Next Generation Life Sciences:
Powered by Generative AI

Contents

Key takeaways

- GenAI technologies have tremendous potential to help life sciences organizations across the value chain improve health outcomes and quality of life, including accelerated drug discovery, faster and more efficient clinical trials, autonomous manufacturing, and improved sales and marketing effectiveness.

- As the industry considers GenAI adoption models, there are justifiable concerns around security and transparency, particularly with respect to patient safety and privacy.

- With extensive experience in working with hundreds of global companies, we offer a best practice approach to help life sciences companies master the delicate balance of opportunity and risk to ensure successful GenAI outcomes.

A transformational revolution

The life sciences industry is on the cusp of a transformational revolution, powered by generative artificial intelligence (GenAI). While the world is abuzz with excitement about this emerging technology, life sciences organizations are gradually realizing its enormous potential to create a better future for all.

Drug discovery and production often involve complex, time-consuming processes. GenAI has the potential to transform these process, facilitating a more efficient drug development journey and helping to expedite the delivery of safer, more effective treatments for patients. In addition, GenAI is multiplying medical device innovations and breakthroughs that offer the promise to extend human life and improve its quality.

Yet in one of the most heavily regulated industries, there are justifiable concerns around security and transparency, particularly with respect to patient safety and privacy. As the industry considers the impacts of an AI transformation, they must also consider the best way forward.

AI: From then to now

Initially, AI focused on recognition tasks, like identifying objects in images. Its next iteration involved reasoning, analyzing what and why something is happening and the likely outcomes.

The most transformative shift happened with the advent of generative or operative capabilities, exemplified by large language models (LLM) like GPT, LaMDA and LLaMA. These models leverage predictions made during the reasoning stage and can make decisions and propose actions.

GenAI and LLMs have the potential to extract insights from unstructured content. Foundational models, such as GPT, LLaMA and open-source alternatives, are 'world-wise,' able to integrate common knowledge that may exist offline, such as in biomedical text or medical imaging. By combining such models with 'enterprise-wise' ones and traditional artificial intelligence and machine learning (AI-ML) techniques, life sciences organizations can create a knowledge superstructure. BioBERT, MedPALM 2, MedAlpaca and BioGPT are some such pre-trained medical large language models.

Generative AI for life sciences value chains

Many life sciences organizations are already extensively experimenting with AI technologies. In the TCS 2023 Global Cloud Study, an astonishing 85% of life sciences respondents said they increased investments in AI-ML in the past one to two years – the highest percentage of all industries surveyed. Meanwhile, 85% said they planned to invest in AI-ML in the next one to two years.[1]

According to the TCS Future of Care research report, which draws from participants across the life sciences and healthcare value chain, there is widespread belief in AI's potential. Around 44% of the respondents expect that AI will be one of the three greatest value drivers of connected care. This potential is expected to help healthcare providers to screen and triage patients and streamline care by automating repetitive tasks more effectively than any other capability.[2]

Life sciences organizations are currently exploring several use cases across the value chain, including the following:

- **Research and discovery:** With the ability to revolutionize drug discovery and new product development processes, GenAI is changing how research is done and bringing new innovative drugs faster to market, including enabling futuristic approaches for designing new molecules, such as de novo drug and protein design. In addition, GenAI can bring significant acceleration in analysis of varied medical data sets like trial data and real-world data to help identify drug candidates, drug interactions, and potential targets for new drugs.

- **Clinical trials:** A faster path to clinical trial outcomes can dramatically improve treatment options. GenAI can help achieve faster, more efficacious trials by analyzing suitable patient populations, predicting outcomes, assisting in authoring protocols, and improving trial design.

- **Regulatory and medical affairs:** GenAI can help accelerate regulatory submissions through the ability to summarize and generate vast amounts of regulatory content, drive improvements in the management of regulatory intelligence and facilitate content reviews. Similarly, GenAI can help transform medical affairs through the ability to summarize existing publications to improve patient and health outcomes. It can also enhance various medical writing tasks, including facilitating greater knowledge from analyzing real world evidence for better understanding and insights.

- **Manufacturing:** By supplementing tacit knowledge with an accessible, reliable knowledge base, GenAI can drive operations productivity and process effectiveness. GenAI helps transform critical processes like quality reports generation, continuous process verification (CVP), maintenance reliability, investigation support, operator training, and tech transfers to ensure the highest levels of product quality and patient safety.

- **Supply chain management:** GenAI can enable planners and supply chain analysts to optimize inventory levels, enable real-time demand for optimized and synchronized production schedules, dynamic allocation, and distribution plans. In addition, GenAI can reimagine order management and fulfilment, enable effective tender and contract compliance analysis, propose best routes, and keep the cost-to-serve models updated and relevant. GenAI can

also help determine supplier risk and potential mitigations while enabling a more responsive and resilient supply chain.

- **Sales and marketing:** GenAI can reinforce customer centricity by creating and customizing a wide variety of content across multiple channels to elevate sales and marketing team performance throughout the customer journey. Intelligent sales assistance and hyper-personalized responses to medical inquiries can result in more targeted offers and product guidance for value-based care.

- **After-sales service:** Within the medical devices and diagnostic industry, GenAI arms those in customer-facing positions with intelligent troubleshooting support and contextual knowledge repositories. Natural language models can guide customers through self-help processes that offer accurate customized responses, and personalized assistance with simulated medical training can aid responses to more complex inquiries.

In *Figure 1*, we list these seven focus areas, along with relevant use cases of GenAI. It is important to note that in most of these examples, intelligent technologies are a digital assistant for humans, not a replacement. GenAI will augment humans in their day-to-day work, empowering them to make consistently better decisions and truly innovate in a way that transforms the entire organization.
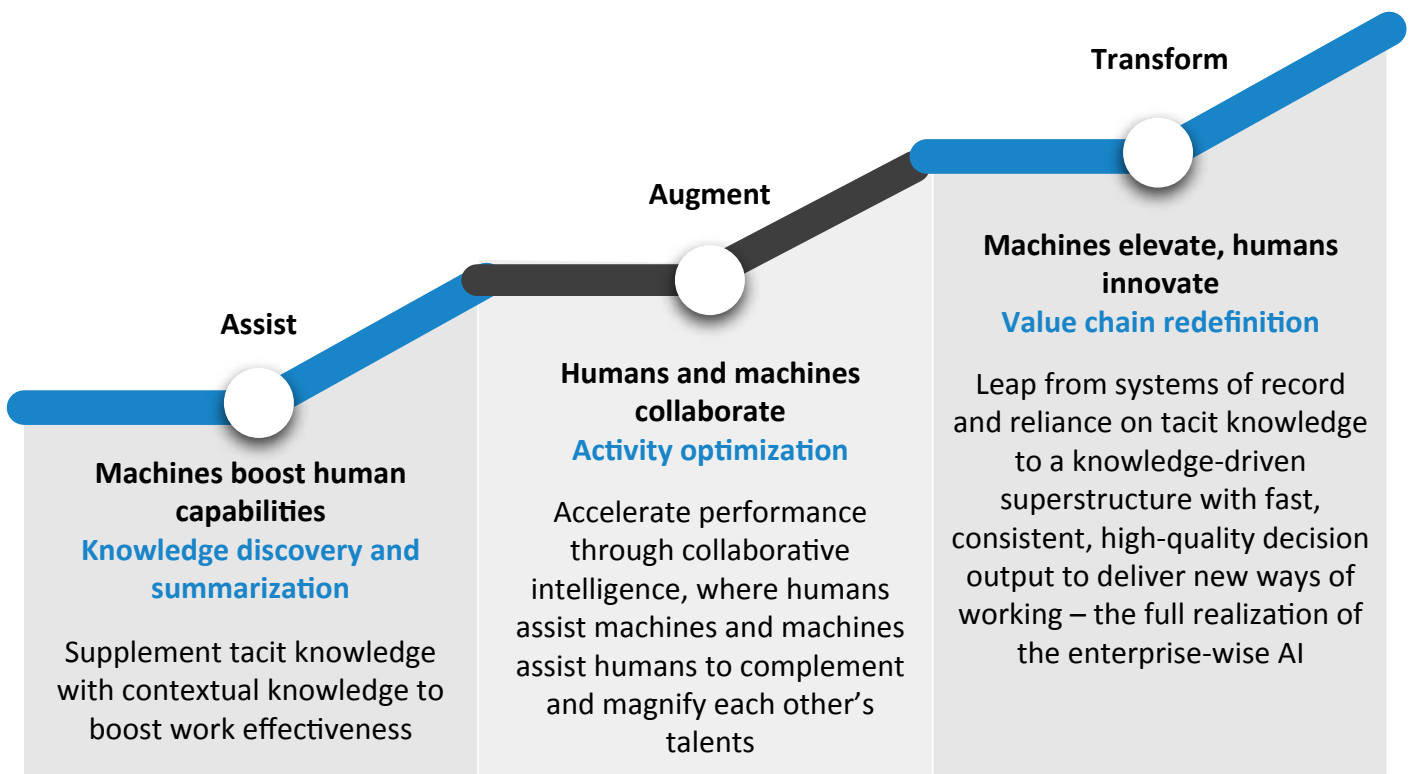
	Research and discovery	Clinical	Regulatory and medical affairs	Manufacturing	Supply chain	Sales and marketing
Pharma or BioTech	• De novo drug design and chemical synthesis • Research assistant to search and summarize scientific information • Protein structure design and property prediction • Prioritize drug repurposing candidates	• Matching synthetic patient data with actual trials data • Design clinical trials and clinical protocol authoring • SDTM or ADaM transformation and generation of SAS codes	• Regulatory strategy builder • Submission content and document builder • Health authority queries (HAQ) response generator • Real-world data (RWD) based scientific evidence generator	• Continuous process verification (CPV) companion • Maintenance smart agent • Deviation investigation digital assistant • Accelerated tech transfer	• Supply network analyzer • Supplier risk analyzer • Next gen operations control tower • Tender smart agent	• Brand perception and competitive analysis • Intelligent sales assistant • Personalized response to medical inquiries
Medtech	• Generative product design • Product personalization and customization • Material discovery for accelerated innovation • Synthetic data generation for design analysis • Automated software code generation and documentation	• Support with clinical trial reporting • Product visualization for summative studies	• Accelerating regulatory submission –generative content • Design history and clinical evaluation report creation • Product compliant analysis • Device literature generation	• Optimize maintenance scheduling • Ultra detailed scheduling • Predictive maintenance using unobtrusive sensing of machines • Automating quality operations • Virtual reliability engineer and virtual inspection	• Supply chain risk analyzer • Field inventory optimization • Contract co-pilot for supply chain to optimize efficiency	• Remote patient monitoring insights • Virtual field assistant • Marketing content generation and customization • Simulated medical training

Figure 1: *Focus areas for GenAI*

Our GenAI vision

Transforming the potential of GenAI into sustained performance requires a multidimensional strategy and an enterprise architecture optimized for cost, quality, security and privacy. In short, it requires a tailored fit – not a one-size-fits-all solution.

Drawing on our extensive experience in working with hundreds of global companies, we take a best practice approach to help life sciences master the delicate balance of opportunity and risk to ensure successful GenAI outcomes.

Transform

Augment

Assist

Machines boost human capabilities
Knowledge discovery and summarization

Supplement tacit knowledge with contextual knowledge to boost work effectiveness

Humans and machines collaborate
Activity optimization

Accelerate performance through collaborative intelligence, where humans assist machines and machines assist humans to complement and magnify each other's talents

Machines elevate, humans innovate
Value chain redefinition

Leap from systems of record and reliance on tacit knowledge to a knowledge-driven superstructure with fast, consistent, high-quality decision output to deliver new ways of working – the full realization of the enterprise-wise AI

Figure 2: *TCS AI continuum – Life sciences*

A GenAI evolution in action

GenAI has significant potential to enhance all aspects of the life sciences value chain. For instance, in pharma manufacturing, quality assurance (QA) is an area where GenAI can add significant value. Based on our domain expertise, and experiential and contextual knowledge, we strongly believe that GenAI has the potential to improve productivity up to 60%, reduce quality risks, and provide an unparalleled user experience.

At the basic level, GenAI can assist, augment, and transform manufacturing QA processes through the ability to detect deviations from standard procedures, auto generate content for annual product quality reviews, and assist in investigations for unplanned deviation. In addition, using GenAI to completely re-imagine the CPV could ensure a faster, more reliable supply of products to market as well as financial benefits in the range of several millions of dollars.
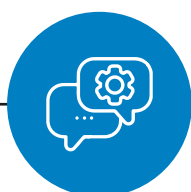
Assist
A QA executive typically spends nearly a third of their time searching, collating, and preparing information to complete the allocated task. For authoring tasks, GenAI can assist QA executives by intelligently collecting information in structured and unstructured formats from across multiple sources, monitoring quality risks (for example, deviation from standard operating steps), or reviewing checklists (for instance, line clearance and documentation of paper batch records).
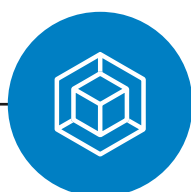
Augment
Another significant portion of time is dedicated to generating or authoring content and documents. GenAI can augment quality assurance executives by generating substantial content for analysis and reporting. Examples can include assistance for investigation, batch review, and release, or automating annual product quality reviews. Organizations can also use GenAI for rapid supplier change impact analysis.
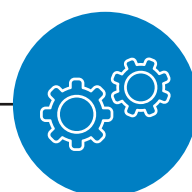
Transform
GenAI also has the power to reimagine some of the QA business processes to help improve product quality and reduce time. Within the CPV function in pharma manufacturing, the focus is to monitor trends around critical quality attributes and process parameters to ensure that the manufacturing process is stable and well-controlled. GenAI can transform CPV processes from protocol generation to management review.

Figure 3: A GenAI evolution in action

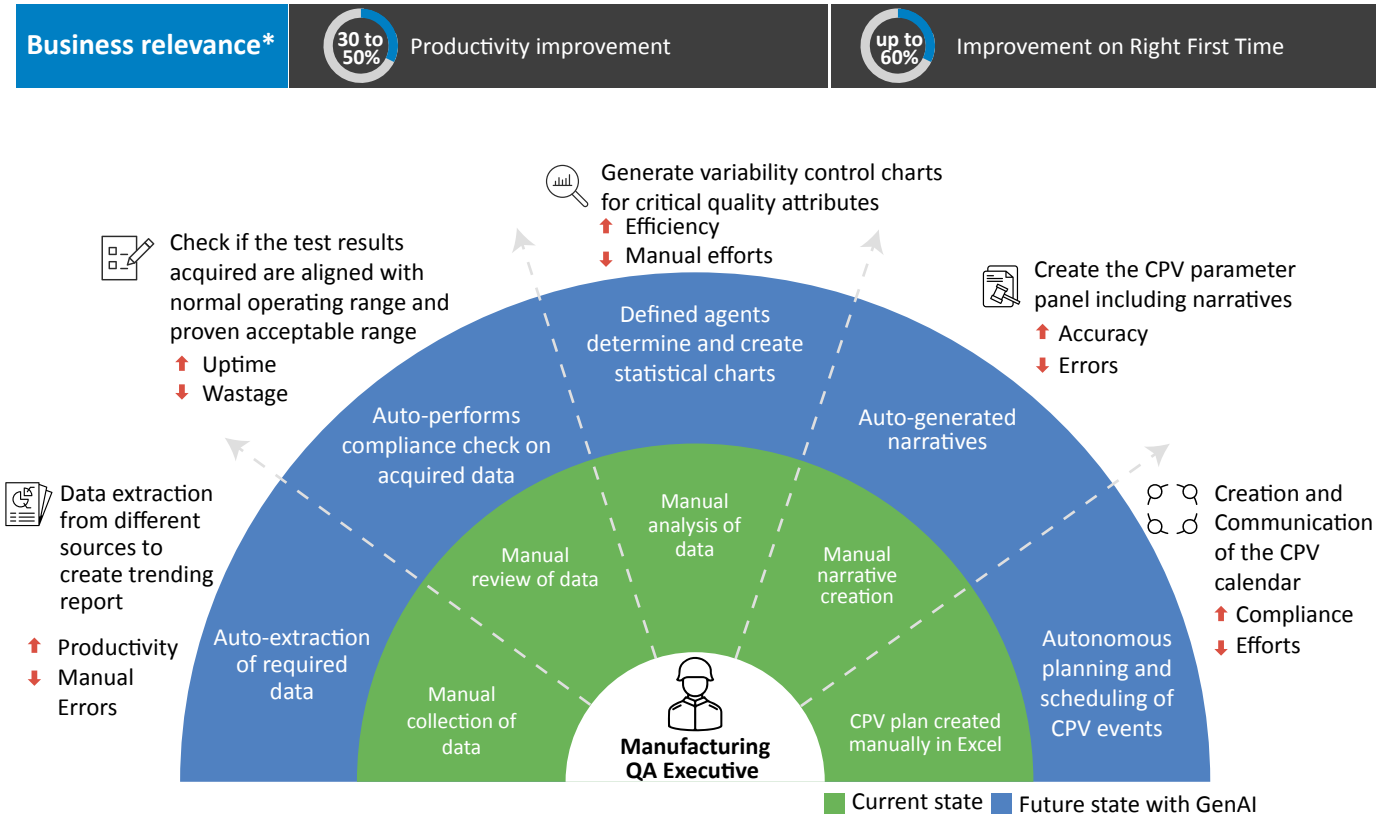# Case in point: GenAI infusion into the daily activities of a pharma manufacturing quality assurance executive

Business relevance*

30 to 50% Productivity improvement

up to 60% Improvement on Right First Time

Generate variability control charts for critical quality attributes
↑ Efficiency
↓ Manual efforts

Check if the test results acquired are aligned with normal operating range and proven acceptable range
↑ Uptime
↓ Wastage

Create the CPV parameter panel including narratives
↑ Accuracy
↓ Errors

Defined agents determine and create statistical charts

Auto-performs compliance check on acquired data

Auto-generated narratives

Manual analysis of data

Manual review of data

Manual narrative creation

Data extraction from different sources to create trending report
↑ Productivity
↓ Manual Errors

Creation and Communication of the CPV calendar
↑ Compliance
↓ Efforts

Auto-extraction of required data

Manual collection of data

CPV plan created manually in Excel

Autonomous planning and scheduling of CPV events

Manufacturing QA Executive

■ Current state ■ Future state with GenAI

Figure 4: *Case in Point: GenAI infusion into the daily activities of a pharma manufacturing quality assurance executive persona*

*Potential benefits based on TCS' experiential and contextual knowledge, domain expertise, and internal model estimates; actual results may vary

Navigating the complexity: A multi-layered enterprise architecture

How do life sciences organizations actually prepare themselves for GenAI?

It can be challenging to develop a robust business case when it's difficult to quantify the business benefits and costs. Any solution must start with a value-augmentation opportunity for business; prioritizing top-down structures, rather than starting with technology adoption.

Further, life sciences organizations have unique regulatory, compliance and data privacy requirements, which must be factored in during the initial stages of development.

For life sciences organizations to fully exploit the potential of GenAI, it is essential to have access to a multitier architecture and integration to enterprise systems. *Figure 5* shows an enterprise architecture framework for Pharma Enterprise.
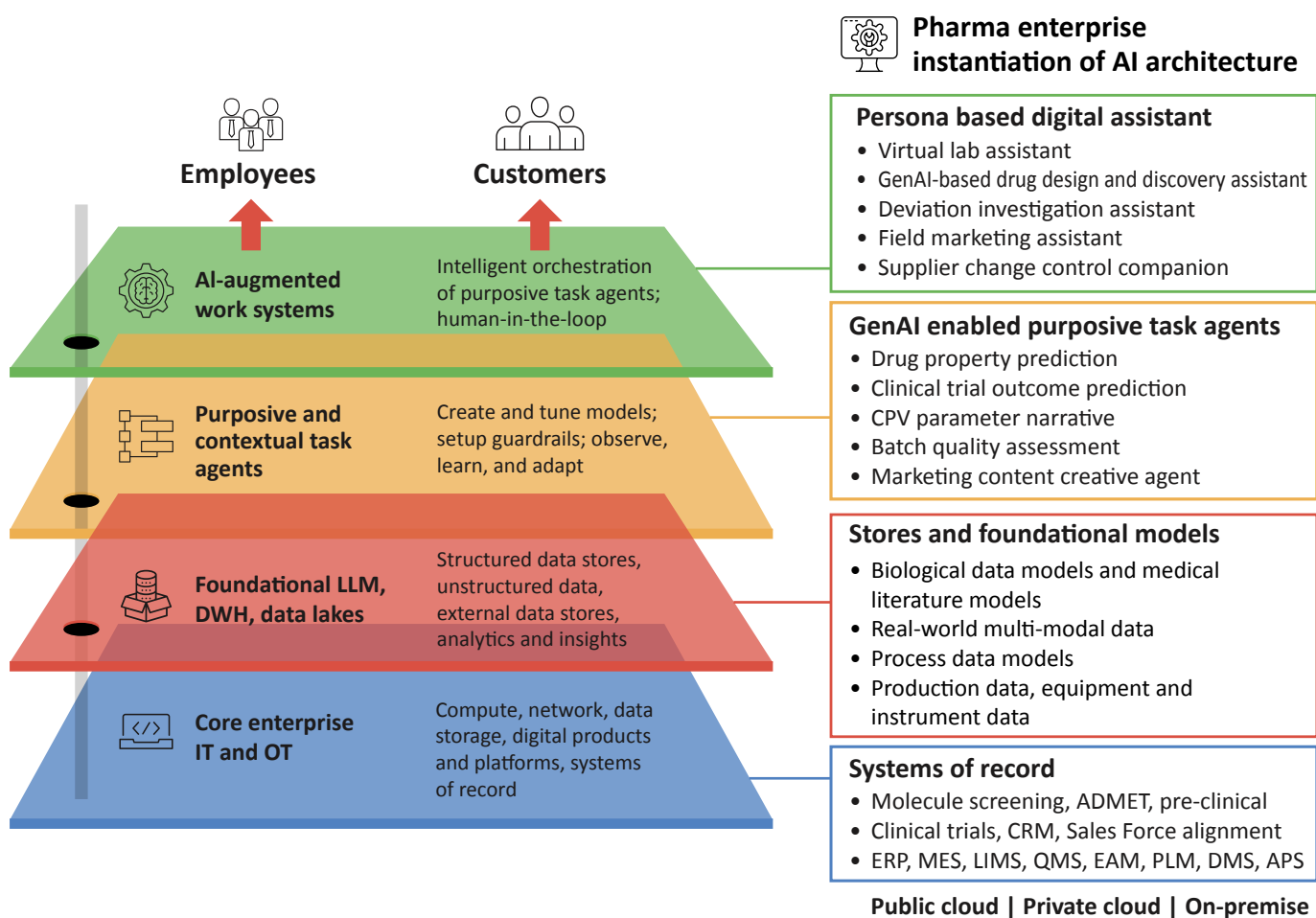
Figure 5: TCS' AI architecture for pharma enterprise

The TCS advantage

Deep domain and contextual expertise
Well-established product and enterprise knowledge and technological expertise across the life sciences value chain enable robust AI applications and ongoing support.

Cross-industry experience
Working with customers across industries such as healthcare (both payer and provider), travel and transportation, retail, and insurance brings an end-to-end holistic view of enterprise business functions and know-how.

Partner ecosystems
Scale and accelerate the path to value through a network of joint solutions and established hyperscaler partnerships, extensive TCS CoIN™ network, and co-innovation facilities such as TCS Pace Port™.

Enterprise AI at scale
Our 3P strategy - patents, products, and platforms - and more than 100,000 trained associates help us enable enterprise AI at scale.

Evolving capabilities
TCS offers multiple areas of capabilities that infuse predictive and GenAI interventions to assist and augment existing value streams.

Executive champions

Debashis Ghosh

President of the Life Sciences, Healthcare,
Energy, Resources, and Utilities Business Group, TCS

Siva Ganesan

Senior Vice President and Head, AI.Cloud, TCS

Vikas Jain

Vice President and Business Unit Head,
Life Sciences, TCS

Nidhi Srivastava

Vice President and Head of Offerings AI.Cloud, TCS

Sanjeev Sachdeva

Global Head, Strategic Capability and
Business Transformation, Life Sciences, TCS

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