to work more closely (and perhaps earlier in the project) with project management than do most QA departments. Ensuring success means that QA must take responsibility (with the project manager) for the success of the project.

There are also staffing implications for the QA department:

- Experience is important. QA staff will need to understand the issues that are most important to project success (e.g., user involvement, budget, calendar, technology, etc.) and be able to define a process that will result in success.
- The QA department must be staffed by people who will be respected by the project managers. How else can they develop an effective working relationship with the project managers?

Mistake 3: Senior management not understanding their responsibility for Quality Assurance.

If senior management does not understand their role in the QA process, then a QA department is doomed. In the life of every QA department there is at least one defining moment and two moments of truth.

The defining moment comes when senior management decides how to staff the QA department and determines where it will fit in the organization. How senior management staffs the QA department, is an indication of how they value it and what they expect from it. If the QA department is not led and staffed by personnel who have the respect of both senior management and the project managers, then it is doomed from the start.

The first moment of truth comes early and usually occurs when a resistant project manager says something like: "Do you want me to get the project done on-time or do you want me to get QA's approval?" The correct answer should be "I want it done on-time *and* with QA's approval." If project managers cannot avoid working with QA staff by this strategy, they will start complaining about the QA staff. This can take a number

of forms: Usually complaints such as “QA does not understand our business”, or some variation on the theme that the QA staff does not know what they are talking about. Unfortunately, if the QA department is not staffed appropriately and does not have a clear understanding of its objectives, this complaint may be valid. When the facts are known, it is usually pretty easy for senior management to understand the issues and determine the correct action. The correct response to this situation is to get both groups together and air the differences.

The second moment of truth comes at budget time. Management is always tempted to reduce or eliminate the QA department’s budget. The rationalization is something like “QA is management’s responsibility; we shouldn’t need a separate QA department.” This moment of truth can be very insidious for a number of reasons:

- If the QA department has been doing a good job and projects are running smoothly, it may look like the QA department is no longer needed. The QA department’s contributions to the success of projects may not be visible or understood by senior management.
- If the QA department has been successful and the QA department’s contributions are understood, management will have strong incentives to reassign QA personnel – frequently to manage key projects. This makes it easier to rationalize cutting QA’s budget. While rotating personnel in and out of the QA department can be a great way to train staff and integrate better practices into the culture of the organization, management must ensure that the QA department is always staffed with strong, capable people who will be respected by the developers.

The “QA is management’s responsibility” issue is so common that it deserves some discussion. Although I firmly believe that QA is management’s responsibility, there are several reasons why a separate QA department is still needed:

1. A QA department provides an important check and balance on the process. If management is not fulfilling its responsibility, a QA review can catch the problem early. It is not uncommon for more urgent responsibilities to distract management from paying as close attention to some projects as it would like. In these situations, a QA department can provide an important service by monitoring projects.
2. A QA department can provide an independent, objective perspective – i.e., two heads are better than one.
3. Some central group needs to be responsible for process. A QA department is the appropriate group.

Mistake 4: Not holding the QA department accountable for project success.

Accountability comes with responsibility. If the QA department is responsible for ensuring success, it should also be held accountable. If senior management does not hold the QA department accountable for unsuccessful projects, it is an indication that management does not believe in the value of a QA department or the capability of the QA staff. I have talked to some QA managers after major production failures and have been amazed that they were not more personally concerned about the failure. When I was managing the QA department, I knew I would be held accountable for any project that ran into trouble. Our president viewed the QA department as an important check and balance on the project managers.

The real issue is how you can hold both a project manager and QA staff accountable for the success of a project. The answer is a concept called “*joint responsibility for success.*” In practical terms what this meant to me when I was responsible for the QA department was very clear. If a project was unsuccessful, the project manager and I would be called into a meeting with the President. He would look both of us in the eye and ask us how we let this problem happen. These were not pleasant meetings. Fortunately, they did not happen often. Sometimes the only way to prevent these meetings is to escalate the issues before they cause project problems.

If QA staff could not resolve issues with project managers, the issues would be reported and escalated to senior management for resolution.

The challenge for QA staff is deciding when to escalate an issue:

- Escalate too often or too quickly and you will create problems both with your working relationship with project managers and with senior management. You will also lose credibility if you escalate issues and management does not support your position.
- Escalate too infrequently and you will risk becoming ineffective. You will likely lose credibility with project managers who will come to believe there are no consequences to ignoring QA staff. You also risk the dreaded meeting with the boss.

When there is an impasse between QA staff and project management, senior management should be prepared to resolve issues. Resolving escalated issues will give senior management insight into the important problems that must be addressed – whether the QA department is the source of the problem or project management is the problem. In some cases, the root of the problem may be user management. Senior management attention may be necessary to resolve the issue. Senior management should be prepared for frequent escalation in the early life of a QA department. As project managers and QA staff develop a working relationship, disputes between QA staff and project management should diminish. In the early days of our QA department, escalation was not uncommon

– perhaps once a month. As the QA department and the organization matured, they were rare – perhaps once a year. There were a few rare occasions when I would escalate an issue because the decision should be made higher up – not by the QA department and not by the project manager. These were usually situations where the target date was critically important, but the QA department did not feel the system (or other deliverable) was ready. In effect, the decision was a business decision to be made by senior management.

Mistake 5: Assuming existing standards/processes are followed and are sufficient.

There are a number of manifestations of this mistake:

- Assuming a vendor has their own process and that it is adequate for the effort. (Even if they do have a strong process, it will be designed to protect their interest, not yours.)
- Underinvestment in process. (Changes in the business and technical environments mean that there will always be opportunities to improve the process. Also, there will likely be projects for which the existing process is not sufficient.)
- Lack of checks and balances to ensure that appropriate process is followed. (Without strong hands-on management or an independent review process, there will be little incentive to adopt new process. As Mark Twain said, “I’m all for progress, it is change I don’t like.”)

One of the most important roles of a QA department is establishing a consistent process for the organization and working with project teams to adapt the process to their unique circumstances. This role puts the QA department in a position to transfer best practices developed by one project to other projects. It will also identify process gaps. In mature organizations, following the right process becomes a habit and is part of the organization’s culture. In less mature organizations, there are several situations a strong QA department can address:

Situation 1: Projects are not consistently using the standard process where it would be appropriate and effective.

Absent some external check and balance (e.g., a QA department), it is likely that many, if not most, projects will not follow the existing standard process – despite it being appropriate and effective. If you are looking for areas where you can make quick improvements and you have a relatively immature development group, this is an area where a QA department can add value very quickly.

Situation 2: The standard process is not appropriate for a particular project.

No matter how good the process is, there will be situations where it does not seem to fit a current project. If project managers decide for themselves not to follow the standard process (i.e., the process is a set of guidelines not standards), then the QA department will lose control. Project managers will take short cuts and the standard process will not be consistently followed when is appropriate and effective. If the QA department dictates that the process always be used (i.e., the process is a set of inflexible standards, not guidelines), then the QA department may cause a project to be unsuccessful. The solution to this problem is to have the QA department and the project manager decide *at the beginning* of a project what deviations from the standard process are appropriate. Project management can deviate from the standard process, but they need the QA department's approval first. When I managed the QA department, our standard process required the project manager to include in the initial project planning a quality plan that described the project's process, emphasized any planned deviations from the standard process, and described all QA reviews.

Situation 3: New process is needed to meet a project's objectives.

No matter how good your current methodologies, process and standards, they will not be sufficient for your most demanding projects. Additional and/or different process/approaches are frequently necessary for very large, high-risk projects or projects using new technology. These projects should drive enhancements to the existing process. A QA department is in a good position to identify the need for new process and ensure the process is enhanced to meet the needs of the projects.

Even in mature organizations, the need to improve the process is ongoing. Fortunately, today's technology makes it much easier to develop and disseminate a new process. In the past, the common approach was to document a process in a binder and distribute the binder to the staff. (Actually, some methodologies had many binders.) Producing, updating, and distributing the process was very expensive. Today, the preferred approach is to make the process accessible on a corporate intranet. While the costs to define the process may not have changed dramatically, the costs to maintain, distribute, and access the process have declined dramatically.

Imperfect or flawed processes cause most system problems (See [1]). Thus, to prevent these problems, an organization must improve its process. If a QA department is to be held accountable for project success, it must have the ability to create, enforce, and improve the process.

Mistake 6: Separating methodology responsibilities from review and enforcement responsibilities.

Among QA professionals, this mistake may be the most controversial. Many QA professionals believe that a QA department should not have a review (i.e., enforcement) responsibility. As a result, many organizations have a QA department that functions as a “help function”, but provides no independent check and balance on critical projects. I think this is a cop-out. The QA staff is a logical and practical check and balance on the project team. QA reviews have the ability to either prevent problems or provide early warning of problems to management. Independent reviews are necessary and valuable. However, they can be confrontational and most people do not enjoy confrontations. One of my colleagues described these reviews as akin to telling a mother her baby was ugly. I can understand why QA professionals want to avoid reviews. Unfortunately they are a necessary and integral part of a successful QA department. One measure of an organization’s maturity is its reaction to the reviews. Immature organizations tend to avoid them or be confrontational. More mature organizations will ask for them even when they are not required. Managers in mature organizations will complain if they think a review is too superficial.

The process responsibility is so intertwined with the review responsibility that they cannot be easily separated without diluting effectiveness and accountabilities. Common problems when responsibilities are separated include:

- A blind adherence to the methodology. If a QA department has a primary objective to implement a process but it does not have a review responsibility, then the QA department will have disincentives to recognize situations where the process, or components of the process, may not fit or may not be cost effective. This is a much more common situation than is generally recognized. Although I was a strong advocate for our methodology, I was careful not to dictate its use where it was not appropriate or cost effective for the project.
- No stake in the methodology. If a QA department has the review responsibility, but does not have methodology responsibility, there are fewer incentives to enforce the methodology and also fewer incentives to keep the methodology relevant to the needs of projects. Perhaps more importantly, the QA department will have less ability to improve the methodology to meet the needs of projects.
- Unrecognized methodology gaps. The purpose of the reviews is two fold – to ensure that a process is defined that, if followed, will result in a successful project and to ensure that the defined process is followed. If a project team plans to follow the standard process, but success is in doubt, then there may be gaps in the process. This too is a very common situation. New technology, very large projects, etc. may create a situation where the existing process is

inadequate. The QA department needs to recognize this and take steps to correct the situation. The QA department will be much more responsive to a project's needs if it has responsibility for both the review and the process/methodology.

- A superficial, weak methodology. This problem is also very common and happens when methodology is the responsibility of a committee (sometimes called a task force) and the requirements for the methodology require a consensus from the committee. Too often, this consensus is not based on the factors that will make projects successful, but what process developers will resist the least. One area that I emphasized was project control. We developed a very strong project control and management reporting process to manage costs and provide early warning of problems. The process was one of the most valuable and effective processes we developed, but it was also one of the least popular. It is very common that the benefits of a process do not accrue (at least in their perception) to the people who must follow the process. While the goal of getting a consensus is understandable, it can be counterproductive in getting an effective, robust process that will ensure successful projects.

When the methodology and the review responsibilities are combined, the QA department is in a better position to take good practices developed by one group, incorporate them into the standard process, and promote their use to other groups. In very large organizations, it is common that one group will have a problem, while another group that is just down the hall has developed a solution to the problem. The QA department can be a catalyst to promote best practices throughout the organization.

The QA department can and should delegate some of the review responsibilities in situations where it may not have expertise. Even so, it should be responsible for ensuring that reviews are effective and followed. For example, if a system warrants a technical review (e.g., a review of the database), it is likely that a different group will have subject matter experts who are more qualified to conduct the review. This is fine. In fact it is an opportunity. It can be a valuable learning experience for both sides.

Mistake 7: Not integrating measurement into the process.

Most organizations and projects have measures that are important to them – usually cost and target date. If you manage just by cost and target date, however, you are guilty of too little measurement. You will encourage meeting cost and target date objectives at the expense of user satisfaction, system reliability, or some other important objective. What's needed is an integrated set of measures (See Figure 1) that:

- Are aligned with the project's and the organization's objectives.
- Provide a balanced perspective.
- Provide insight to the appropriate person.
- Are natural byproducts of the process.

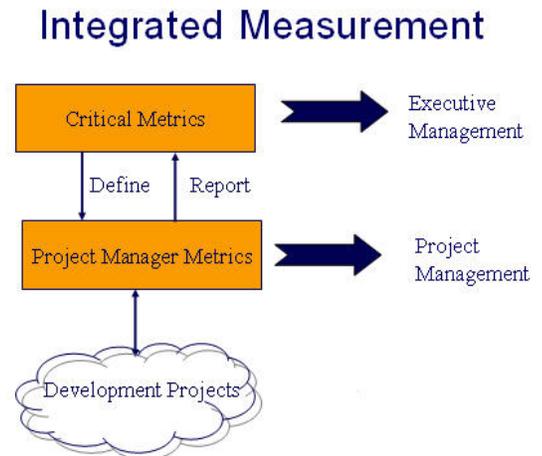


Figure 1

Properly done, measurement can make life easier for the QA department, project managers, and senior management. One of the biggest challenges a QA department can have is convincing project teams to implement a new process. When a QA department is new and is still on its honeymoon, the QA department can enlist senior management to enforce a new process. After the honeymoon, this approach may not work. Measurement, however, offers the QA department a way to put the responsibility on the project teams to implement the process.

For example, if variance from estimate is important to the organization, measure it. Initially you will need to develop or define a process to measure the variance. Once you start measuring variance, you will need process to better understand the cause of the variance and to reduce the variance. Depending on the source of the variance, the process could be a better estimating process, a better change control process, a better requirements process, or some other process. You get what you measure. If you measure the right things, attention will be focused in the right areas. This will result in improvements. Conversely, if you measure too many things, the wrong things, or do not measure enough of the right things, attention will not always be focused where it is needed.

Measurement helps drive the process improvement priorities. It also makes the QA department's job reviewing projects much easier. Initially the problem will be that the metrics are not being computed, or if they are, project managers may not be anxious to share them. Bad news does not always travel quickly. If the metrics are indeed important to senior management, the QA department will have the clout necessary to get project managers to compute **and report** the metrics.

The right metrics can quickly pinpoint problem areas. When the metrics pinpoint problems, project managers may try to hide the problems. This is common and another reason for an independent QA department. If the required metrics (e.g., variance, defects, change, etc.) are not reported on a project status report, the project likely has problems. Either the project manager knows the numbers are not good and does not want to bring management's attention to the problem, or the project manager does not know what the numbers are and thus does not have the project under control.

Mistake 8: Ignoring, misunderstanding, or not communicating risk.

Risk is inherent in software development. The risk of delaying a system and forgoing possibly significant benefits, for example, must be balanced against the risk of installing a system with potentially costly defects. Since risk cannot be eliminated, the goal is to understand risk so that prudent decisions can be made and made early in the project by the right group.

QA is really a form of risk management. There are many ways a QA department can contribute to a better understanding and management of the risks facing a project. Integrating risk management into the software development process and using measurement to communicate the risks to the project team and to management are two areas where a QA department can add significant value.

Since many software development risks are commonly encountered, techniques that identify them and address them can easily be built into the process. For example:

- The risk associated with a cost or target date estimate should be included in the estimate documentation along with a clear communication of the source of the risk (e.g., vague requirements, scarce resources, etc.) to senior management. Requiring assumptions to be included with an estimate is one way to better communicate the risk associated with an estimate.
- The risk associated with requirements should be understood. If, for example, the requirements are not well understood, more user involvement will be warranted. If scope creep is a risk, a robust change control process will be needed.
- Testing should focus on the high-risk parts of the system.

Metrics can be a very powerful way to identify, communicate, and address risks. One very common situation occurs when a system is nearing its planned installation date – especially if a third party is developing the system. Developers are under pressure to get the system installed and will focus on the number of open defects. While this is a useful measure, it does not provide a balanced perspective of the risk involved with installing the system. The defect arrival rate (i.e., how many defects have been found during a specified period of time) can provide a better indication of whether or not the system is ready to install (See Figure 2). If the developers found and closed 100 defects during the last week, the open defect count might be zero. However, the defect arrival rate says that the risk of installing is still unacceptably high.

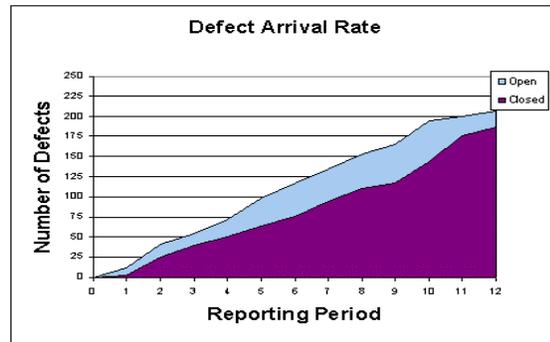


Figure 2

Mistake 9: Lack of management reporting from the QA department.

Even if the QA department is doing a good job ensuring successful projects, the QA department may not be secure. The QA department may be eliminated if senior management does not understand the contribution QA is making. Publicizing successes won't work in the long run – the QA department will appear to be taking credit for project managers' successes. The QA department needs to produce a deliverable that senior management wants, such as a report that includes the following kinds of information:

- Quantitative project status information/critical metrics information: The goal is to give management a simple, yet insightful, quantitative picture of the status of projects. The status information from individual project status reports would be reported and then consolidated into a critical metrics report (See Figure 3).
- Qualitative project status information: The goal is to provide analysis of the quantitative information and make recommendations where appropriate.
- QA Activities: The QA department also should communicate what it is doing to add value to the organization that is not included in the above information – e.g., new processes that have been developed to improve the critical metrics, training conducted, etc.

Project	QA Score	Approved Budget	Current Forecasted Actual Cost	% Earned Value	Cost Efficiency	Schedule Efficiency	Defect Arrival Rate
Order Entry	78	\$3,234,000	\$3,999,954	60%	82%	88%	25
Inventory	90	\$2,393,000	\$2,595,297	10%	92%	100%	0
Accounts Receivable	66	\$500,000	\$650,399	40%	67%	83%	35
Marketing	95	\$400,000	\$397,932	80%	101%	99%	1

Sample Critical Metrics Report

Figure 3

Mistake 10: The QA department is positioned too low in the organization.

The QA department must be a peer of or positioned higher than the application development organization. The QA staff responsible for conducting the reviews should be at a peer level or higher than the project managers.

All too often the QA department is positioned too low in the organization. This creates a number of problems:

- The QA department cannot be staffed properly because of compensation, skill issues, etc.
- It is more difficult to influence project managers if the QA staff is not at a peer level.
- It is more difficult to escalate issues to the proper level of management that can resolve them.

Is it possible to position the QA department too high in the organization? This is not a common problem. It is also not a panacea. I have seen general corporate QA departments that reported very high in their organizations. While these QA departments may have been effective addressing important corporate quality objectives (e.g., manufacturing quality, service quality, etc.), they did not have much of an impact on software quality. To effectively address more than superficial software quality issues, the QA department needs to both understand software development and to work closely with the people developing the software. This is unlikely to happen if the group is positioned too high in the organization.

Conclusion

Improving software quality and the predictability of software development is a critical success factor for most organizations. Moreover, government legislation is increasingly making companies accountable for the quality and reliability of their systems (e.g., Sarbanes–Oxley). An effective QA department that both provides checks and balances to the developers and is responsible for ensuring an effective process will be defined and followed is necessary to achieve consistently reliable software. The key elements of a successful QA department include:

- Proper definition of objectives and responsibilities.
- A senior management that understands its own responsibility for software quality.
- QA department accountability and joint responsibility for success.
- Integration of methodology and enforcement responsibilities.
- Integration of measurement and risk management into the software development process.

References

[1] *Establishing a Software Defect Management Process*, Quality Assurance Institute Research Report #8, 1995.

[2] Crosby, Philip, *Quality is Free*, Mentor, 1980, p. 1.

[3] Wilson, Peter B., “The Challenge Ahead For QA Professionals”, *The Journal of the Quality Assurance Institute*, April 1994, pp. 2-3.