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Quality Framework, Principles, control practices, benchmark, internal controls addressing needs of current world

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Abstract
The article provides overview of Quality Assurance and Improvement Program. Describing quality 4.0 principles, tools, value propositions, quality management, planning, metrics and measurement used as benchmark to keep a check and continuously improve quality of work, products, processes. Internal control and security used by management, IT security, financial, accounting, and operational teams to meet their goals are discussed.

Keywords: Quality Control, Quality Assurance, QAIP, Internal Audit, Quality 4.0, Quality tools, Quality Fundamentals, Quality Principles, Quality Management, Machine Learning, Block Chain Quality Planning, Benchmark, Metrics and measurement, Internal Control and Security, Monitoring, Audit

1. Introduction

1. Quality Assurance and improvement Program

A Quality Assurance and improvement Program (QAIP) covers the entire spectrum of assurance and consulting work performed by the internal audit activity. QAIPs include three components:

- Ongoing monitoring is an integral part of the day-to-day supervision, review, and measurement of the internal audit activity. Ongoing monitoring is incorporated into the routine policies and practices used to manage the internal audit activity and uses processes, tools, and information considered necessary to evaluate conformance with the Code of Ethics and the Standards.
- Periodic self-assessments are conducted to evaluate whether or not the internal audit activity operate efficiently and effectively, and to evaluate conformance to the Code of Ethics and the Standards. These assessments also evaluate the internal audit activity's charter, plans, policies, procedures, practices, and applicable legislative and regulatory requirements.
- External assessments should be conducted at least once every five years by a qualified assessor or an independent assessment team from outside the organization.

2. QAIP from an organization stand point

A Quality Assurance Improvement Program ("QAIP") built with the sole focus of assessing whether audit teams are following the internal audit (IA) functions. Asses the internal audit methodologies to meet the demand of stakeholders. Board of Directors and Audit Committees expect that IA functions are developing in line with the changing external and internal environment.

- Heads of IA need to demonstrate additional value and return on investment from their quality assurance program.
- To develop an impactful QAIP model, an IA function should consider a flexible, cost effective and scalable quality assurance methodology. The methodology should define a complete set of requirements on areas like IA capabilities, technology support and deliverables.
- This approach requires not just senior internal audit professionals, but also subject matter experts across the key business risks and operational processes, to provide views on the adequacy of audit coverage and quality of work. The desired methodology should be capable of addressing three key objectives of quality assurance:

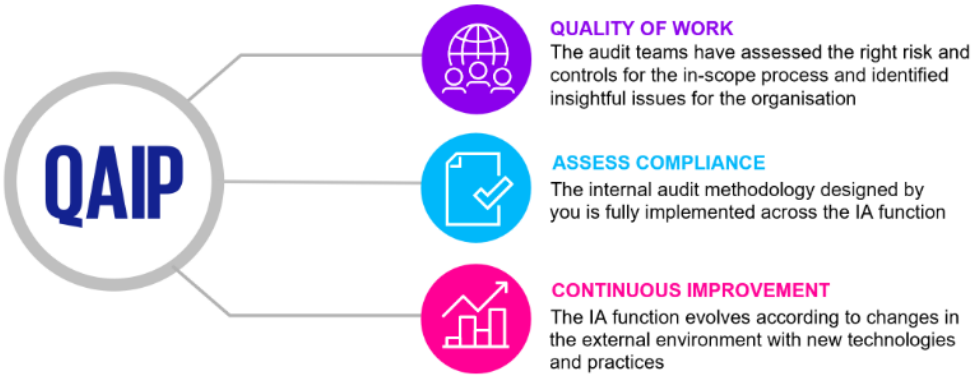

Fig 1:

QAIP components from KPMG site

Quality of Work

- Audit Planning and Engagement Scoping
  - Have the audit teams identified the right risks and controls during the scoping phase of audit?
  - Are prior, ongoing and upcoming audits properly taken into consideration when planning the scope of work?

- Quality of Fieldwork Performed
  - Is sufficient work performed in accordance with plan to reach a well justified conclusion on the audit area?
  - Are audit teams using the right data analytics in applicable areas?

- Conclusions and Reporting
  - Where significant judgement has been applied, have conclusions been reached adequately?
  - Is the tone of the audit report in line with the issue and audit ratings?

- Use of SMEs in Specialized Audits

Have the audit teams consulted subject matter experts at appropriate stages during the audit to ensure industry trends and emerging practices are considered?

Access Compliance

- Audit Process

Is the audit process description sufficient as guidance to audit teams?

- Gateway and Milestone Approvals
  - Are the audit plan, testing and documentation approved by the authorised personnel?
  - Are teams reporting and seeking consultation from senior management and the Audit Committee on a regular basis?

- Audit Execution

Have the teams performed the audit work as planned?

- Documentation
  - Is the documentation of work at re-performance standards?
  - Is appropriate rationale documented where audit issues are deemed not reportable?

Continous improvement

- Audit Methodology Assessment
  - Do you have a robust methodology, approach and templates to cope with the continuous change in the external and internal environment?

- Audit Data Trend Analysis

Have you utilised available data to assess the performance of your IA function?

- Audit Timeliness and Performance Benchmarking
  - How do your audit cycle times compare relative to peer IA functions?
  - Do you have the mechanism to identify specific continuous improvement opportunities for your IA function?

- Knowledge and Insight Sharing

Have you organized any sharing sessions or workshops with the audit teams to share the key observations and findings from the IA reviews?

The Fundamentals and Applications of Quality Principles

Technological advances of the past decade have resulted in a new industrial revolution often referred to as the fourth industrial revolution or "Industry 4.0." It's a revolution driven by the exponential growth of disruptive technologies and the changes those technologies are bringing to the workplace, the workforce, and the markets organizations serve.

"Quality 4.0" is a term that references the future of quality and organizational excellence within the context of Industry 4.0 needs and performance expectations. Quality professionals can play a vital role in leading their organizations to apply proven quality disciplines to new, digital, and disruptive technologies.

Establishing and Implementing Quality 4.0 Principles: To achieve excellence through quality is to embrace the future of quality. It is paramount that quality professionals help their organizations make the vital connection between quality excellence and their ability to thrive in disruption, using quality principles to enable transformation and growth with digital tools.

People

Quality 4.0 is more than technology. It's a new way for quality professionals to manage quality with the digital tools available today and understanding how to apply them and achieve excellence through quality. By speaking the digital language and making the case for quality to more effectively handle disruption, quality professionals can elevate their role from enforcers to navigators to successfully guide organizations through digital disruption and toward

excellence.

Process
As more work is automated, the need for flawless processes remains the same, if not more important. Existing processes will be broken and the need to educate the next generation of workers to implement new processes and strategies is vital not only to the quality professional, but also business operations. Quality is a vital link and should be included at the strategic level for sustainability during digital transformation.

Technology
Technology is growing 10 times faster than it used to, and organizations' platforms, such as processes, systems, data, operations, and governance, must keep pace. Technology also is a great leveler because it gives any individual with the right idea and intent the capabilities previously available only to large organizations. Quality professionals must move from data analyst roles to data wrangler roles to elevated data management roles by engaging with new technologies, understanding how technologic advancements create various outputs, and determining how and when to use them.

Quality 4.0 Tools
Deploying an organization's digital strategy won't be without challenges to overcome. There are common challenges that cut across all industries and digital maturity levels, and others that are specific to an organization. In addition to the timeless and well-known quality tools and principles, the Quality 4.0 tools below should be leveraged to alleviate these challenges when implementing and deploying systems to support digital transformation.

Artificial intelligence
Visual recognition, language processing, chatbots, personal assistants, navigation, robotics, making complex decisions.

Big data
Infrastructure (such as MapReduce, Hadoop, Hive, and NoSQL databases), access to data sources, tools for managing and analyzing large data sets without having to use supercomputers.

Blockchain
Increasing transparency and auditability of transactions (for assets and information), monitoring conditions so transactions don't occur unless quality objectives are met.

Deep learning
Image classification, complex pattern recognition, time series forecasting, text generation, creating sound and art, creating fictitious video from real video, adjusting images based on heuristics (make a frowning person in a photo appear to smile, for example).

Enabling technologies
Enabling technologies: affordable sensors and actuators, cloud computing, open-source software, augmented reality (AR), mixed reality, virtual reality (VR), data streaming (such as Kafka and Storm), 5G networks, IPv6, Internet of Things (IoT).

Machine learning
Text analysis, recommendation systems, spam filters, fraud detection, classifying objects into groups, forecasting.

Data science
The practice of bringing together heterogeneous data sets for making predictions, performing classifications, finding patterns in large data sets, reducing large sets of observations to most significant predictors, applying sound traditional techniques (such as visualization, inference, and simulation) to generate viable models and solutions.

Quality 4.0 Value Propositions
New technology should always be introduced with a clear articulation of the desired benefits it will deliver and impact to the overall organization's operations and performance. Value propositions for Quality 4.0 initiatives fall into six categories, listed in order of significance:

- Augment (or improve upon) human intelligence.
- Increase the speed and quality of decision making.
- Improve transparency, traceability, and auditability.
- Anticipate changes, reveal biases, and adapt to new circumstances and knowledge.
- Evolve relationships, organizational boundaries, and concept of trust to reveal opportunities for continuous improvement and new business models.
- Learn how to learn by cultivating self awareness and other awareness as skills.

Results of Quality 4.0

- Systems thinking
- Data-driven decision making
- Leadership for organizational learning
- Establishing processes for continuous improvement
- Understanding how decisions affect people: lives, relationships, communities, well-being, health, and society in general

Quality Management
Two major functions of Quality Management are Quality Assurance and Quality Control. The terms Quality Assurance and Quality Control have many interpretations because of the multiple definitions for the words "assurance" and "control." For example, "assurance" can mean the act of giving confidence, the state of being certain or the act of making certain; "control" can mean an evaluation to indicate needed corrective responses, the act of guiding or the state of a process in which the variability is attributable to a constant system of chance causes.
One definition of quality assurance is: all the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality.
One definition for quality control is: the operational techniques and activities used to fulfill requirements for quality. Often, however, "quality assurance" and "quality control" are used interchangeably, referring to the actions performed to ensure the quality of a product, service or process.

Fig 2:

Quaity Management, Quality Assurance and Quaity Control from asg.org.
Quality assurance and quality control are two aspects of quality management. While some quality assurance and quality control activities are interrelated, the two are defined differently. Typically, QA activities and responsibilities cover virtually all of the quality system in one fashion or another, while QC is a subset of the QA activities. Also, elements in the quality system might not be specifically covered by QA/QC activities and responsibilities but may involve QA and QC.

Quality Assurance
Quality assurance can be defined as "part of quality management focused on providing confidence that quality requirements will be fulfilled." The confidence provided by quality assurance is twofold—internally to management and externally to customers, government agencies, regulators, certifiers, and third parties. An alternate definition is "all the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality."

Quality Control
Quality control can be defined as "part of quality management focused on fulfilling quality requirements." While quality assurance relates to how a process is performed or how a product is made, quality control is more the inspection aspect of quality management. An alternate definition is "the operational techniques and activities used to fulfill requirements for quality."

Quality Planning
Quality represents a fundamental aspect for end users when buying and interacting with products or services because it is the foundation for branding through customer satisfaction. But quality in project management has a different meaning since it involves the delivery of project activities and outputs as effectively as possible. As a project manager, you are responsible for the overall quality of the work done by setting project quality goals, continuously auditing through project assurance (with regard to the process of checking the performance of the quality management plan) and products or services acceptance metrics through quality controls. Quality planning is fundamental for project success because quality itself is connected to the project triple constraints (time, cost, and scope)

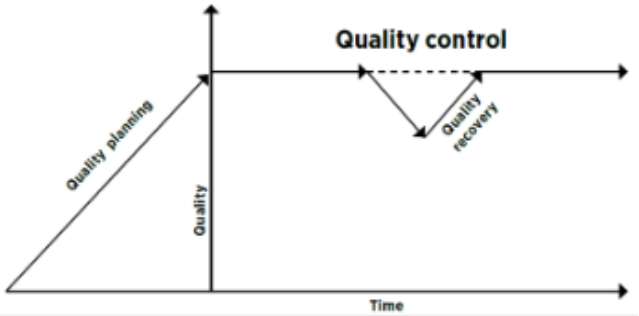

Fig 3: Picture depicting Quality planning on a scale of time and quality impacting Quality Control and recovery from asq.org

Quality planning using the Agile approach
Unlike in Waterfall or project-controlled environments (Prince2), when teams work with an Agile mindset, individuals and interactions take over process and tools, working software are preferred to comprehensive documentation, collaboration takes over negotiations, and responding to change over following a plan. Therefore, quality planning and control are embedded in the product backlog items, sprint backlogs and sprint reviews as an incremental quality improvement process agreed amongst the scrum team, product owner and clients.
Quality may decrease when a project has a short window of time for output delivery or when the budget is consistently cut. Over-scoping a project with extra activities due to the stakeholder's request for additional products or services features can also compromise the project management quality

plan and the project's overall success. In other words, projects cannot be considered successful if stakeholders' quality metrics are not met, even if the project activities are delivered on time and within budget. It is imperative for project managers to make sure that the final project delivery suits stakeholders' expectations so that deliverables and outcomes are beneficial for end users and the community. If you don't know what quality standards your stakeholders consider acceptable, you won't be able to ensure that your project will fulfil their expectations. That is why project managers must manage and control quality, just as they do costs, scope, and time.

Quality planning concerns gathering products or services requirements, usually collected in the initiation stage of the project life cycle (i.e., kick-off meeting or previous meetings with clients). These generally identify how project managers will assess the quality and avoid faults in the planning stage. Usually, organizations have a quality management system in place, consisting of internal policy that aligns with national and international standards (i.e., ISO 9000), that specifies how quality is assessed and measured across the organization. Project managers must ensure through the quality planning that projects adhere to the corporate policy as well as to the territory legislation, standards, and guidelines where the service or product is made available. High quality is accomplished by preparing for issues rather than reacting to them as they arise. Requirements are established, and then methods are implemented to meet those standards and policies.

The foundation of quality planning is to set a standard for customer satisfaction through conformance to requirements and fitness of usage. The foremost is based on quantitative inspections of how much the product or service delivered deviates from the targeted minimum quality requirements established with stakeholders (i.e., colour, geometric tolerances, number of features embedded, etc.). The latter refers to how well deliverables do what they were planned to do (practicality or comfort to consume a service or use a product influenced by the design or hardware limitations).

Quality Control Practices

Quality control refers to the systematic process of identifying, monitoring and correcting potential defects or deviations in products or services. This process ensures that the final output meets the established quality standards and customer requirements. QC is an essential part of the overall quality management system (QMS) and involves regular inspections, testing, and monitoring of various production stages.

ISO 9001:2015 defines Quality Control as "a part of quality management focused on fulfilling quality requirements." It includes activities such as the inspection and testing of incoming raw materials, in-process products, and finished goods.

Fig 4: History of Quality Control from qualitygurus.

Benefits and Importance of Quality Control

- Customer Satisfaction: Consistently delivering high-quality products and services helps build customer trust and loyalty, increasing the likelihood of repeat business and positive word-of-mouth marketing.
- Regulatory Compliance: QC processes help companies adhere to industry-specific regulations and standards, preventing costly fines or sanctions.
- Brand Reputation: A strong commitment to quality control enhances a company's reputation for producing reliable, high-quality products or services.
- Cost Savings: Identifying and correcting defects early in production minimizes waste and reduces the need for expensive rework or recalls.
- Competitive Advantage: Companies with robust QC systems are better positioned to differentiate themselves from competitors and capture market share.

Key Strategies for Effective Quality Control

- Establish Clear Quality Standards: Define and communicate the specific quality criteria for each product or service, ensuring all team members understand the expectations.
- Implement Regular Inspections and Testing: Conduct routine checks at various stages of production to identify defects and deviations from quality standards.

- Invest in Employee Training: Provide ongoing training to equip employees with the necessary skills and knowledge to maintain high-quality standards.
- Utilize Statistical Process Control (SPC): SPC techniques can help identify trends and patterns in production data, enabling companies to predict and prevent quality issues.
- Embrace Continuous Improvement: Encourage a culture that values ongoing learning and improvement and proactively empowers employees to identify and address quality concerns.

Quality Control Approaches

Different industries and organizations may adopt various approaches to quality, depending on their specific needs and goals. Some popular QC methodologies include:

- Total Quality Management (TQM): A holistic approach to quality management focuses on continuous improvement, customer satisfaction, and employee involvement. It aims to integrate quality principles into all aspects of a company's operations.
- Six Sigma: Six Sigma is a data-driven quality management methodology seeking to reduce defects and process variation. The goal is to achieve a defect rate of 3.4 per million opportunities, ensuring near-perfect quality.
- Lean Manufacturing: Lean focuses on eliminating waste and optimizing processes to deliver maximum value to customers. Although not explicitly a quality control approach, Lean principles can significantly contribute to improving product quality by enhancing efficiency and reducing defects.
- ISO 9001: This international standard sets out the criteria for a quality management system. Achieving ISO 9001 certification demonstrates a company's commitment to maintaining consistent quality standards and continuously improving its processes.

Quality control plays a crucial role in ensuring that businesses deliver high-quality products and services, meeting customer expectations and regulatory requirements. Companies can develop and implement effective QC systems that contribute to long-term success by understanding its importance, benefits, and key strategies.

Metrics and Measurement

Benchmarking is defined as the process of measuring products, services, and processes against those of organizations known to be leaders in one or more aspects of their operations. Benchmarking provides necessary insights to help you understand how your organization compares with similar organizations, even if they are in a different business or have a different group of customers.

Benchmarking can also help organizations identify areas, systems, or processes for improvements—either incremental (continuous) improvements or dramatic (business process re-engineering) improvements.

Benchmarking has been classified into two distinct categories: technical and competitive. The House of Quality matrix and Gantt charts are often used to plot the benchmarking evaluation.

Technical benchmarking

Technical benchmarking is performed by design staff to determine the capabilities of products or services, especially in comparison to the products or services of leading competitors. For example, on a scale of one to four, four being best, how do designers rank the properties of your organization's products or services? If you cannot obtain hard data, the design efforts may be insufficient, and products or services may be inadequate to be competitive.

Competitive Benchmarking

Competitive benchmarking compares how well (or poorly) an organization is doing with respect to the leading competition, especially with respect to critically important attributes, functions, or values associated with the organization's products or services. For example, on a scale of one to four, four being best, how do customers rank your organization's products or services compared to those of the leading competition? If you cannot obtain hard data, marketing efforts may be misdirected and design efforts misguided.

Benchmarking Considerations

- Before an organization can achieve the full benefits of benchmarking, its own processes must be clearly understood and under control.
- Benchmarking studies require significant investments of manpower and time, so management must champion the process all the way through, including being ready and willing to make changes based on what is learned.
- Too broad a scope dooms the project to failure. A subject that is not critical to the organization's success won't return enough benefits to make the study worthwhile.
- Inadequate resources can also doom a benchmarking study by underestimating the effort involved or inadequate planning. The better you prepare, the more efficient your study will be.

Benchmarking Procedure

Plan

- Define a tightly focused subject of the benchmarking study. Choose an issue critical to the organization's success.
- Form a cross-functional team. During Step 1 and 2, management's goals and support for the study must be firmly established.
- Study your own process. Know how the work is done and measurements of the output.
- Identify partner organizations that may have best practices.

Collect

- Collect information directly from partner organizations. Collect both process descriptions and numeric data, using questionnaires, telephone interviews, and/or site visits.

Analyze

- Compare the collected data, both numeric and descriptive.
- Determine gaps between your performance measurements and those of your partners.
- Determine the differences in practices that cause the gaps.

Adapt

- Develop goals for your organization's process.

- Develop action plans to achieve those goals.
- Implement and monitor plans.

Internal Control and Security

Businesses today are constantly facing new IT risks, and it can be challenging to keep up with the changes in technology and best practices for protecting your business and the valuable data in your possession. For example, since most workers have begun to work from home due to the global coronavirus health crisis, organizations have become more vulnerable to cyber-attacks and other types of operational disruptions.

One of the most effective ways to ensure your organization is taking the correct steps to mitigate risks is to develop a set of internal controls that ensure your processes, policies, and procedures are designed to protect your valuable corporate assets and keep your company secure and intact. Internal controls help your employees carry out their jobs in a way that protects your organization, your clients, and your bottom line.

Internal controls are used by management, IT security, financial, accounting, and operational teams to achieve the following goals:

- Ensure the reliability and accuracy of financial information – Internal controls ensure that accurate, up to date and complete information is reflected in accounting systems and financial reports. For example, the Sarbanes-Oxley Act of 2002 (SOX) requires annual proof that
- A business accurately reports their financials
- Their procedures effectively prevent fraud
- They have addressed any uncertainties.
- Prevent fraudulent business activity – Internal controls create a reliable system for managing business operations and keeping a check on potential business fraud. Businesses subject to SOX are required to have a process for identifying fraud that is acceptable to regulators.
- Safeguard sensitive, confidential, and valuable information – Internal controls are designed to protect information from being lost or stolen and to reduce the costs an organization may incur when it suffers from security incidents.
- Ensure compliance – Internal controls help ensure that a business is in compliance with the federal, state, and local laws, industry-specific regulations, and voluntary cybersecurity frameworks such as SOC 2 or ISO 27001.
- Improve the efficiency and effectiveness of business operations – Internal controls help companies reduce complexity, standardize and consolidate their operational and financial processes and eliminate manual effort. This often results in more efficient, more consistent, and more effective services and operations.

Five kinds of internal controls

The Committee of Sponsoring Organizations of the Treadway Commission (COSO) provides five types of internal control to help companies develop their own unique and effective internal controls.

Control environment

This comprises the framework and basis of your internal controls program, including the processes and structures that create the foundation of the internal controls your business carries out. The control environment also includes:

The integrity and ethical values of your organization Parameters for how and when the board carries out their responsibilities, and Incentives and rewards.

Simply put, the control environment is the culture your company creates around internal controls. The executives, upper management, and team leads must all communicate the importance of internal controls downward and every process must take place within the parameters of the control environment.

Risk assessment

To build effective internal controls, a business must first understand what risks they are controlling for and what their business is up against in terms of internal and external risks. A proper risk assessment means identifying risks in all areas of your business, both inside your organization and outside, and then identifying ways to mitigate those risks or bring them down to an acceptable level.

Below, are some questions to consider to make sure your risk assessment is comprehensive:

- Does your risk strategy include a comprehensive view that considers both existing and emerging risks?
- How are risk tolerance levels defined?
- Are key stakeholders involved in setting risk tolerance levels?
- How effectively does the design of the control mitigate the risk?
- For more details on how to conduct a thorough security risk assessment, check out this blog post Conducting an Information Security Risk Assessment: a Primer

Control activities

Control activities are where the rubber meets the road. They are how your risk management strategies are actually carried out in the policies and procedures that govern the day-to-day activities of your employees. These activities are embedded throughout your entire company, and they are designed to identify, monitor, and, ultimately, prevent risks from manifesting.

Information and communication: In many ways, communication is the most important part of the internal controls your organization puts in place. If an internal control shows that a process isn't working, and that isn't communicated upwards to those who can fix it, what's the point of having the internal control in the first place? How will your organization benefit from internal control if a manager doesn't have a channel for communicating with control owners and policymakers within the company?

There must be an open channel of communication regarding internal controls, and robust reporting and information gathering is key to reaping the benefits of all the work and time that go into internal controls.

Yet, too often, compliance teams don't have a comprehensive view into all risk areas and internal controls within their organization. Without such information, compliance teams are unable to see the gaps in their control environment and miss the opportunity to make timely adjustments to shore up controls and mitigate risks.

Monitoring

To gauge the effectiveness of your internal controls, and to

ensure you're addressing any gaps in the controls you've developed, you need to continuously monitor your controls and conduct tests to make sure your processes are working as designed. Ideally, these tests are automated, not manual. This reduces the chance of human error that can leave your assets vulnerable. For example, forgetting to revoke access privileges to critical systems when an employee quits will leave your organization open to threats. But it's easy to forget to remove a departing employees' access to certain systems if it is a manual process. Automating this process removes that risk from the equation.

Additionally, having open communication and a dedicated channel for people who have concerns or have experienced issues is an important practice to ensure the continued success of your internal controls. Further, conducting internal controls audits will also give you insight into how your internal controls are performing.

Conducting an internal control audit

Internal control audit simply tests the effectiveness of your internal controls. When it comes to financial internal controls, the Sarbanes Oxley Act made businesses legally responsible for ensuring their financial statements are accurate, and the Public Company Accounting Oversight Board developed the standard that used to evaluate internal controls in their Auditing Standard No. 5.

Financial internal controls audits are performed by CPAs and require an organization to provide proof of the process your organization uses to evaluate your controls and financial statements. This can require a lot of documentation, but if your organization has been monitoring your internal controls and creating regular and thorough reports, and consolidating all of that information in one place, producing it should be relatively simple.

Conclusion

Quality Assurance and improvement program (QAIP) plays a crucial role in improving software quality, reducing defects, optimizing development cycles, supervision, review and measurement of internal audit activities. Adherence to quality 4.0 principles allows for stability and ease of implementation for Quality management, measurement thus facilitating smooth internal and external audits.

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