WHITE PAPER:

Transitioning from Computer Systems Validation to Computer Systems Assurance Factors Life Science organizations need to Consider

Computer System Assurance (CSA) - the new approach to validation

The FDA's Case for Quality launched in 2011 stated that the initiative was set up to promote implementation of critical-to-quality practices during device design and production.[1] The objective was to encourage industry collaboration, innovation, automation, and digital technologies. Through its efforts with industry, the FDA was able to identify best practices and learn the impediments that exist for organizations.

It became apparent to the FDA that the current approach to validation, Computer System Validation(CSV), was perceived as a barrier to technology implementation because of the need to produce excessive, non-value-adding documentation that drove longer validation timeframes and increasing costs.

Manufacturers were hesitant to invest in highly automated technologies as the cost to validate these systems was very high. The validation process had not kept pace with the technological advancements and was hurting the growth of the Life Sciences industry.

The FDA therefore decided it was time for a new approach. This new approach is Computer System Assurance (CSA). It represents a change in the way systems are validated. The idea with CSA is to allow organizations to focus on rigorous testing on areas that directly impact patient safety and device quality.[2]

How does CSA differ from CSV?

The Traditional CSV approach

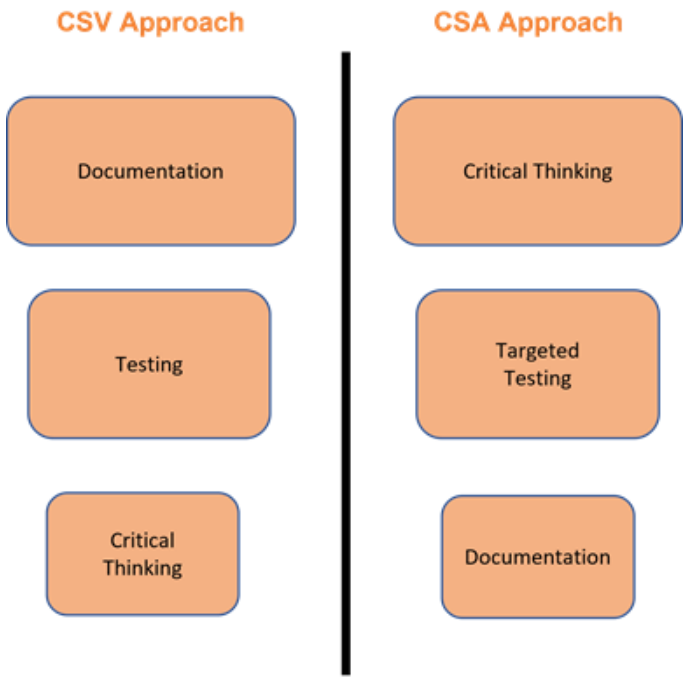
With the traditional CSV approach the primary activity centered on the securing of evidence for auditors, rather than the assurance of the quality of systems being validated.

CSV requires significant documentation. The Life Sciences industry has been focusing on a "compliance mindset" and treating everything equally for the sake of the auditors. This created a significant cost impact and potential blind spots.[3]

The CSV approach creates barriers to pursuing automation due to time, cost, use of automated testing tools, and the need for extensive documentation. Additionally, the risk assessment process has evolved into a very complex process which is time consuming and burdensome and a focus on gathering evidence for auditors. There is also the fact that 80% of deviations encountered during the validation process are due to tester or test script errors.[4]

New CSA approach

Because of the issues with CSV, the CSA approach was developed. It focuses on critical thinking and objective analysis and evaluation in order to ensure the focus is in the right place. Leveraging targeted testing to achieve results. Documentation remains important, however, the larger focus is on testing and on those areas that are critical to patient safety and product quality.



Whereas CSV focuses heavily on documentation, the CSA approach focuses a high priority on those areas effecting patient safety and product quality.

With CSA, the assurance is based on the true risk level. This assurance and risk level result in ad-hoc testing, where only a summary document is required, to robust scripted testing that is used today. The CSA risk-based assurance approach concentrates more stringent scripted testing on high-risk areas that directly impact human safety and product quality, while unscripted testing can be utilized on areas that indirectly impact patient safety and product quality. For those areas where the risk is deemed to be low, ad-hoc testing can be leveraged.

Risk-Based Assurance Process

Risk	Impact	Assurance Method
High	**Directly** impacts product quality or human safety	Scripted Testing
Medium	**Indirectly** impacts product quality or patient safety	Unscripted Testing
Low	Not high or medium risk (e.g., business risk)	Ad-hoc Testing

Source: SL Controls: Is Your Company Ready for the FDA's Upcoming Guidance on Computer Software Assurance?[5]

CSA involves applying different degrees of validation testing according to the risk associated with the software. The process can be broken down into four broad steps:

1. **Identify the intended software use –** if the software does not impact patient safety or product quality, you don't need to apply the same level of assurance as those that do.
2. **Determine areas or functions that can impact product quality, patient safety, or system integrity –** Calculate the risk/impact on patient safety and product quality, along with the implementation method of the software functionality.
3. **Leverage vendor documentation where possible -** If the vendor has quality documentation and validation in place, use it versus creating your own documentation.
4. **Conduct scripted and unscripted testing activities as needed based on risk -** This risk-based approach requires experts who understand business processes and can evaluate the system's functionality to get more value from their software.

Why Move to CSA?

Before we discuss the steps that should be taken to move to CSA, why should an organization move to this new approach? A recent study that was done sheds some light on this. In December 2020 by the Medical Device Innovation Consortium (MDIC) Case for Quality Forum, the FDA and industry partners highlighted the results and benefits companies have achieved with CSA, including:

- 90% or higher reduction in test script and tester errors
- Validation time was cut 50% or more, with faster implementation overall
- Lower total project cost
- Higher morale, quality, and productivity
- More time for critical thinking versus generating documentation[6]

The key advantages of the CSA approach can be summarized as follows:

- A reduction in cycle times (test creation, review and approval).
- Only the High-Risk features of a system will require scripted testing.
- Reduced test script execution time.
- Lower number of detected defects for example script errors & configuration.
- Less generated documents.
- Testing focused on ensuring SW Quality and patient safety.
- Better use of Supplier Qualification.
- Maximized use of CSV and Project Resources expertise (e.g., SMEs).
- The release of the CSA guidelines will support companies who have taken the path to automation.[7]

Who is Looking to Implement CSA and What are their Concerns?

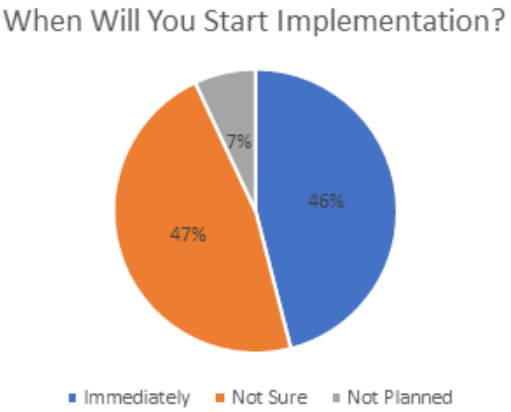
Another question that comes to mind is, are organizations actually planning on moving to CSA and why? Also what are their concerns about moving to this new method?

In January 2021, the FDA-Industry CSA team during a live webinar asked more than 570 industry peers, practitioners and subject matter experts several questions related to CSA. The following were the results.

The question was asked, "When will you start implementing CSA?"

- 46% immediately or this year
- 47% unsure
- 7% had no plans

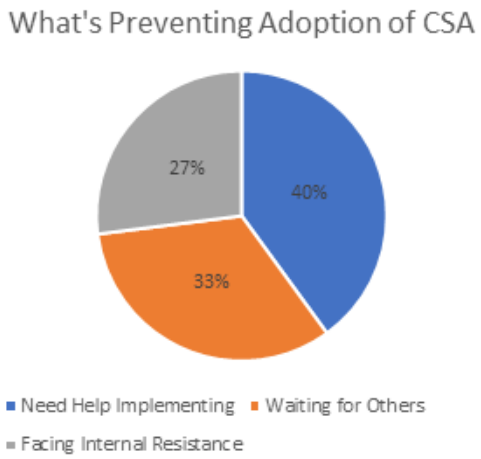
Source: American Pharmaceutical Review: Understanding FDA's CSA Guidance in the Context of Current Regulations and GAMP[8]



Another question was asked, "If unsure or no plans (54%), what is preventing you from adopting CSA?"

- 40% need help implementing
- 33% waiting for others
- 27% were facing internal resistance.

Source: American Pharmaceutical Review: Understanding FDA's CSA Guidance in the Context of Current Regulations and GAMP[9]



For organizations who are among those planning to transition to CSA or are one of those who are unsure or have no immediate plans currently, the below information will be of value, if and when the business decides to move.

Developing a Plan to Get to CSA

There's an old saying that if you fail to plan, you plan to fail. Having a plan to proceed forward with CSA is crucial to an organization's success. Given that is the case, the below steps are the best practices for expediting the transition to CSA.

- Evaluate current environment and validation process – How much time is the business spending on planning, testing, designing, documenting, and other areas along with current processes and resources.
- Leverage metrics to understand current environment – To better understand the current operation the organization should apply metrics. The metrics should measure the performance and include costs, time spent on validation, and cut across multiple aspects of the business. The areas to include are:
  - People aspect– measuring the performance against objectives along with skill levels of team members.
  - Process aspect – to evaluate operational processes, both qualitative or quantitative methods can be used. This can assist in assessing what areas are running well.

- Product aspect – measure the specific criteria that will assist research, manufacturing, and marketing in understanding the success of product and product characteristics (i.e. testing, number of deviations, quality, etc.).
- Project aspect – measure key performance indicators (KPIs) associated with project management and project control. A few areas to measure would be quality of deliverables, schedule variance and performance, cost associated with missed deadlines, work-in-progress, cancellations, and customer satisfaction.[10]

- Build a plan to transition– Plan how business will implement the CSA approach. How will the organization transition resources and processes over to the new approach that will focus on critical thinking related to patient safety, product quality, data integrity, operational efficiency, and effectiveness.
- Perform a vendor audit – Review vendor's documentation to determine the quality and applicability of their SDLC as well as other IT processes.
- Create a change management plan – Put in place the right communication and training programs to support the business's people in this transition. This includes shifting the culture from an organization focused on a compliance-centric mindset to a quality focused culture. The key is to ensure understanding of the core concepts related to CSA including critical thinking, the risk-based approach, and the focus on patient safety, product quality, data integrity and those activities that focus on these areas.[11]
- Ensure Strategy and Execution are in synch – As the business proceeds through implementation, the execution of the various steps should tie back to the strategy developed. The organization should ensure this connection to ensure success.

Key Methodologies, Technologies, and other Considerations to Achieve CSA

There are several important factors to consider to ensure a successful transition to CSA. They are focused on those areas that can provide a major impact to your CSA implementation.

- **Leveraging Agile Methodologies**
  - **Leverage Scrum**
    Scrum is an approach that relies on teams working together in short phases, enabling rapid feedback, continual improvement, and fast adaptation to change to accomplish an objective. By incorporating this agile approach with the CSA implementation the organization will be able to bring in efficiencies and optimization into their processes supporting CSA.
  - **Test-driven development (TDD)**
    TDD is a software development methodology that focuses on establishing unit test cases before writing actual code. It's a method that combines programming, unit testing, and refactoring in an iterative. TDD will enable organizations and teams to reduce the amount of documented testing that would need to be performed as part of the system release.
  - **Follow Behavioral-driven development**
    BDD is an agile software development process in which an application is documented and designed around the behavior that a user expects to see when interacting with it. BDD will help reduce the rigor and the complexities of developing test cases from the requirements alone – incorporating the learnings from the BDD sessions into the testing phase will greatly reduce the time for the testing phase as well as bring in efficiencies.
  - **Introduce early testing techniques**
    By incorporating configuration and experimentation in lower environments to find defects early, organizations can improve process efficiencies across the SDLC as well get to release faster.

- **Leveraging automation and digital technology**

  - Continuous Integration
    The method of automating the integration of code changes from various contributors into a single software project is known as continuous integration (CI). It's a key DevOps best practice that allows developers to merge code changes into a common repository, from which builds and tests can be executed. Using this approach, organizations can test more holistically and focus more on the integration testing rather than the functional testing.

  - Employ Automated Controls and Quality Management System (QMS) tools
    By leveraging automated controls throughout the organization the quality function can receive feedback quickly from systems that are able to collect that data and provide it in a consolidated fashion. A QMS or Enterprise Quality Management System (EQMS) is an important component to any digital quality framework. The objective of EQMS is to manage content and business processes for quality and compliance across the value chain. This EQMS platform integrates with the IT architecture and data model and facilitates cross-functional communication and collaboration.

    It is essential that the EQMS is not siloed. Quality information should be collected as data and leveraged across the organization to make informed decisions.

    The EQMS has to also have an interface to other systems whether it is ERP, PLM, supplier quality, vendor management, or other enterprise systems integral to the organization. Those interfaces are critical because that is where data resides, and access to that data is vital for decision making.

    EQMS also needs to be mobile. It can't be at one particular location or region or within one area. The EQMS has to provide the ability to look at data wherever, whenever, and however needed. Having this visibility to the pertinent data allows teams to make decisions faster as well as implement controls that prevent issues and non-conformances further in the processes.

Conclusion

The FDA's CSA guidelines have in many ways rectified the situation that Life Sciences organizations faced with the traditional CSV approach. By changing the focus from a significant documentation requirement to an emphasis on critical thinking and targeted testing, this facilitates improved patient safety, product quality, and risk control. This also removes the cost barriers that Life Sciences organizations encountered and therefore opens up the opportunity for innovation through technology.

With the new CSA approach, Life Sciences organizations are now able to embrace digital transformation across their business along with the challenges that Industry 4.0 brings. This is hopefully the beginning of the changes that will take place to help Life Science organization to leverage technology to expand into the future.

With the new CSA approach, the key to success is ensuring the organization understands its current environment and has a plan to ensure success. This approach involves incorporating methodologies and technologies that facilitate the transition process. It is also equally important to have the right people expertise involved, both internal and external, to have a successful implementation.

About Astrix:

For over 25 years, Astrix has been a market-leader in dedicated digital transformation & dedicated staffing services for science-based businesses. Through our proven laboratory informatics, digital quality & compliance, and scientific staffing services we deliver the highly specialized people, processes, and technology to fundamentally transform how science-based businesses operate. Astrix was founded by scientists to solve the unique challenges which science-based businesses face in the laboratory and beyond. We're dedicated to helping our clients speed & improve scientific outcomes to help people everywhere.

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