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# THE NEXT GENERATION MODEL: BREAKTHROUGH IN TECHNOLOGY INNOVATION AND PROCESS OPTIMIZATION FOR ECLINICAL TRAILS RAPID DEPLOYMENT APPROACH THROUGH FLEXIBLE SYSTEM DESIGN

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## ABSTRACT

*In the pharmaceutical industry, the pressure on small companies to bring innovative products to market versus large competitors is unprecedented. With the desire to decrease the cost of conducting trials, reducing time-to-market and improving their competitive edge, smaller bio-techs and pharmaceuticals will require inventive strategies for building, designing and deploying their studies. With the availability of flexible configurable Electronic Data Capture (EDC) systems that come equip with pre-configured, pre-packaged and standard offerings, for Phase I and II trails, both study design and development time would be radically reduced. With traditional EDC systems requiring 8-12 weeks to configure, flexible systems that offer pre-packaged, yet modifiable offering to configure, would significantly reduce design and development time by over fifty percent. However, adopting a flexible technology system alone can not solve this industry dilemma for speed to market. Well-defined process strategies defined by the pharmaceutical stakeholders is the remaining ingredient to transform a new platform to further reduce costs historically associated to the long lifecycle of clinical trail development. When time-to-market is critical, the breakthrough of technology innovation and process optimization can streamline and enhance productivity in the eClinical development cycle.*

*For bio/pharmaceutical companies to succeed in the race for the cure, there must be both enterprise and strategy flexibility within the organization to introduce new methodologies in tradition clinical trial design phases. The more flexibility a pharmaceutical company allows, the more resilient and resistant to market threats – and responsive to opportunities – it becomes. This paper will show the mapping of the Flexibility in an Organization and Impact on Performance. Flexibility Options will be outlined and considerations using Flexible system tools. consideration Using Flexible Systems Tools. The analysis includes SAP – LAP Framework and SAP – LAP Models and Linkages. This paper will show how a more flexible pharmaceutical business infrastructure can help an organization cut costs, reduce time to market, increase profits– and, perhaps most importantly, prepare for unpredicted challenges in a rapidly changing industry with the use of adaptive trial design.*

## Background - Industry Challenge

Managing trials of new drugs is a major undertaking for pharmaceutical companies. The pharmaceutical industry witnesses increasing competitive and regulatory pressures. In this fast-paced market, being the most efficient in identifying viable new compounds is not just a means

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of achieving growth, but also a key to survival. The first company to market with a new drug can enjoy a virtual monopoly for years, generate tremendous profits, and possibly transform the lives of millions of people. The second gets very limited benefits.

Approximately, 10,000 compounds synthesized, only ten will be advanced to clinical development, of which on average, only one will be approved for commercial introduction. It is reported that US pharmaceutical companies spend an average of over 1 billion over ten to twelve years to bring a new product to market. Once on the market seven out of ten products fail to return the cost of the company's investment. – Journal of Health Economics 22 (2003) 151–185

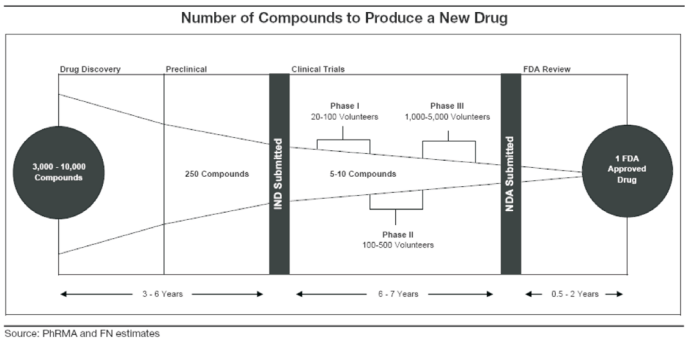



Figure 1: Number of Compound to Produce a New Drug

Drug discovery is not only costly and risky but there are additional uncertainties over whether or not the process can be managed correctly and whether or the benefits from new drug discovery can be appropriated through technology. The pharmaceutical industry competitive challenge is the struggle for speed, as a single day of delay in getting a new product to market can cost millions of dollars in sales.

> "An additional reason for speed is, of course, the cost of the new drug development process itself: currently $30,000 per day, which is rising by 10–12% per year." – Journal of Health Economics 22 (2003) 151–185

Adopting technology innovation to optimize the clinical trails management has become an increasingly growing priority for the pharmaceutical industry. With the pharmaceutical industry under increasing pressure to raise productivity and cut drug development costs, technology innovation is critical to maintain market competitiveness for pharmaceutical companies.

Clinical trials are the backbone for the success within the pharmaceutical product pipeline. Ensuring the success of clinical trials by rising to the challenge of regulatory demands and getting a product into clinical trials on time can play a pivotal role in the launch of a new drug. Automation of the clinical trials workflow could speed up the process that would allow companies to be first to market with new drugs and increase profitability. Technology innovation introduces entirely new possibilities for drug development perhaps not possible before.

New product development has strategic importance for a firm's success. In the pharmaceutical industry, attention to new product development is especially critical. The long lead time to develop new drugs and the high costs of development mean that drug companies can not afford failure. Moreover, new drugs reaching the market often have a rather short time-span left for patent protection. Generic versions, off-label use of established drugs, not mention intense competition worldwide for "blockbuster" drugs, create additional pressures on the R & D capabilities

of a pharmaceutical company.

By inducing technology innovation and process optimization through flexible systems, pharmaceutical and biotech firms can accelerate the clinical and data management process, be first to market with new drugs, and increase profitability. Success in clinical development is key to the long-term success of pharmaceutical and biotech companies. This proposal will focus on the implementation and effects of technology innovation to streamline clinical trials processes to give pharmaceutical companies competitive advantages for early new product development.

## Problem Statement

The clinical data is the heart of clinical trial process. The challenge for pharmaceutical companies is to quickly expedite the handling of the clinical data. The quality of the data is extremely important for Pharmaceutical executives to make earlier decisions about the future direction for a drug to market. Through proven case studies, Clinical Trials can be designed in less time using EDC systems than managing the trial using paper Case Report Forms.

## Emerging Technologies

Enabling technology adoption for an eClinical solution allows EDC to hold the key to far-reaching competitive advantages for drug and medical device companies. Pharmaceutical companies that are bringing EDC in-house are doing so because they recognize EDC as a strategic weapon in their pursuit of more efficient, costeffective clinical trials. Choosing an EDC technology that is flexible and scalable is the ideal goal as it gives corporations control over how much of the system can be implemented and tailored to clinical protocol studies based on their corporate strategies. To further accelerate this implementation, flexible EDC systems coupled with this next generation process model breakthrough will change the landscape for clinical trials development. The technology and process combination of this potent formula of can allow, pharmaceutical and biotech firms to accelerate the clinical and data management process, be first to market with new drugs, and increase profitability.

## Research Method

This paper will focus on the levering enabling technologies that will be the catalyst for changing the paradigm of eClinical process implementation. There will be an evaluation on the Waterfall Software Lifecycle (SLC) comparing the origin of the eClinical study development lifecycle and the contempory catalyst for rapid deployment. EDC systems providing intuitive and ultra – efficient study configuration coupled with the process optimization to take the final transition from development to configuration. Supporting details will be elaborated on the issues encountered by pharmaceutical companies during their configuration stages and what the steps are to overcome them. The SAP-LAP Framework is used to outline the framework consisting of the situation, actor, process, learning, action and performance criteria.

## Systematic Flexibility

The integration point where technology innovation meets process optimizatio will require flexibility for corporations to continuously analyze, adopt and refine. Through the SAP-LAP framework model, principles from the situation, actor, process, learning, action and performance will require the following types of flexibility.


Figure 2: Types of Flexibility

Table 1: SLA – LAP Framework

Framework consists of situation, actor, process, learning, action and performance.

| | |
|---|---|
| **S**ituation | Pharmaceutical companies need to find ways to reduce the time from discovery through approval. The rapidly increasing costs and risks of developing drugs have led to the creation of a fast-growing business within the pharmaceutical industry: finding ways to improve the efficiency of the R&D process.<br><br>Streamlining clinical development through technology and process efficiency is on the rise given the highly competitive regulated industry. It takes takes ~8 years on average for new chemical entities (NCEs) to reach the market, leaving less than ~12 years of patent protection.<br><br>One of the primary factors to aid in this problem is expediting the data collection of the real time results of clinical trial testing. |
| **A**ctors | Internal Stakeholders<br>• **Bio/Pharmaceutical**: Data Managers, Clinical Programmers, Site Coordinators, Investigators, Site Monitors, Data Manager, Site Manager, CRF Designers, Database Designers<br>• **Clinical Research Organizations (CROs)**; Data Managers, Clinical Programmers<br>• **Technology Vendors** (EDC Technology Application System Providers, 3rd Party Providers)<br><br>External Stakeholders<br>• FDA and Regulatory Approvals |
| **P**rocess | Business Process Re-Engineering and integration of eCRF design using Adaptive Trial approach. SDLC Lifecycle mapped to the Clinical Trial Development cycle Phase I, Phase II, Phase III, Phase IV.<br>Impacted Clinical Processes<br>• Program / Study Design<br>• Database Design<br>• Study Start-Up<br>• Ongoing Study / Site Management<br>• Data Analysis & CSR Preparation<br>• Study Closure / Database Lock |
| **L**earning | Training, Education of Electronic Data Capture (EDC) tools, continuous improvement in process implementation |

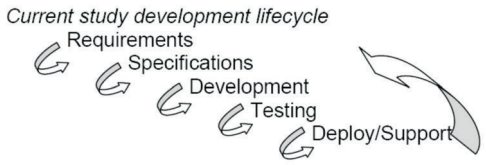
| | |
|---|---|
| **Action** | Combined Process Efficiency, Adaptive Clinical Trial Design and full integrated global EDC Technology. |
| **Performance** | Reduce # of days to configure clinical trial case report forms for data collection and analysis. |

The following Actors will impact the flow of the process optimization. The following roles in Clinical Development teams will play a significant role in the overall for outlining the adaptive trial process optimization.

| Clinical Project Management | Clinical Safety | Clinical Data Management |
|---|---|---|
| *Responsibilities to Consider...*<br>• Planning for projects that use EDC<br>• Managing and reporting progress and milestones with EDC projects | *Responsibilities to Consider...*<br>• Acknowledgement of SAEs<br>• Reporting of SAEs to regulatory authorities<br>• Review and reconciliation of safety information<br>• Reporting data to Data Safety and Monitoring Boards | *Responsibilities to Consider...*<br>• Data Management plans<br>• Data Validation design |
| **Clinical Trial Financial Mgmt** | **Clinical Operations** | **External Vendors** |
| *Responsibilities to Consider...*<br>• Initial and ongoing clinical site payment<br>• Reimbursements<br>• Contract administration | *Responsibilities to Consider...*<br>• Monitoring teams supporting clinical operations<br>• In-house clinical trial management<br>• Site relationship management | *Responsibilities to Consider...*<br>• CROs supporting and/or conducting trials<br>• IVRS providing Randomization and Drug Dispensation<br>• Central Laboratories providing lab analysis and sample management |

## Traditional Approach: Waterfall SLC (Software Life Cycle)

Typically the Clinical development process for configuring system study trial design has followed the Waterfall model. The standard waterfall model for systems development is an approach that goes through the following cycles and steps. The actors listed above go through the linear processes which can elongate the clinical development process into 12 week implementation.




### *Current Specification Document Design Approach*

The current process lifecycle uses paper specification to communicate EDC configuration requirements between all key stakeholders including Data Management, Clinical Operations, Statistics, Program and Project Managements. This iterative lifecycle is cycled back to the technical teams to interpret the design the trail. As changes occur, this cycle moves back in the process, thus adding delays to the timelines cascading a domino effect to timelines. A delay in development leads to late enrolment for subjects on a trial, pushing the delays to monitor the results of the study and thus the ripple effect to close the trial and submission to the FDA. In the height of competition to be first to market, every day counts.

Process steps that Clinical Developers and Data Managers go through with sponsors include this linear process that includes the following:

1. Document tem Concept
2. Identify System Requirements and Analyze Them
3. Break the System into Pieces (Architectural Design)
4. Design Each Piece (Detailed Design)
5. Code the System Components and Test Them Individually (Coding,

Debugging, and Unit Testing)

6. Integrate the Pieces and Test the System (System Testing)
7. Deploy the System and Operate It

## Next Generation Model: Rapid Configuration Approach

This future model requires behavior changes for the key clinical stakeholders to move away from the traditional waterfall SDLC and take a leap into the accelerated approach. This alterative design approach will take EDC system configuration environment as the combined specification and configuration tool.

The size and complexity of clinical programs are increasing disproportionately faster than available resources. To succeed, clinical organizations must find new, more efficient ways of operating. That requires reviewing (and often revamping) current work processes, organizational structures, and technologies. Clinical development leaders that are seeking to improve the efficiency and effectiveness of their operations. Experts are desired to help drive change initiatives so that their key staff can remain focused on producing clinical results. To succeed, clinical organizations must find new, more efficient ways of operating

By replacing design and requirements specifications and turning them into human readable definitions development is the heart of this breakthrough for eClinical Trials deployment. Rapid Deployment strategies will be outlined during the presentation to address the needs of various protocols and therapeutic areas. Additionally, discussions on the ability to reduce process workflows through the utilization of a flexible system and process designs will be broached.

This breakthrough in technology innovation and process optimization puts the 'customers' in charge of the development process. This collapses and consolidates the teams normally required to perform the activities of writing business requirements, interpreting requirements into system requirements and designing the application. Putting the key in the hands of the sponsor customers allow a higher level of flexibility in the outputs of the end results since requirements outlined prior to development tend to alter as the final development is completed.

Accelerating the speed of the configuration process for the development of eCase Report Forms (eCRFs), changes the landscape for the clinical trial process. Clinical and Data Managers can provide higher level of quality skills and focus on the data analysis, data collection, data cleaning and data reporting. EDC Application Supper Providers are keenly focused on promoting such functionalities within their EDC offerings tools as sponsor customers will be growing with this system requirements. This empowers sponsors to drive solutions into the design of the study forms for clinical trial management. The birth of accelerating this design process unfolds addition areas for flexibility in the architecture of clinical study development. Strategy flexibility is needed to determine system, technology, organizational and process flexibility.

## Strategic Flexibility

The implementation strategy will encompass change to processes and methodologies, integrating

technologies and revising the supporting organizational infrastructure within a defined time frame. The impact of the strategic flexibility a corporation will face is the implementation Strategy on People, Process & Technology.

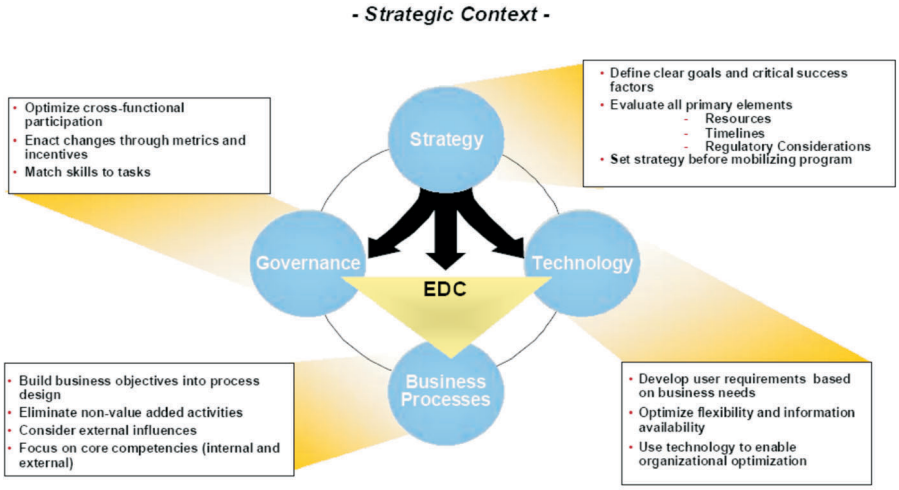



Figure 3: EDC Strategy Model

Enterprise change management deployment requires executive management support to identify the shared vision to shape the strategy and develop the execution plan specifically fit for an organization. Establishing clear goals before mobilizing the program is essential. Creating a governance board will led the vision of the strategy. Any effective technology implementation revolves around effective adjustments to the process, integrations of additional technologies and tools, and an organization that is optimized to take advantage of the implementation. These changes cannot happen without effective leadership teams identifying and guiding the necessary changes. The business process defines the rules Executive Management Support, Established Governance Teams and clearly defined Corporate Goals.

## Infrastructure Flexibility: Breakthrough in Clinical Design

The design of the clinical trial dictates how the system configuration will be constructed to support the data collection for the study. This essential step is pivotal for leveraging emerging technologies and advancing the business process reengineering. Below is a comparison table of the clinical trial phases.

Table 2: Clinical Trials Matrix

COMPARISON OF CLINICAL TRIAL PHASES

| | PHASE I | PHASE II | PHASE III | PHASE IV |
|---|---|---|---|---|
| OBJECTIVES: | Determine the metabolic and pharmacological actions and the maximally tolerated dose | Evaluate effectiveness, determine the short-term side effects and identify common risks for a specific population and disease | Obtain additional information about the effectiveness on clinical outcomes and evaluate the overall risk-benefit ratio in a demographically diverse sample | Monitor ongoing safety in large populations and identify additional uses of the agent that might be approved by the FDA |
| FACTORS TO BE IDENTIFIED: | -Bioavailability<br>-Bioequivalence<br>-Dose proportionality<br>-Metabolism<br>-Pharmacodynamics<br>-Pharmacokinetics | -Bioavailability<br>-Drug-disease interactions<br>-Drug-drug interactions<br>-Efficacy at various doses<br>-Pharmakodynamics<br>-Pharmakokinetics<br>-Patient safety | -Drug-disease interactions<br>-Drug-drug interactions<br>-Dosage intervals<br>-Risk-benefit information<br>-Efficacy and safety for subgroups | -Epidemiological data<br>-Efficacy and safety within large, diverse populations<br>-Pharmacoeconomics |
| DATA FOCUS: | -Vital signs<br>-Plasma and serum levels<br>-Adverse events | -Dose response and tolerance<br>-Adverse events<br>-Efficacy | -Laboratory data<br>-Efficacy<br>-Adverse events | -Efficacy<br>-Pharmacoeconomics<br>-Epidemiology<br>-Adverse events |

| | | | | |
|---|---|---|---|---|
| DESIGN FEATURES: | -Single, ascending dose tiers<br>-Unblinded<br>-Uncontrolled | -Placebo controlled comparisons<br>-Active controlled comparisons<br>-Well-defined entry criteria | -Randomized<br>-Controlled<br>-2-3 treatment arms<br>-Broader eligibility criteria | -Uncontrolled<br>-Observational |
| DURATION: | Up to 1 month | Several months | Several years | Ongoing (following FDA approval) |
| POPULATION: | Healthy volunteers or individuals with the target disease (such as cancer or HIV) | Individuals with target disease | Individuals with target disease | Individuals with target disease, as well as new age groups, genders, etc. |
| SAMPLE SIZE: | 20 to 80 | 200 to 300 | Hundreds to thousands | Thousands |
| EXAMPLE: | Study of a single dose of Drug X in normal subjects | Double-blind study evaluating safety and efficacy of Drug X vs. placebo in patients with hypertension | Study of Drug X vs. standard treatment in hypertension study | Study of economic benefit of newly-approved Drug X vs. standard treatment for hypertension |

Research Coordinator Orientation, University of Pittsburgh, 2002

Traditionally, clinical trials can run 14 – 24 months. At the end of the trial during database lock, the data is reviewed to determine the results of the study. Performing interim analyses can increase speed and accuracy from the data analysis. In the design of the clinical trial, organizations need to map out the expected data flow, identify and validate required technology integrations and determine the determine appropriate edit checks to fire queries.

Interim analysis can lead to real time data collection, cleansing and monitoring. Gives the ability to review and analyze the data often. The simulations and modeling maintain the statistical validity of the data.

Adaptive Clinical Trial Design allows interactive data collection, analysis and earlier decision making. By adopting the adaptive process, organization can access real time data for early decision making. Clinical Monitors can assets results from subjects response to a drug. Interim analysis phase allows pharmaceutical companies to utilize real time data and determine whether to keep the treatment arm running for a trial or dismiss and kill the clinical study.

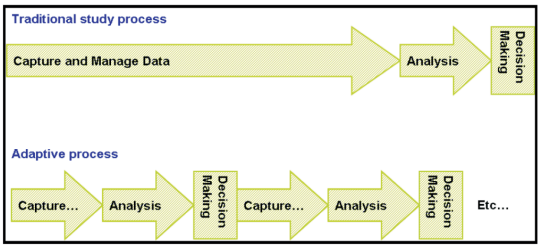



Figure 4: Clinical trial process: Traditional vs Adaptive
Study design method to streamline clinical development process

Adaptive trials allow more efficient drug development. By combining and blended phases in a trial, the data can be comparative and the learning factor can confirm the direction for the drug development. Designing a study using the adaptive trials approach can save time by combining two phases: Phase 1 & 2A, Phase 2a & 2b, Phase 2b

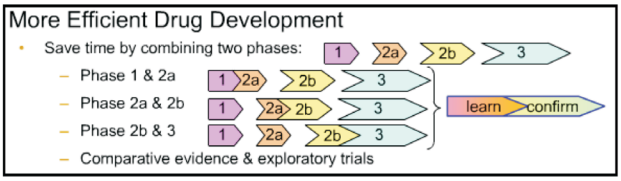



Figure 5: Combining Clinical Trial Phases
Process optimization through design on trial management

Primary benefits of applying adaptive process include better ethics since adaptive randomization will favor effective treatments. Depending on the early warning signs, determination can be identified if a drug is ineffective or toxic, which may avoid serious adverse events within the clinical trial. This adaptive process will also lead to better science as more dosages will be introduced and leanings about dosage respond model and toxicity into a pivotal trial. This is a significant breakthrough as this response and reducing failure rate in that phase can lead to an early termination of a trial and reduce failure risk of those volunteer subjects.

Adaptive trial design can lead to more efficient drug development by combing phases and accelerate the ' learn and confirm' methodology but applying immediate leanings to next steps within the trial, therefore possibly shorting development process for later trials.

## Process Change

Pharmaceutical companies that have had EDC experience have already discovered that they cannot automatically switch from a pilot project to full-scale implementation because major process changes are often required to support the software. It is the equivalent of taking a square peg and forcing it into a round hole. Their needs to be the right process identified that specifically match the supporting technology for a seamless implementation that 'fits' the organization. Breaking down the high level process into activities, organizations can measure their flexibility.

Table 3: Process Mapping EDC Implementation tasks
Matrix to provide the cross-road where technology meets the impacted organizational processes

| High-Level Process | Activities | Considerations |
|---|---|---|
| Program / Study Design | Protocol Authoring | • How will EDC timelines affect protocol development?<br>• How will EDC-specific language be incorporated? |
| | Study Planning | • How will protocol team members be trained on how to use the EDC tool?<br>• What should be updated in existing clinical development SOPs and templates (e.g., Input / Output Plan, Data Review Plan, Statistical Analysis Plan)?<br>• How will the use of EDC affect study start-up timelines? |
| Database Design | CRF Design and Database Development | • How will CRF layout and validation checks be designed now that they will be done directly in EDC?<br>• Who will design and configure the eCRFs and data validations?<br>• How will defining global standards for CRFs and re-usable non-standard modules fit into the process?<br>• How will CRF Completion Instructions be affected with the use of EDC?<br>• How will CRF design merge with data extraction design into one process?<br>• How will the organization be affected now that database design is no longer required?<br>• Who will require workflow administration training?<br>• How will usability of EDC screens and online validations from the site's perspective be tested?<br>• How will EDC affect timing of project configuration relative to First Patient First Visit? |

| High-Level Process | Activities | Considerations |
|---|---|---|
| Study Start-Up | EDC Account Creation | • Who will be responsible for the creation and maintenance of EDC accounts? |
| | Country / Site Selection | • How will use of EDC technology (connectivity, Internet, etc.) affect site selection?<br>• How will sites be evaluated for connection and provisioning requirements? |
| | Provisioning | • How will provisioning sites with EDC hardware (i.e. laptops) and connectivity impact the current process?<br>• If hardware is provided to a site, how will the expense be handled? |
| | Clinical Supplies | • How will randomization and drug supply be handled in an EDC study?<br>• How will the IVRS system work / integrate with the EDC tool, if at all? |
| | Investigator / Site Training | • How will initial and ongoing EDC training (e.g., EDC tool, site initiation, processes) be delivered to sites and investigators?<br>• How will EDC affect the relationship between the sponsor and investigator? |
| | Clinical Trial Agreement | • How will EDC considerations (e.g., site assessments, provisioning) affect the Clinical Trial Agreement process? |
| Ongoing Study / Site Management | Data Entry Workflow | • How will workflow in EDC affect the data entry process?<br>• How will sites entering data directly from Source Documents into eCRFs using EDC fit into the process?<br>• How will automated edit checks impact the process? |

| High-Level Process | Activities | Considerations |
|---|---|---|
| Study Closure | Database Lock | • How can EDC be utilized to lessen the time to Database lock?<br>• How will interim locks for EDC sites impact the resolution of discrepancies?<br>• How will site access be removed (e.g., deleting accounts, locking all data, shutting down the URL)?<br>• How will the decreased need to audit the database for EDC sites affect the database lock process? |
| | Site Closure Visits | • How will incorporating EDC related items (e.g., Provisioning, Records Retention, patient data archival) affect the current site closure process? |
| | Archiving | • How will investigators receive a record of their study data?<br>• When will archiving activities begin relative to database lock?<br>• How will sites access to EDC change once the study is closed? |

## Organizational Flexibility

When introducing EDC into an organization, the following factors needs to be considered

### *I. Ensure EDC becomes an integral part of the organization's strategic plan.*

EDC must be leveraged into the organizations strategy of process, people and overall technology. An organization must measure how well the enterprise technology performs against its strategic objectives.

According to an executive sponsor from an experienced EDC pharmaceutical company, *"EDC is not an IT project. It has an IT component* and it uses contemporary technology, but successful implementation requires that responsibility reside elsewhere. In my opinion, effective leadership and change management are the most critical success factors with technology playing a vital, but smaller role."

Breaking down the clinical development process into 3 main category Study Design, Study Conduct and Study Close. These areas have impact across all clinical processes.

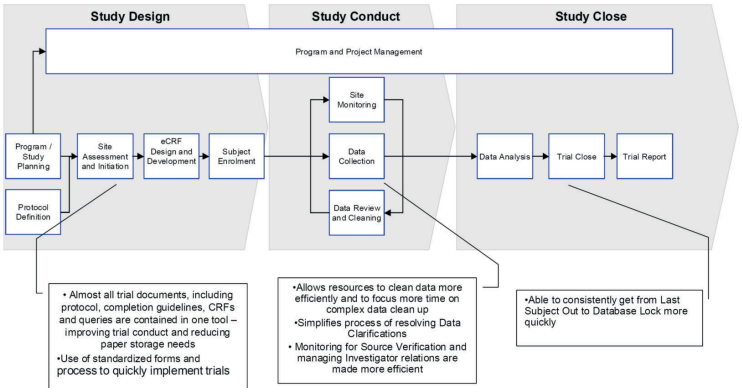



Figure 6: Study Phases Approach
Flexible impact of responsibilities per phase based on technology and process optimization

### *II. Align organizational roles and map to the specific functionality that can be preformed within the technology.*

Through the advancement of graphical user interface (GUI) available in today's configurable technologies, there may be less of a need to have a higher technical resource to configure a piece of the application. Whereas there may have been a need for a technical clinical developer to design a electronic Case Report Form (eCRF), this now can be configured by a Data Manager who may not need an application development skill set.

Depending on the EDC technology that a pharmaceutical company selects will determine

| CRF / Database Designer | Site Coordinator | Investigator |
|---|---|---|
| *Responsibilities to Consider...*<br>• Input / Output Plan<br>• CRF and eCRF Design<br>• CRF and eCRF Development and Testing<br>• Data Validation Development and Testing | *Responsibilities to Consider...*<br>• Data Entry<br>• Data Review / Correction<br>• Alerting Principal Investigator of eCRF status<br>• Query resolution | *Responsibilities to Consider...*<br>• Data Entry<br>• Data Clarification<br>• Signatures<br>• Site Staff Compliance with Federal Regulations on Electronic Records and Signatures |

| Site Monitor | Data Manager | Site Manager |
|---|---|---|
| *Responsibilities to Consider...*<br>• Data Review and Verification (SDV)<br>• Creating Discrepancies<br>• Reviewing and Closing Discrepancies<br>• Site's First Point of Contact for Study Questions<br>• Protocol deviations | *Responsibilities to Consider...*<br>• Ongoing Data Review to Identify Inconsistencies<br>• Creating, Routing, and Discrepancies Appropriately<br>• Locking Data<br>• Protocol deviations | *Responsibilities to Consider...*<br>• Early Process Control of Data Entry, Verification, and Cleaning Processes<br>• Identifying and Communicating eCRF / Protocol Compliance Issues to Site<br>• Performance or Data Quality |

III. ***Develop goals and establish metrics to evaluate and maximize the return on investment*** Key performance indicators (KPIs) are the measurement scale to determine the success rate of the organizational flexibly. Measurement variables that organizations can use to confirm effectiveness of EDC adoption include: # days to database lock, # of days of study start up.

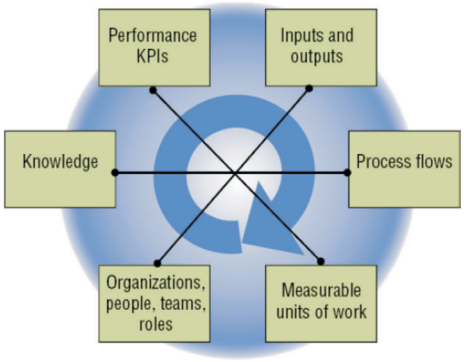



Figure 6: Technology Flexibility
Divisions of how technology impacts the sum of parts that equal a greater cohesive whole. Measurement areas include organizational and operational processes.

IV. ***Execute standard implementations globally.*** Organizations that can work through challenges and adaptations on a global scale will be highly efficient. Management executives that can align consistency of implementation globally is paramount. Establishing global standards for role harmonization and consistent use of EDC

Faster and quicker to market requires companies to focus on establishing enterprise standardization on clinical research globally. This standardization trend in the clinical research is occurring at an accelerating rate. The ability to have a consistent manner of handing data unfolds to additional areas for how the clinical data is managed that includes every aspect of data collection, management, manipulation, storage, dissemination, and submission in

clinical research.

The benefits of standards are exponential not just to the immediate Pharmaceutical company internally, but it establishes a common language and common reference points so the data can measure and communicate technology solutions to third party companies and regulatory bodies. Standards drive compatibility and create new ways the community measures and communicates their impact. Pharmaceutical and biotech companies are now mandating technology solutions and tools to comply with a certain amount of standardization. The force behind the drive is the FDA wanting companies to use submission standards. That sends a very strong signal to sponsor companies: in order to comply with federal guidelines, we need to enforce these standards, ensure adoption, and improve compatibility.

V. ***Recognize where new processes are required and whether existing*** processes can be streamlined using EDC. Flexibility Monitoring measures *performance* and allows the automotive company to sense and *respond to changes* and react accordingly. The Learning Factor plays a significant role to the incorporation of new process added to the overall implementation.

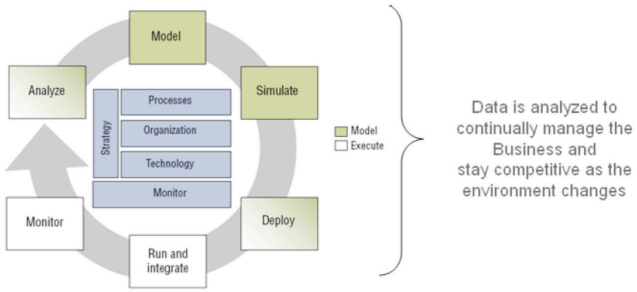



Figure 7: Monitor Flexibility
Continuous measurement to improve the process through learning knowledge gained through cycle implementations.

VI. ***Identify the correct roles and responsibilities for the corresponding task.*** It is highly import process to create the ideal role to map to the process. The goal is to consolidate roles where possible since there will be overlap in activities.

## Conclusion

The more flexible a business is the more resilient and resistant to market threats and responsive to opportunities it becomes. The problem question addressed in this paper was how pharmaceutical companies can cut costs, reduce time to market, increase profits and, perhaps most importantly, prepare for unpredicted challenges in a rapidly changing industry. The prescription for success solutions that included combining the potent ingredients of technology innovation and process optimization with the main dosage of organizational flexibility.

The results include uncovered significant challenges and roadblocks to achieving greater flexibility across the clinical trial adaptive clinical design, rapid methods for configurable EDC eCRF builds and process alignment on refined organization roles. Despite the climate of turmoil and rapid environmental changes in the industry, flexibility has great power to illuminate the path of excellence and success. The organizational flexibility allows more scope for improvement. There is least resistance to change, thus all the energies move in the direction of achieving corporate goals.

Much of the resistance is cultural. Collectively sponsor companies have agreed that the lack of regulatory direction from the FDA and lack of leadership from the vendor community are major causes of resistance to change. The market is too fragmented, too risky, too expensive, and it lacks data interchange standards to support innovations and make them compatible. For an industry that prides itself on innovation, the pharmaceutical market has been remarkably slow to adopt new technology. This may be concluded do to sponsor companies are very risk averse culturally given the high changes, competitive and risk.

### *Standards Flexibility*

Standardization throughout the clinical research enterprise is occurring at an accelerating rate. Standards are touching every aspect of data collection, management, manipulation, storage, dissemination, and submission in clinical research. Standards are also playing a key role in establishing a common language and common reference points so we can measure and communicate technology solutions and their impact. Standards drive compatibility and create new ways the community measures and communicates their impact.

### *Technology Flexibility*

EDC is more than just new technology; it's a new way of thinking about clinical trials. Implementing EDC while maintaining the processes that supported a paper-based system is like trying to play a CD on a turntable. The technology is only effective when it is supported by the right base of business processes.

Most companies approach innovation with extreme caution. They typically do so in a pilot effort that might require an internal champion to carry the technology forward. But these organizations are very fragmented and heterogeneous so the groups don't talk to each other. They may not support one another for fear their own project might be disrupted. They almost want to see another group fail before they'll even consider another group's solution. And there's also pretty high turnover among the champions. So most companies get stuck in this perpetual pilot testing phase, and only after highly visible success stories will companies consider innovation on an enterprise-wide scale. It might take pressure from the regulatory agencies to stimulate widespread adoption. Sometimes it means watching a competitor enjoy such a dramatic improvement that suddenly senior management pushes the implementation or execution levels to more widely adopt innovation.

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